

### NTC热敏电阻材料：

负温度系数（NTC）热敏电阻材料由高纯度过渡金属Mn Cu Ni等元素的氧化物经共沉淀制粉、等静压成型后1200-1400°C高温烧结而成，结合先进的半导体切、划片工艺及玻封、环氧工艺制成各种类型NTC热敏电阻，产品种类齐全、精度高、稳定性好。阻值范围0.5~2000kΩ，B值范围2500~4500。

### NTC热敏电阻的基本特性：

NTC热敏电阻的基本物理特性有：电阻值、B值、耗散系数、时间常数。

#### 其定义如下：

##### 电阻值 R (kΩ)：

电阻值可以近似地用如下公式表达：

其中：R<sub>1</sub>、R<sub>2</sub> 为绝对温度下T<sub>1</sub>、T<sub>2</sub>时的电阻值（kΩ）；  
B：B值（K）

$$R_2 = R_1 \times EXP \left[ B \times \left( \frac{1}{T_2} - \frac{1}{T_1} \right) \right]$$

##### B值 B (K)：

B值反映了两个温度之间的电阻变化，可用下述公式计算：

其中：R<sub>1</sub>、R<sub>2</sub> 绝对温度T<sub>1</sub>、T<sub>2</sub>时的电阻值（Ω）

$$B = \frac{\ln R_1 - \ln R_2}{1/T_1 - 1/T_2} \\ = 2.3026 \times \frac{\lg R_1 - \lg R_2}{1/T_1 - 1/T_2}$$

##### 耗散系数 δ (mW/°C)：

耗散系数是指热敏电阻消耗的功率与环境温度变化之比：

其中：W 热敏电阻消耗的功率（mW）  
T 热平衡时的温度  
T<sub>0</sub> 周围环境温度  
I 在温度T时通过热敏电阻电流  
R 在温度T时热敏电阻的电阻值（Ω）

$$\delta = \frac{W}{T - T_0} = \frac{I^2 R}{T - T_0}$$

##### 时间常数τ (sec.)：

热敏电阻在零功率状态下，当环境温度由一个特定温度向另一个特定温度突变时，温度变化63.2%所需时间。

# 电阻-温度特性表

R (25°C)		10.00kohm			B(25/50)		3950K	
Temp	Resistance (kΩ)			resistance tol. (%)		Temp tol. (°C)		
°C	Rmin	R(t)/Nominal	Rmax	MIN	MAX	MIN	MAX	
0	32.51	32.84	33.20	-1.0%	1.1%	-0.21	0.21	
1	30.91	31.22	31.54	-1.0%	1.0%	-0.20	0.21	
2	29.39	29.68	29.98	-1.0%	1.0%	-0.20	0.20	
3	27.95	28.22	28.50	-1.0%	1.0%	-0.20	0.20	
4	24.59	24.85	25.10	-0.9%	1.0%	-0.20	0.20	
5	25.31	25.54	25.78	-0.9%	0.9%	-0.20	0.20	
6	24.09	24.31	24.53	-0.9%	0.9%	-0.20	0.20	
7	22.94	23.14	23.34	-0.9%	0.9%	-0.20	0.20	
8	21.85	22.04	22.22	-0.8%	0.9%	-0.20	0.20	
9	20.82	20.99	21.14	-0.8%	0.8%	-0.20	0.20	
10	19.84	20.00	20.14	-0.8%	0.8%	-0.20	0.20	
11	18.91	19.04	19.21	-0.8%	0.8%	-0.20	0.20	
12	18.03	18.17	18.30	-0.8%	0.8%	-0.20	0.20	
13	17.20	17.32	17.45	-0.7%	0.7%	-0.20	0.20	
14	14.41	14.52	14.64	-0.7%	0.7%	-0.15	0.20	
15	15.44	15.74	15.87	-0.7%	0.7%	-0.15	0.15	
16	14.95	15.04	15.14	-0.7%	0.7%	-0.15	0.15	
17	14.27	14.34	14.45	-0.6%	0.6%	-0.15	0.15	
18	13.43	13.71	13.80	-0.6%	0.6%	-0.15	0.15	
19	13.02	13.10	13.17	-0.6%	0.6%	-0.15	0.15	
20	12.44	12.51	12.58	-0.6%	0.6%	-0.15	0.15	
21	11.89	11.94	12.02	-0.5%	0.5%	-0.15	0.15	
22	11.37	11.43	11.49	-0.5%	0.5%	-0.15	0.15	
23	10.87	10.93	10.98	-0.5%	0.5%	-0.15	0.15	
24	10.40	10.45	10.50	-0.5%	0.5%	-0.15	0.15	
25	9.955	10.00	10.05	-0.5%	0.5%	-0.10	0.10	
26	9.530	9.571	9.613	-0.4%	0.4%	-0.10	0.10	
27	9.124	9.143	9.201	-0.4%	0.4%	-0.10	0.10	
28	8.741	8.775	8.809	-0.4%	0.4%	-0.10	0.10	
29	8.374	8.405	8.434	-0.4%	0.4%	-0.10	0.10	
30	8.025	8.053	8.081	-0.3%	0.3%	-0.10	0.10	
31	7.692	7.717	7.742	-0.3%	0.3%	-0.08	0.10	
32	7.375	7.397	7.420	-0.3%	0.3%	-0.10	0.10	
33	7.072	7.092	7.112	-0.3%	0.3%	-0.10	0.10	
34	6.784	6.801	6.819	-0.3%	0.3%	-0.10	0.10	
35	6.508	6.524	6.540	-0.2%	0.2%	-0.10	0.10	
36	6.244	6.259	6.273	-0.2%	0.2%	-0.10	0.10	
37	5.995	6.007	6.019	-0.2%	0.2%	-0.10	0.10	
38	5.753	5.744	5.779	-0.2%	0.2%	-0.10	0.10	
39	5.523	5.534	5.549	-0.2%	0.2%	-0.10	0.10	
40	5.302	5.314	5.330	-0.3%	0.3%	-0.10	0.10	
41	5.092	5.104	5.121	-0.3%	0.3%	-0.10	0.10	
42	4.891	4.904	4.921	-0.3%	0.3%	-0.10	0.10	
43	4.699	4.714	4.729	-0.3%	0.3%	-0.10	0.10	
44	4.514	4.531	4.547	-0.3%	0.3%	-0.10	0.10	
45	4.340	4.354	4.372	-0.4%	0.4%	-0.10	0.10	
46	4.173	4.189	4.205	-0.4%	0.4%	-0.10	0.10	
47	4.012	4.029	4.045	-0.4%	0.4%	-0.15	0.15	
48	3.859	3.875	3.892	-0.4%	0.4%	-0.15	0.15	
49	3.712	3.729	3.745	-0.4%	0.4%	-0.15	0.15	
50	3.572	3.588	3.605	-0.5%	0.5%	-0.15	0.15	
51	3.435	3.451	3.467	-0.5%	0.5%	-0.15	0.15	
52	3.303	3.320	3.334	-0.5%	0.5%	-0.15	0.15	
53	3.178	3.194	3.211	-0.5%	0.5%	-0.15	0.15	
54	3.058	3.074	3.091	-0.5%	0.5%	-0.15	0.15	
55	2.944	2.960	2.974	-0.6%	0.6%	-0.20	0.20	
56	2.834	2.850	2.867	-0.6%	0.6%	-0.20	0.20	
57	2.729	2.744	2.762	-0.6%	0.6%	-0.20	0.20	
58	2.629	2.644	2.662	-0.6%	0.6%	-0.20	0.20	
59	2.534	2.550	2.564	-0.6%	0.6%	-0.20	0.20	
60	2.442	2.458	2.474	-0.6%	0.6%	-0.20	0.20	
61	2.354	2.370	2.384	-0.7%	0.7%	-0.20	0.20	
62	2.270	2.284	2.302	-0.7%	0.7%	-0.20	0.20	
63	2.190	2.205	2.221	-0.7%	0.7%	-0.25	0.25	
64	2.113	2.128	2.144	-0.7%	0.7%	-0.25	0.25	
65	2.039	2.054	2.069	-0.7%	0.7%	-0.25	0.25	
66	1.968	1.983	1.998	-0.8%	0.8%	-0.25	0.25	
67	1.900	1.915	1.930	-0.8%	0.8%	-0.25	0.25	
68	1.835	1.850	1.865	-0.8%	0.8%	-0.25	0.25	
69	1.773	1.787	1.802	-0.8%	0.8%	-0.25	0.25	
70	1.713	1.727	1.742	-0.8%	0.8%	-0.25	0.25	

  

R (25°C)		2.252kohm			B(25/50)		3950K	
Temp	Resistance (kΩ)			resistance tol. (%)		Temp tol. (°C)		
°C	Rmin	R(t)/Nominal	Rmax	MIN	MAX	MIN	MAX	
0	7.334	7.411	7.490	-1.0%	1.1%	-0.21	0.21	
1	4.971	7.043	7.114	-1.0%	1.0%	-0.20	0.20	
2	4.429	6.495	6.742	-1.0%	1.0%	-0.20	0.20	
3	4.305	6.344	6.429	-1.0%	1.0%	-0.20	0.20	
4	5.999	6.054	6.113	-0.9%	1.0%	-0.20	0.20	
5	5.709	5.742	5.815	-0.9%	0.9%	-0.20	0.20	
6	5.434	5.483	5.533	-0.9%	0.9%	-0.20	0.20	
7	5.175	5.220	5.264	-0.9%	0.9%	-0.20	0.20	
8	4.929	4.971	5.013	-0.8%	0.9%	-0.20	0.20	
9	4.695	4.734	4.774	-0.8%	0.8%	-0.20	0.20	
10	4.475	4.511	4.547	-0.8%	0.8%	-0.20	0.20	
11	4.264	4.299	4.332	-0.8%	0.8%	-0.20	0.20	
12	4.047	4.098	4.129	-0.8%	0.8%	-0.20	0.20	
13	3.879	3.908	3.934	-0.7%	0.7%	-0.20	0.20	
14	3.701	3.727	3.754	-0.7%	0.7%	-0.20	0.20	
15	3.532	3.554	3.580	-0.7%	0.7%	-0.15	0.15	
16	3.371	3.394	3.414	-0.7%	0.7%	-0.15	0.15	
17	3.219	3.239	3.260	-0.6%	0.6%	-0.15	0.15	
18	3.074	3.093	3.112	-0.6%	0.6%	-0.15	0.15	
19	2.937	2.954	2.972	-0.6%	0.6%	-0.15	0.15	
20	2.807	2.823	2.839	-0.6%	0.6%	-0.15	0.15	
21	2.683	2.697	2.712	-0.5%	0.5%	-0.15	0.15	
22	2.565	2.578	2.592	-0.5%	0.5%	-0.15	0.15	
23	2.453	2.465	2.478	-0.5%	0.5%	-0.15	0.15	
24	2.347	2.358	2.369	-0.5%	0.5%	-0.15	0.15	
25	2.242	2.252	2.262	-0.5%	0.5%	-0.10	0.10	
26	2.150	2.159	2.168	-0.4%	0.4%	-0.10	0.10	
27	2.059	2.067	2.074	-0.4%	0.4%	-0.10	0.10	
28	1.972	1.979	1.987	-0.4%	0.4%	-0.10	0.10	
29	1.889	1.894	1.903	-0.4%	0.4%	-0.10	0.10	
30	1.810	1.817	1.823	-0.3%	0.3%	-0.10	0.10	
31	1.735	1.741	1.744	-0.3%	0.3%	-0.10	0.10	
32	1.664	1.669	1.674	-0.3%	0.3%	-0.10	0.10	
33	1.595	1.600	1.604	-0.3%	0.3%	-0.10	0.10	
34	1.530	1.534	1.538	-0.3%	0.3%	-0.10	0.10	
35	1.468	1.472	1.475	-0.2%	0.2%	-0.10	0.10	
36	1.409	1.412	1.415	-0.2%	0.2%	-0.10	0.10	
37	1.352	1.355	1.358	-0.2%	0.2%	-0.10	0.10	
38	1.298	1.301	1.304	-0.2%	0.2%	-0.10	0.10	
39	1.244	1.249	1.252	-0.2%	0.2%	-0.10	0.10	
40	1.194	1.199	1.202	-0.3%	0.3%	-0.10	0.10	
41	1.149	1.152	1.155	-0.3%	0.3%	-0.10	0.10	
42	1.103	1.107	1.110	-0.3%	0.3%	-0.10	0.10	
43	1.060	1.063	1.067	-0.3%	0.3%	-0.10	0.10	
44	1.019	1.022	1.024	-0.3%	0.3%	-0.10	0.10	
45	0.9791	0.9824	0.9842	-0.4%	0.4%	-0.10	0.10	
46	0.9413	0.9448	0.9484	-0.4%	0.4%	-0.10	0.10	
47	0.9051	0.9087	0.9124	-0.4%	0.4%	-0.15	0.15	
48	0.8705	0.8742	0.8778	-0.4%	0.4%	-0.15	0.15	
49	0.8374	0.8411	0.8448	-0.4%	0.4%	-0.15	0.15	
50	0.8058	0.8095	0.8132	-0.5%	0.5%	-0.15	0.15	
51	0.7747	0.7784	0.7822	-0.5%	0.5%	-0.15	0.15	
52	0.7451	0.7488	0.7524	-0.5%	0.5%	-0.15	0.15	
53	0.7168	0.7205	0.7243	-0.5%	0.5%	-0.15	0.15	
54	0.6898	0.6935	0.6972	-0.5%	0.5%	-0.15	0.15	
55	0.6640	0.6677	0.6714	-0.6%	0.6%	-0.20	0.20	
56	0.6395	0.6430	0.6467	-0.6%	0.6%	-0.20	0.20	
57	0.6157	0.6194	0.6230	-0.6%	0.6%	-0.20	0.20	
58	0.5931	0.5968	0.6004	-0.6%	0.6%	-0.20	0.20	
59	0.5715	0.5751	0.5788	-0.6%	0.6%	-0.20	0.20	
60	0.5509	0.5544	0.5580	-0.6%	0.6%	-0.20	0.20	
61	0.5311	0.5344	0.5382	-0.7%	0.7%	-0.20	0.20	
62	0.5121	0.5157	0.5193	-0.7%	0.7%	-0.20	0.20	
63	0.4940	0.4975	0.5010	-0.7%	0.7%	-0.25	0.25	
64	0.4764	0.4801	0.4835	-0.7%	0.7%	-0.25	0.25	
65	0.4600	0.4634	0.4668	-0.7%	0.7%	-0.25	0.25	
66	0.4440	0.4474	0.4508	-0.8%	0.8%	-0.25	0.25	
67	0.4287	0.4320	0.4354	-0.8%	0.8%	-0.25	0.25	
68	0.4140	0.4173	0.4206	-0.8%	0.8%	-0.25	0.25	
69	0.3999	0.4032	0.4064	-0.8%	0.8%	-0.25	0.25	
70	0.3864	0.3896	0.3928	-0.8%	0.8%	-0.25	0.25	





# 电阻—温度特性表

R <sub>25°C</sub>	2KΩ	5KΩ	10KΩ	10KΩ	10KΩ	20KΩ	50KΩ	100KΩ	100KΩ	200KΩ	500KΩ	1000KΩ
B <sub>25/50°C</sub>	3400	3470	3380	3600	3950	3950	3950	3950	3990	4250	4280	4430
T(°C)	R(kΩ)	R(kΩ)	R(kΩ)	R(kΩ)	R(kΩ)	R(kΩ)	R(kΩ)	R(kΩ)	R(kΩ)	R(kΩ)	R(kΩ)	R(kΩ)
-40	41.86	108.92	199.4	248.0	324.7	677.5	1666	3271	3430	8380	20913	46530
-35	31.52	81.90	151.41	183.8	237.5	488.2	1204	2371	2471	5951	14855	32863
-30	23.98	62.15	115.92	137.61	174.94	355.6	879.0	1736	1801	4268	10673	23423
-25	18.418	47.58	89.44	104.10	129.76	261.6	648.5	1284	1326	3088	7737	16839
-20	14.269	36.73	69.57	79.50	96.97	194.5	483.3	958.8	986.3	2257	5663	12217
-15	11.140	28.59	54.56	61.27	73.04	146.03	363.7	722.5	740.7	1667	4185	8948
-10	8.765	22.43	43.11	47.62	55.45	110.69	276.2	549.1	561.2	1243	3122	6612
-5	6.951	17.721	34.31	37.28	42.41	84.59	211.2	420.7	428.5	934.3	2347	4928
0	5.551	14.108	27.48	29.41	32.69	65.21	162.90	325.0	329.8	708.5	1779	3704
5	4.461	11.318	22.16	23.36	25.42	50.73	126.69	253.1	255.8	542.3	1359	2808
10	3.611	9.131	17.980	18.689	19.89	39.71	99.22	198.4	199.8	417.1	1046	2142
15	2.945	7.416	14.686	15.058	15.685	31.33	78.32	156.62	157.35	323.3	811.6	1647
20	2.420	6.071	12.083	12.233	12.481	24.95	62.36	124.73	125.01	253.3	634.9	1279
25	2.000	5.000	10.000	10.000	10.000	20.00	50.00	100.00	100.00	200.0	500.0	1000
30	1.6593	4.137	8.310	8.209	8.054	16.114	40.27	80.54	80.37	158.52	395.7	785.1
35	1.3841	3.439	6.941	6.776	6.525	13.058	32.63	65.26	64.98	126.41	315.0	620.2
40	1.1605	2.873	5.825	5.623	5.317	10.640	26.59	53.17	52.84	101.41	252.3	492.9
45	0.9778	2.411	4.912	4.689	4.357	8.715	21.78	43.56	43.20	81.82	203.3	394.0
50	0.8278	2.032	4.160	3.929	3.589	7.176	17.940	35.88	35.51	66.38	164.67	316.8
55	0.7051	1.7184	3.541	3.311	2.969	5.933	14.865	29.74	29.37	54.25	134.30	256.6
60	0.6032	1.4603	3.027	2.803	2.471	4.933	12.379	24.77	24.41	44.56	110.10	208.9
65	0.5183	1.2468	2.599	2.384	2.068	4.124	10.357	20.72	20.38	36.78	90.71	170.94
70	0.4471	1.0693	2.240	2.036	1.7403	3.466	8.705	17.418	17.100	30.50	75.09	140.57
75	0.3869	0.9232	1.9377	1.7455	1.4758	2.934	7.346	14.689	14.403	25.38	62.39	116.01
80	0.3362	0.8002	1.6827	1.5025	1.2573	2.495	6.226	12.442	12.185	21.22	52.07	96.19
85	0.2931	0.6963	1.4665	1.2984	1.0760	2.131	5.299	10.582	10.352	17.816	43.66	80.11
90	0.2567	0.6074	1.2828	1.1264	0.9231	1.8255	4.529	9.044	8.836	15.037	36.78	67.07
95	0.2256	0.5314	1.1259	0.9806	0.7919	1.5690	3.887	7.760	7.572	12.746	31.11	56.39
100	0.1989	0.4664	0.9912	0.8566	0.6870	1.3533	3.349	6.684	6.515	10.848	26.43	47.60
105	0.1760	0.4104	0.8752	0.7506	0.5959	1.1712	2.895	5.778	5.625	9.266	22.53	40.32
110	0.1562	0.3623	0.7749	0.6598	0.5188	1.0172	2.512	5.011	4.874	7.944	19.27	34.29
115	0.1390	0.3207	0.6881	0.5817	0.4532	0.8863	2.186	4.360	4.237	6.834	16.545	29.26
120	0.1241	0.2848	0.6127	0.5144	0.3972	0.7747	1.9093	3.806	3.695	5.900	14.252	25.06
125	0.1110	0.2535	0.5469	0.4561	0.3493	0.6793	1.6723	3.333	3.232	5.110	12.317	21.53
130	0.0996	0.2265	0.4894	0.4056	0.3081	0.5976	1.4687	2.926	2.835	4.439	10.676	18.561
135	0.0896	0.2028	0.4391	0.3616	0.2727	0.5273	1.2936	2.577	2.494	3.869	9.282	16.053
140	0.0808	0.1821	0.3949	0.3233	0.2420	0.4665	1.1427	2.275	2.200	3.382	8.096	13.928
145	0.0731	0.1639	0.3561	0.2897	0.2153	0.4138	1.0122	2.015	1.9465	2.965	7.082	12.122
150	0.0662	0.1478	0.3218	0.2603	0.1921	0.3681	0.8990	1.7891	1.7267	2.606	6.212	10.581
155	/	0.1335	0.2916	0.2316	0.1717	0.3281	0.8010	1.5938	1.5369	2.298	5.468	9.268
160	/	0.1208	0.2649	0.2118	0.1539	0.2932	0.7154	1.4233	1.3714	2.032	4.826	8.139
165	/	0.1096	0.2411	0.1917	0.1383	0.2626	0.6405	1.2740	1.2265	1.8014	4.270	7.167
170	/	0.0997	0.2198	0.1739	0.1246	0.2357	0.5747	1.1429	1.0995	1.6007	3.788	6.327
175	/	0.0908	0.2008	0.1580	0.1125	0.2121	0.5168	1.0276	0.9879	1.4257	3.368	5.599
180	/	0.0830	0.1836	0.1438	0.1020	0.1912	0.4653	0.9249	0.8886	1.2722	2.999	4.962
185	/	0.0760	0.1682	0.1311	0.0926	0.1727	0.4198	0.8343	0.8011	1.1379	2.677	4.409
190	/	0.0698	0.1544	0.1197	0.0843	0.1564	0.3796	0.7543	0.7238	1.0201	2.395	3.926
195	/	0.0641	0.1419	0.1096	0.0768	0.1419	0.3440	0.6834	0.6554	0.9165	2.147	3.505
200	/	0.0590	0.1307	0.1004	0.0702	0.1290	0.3124	0.6204	0.5917	0.8252	1.9295	3.136
205	/	0.0544	0.1207	0.0923	0.0642	0.1175	0.2848	0.5652	0.5416	0.7453	1.7396	2.815
210	/	0.0502	0.1116	0.0849	0.0589	0.1073	0.2600	0.5159	0.4942	0.6743	1.5714	2.533
215	/	0.0464	0.1034	0.0783	0.0540	0.0981	0.2378	0.4717	0.4517	0.6112	1.4221	2.283
220	/	0.0429	0.0959	0.0723	0.0496	0.0898	0.2178	0.4320	0.4135	0.5550	1.2893	2.061
225	/	0.0397	0.0890	0.0668	0.0457	0.0823	0.1999	0.3962	0.3792	0.5048	1.1709	1.8647
230	/	0.0367	0.0827	0.0618	0.0420	0.0756	0.1835	0.3637	0.3479	0.4596	1.0643	1.6885
235	/	0.0340	0.0770	0.0572	0.0387	0.0694	0.1687	0.3343	0.3196	0.4190	0.9689	1.5312
240	/	0.0315	0.0717	0.0531	0.0357	0.0638	0.1553	0.3076	0.2940	0.3825	0.8832	1.3906
245	/	0.0292	0.0669	0.0493	0.0329	0.0588	0.1431	0.2834	0.2708	0.3496	0.8062	1.2648
250	/	0.0271	0.0624	0.0458	0.0304	0.0542	0.1320	0.2614	0.2497	0.3200	0.7369	1.1519
255	/	0.0252	0.0583	0.0426	0.0281	0.0500	0.1219	0.2414	0.2305	0.2933	0.6744	1.0506