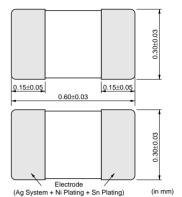
# **NTC Thermistors**



# for Temperature Compensation 0201 (0603) Size

0201/0402/0603/0805 sized Chip NTC Thermistor have Ni barrier termination and provide excellent solderability and offer high stability in environment by unique inner construction.

# 4



#### ■ Features

- Excellent solderability and high stability in environment
- 2. Excellent long time aging stability
- 3. High accuracy in resistance and B-constant
- 4. Reflow soldering possible
- 5. Lead is not contained in the product.

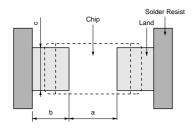
### ■ Applications

- Temperature compensation of transistor, IC, crystal oscillator of mobile communications equipment
- 2. Temperature sensor for rechargeable batteries
- 3. Temperature compensation of LCD
- 4. Temperature compensation and sensing of car audio equipment (CD, MD, Tuner)
- Temperature compensation of several kinds of circuits

Part Number	Resistance (25°C)	B-Constant (25-50°C) (K)	Permissive Operating Current (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Dissipation Constant (25°C) (mW/°C)	Operating Temperature Range (°C)
NCP03YS110□05RL	11ohm	2750 ±3%	9.50	100	1.0	-40 to 125
NCP03YS220□05RL	22ohm	2750 ±3%	6.70	100	1.0	-40 to 125
NCP03YS330□05RL	33ohm	2750 ±3%	5.50	100	1.0	-40 to 125
NCP03YS470□05RL	47ohm	2750 ±3%	4.60	100	1.0	-40 to 125
NCP03YS680□05RL	68ohm	2750 ±3%	3.80	100	1.0	-40 to 125
NCP03YS101□05RL	100ohm	2750 ±3%	3.10	100	1.0	-40 to 125
NCP03XH682□05RL	6.8k ohm	3380 ±3%	0.38	100	1.0	-40 to 125
NCP03XH103□05RL	10k ohm	3380 ±3%	0.31	100	1.0	-40 to 125
NCP03XH153□05RL	15k ohm	3380 ±3%	0.25	100	1.0	-40 to 125
NCP03XH223□05RL	22k ohm	3380 ±3%	0.21	100	1.0	-40 to 125
NCP03WF333□05RL	33k ohm	4250 ±3%	0.17	100	1.0	-40 to 125
NCP03WB473□05RL	47k ohm	4050 ±3%	0.14	100	1.0	-40 to 125
NCP03WL473□05RL	47k ohm	4485 ±3%	0.14	100	1.0	-40 to 125
NCP03WF683□05RL	68k ohm	4250 ±3%	0.12	100	1.0	-40 to 125
NCP03WL683□05RL	68k ohm	4485 ±3%	0.12	100	1.0	-40 to 125
NCP03WF104□05RL	100k ohm	4250 ±3%	0.10	100	1.0	-40 to 125
NCP03WL104□05RL	100k ohm	4485 ±3%	0.10	100	1.0	-40 to 125
NCP03WL154□05RL	150k ohm	4485 ±3%	0.08	100	1.0	-40 to 125
NCP03WL224□05RL	220k ohm	4485 ±3%	0.06	100	1.0	-40 to 125

A blank column is filled with resistance tolerance codes. (J:  $\pm 5\%$ , K:  $\pm 10\%$ )

### ■ Standard Land Dimensions



Soldering Methods	а	b	С
Reflow Soldering	0.25	0.25	0.3

(in mm)

# for Temperature Compensation Temperature Characteristics (Center Value)

	NCP□□YS110		NCP□□XC220		NCP□□XC330	NCP□□YS470	NCP□□XC470	NCP□□YS680
Resistance	11Ω	22Ω	22Ω	33Ω	33Ω	47Ω	47Ω	68Ω
B-Constant	2750K	2750K	3100K	2750K	3100K	2750K	3100K	2750K
Temp. (°C)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)
-40	127.366	254.732	355.823	382.098	533.734	544.201	760.166	787.354
-35	101.662	203.325	273.975	304.987	410.962	434.376	585.310	628.459
-30	81.726	163.452	213.003	245.178	319.504	349.193	455.051	505.215
<del>-25</del>	66.148	132.296	166.943	198.444	250.415	282.633	356.652	408.915
<del>-20</del>	53.946	107.893	131.997	161.839	197.996	230.498	281.994	333.487
<u>–20</u> –15								
	44.273	88.546	105.318	132.819	157.978	189.167	224.998	273.688
	36.494	72.987	84.670	109.481	127.005	155.927	180.886	225.597
5	30.262	60.523	68.628	90.785	102.942	129.299	146.614	187.071
0	25.226	50.451	55.981	75.677	83.972	107.782	119.596	155.940
5	21.150	42.300	45.859	63.449	68.789	90.367	97.972	130.744
10	17.828	35.657	37.819	53.485	56.728	76.176	80.794	110.212
15	15.103	30.205	31.396	45.308	47.094	64.529	67.073	93.361
20	12.859	25.719	26.211	38.578	39.317	54.944	55.997	79.494
25	11.000	22.000	22.000	33.000	33.000	47.000	47.000	68.000
30	9.452	18.904	18.560	28.356	27.840	40.386	39.651	58.430
35								
	8.162	16.323	15.735	24.485	23.603	34.872	33.616	50.454
40	7.077	14.155	13.403	21.232	20.104	30.239	28.633	43.750
45	6.161	12.323	11.462	18.484	17.193	26.326	24.487	38.089
50	5.389	10.778	9.842	16.167	14.763	23.025	21.026	33.313
55	4.731	9.461	8.488	14.192	12.732	20.213	18.133	29.244
60	4.168	8.336	7.348	12.504	11.022	17.809	15.698	25.766
65	3.687	7.374	6.399	11.061	9.598	15.753	13.670	22.792
70	3.273	6.545	5.595	9.817	8.392	13.982	11.952	20.230
75	2.915	5.830	4.896	8.744	7.345	12.454	10.461	18.019
80	2.605	5.210	4.299	7.814	6.448	11.130	9.184	16.102
85	2.335	4.671	3.795	7.006	5.692	9.979	8.107	14.437
90	2.100	4.201	3.360	6.301	5.040	8.974	7.179	12.984
95	1.894				4.474			
		3.789	2.983	5.683		8.094	6.373	11.710
100	1.713	3.427	2.656	5.140	3.983	7.320	5.673	10.591
105	1.554	3.107	2.367	4.661	3.551	6.638	5.057	9.604
110	1.412	2.825	2.116	4.237	3.173	6.035	4.520	8.731
115	1.287	0.574					4 000	7.057
	1.207	2.574	1.901	3.862	2.851	5.500	4.060	7.957
120	1.176	2.352	1.901 1.712	3.862	2.851	5.500	3.657	7.269
120	1.176	2.352	1.712 1.543	3.528	2.568	5.024	3.657	7.269
120 125	1.176	2.352 2.153	1.712	3.528 3.230	2.568	5.024 4.600	3.657	7.269
120 125	1.176 1.077	2.352 2.153	1.712 1.543	3.528 3.230	2.568 2.314	5.024 4.600	3.657 3.296	7.269 6.655
120 125 Part Number Resistance	1.176 1.077 NCP□□XC680 68Ω	2.352 2.153 NCP□□YS101 100Ω	1.712 1.543 NCP□□XF101 100Ω	3.528 3.230 NCP□□XF151 150Ω	2.568 2.314 NCP□□XM221 220Ω	5.024 4.600 NCP□□XM331 330Ω	3.657 3.296 NCP□□XQ471 470Ω	7.269 6.655 NCP□□XQ681 680Ω
120 125 Part Number Resistance B-Constant	1.176 1.077 NCP□□XC680 68Ω 3100K	2.352 2.153 NCP□□YS101 100Ω 2750K	1.712 1.543 NCP□□XF101 100Ω 3250K	3.528 3.230 NCP□□XF151 150Ω 3250K	2.568 2.314 NCP□□XM221 220Ω 3500K	5.024 4.600 NCP□□XM331 330Ω 3500K	3.657 3.296 NCP□□XQ471 470Ω 3650K	7.269 6.655 NCP□□XQ681 680Ω 3650K
120 125 Part Number Resistance B-Constant Temp. (°C)	1.176 1.077 NCP□□XC680 68Ω 3100K Resistance (Ω)	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω)	1.712 1.543 NCP□□XF101 100Ω 3250K Resistance (Ω)	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω)	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω)	5.024 4.600 NCP□□XM331 330Ω 3500K Resistance (Ω)	3.657 3.296 NCP□XQ471 470Ω 3650K Resistance (Ω)	7.269 6.655 NCP□XQ681 680Ω 3650K Resistance (Ω)
120 125 Part Number Resistance B-Constant Temp. (°C) -40	1.176 1.077 NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874	1.712 1.543 NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904	5.024 4.600 NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856	3.657 3.296 NCP□XQ471 470Ω 3650K Resistance (Ω) 11822.473	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854
Part Number Resistance B-Constant Temp. (°C) -40 -35	1.176 1.077 NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204	1.712 1.543 NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755	5.024 4.600 NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632	3.657 3.296 NCP□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745	7.269 6.655 NCP□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248
Part Number Resistance B-Constant Temp. (°C) -40 -35 -30	1.176 1.077 NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963	1.712 1.543 NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873	5.024 4.600 NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309	3.657 3.296 NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224	7.269 6.655 NCP□ XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855
Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25	1.176 1.077 NCP□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346	1.712 1.543 NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887	5.024 4.600 NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831	3.657 3.296 NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219
120 125 Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20	1.176 1.077 NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422	1.712 1.543 NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037	5.024 4.600 NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555	3.657 3.296 NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436
120 125 Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15	1.176 1.077 NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482	1.712 1.543 NCP□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441	3.528 3.230 NCP□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661	2.568 2.314 NCP□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034	5.024 4.600 NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599
120 125 Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10	1.176 1.077 NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760	1.712 1.543 NCP□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700	3.528 3.230 NCP□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620	5.024 4.600 NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675
120 125 Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5	1.176 1.077 NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123	2.352 2.153 NCP $\square$ YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105	1.712 1.543 NCP□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877	3.528 3.230 NCP□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315	2.568 2.314 NCP□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411
120 125 Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10	1.176 1.077 NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760	1.712 1.543 NCP□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700	3.528 3.230 NCP□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620	5.024 4.600 NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675
120 125 Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5	1.176 1.077 NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123	2.352 2.153 NCP $\square$ YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105	1.712 1.543 NCP□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877	3.528 3.230 NCP□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411
120 125 Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 0	1.176 1.077 NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270	1.712 1.543 NCP□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785	3.528 3.230 NCP□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474	5.024 4.600 NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 0 5	1.176 1.077 NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076	1.712 1.543 NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395	3.528 3.230 NCP□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010	5.024 4.600 NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257	7.269 6.655  NCP□□XO681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 0 5 10	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25	1.176 1.077  NCP□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000	2.352 2.153 NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000	3.528 3.230  NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000
120 125  Part Number Resistance B-Constant Temp. (°C) -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669	3.528 3.230  NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 0 10 15 20 25 30 35	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361	3.528 3.230  NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456	3.528 3.230  NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 262.177	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426 35.428	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339 56.013	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456 50.470	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184 75.705	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681 105.336	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521 158.004	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 262.177 218.069	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320 315.504
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339 56.013 48.989	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184 75.705 64.543	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 262.177	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426 35.428	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339 56.013	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456 50.470	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184 75.705	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681 105.336	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521 158.004	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 262.177 218.069	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320 315.504
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426 35.428 30.421	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339 56.013 48.989	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456 50.470 43.029	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184 75.705 64.543	2.568 2.314 NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681 105.336 88.717	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521 158.004 133.076	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 262.177 218.069 182.297	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320 315.504 263.749
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 25 20 25 30 35 40 45 50 55	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426 35.428 30.421 26.235	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339 56.013 48.989 43.006	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456 50.470 43.029 36.830	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184 75.705 64.543 55.246	2.568 2.314  NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681 105.336 88.717 75.059	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521 158.004 133.076 112.588	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 262.177 218.069 182.297 153.150	7.269 6.655  NCP□□XO681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320 315.504 263.749 221.579
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426 35.428 30.421 26.235 22.712	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339 56.013 48.989 43.006 37.891 33.517	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456 50.470 43.029 36.830 31.649 27.364	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184 75.705 64.543 55.246 47.473 41.045	2.568 2.314  NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681 105.336 88.717 75.059 63.777 54.415	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521 158.004 133.076 112.588 95.666 81.622	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 262.177 218.069 182.297 153.150 129.249 109.551	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320 315.504 263.749 221.579 186.998 158.499
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 10 15 20 25 30 35 40 45 50 55 60 65 70	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426 35.428 30.421 26.235 22.712 19.778 17.293	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339 56.013 48.989 43.006 37.891 33.517 29.750	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456 50.470 43.029 36.830 31.649 27.364 23.756	3.528 3.230 NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184 75.705 64.543 55.246 47.473 41.045 35.634	2.568 2.314  NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681 105.336 88.717 75.059 63.777 54.415 46.631	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521 158.004 133.076 112.588 95.666 81.622 69.946	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 262.177 218.069 182.297 153.150 129.249 109.551 93.281	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320 315.504 263.749 221.579 186.998 158.499 134.960
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -35 -30 -25 -20 -15 -10 -5 10 15 20 25 30 35 40 45 50 55 60 65 70 75	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426 35.428 30.421 26.235 22.712 19.778 17.293 15.134	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339 56.013 48.989 43.006 37.891 33.517 29.750 26.498	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456 50.470 43.029 36.830 31.649 27.364 23.756 20.651	3.528 3.230  NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184 75.705 64.543 55.246 47.473 41.045 35.634 30.976	2.568 2.314  NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681 105.336 88.717 75.059 63.777 54.415 46.631 40.115	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521 158.004 133.076 112.588 95.666 81.622 69.946 60.172	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 218.069 182.297 153.150 129.249 109.551 93.281 79.750	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320 315.504 263.749 221.579 186.998 158.499 134.960 115.383
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -40 -35 -30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426 35.428 30.421 26.235 22.712 19.778 17.293 15.134 13.288	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339 56.013 48.989 43.006 37.891 33.517 29.750 26.498 23.680	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456 50.470 43.029 36.830 31.649 27.364 23.756 20.651 18.011	3.528 3.230  NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184 75.705 64.543 55.246 47.473 41.045 35.634 30.976 27.016	2.568 2.314  NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681 105.336 88.717 75.059 63.777 54.415 46.631 40.115 34.637	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521 158.004 133.076 112.588 95.666 81.622 69.946 60.172 51.955	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 262.177 218.069 182.297 153.150 129.249 109.551 93.281 79.750 68.446	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 12685.248 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320 315.504 263.749 221.579 186.998 158.499 134.960 115.383 99.029
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -40 -40 -5 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 65 70 75 80 85	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426 35.428 30.421 26.235 22.712 19.778 17.293 15.134 13.288 11.729	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339 56.013 48.989 43.006 37.891 33.517 29.750 26.498 23.680 21.231	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456 50.470 43.029 36.830 31.649 27.364 23.756 20.651 18.011 15.800	3.528 3.230  NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184 75.705 64.543 55.246 47.473 41.045 35.634 30.976 27.016 23.700	2.568 2.314  NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681 105.336 88.717 75.059 63.777 54.415 46.631 40.115 34.637 30.013	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521 158.004 133.076 112.588 95.666 81.622 69.946 60.172 51.955 45.019	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 262.177 218.069 182.297 153.150 129.249 109.551 93.281 79.750 68.446 58.996	7.269 6.655  NCP□□XQ681 680Ω 3650K Resistance (Ω) 17104.854 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320 315.504 263.749 221.579 186.998 158.499 134.960 115.383 99.029 85.356
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -40 -40 -5 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426 35.428 30.421 26.235 22.712 19.778 17.293 15.134 13.288 11.729 10.386	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339 56.013 48.989 43.006 37.891 33.517 29.750 26.498 23.680 21.231 19.094	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456 50.470 43.029 36.830 31.649 27.364 23.756 20.651 18.011 15.800 13.908	3.528 3.230  NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184 75.705 64.543 55.246 47.473 41.045 35.634 30.976 27.016 23.700 20.862	2.568 2.314  NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681 105.336 88.717 75.059 63.777 54.415 46.631 40.115 34.637 30.013 26.110	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521 158.004 133.076 112.588 95.666 81.622 69.946 60.172 51.955 45.019 39.165	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 262.177 218.069 182.297 153.150 129.249 109.551 93.281 79.750 68.446 58.996 51.036	7.269 6.655  NCP□□XO681 680Ω 3650K Resistance (Ω) 17104.854 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320 315.504 263.749 221.579 186.998 158.499 134.960 115.383 99.029 85.356 73.839
120 125  Part Number Resistance B-Constant Temp. (°C) -40 -40 -40 -5 -25 -20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 65 70 75 80 85	1.176 1.077  NCP□□XC680 68Ω 3100K Resistance (Ω) 1099.815 846.832 658.372 516.007 407.991 325.529 261.707 212.123 173.033 141.747 116.894 97.042 81.016 68.000 57.368 48.636 41.426 35.428 30.421 26.235 22.712 19.778 17.293 15.134 13.288 11.729	2.352 2.153  NCP□□YS101 100Ω 2750K Resistance (Ω) 1157.874 924.204 742.963 601.346 490.422 402.482 331.760 275.105 229.324 192.270 162.076 137.296 116.902 100.000 85.927 74.197 64.339 56.013 48.989 43.006 37.891 33.517 29.750 26.498 23.680 21.231	1.712 1.543  NCP□□XF101 100Ω 3250K Resistance (Ω) 1824.175 1390.685 1070.653 831.138 650.960 514.441 409.700 328.877 265.759 215.785 176.395 145.161 120.152 100.000 83.669 70.361 59.456 50.470 43.029 36.830 31.649 27.364 23.756 20.651 18.011 15.800	3.528 3.230  NCP□□XF151 150Ω 3250K Resistance (Ω) 2736.262 2086.028 1605.979 1246.708 976.440 771.661 614.550 493.315 398.639 323.677 264.592 217.742 180.228 150.000 125.503 105.541 89.184 75.705 64.543 55.246 47.473 41.045 35.634 30.976 27.016 23.700	2.568 2.314  NCP□□XM221 220Ω 3500K Resistance (Ω) 4947.904 3703.755 2798.873 2135.887 1645.037 1278.034 1000.620 789.612 627.752 502.474 405.010 328.480 268.044 220.000 181.576 150.668 125.681 105.336 88.717 75.059 63.777 54.415 46.631 40.115 34.637 30.013	5.024 4.600  NCP□□XM331 330Ω 3500K Resistance (Ω) 7421.856 5555.632 4198.309 3203.831 2467.555 1917.051 1500.930 1184.418 941.628 753.711 607.514 492.720 402.066 330.000 272.365 226.002 188.521 158.004 133.076 112.588 95.666 81.622 69.946 60.172 51.955 45.019	3.657 3.296  NCP□□XQ471 470Ω 3650K Resistance (Ω) 11822.473 8767.745 6570.224 4971.784 3796.933 2923.400 2269.599 1775.225 1399.050 1110.220 887.257 713.463 577.375 470.000 384.800 316.757 262.177 218.069 182.297 153.150 129.249 109.551 93.281 79.750 68.446 58.996	7.269 6.655  NCP□□XO681 680Ω 3650K Resistance (Ω) 17104.854 9505.855 7193.219 5493.436 4229.599 3283.675 2568.411 2024.158 1606.275 1283.691 1032.245 835.351 680.000 556.733 458.287 379.320 315.504 263.749 221.579 186.998 158.499 134.960 115.383 99.029 85.356

38.640

33.790

29.664

26.123

23.091

20.472

55.905

48.888

42.918

37.795

33.409

29.618

100

105

110

115

120

125

8.208

7.317

6.539

5.874

5.291

4.768

15.575

14.124

12.840

11.702

10.690

9.787

10.844

9.622

8.563

7.648

6.850

6.162

16.265

14.434

12.844

11.472

10.275

9.243

19.957

17.541

15.453

13.663

12.114

10.778

29.935

26.312

23.180

20.494

18.171

16.168

# for Temperature Compensation Temperature Characteristics (Center Value)

☐ Continued f	from the preceding p	page.						
Part Number	NCP□□XQ102	NCP□□XW152	NCP□□XW222	NCP□□XW332	NCP□□XM472	NCP□□XH682	NCP□□XW682	NCP□□XH103
Resistance	1kΩ	1.5kΩ	2.2kΩ	3.3kΩ	4.7kΩ	6.8kΩ	6.8kΩ	10kΩ
B-Constant	3650K	3950K	3950K	3950K	3500K	3380K	3950K	3380K
Temp. (°C)	Resistance ( $k\Omega$ )	Resistance (kΩ)	Resistance (kΩ)		Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance ( $k\Omega$ )
<u>-40</u>	25.154	51.791	75.961	113.941	105.705	133.122	234.787	195.652
-35	18.655	37.172	54.520	81.779	79.126	100.810	168.515	148.171
-30	13.979	27.005	39.607	59.411	59.794	77.113	122.422	113.347
-25 -20	10.578 8.079	19.843 14.728	29.103 21.601	43.654 32.401	45.630 35.144	59.566 46.419	89.953 66.766	87.559 68.237
<u>-20</u> -15	6.220	11.044	16.198	24.297	27.303	36.494	50.066	53.650
<del>-10</del>	4.829	8.362	12.264	18.396	21.377	28.913	37.906	42.506
<del></del> 5	3.777	6.389	9.370	14.055	16.869	23.052	28.963	33.892
0	2.977	4.922	7.219	10.829	13.411	18.512	22.313	27.219
5	2.362	3.825	5.609	8.414	10.735	14.977	17.338	22.021
10	1.888	2.994	4.391	6.586	8.653	12.191	13.571	17.926
15	1.518	2.361	3.463	5.195	7.018	9.979	10.705	14.674
20	1.229	1.876	2.751	4.126	5.726	8.215	8.503	12.081
25	1.000	1.500	2.200	3.300	4.700	6.800	6.800	10.000
30	0.819	1.207	1.771	2.656	3.879	5.654	5.474	8.315
35	0.674	0.978	1.434	2.152	3.219	4.724	4.434	6.948
40 45	0.558 0.464	0.797 0.653	1.169 0.958	1.753 1.437	2.685 2.250	3.967 3.343	3.613 2.961	5.834 4.917
50	0.388	0.538	0.956	1.437	1.895	2.829	2.440	4.161
55	0.326	0.446	0.654	0.981	1.604	2.403	2.022	3.535
60	0.275	0.371	0.545	0.817	1.363	2.049	1.683	3.014
65	0.233	0.311	0.456	0.684	1.163	1.758	1.409	2.586
70	0.199	0.261	0.383	0.575	0.996	1.514	1.185	2.228
75	0.170	0.221	0.324	0.486	0.857	1.308	1.001	1.925
80	0.146	0.187	0.275	0.412	0.740	1.134	0.849	1.669
85	0.126	0.160	0.234	0.351	0.641	0.987	0.724	1.452
90	0.109	0.137	0.200	0.301	0.558	0.862	0.620	1.268
95	0.094	0.117	0.172	0.258	0.487	0.754	0.532	1.110
100	0.082	0.101	0.149	0.223	0.426	0.662	0.459	0.974
105 110	0.072 0.063	0.088 0.076	0.129 0.112	0.193 0.168	0.375 0.330	0.583 0.515	0.398 0.346	0.858 0.758
115	0.056	0.076	0.112	0.146	0.330	0.456	0.302	0.738
120	0.049	0.058	0.085	0.128	0.259	0.405	0.264	0.596
125	0.044	0.051	0.075	0.113	0.230	0.361	0.232	0.531
Dart Nameland	NODE WATER	NODE VIAGO	NCP□□XW153	NODERVIDOS	NODEENWAR	NODEE NAME 222	NCP□□WB333	NODE WESSE
Resistance	NCP□□XV103 10kΩ	15kΩ	15kΩ	22kΩ	22kΩ	22kΩ	33kΩ	33kΩ
B-Constant	3900K	3380K	3950K	3380K	3950K	4485K	4050K	4250K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	
<b>-40</b>	328.996			111111111111111111111111111111111111111				Resistance (KΩ)
-35		293.651	517.912	430.688	759.605	1073.436	, ,	1451.049
-30	237.387	293.651 222.375	517.912 371.724	430.688 326.150	759.605 545.196	1073.436 753.900	1227.263 874.449	. ,
	173.185		371.724 270.048	326.150 249.484	545.196 396.070		1227.263	1451.049 1019.238 725.084
-25	173.185 127.773	222.375	371.724 270.048 198.426	326.150	545.196	753.900 535.073 383.590	1227.263 874.449 630.851 460.457	1451.049 1019.238
-20	173.185 127.773 95.327	222.375 170.103 131.395 102.394	371.724 270.048 198.426 147.278	326.150 249.484 192.712 150.178	545.196 396.070 291.025 216.008	753.900 535.073 383.590 277.643	1227.263 874.449 630.851 460.457 339.797	1451.049 1019.238 725.084 522.021 379.842
-20 -15	173.185 127.773 95.327 71.746	222.375 170.103 131.395 102.394 80.501	371.724 270.048 198.426 147.278 110.439	326.150 249.484 192.712 150.178 118.068	545.196 396.070 291.025 216.008 161.977	753.900 535.073 383.590 277.643 202.813	1227.263 874.449 630.851 460.457 339.797 253.363	1451.049 1019.238 725.084 522.021 379.842 279.371
-20 -15 -10	173.185 127.773 95.327 71.746 54.564	222.375 170.103 131.395 102.394 80.501 63.778	371.724 270.048 198.426 147.278 110.439 83.617	326.150 249.484 192.712 150.178 118.068 93.540	545.196 396.070 291.025 216.008 161.977 122.638	753.900 535.073 383.590 277.643 202.813 149.462	1227.263 874.449 630.851 460.457 339.797 253.363 190.766	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566
-20 -15 -10 -5	173.185 127.773 95.327 71.746 54.564 41.813	222.375 170.103 131.395 102.394 80.501 63.778 50.851	371.724 270.048 198.426 147.278 110.439 83.617 63.888	326.150 249.484 192.712 150.178 118.068 93.540 74.581	545.196 396.070 291.025 216.008 161.977 122.638 93.702	753.900 535.073 383.590 277.643 202.813 149.462 111.082	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639
-20 -15 -10 -5 0	173.185 127.773 95.327 71.746 54.564 41.813 32.330	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814
-20 -15 -10 -5 0	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925
-20 -15 -10 -5 0 5	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204
-20 -15 -10 -5 0	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925
-20 -15 -10 -5 0 5 10	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675
-20 -15 -10 -5 0 5 10 15	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937
-20 -15 -10 -5 0 5 10 15 20 25 30 35	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635 3.019	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240 5.301	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382 4.459	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152 7.775	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894 6.540	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871 5.543	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538 9.506	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954 8.940
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635 3.019 2.521	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240 5.301 4.520	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382 4.459 3.713	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152 7.775 6.630	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894 6.540 5.446	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871 5.543 4.497	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538 9.506 7.870	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954 8.940 7.334
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635 3.019 2.521 2.115	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240 5.301 4.520 3.878	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382 4.459 3.713 3.108	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152 7.775 6.630 5.688	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894 6.540 5.446 4.559	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871 5.543 4.497 3.669	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538 9.506 7.870 6.549	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954 8.940 7.334 6.046
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635 3.019 2.521 2.115 1.781	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240 5.301 4.520 3.878 3.340	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382 4.459 3.713 3.108 2.613	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152 7.775 6.630 5.688 4.899	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894 6.540 5.446 4.559 3.832	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871 5.543 4.497 3.669 3.009	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538 9.506 7.870 6.549 5.475	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954 8.940 7.334 6.046 5.011
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635 3.019 2.521 2.115 1.781 1.509	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240 5.301 4.520 3.878 3.340 2.886	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382 4.459 3.713 3.108 2.613 2.208	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152 7.775 6.630 5.688 4.899 4.233	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894 6.540 5.446 4.559 3.832 3.239	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871 5.543 4.497 3.669 3.009 2.481	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538 9.506 7.870 6.549 5.475 4.595	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954 8.940 7.334 6.046 5.011 4.170
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635 3.019 2.521 2.115 1.781 1.509 1.284	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240 5.301 4.520 3.878 3.340 2.886 2.502	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382 4.459 3.713 3.108 2.613 2.208 1.873	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152 7.775 6.630 5.688 4.899 4.233 3.669	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894 6.540 5.446 4.559 3.832 3.239 2.748	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871 5.543 4.497 3.669 3.009 2.481 2.056	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538 9.506 7.870 6.549 5.475 4.595 3.874	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954 8.940 7.334 6.046 5.011 4.170 3.487
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635 3.019 2.521 2.115 1.781 1.509	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240 5.301 4.520 3.878 3.340 2.886	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382 4.459 3.713 3.108 2.613 2.208	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152 7.775 6.630 5.688 4.899 4.233	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894 6.540 5.446 4.559 3.832 3.239	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871 5.543 4.497 3.669 3.009 2.481	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538 9.506 7.870 6.549 5.475 4.595	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954 8.940 7.334 6.046 5.011 4.170
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635 3.019 2.521 2.115 1.781 1.509 1.284 1.097	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240 5.301 4.520 3.878 3.340 2.886 2.502 2.177	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382 4.459 3.713 3.108 2.613 2.208 1.873 1.597	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152 7.775 6.630 5.688 4.899 4.233 3.669 3.194	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894 6.540 5.446 4.559 3.832 3.239 2.748 2.342	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871 5.543 4.497 3.669 3.009 2.481 2.056 1.713	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538 9.506 7.870 6.549 5.475 4.595 3.874 3.282	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954 8.940 7.334 6.046 5.011 4.170 3.487 2.928
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 65 70 75 80 85 90	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635 3.019 2.521 2.115 1.781 1.509 1.284 1.097 0.941	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240 5.301 4.520 3.878 3.340 2.886 2.502 2.177 1.901	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382 4.459 3.713 3.108 2.613 2.208 1.873 1.597 1.367	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152 7.775 6.630 5.688 4.899 4.233 3.669 3.194 2.788	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894 6.540 5.446 4.559 3.832 3.239 2.748 2.342 2.004	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871 5.543 4.497 3.669 3.009 2.481 2.056 1.713 1.434	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538 9.506 7.870 6.549 5.475 4.595 3.874 3.282 2.789	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954 8.940 7.334 6.046 5.011 4.170 3.487 2.928 2.469
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 65 70 75 80 85 90	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635 3.019 2.521 2.115 1.781 1.509 1.284 1.097 0.941 0.810 0.701 0.608	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240 5.301 4.520 3.878 3.340 2.886 2.502 2.177 1.901 1.664	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382 4.459 3.713 3.108 2.613 2.208 1.873 1.597 1.367 1.174 1.013 0.878	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152 7.775 6.630 5.688 4.899 4.233 3.669 3.194 2.788 2.440	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894 6.540 5.446 4.559 3.832 3.239 2.748 2.342 2.004 1.722 1.486 1.287	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871 5.543 4.497 3.669 3.009 2.481 2.056 1.713 1.434 1.206 1.019 0.866	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538 9.506 7.870 6.549 5.475 4.595 3.874 3.282 2.789 2.379 2.038 1.751	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954 8.940 7.334 6.046 5.011 4.170 3.487 2.928 2.469 2.091 1.777
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635 3.019 2.521 2.115 1.781 1.509 1.284 1.097 0.941 0.810 0.701 0.608 0.530	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240 5.301 4.520 3.878 3.340 2.886 2.502 2.177 1.901 1.664 1.460 1.286 1.136	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382 4.459 3.713 3.108 2.613 2.208 1.873 1.597 1.367 1.174 1.013 0.878 0.763	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152 7.775 6.630 5.688 4.899 4.233 3.669 3.194 2.788 2.440 2.141 1.887 1.667	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894 6.540 5.446 4.559 3.832 3.239 2.748 2.342 2.004 1.722 1.486 1.287 1.119	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871 5.543 4.497 3.669 3.009 2.481 2.056 1.713 1.434 1.206 1.019 0.866 0.739	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538 9.506 7.870 6.549 5.475 4.595 3.874 3.282 2.789 2.038 1.751 1.509	1451.049 1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954 8.940 7.334 6.046 5.011 4.170 3.487 2.928 2.469 2.091 1.777 1.516 1.298
-20 -15 -10 -5 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105	173.185 127.773 95.327 71.746 54.564 41.813 32.330 25.194 19.785 15.651 12.468 10.000 8.072 6.556 5.356 4.401 3.635 3.019 2.521 2.115 1.781 1.509 1.284 1.097 0.941 0.810 0.701 0.608	222.375 170.103 131.395 102.394 80.501 63.778 50.851 40.836 33.037 26.891 22.012 18.122 15.000 12.471 10.421 8.750 7.374 6.240 5.301 4.520 3.878 3.340 2.886 2.502 2.177 1.901 1.664 1.460 1.286	371.724 270.048 198.426 147.278 110.439 83.617 63.888 49.221 38.245 29.936 23.613 18.756 15.000 12.074 9.780 7.969 6.531 5.382 4.459 3.713 3.108 2.613 2.208 1.873 1.597 1.367 1.174 1.013 0.878	326.150 249.484 192.712 150.178 118.068 93.540 74.581 59.893 48.454 39.441 32.284 26.578 22.000 18.291 15.284 12.833 10.816 9.152 7.775 6.630 5.688 4.899 4.233 3.669 3.194 2.788 2.440 2.141 1.887	545.196 396.070 291.025 216.008 161.977 122.638 93.702 72.191 56.093 43.907 34.633 27.509 22.000 17.709 14.344 11.688 9.578 7.894 6.540 5.446 4.559 3.832 3.239 2.748 2.342 2.004 1.722 1.486 1.287	753.900 535.073 383.590 277.643 202.813 149.462 111.082 83.233 62.858 47.831 36.664 28.304 22.000 17.214 13.557 10.744 8.566 6.871 5.543 4.497 3.669 3.009 2.481 2.056 1.713 1.434 1.206 1.019 0.866	1227.263 874.449 630.851 460.457 339.797 253.363 190.766 144.964 111.087 85.842 66.861 52.470 41.471 33.000 26.430 21.298 17.266 14.076 11.538 9.506 7.870 6.549 5.475 4.595 3.874 3.282 2.789 2.379 2.038 1.751	1019.238 725.084 522.021 379.842 279.371 207.566 155.639 117.814 89.925 69.204 53.675 41.937 33.000 26.143 20.845 16.723 13.498 10.954 8.940 7.334 6.046 5.011 4.170 3.487 2.928 2.469 2.091 1.777 1.516

0.987

0.832

1.168

0.750

0.471

0.796

125

0.358

0.511

# for Temperature Compensation Temperature Characteristics (Center Value)

\( \) Continued from the preceding page.

Part Number         NCP         WB473         NCP         WL473         NCP         WB473         NCP         WL473         NCP         WF683         NCP         WL683         NCP         WF104         NCP           Resistance         33kΩ         47kΩ         47kΩ         68kΩ         68kΩ         68kΩ         100kΩ         100           B-Constant         4485K         4050K         4485K         4150K         4250K         4485K         4250K*         448           Temp. (°C)         Resistance (kΩ)         Resistan	kΩ 5K ce (kΩ) 254 818
B-Constant         4485K         4050K         4485K         4150K         4250K         4485K         4250K*         485         4250K*         486         4250K*         485         4250K*	5K ce (kΩ) 254 818
Temp. (°C)         Resistance (kΩ)         Resistance (k	ce (kΩ) 254 818
-40     1610.154     1747.920     2293.249     2735.359     2990.041     3317.893     4397.119     4879       -35     1130.850     1245.428     1610.605     1937.391     2100.247     2330.237     3088.599     3426	254 818
-35     1130.850     1245.428     1610.605     1937.391     2100.247     2330.237     3088.599     3426	818
	149
<u>-30</u> <u>802.609</u> <u>898.485</u> <u>1143.110</u> <u>1389.345</u> <u>1494.113</u> <u>1653.862</u> <u>2197.225</u> <u>2432</u>	
<u>-25</u> <u>575.385</u> <u>655.802</u> <u>819.487</u> <u>1008.014</u> <u>1075.679</u> <u>1185.641</u> <u>1581.881</u> <u>1743</u>	
<u>-20</u> 416.464 483.954 593.146 738.978 782.705 858.168 1151.037 1262	
<u>-15</u> 304.219 360.850 433.281 547.456 575.674 626.875 846.579 921.	375
<u>-10 224.193 271.697 319.305 409.600 427.712 461.974 628.988 679.</u>	373
<u>-5</u> 166.623 206.463 237.312 309.217 320.710 343.345 471.632 504.	919
0 124.850 158.214 177.816 235.606 242.768 257.266 357.012 378.	333
5 94.287 122.259 134.287 180.980 185.300 194.287 272.500 285.	717
10         71.747         95.227         102.184         140.139         142.603         147.841         209.710         217.	414
15 54.996 74.730 78.327 109.344 110.602 113.325 162.651 166.	654
20 42.455 59.065 60.467 85.929 86.415 87.484 127.080 128.	353
25 33.000 47.000 47.000 68.000 68.000 68.000 100.000 100.	000
30 25.822 37.643 36.776 54.167 53.871 53.208 79.222 78.2	47
35 20.335 30.334 28.962 43.421 42.954 41.903 63.167 61.6	22
40 16.115 24.591 22.952 35.016 34.460 33.208 50.677 48.6	35
45 12.849 20.048 18.301 28.406 27.814 26.477 40.904 38.5	37
50 10.306 16.433 14.679 23.166 22.572 21.237 33.195 31.2	31
55 8.314 13.539 11.842 18.997 18.422 17.133 27.091 25.	95
60 6.746 11.209 9.607 15.657 15.113 13.900 22.224 20.4	41
65 5.503 9.328 7.837 12.967 12.459 11.339 18.323 16.6	75
70 4.513 7.798 6.428 10.794 10.325 9.300 15.184 13.6	77
75 3.721 6.544 5.300 9.021 8.592 7.668 12.635 11.2	77
80 3.084 5.518 4.393 7.575 7.185 6.356 10.566 9.3	46
85 2.569 4.674 3.659 6.387 6.033 5.294 8.873 7.7	35
90 2.151 3.972 3.063 5.407 5.087 4.432 7.481 6.5	17
95 1.809 3.388 2.577 4.598 4.309 3.728 6.337 5.4	32
100 1.529 2.902 2.178 3.922 3.661 3.151 5.384 4.6	34
105 1.299 2.494 1.849 3.359 3.124 2.676 4.594 3.9	35
110 1.108 2.150 1.578 2.887 2.675 2.283 3.934 3.3	
115 0.949 1.860 1.352 2.489 2.299 1.956 3.380 2.8	
120 0.817 1.615 1.164 2.155 1.983 1.684 2.916 2.4	
125         0.707         1.406         1.006         1.870         1.715         1.456         2.522         2.1	

Part Number	NCP□□WL154	NCP□□WM154	NCP□□WL224	NCP□□WM224	NCP□□WM474
Resistance	150kΩ	150kΩ	220kΩ	220kΩ	470kΩ
B-Constant	4485K	4500K	4485K	4500K	4500K
Temp. (°C)	Resistance (kΩ)				
-40	7318.881	7899.466	10734.358	11585.884	24751.661
-35	5140.228	5466.118	7539.001	8016.973	17127.169
-30	3648.224	3834.499	5350.729	5623.931	12014.762
-25	2615.385	2720.523	3835.898	3990.100	8524.305
-20	1893.018	1951.216	2776.427	2861.784	6113.811
-15	1382.813	1415.565	2028.126	2076.162	4435.437
-10	1019.059	1036.984	1494.620	1520.909	3249.216
<b>—</b> 5	757.379	767.079	1110.822	1125.049	2403.515
0	567.499	572.667	832.332	839.912	1794.358
5	428.575	431.264	628.577	632.521	1351.294
10	326.121	327.405	478.310	480.194	1025.870
15	249.981	250.538	366.639	367.455	785.018
20	192.979	193.166	283.036	283.310	605.252
25	150.000	150.000	220.000	220.000	470.000
30	117.370	117.281	172.143	172.012	367.480
35	92.433	92.293	135.569	135.364	289.186
40	73.252	73.090	107.436	107.198	229.014
45	58.406	58.240	85.662	85.419	182.485
50	46.846	46.665	68.708	68.441	146.215
55	37.793	37.605	55.429	55.153	117.828
60	30.661	30.453	44.970	44.665	95.420
65	25.013	24.804	36.686	36.379	77.718
70	20.516	20.293	30.090	29.763	63.584
75	16.916	16.679	24.810	24.462	52.260
80	14.019	13.776	20.562	20.205	43.166
85	11.678	11.428	17.128	16.761	35.808
90	9.776	9.520	14.338	13.962	29.828
95	8.223	7.966	12.061	11.684	24.961
100	6.951	6.688	10.194	9.809	20.955
105	5.902	5.639	8.657	8.270	17.668
110	5.035	4.772	7.385	6.998	14.951
115	4.315	4.052	6.329	5.942	12.695
120	3.714	3.454	5.448	5.067	10.824
125	3.211	2.955	4.710	4.334	9.259

<sup>\*</sup> B-Constant of NCP18WF104F type is 4200K. Please contact us for the detail data.

## Chip Type **(1)** Caution/Notice

#### ■ ① Caution (Storage and Operating Conditions)

This product is designed for application in an ordinary environment (normal room temperature, humidity and atmospheric pressure).

Do not use under the following conditions because all these factors can deteriorate the product characteristics or cause failures and burn-out.

- Corrosive gas or deoxidizing gas
   (Chlorine gas, Hydrogen sulfide gas, Ammonia gas, Sulfuric acid gas, Nitric oxide gas, etc.)
- 2. Volatile or flammable gas
- 3. Dusty conditions
- 4. Under high or low pressure
- 5. Wet or humid locations
- Places with salt water, oils, chemical liquids or organic solvents
- 7. Strong vibrations
- 8. Other places where similar hazardous conditions exist

### ■ ①Caution (Others)

Be sure to provide an appropriate fail-safe function on your product to prevent secondary damages that may be caused by the abnormal function or the failure of our product.

#### ■ Notice (Storage and Operating Conditions)

To keep solderability of product from declining, the following storage condition is recommended.

- Storage condition:
   Temperature -10 to +40 degree C
   Humidity less than 75%RH (not dewing condition)
- Storage term: Use this product within 6 months after delivery by first-in and first-out stocking system.

#### ■ Notice (Rating)

Use this product within the specified temperature range.

Higher temperature may cause deterioration of the characteristics or the material quality of this product.

#### ■ Notice (Handling)

The ceramic of this product is fragile, and care must be taken not to load a excessive press-force or not to give a shock at handling.

Such forces may cause cracking or chipping.

- Handling after unpacking:
   After unpacking, reseal product promptly or store it in a sealed container with a drying agent.
- Storage place:
   Do not store this product in corrosive gas (sulfuric acid gas, chlorine gas, etc.) or in direct sunlight.

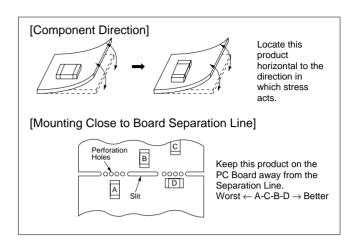


# Chip Type **(A)** Caution/Notice

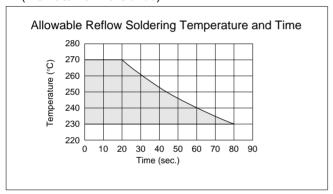
### ■ Notice (Soldering and Mounting)

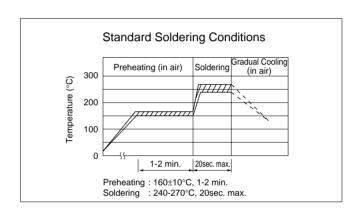
### 1. Mounting Position

Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

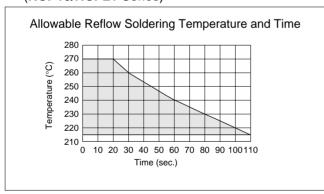


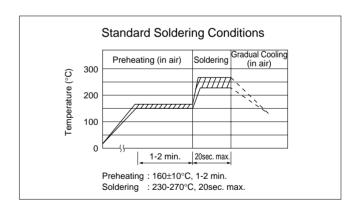
### 2. Reflow Soldering Conditions (NCP03/NCP15 Series)



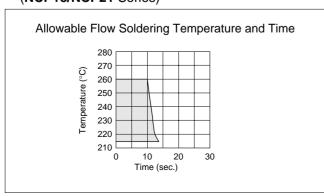


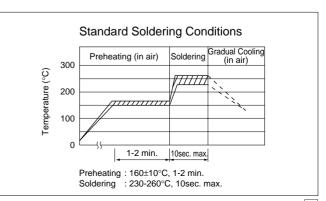
#### (NCP18/NCP21 Series)





### 3. Flow Soldering Conditions (NCP18/NCP21 Series)





Continued on the following page.

# Chip Type **(1)** Caution/Notice

Continued from the preceding page.

4. Solder and Flux

(1) Solder and Paste

(a) Reflow Soldering: NCP03/15/18/21 Series Use RA/RMA type or equivalent type of solder paste. For your reference, we are using the solder paste below for any internal tests of this product.

•RMA9086 90-4-M20 (Sn:Pb=63wt%:37wt%) (Manufactured by Alpha Metals Japan Ltd.)

•M705-221BM5-42-11 (Sn:Ag:Cu=96.5wt%:3.0wt%:0.5wt%) (Manufactured by Senju Metal Industry Co., Ltd.)

(b) Flow Soldering : NCP18/21 Series

We are using the solder paste below. For any internal tests of this product.

•Sn: Pb=63wt%:37wt%

•Sn : Ag : Cu=96.5wt% : 3.0wt% : 0.5wt%

(2) Flux

Use Rosin-based flux.

Do not use strong acidic flux (with halide content exceeding 0.2wt%)

### 5. Cleaning Conditions

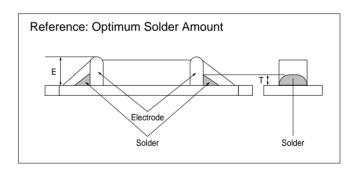
For removing the flux after soldering, observe the following points in order to avoid deterioration of the characteristics or any change of the external electrodes' quality.

	NCP03/15	NCP18/21
Solvent	Isopropyl Alcohol	Isopropyl Alcohol
	Less than 5min. at room	Less than 5min. at room
Dipping Cleaning	temp. or less than 2min.	temp. or less than 2min.
	at 40°C max.	at 40°C max.
	Less than 5min. 20W/ ℓ	Less than 1min. 20W/ $\ell$
Ultrasonic Cleaning	Frequency of 28 to	Frequency of several
	40kHz.	10kHz to 100kHz.

#### 6. Drying

After cleaning, promptly dry this product.

- 7. Printing Conditions of Solder Paste
- The amount of solder is critical. Standard height of fillet is shown in the table below.
- Too much soldering may cause mechanical stress, resulting in cracking, mechanical and/or electronic damage.



Part Number	The solder paste thickness	Т
NCP03	100μm	1/3E≦T≦E
NCP15	100μm	1/3E≦T≦E
NCP18/NCP21	150μm	0.2mm≦T≦E

- 8. Adhesive Application and Curing
- Thin or insufficient adhesive may result in loose component contact with land during flow soldering.
- Low viscosity adhesive causes chips to slip after mounting.



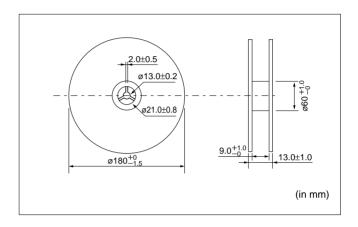
# **Chip Type Package**

■ Minimum Quantity Guide

Don't Nivershow	Quantity (pcs.)			
Part Number	Paper Tape	Plastic Tape		
NCP03	15000			
NCP15	10000	-		
NCP18	4000			
NCP21	-	4000		

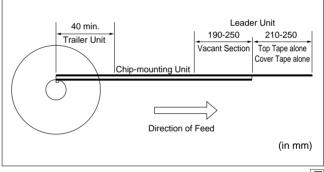
### ■ Tape Carrier Packaging

#### 1. Dimensions of Reel



### 2. Taping Method

- (1) A tape in a reel contains Leader unit and Trailer unit where products are not packed. (Please refer to the figure right.)
- (2) The top and base tapes or, plastic and cover tape are not stuck at the first five pitches minimum.
- (3) A label should be attached on the reel. (MURATA's part number, inspection number and quantity should be marked on the label.)
- (4) Taping reels are packed in a package.



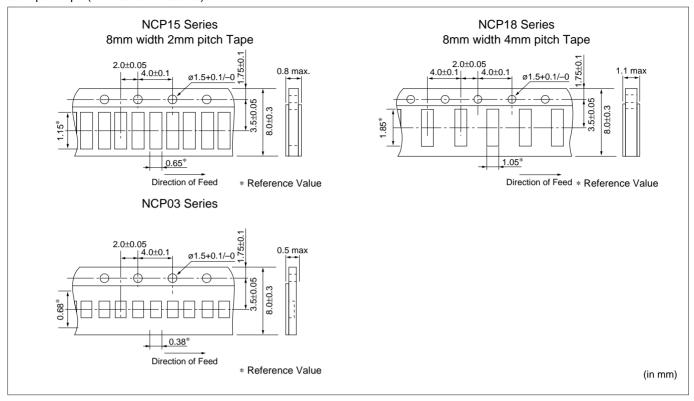
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# **Chip Type Package**

Continued from the preceding page.

#### 3. Paper Tape (NCP03/15/18 Series)



#### (1) Other Conditions

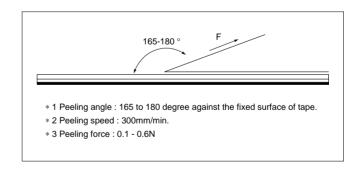
#### (a) Packaging

Products are packaged in the cavity of the base tape and sealed by top tape and bottom tape.

#### (b) Tape

Top tape and bottom tape have no joints and products are packaged and sealed in the cavity of the base tape, continuously.

#### (2) Peeling force of top tape



#### (3) Pull Strength

Pull strength of top tape is specified at 10N minimum. Pull strength of bottom tape are specified 5N minimum.

Continued on the following page.

