

NTC Thermistors



● Part Numbering

NTC Thermistors for Temp. Sensor and Compensation Chip Type

(Part Number)

NC	P	18	XH	103	J	03	RB
①	②	③	④	⑤	⑥	⑦	⑧

① Product ID

Product ID	
NC	NTC Thermistors Chip Type

② Series

Code	Series
P	Plated Termination Series

③ Dimensions (L×W)

Code	Dimensions (L×W)	EIA
03	0.60×0.30mm	0201
15	1.00×0.50mm	0402
18	1.60×0.80mm	0603
21	2.00×1.25mm	0805

④ Temperature Characteristics

Code	Temperature Characteristics
XC	Nominal B-Constant 3100—3149K
XF	Nominal B-Constant 3250—3299K
XH	Nominal B-Constant 3350—3399K
XM	Nominal B-Constant 3500—3549K
XQ	Nominal B-Constant 3650—3699K
XV	Nominal B-Constant 3900—3949K
XW	Nominal B-Constant 3950—3999K
WB	Nominal B-Constant 4050—4099K
WD	Nominal B-Constant 4150—4199K
WF	Nominal B-Constant 4250—4299K
WL	Nominal B-Constant 4450—4499K
WM	Nominal B-Constant 4500—4549K

⑤ Resistance

Expressed by three-digit alphanumerics. The unit is ohm (Ω).
The first and second figures are significant digits, and the third figure expresses the number of zeros which follow the two figures.

Ex.

Code	Resistance
102	1k Ω
103	10k Ω
104	100k Ω

⑥ Resistance Tolerance

Code	Resistance Tolerance
D	±0.5%
F	±1%
E	±3%
J	±5%

⑦ Individual Specifications

Structures and others are expressed by two figures.

Ex.

Code	Individual Specifications
03	Standard Type

⑧ Packaging

Code	Packaging
RA	Plastic Taping 4mm Pitch (4000 pcs.)
RB	Paper Taping 4mm Pitch (4000 pcs.)
RC	Paper Taping 2mm Pitch (10000 pcs.)
RL	Paper Taping 2mm Pitch (15000 pcs.)

NTC Thermistors



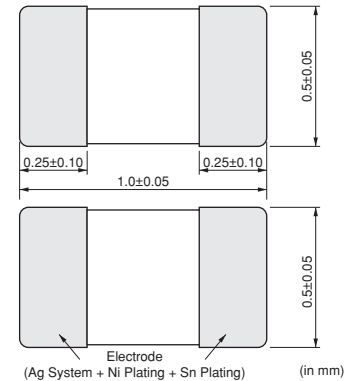
Temperature Sensor and Compensation 0402 (1005) Size

2

Chip NTC Thermistor have Ni barrier termination and provide excellent solderability and offer high stability in environment by unique inner construction.

■ Features

1. 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. Same B-constant in the same resistance in the three sizes (0805 size / 0603 size / 0402 size)
Easy to use smaller size in the circuits
6. NCP series are recognized by UL/cUL.
(UL1434, File No.E137188)



■ Applications

1. Temperature compensation for transistor, IC and crystal oscillator in mobile communications
2. Temperature sensor for rechargeable batteries
3. Temperature compensation of LCD
4. Temperature compensation in general use of electric circuits

Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	B-Constant (25-80°C) (Reference Value) (K)	B-Constant (25-85°C) (Reference Value) (K)	B-Constant (25-100°C) (Reference Value) (K)	Permissible Operating Current (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Dissipation Constant (25°C) (mW/°C)
NCP15XC220□03RC	22	3100 ±3%	3126	3128	3136	6.70	100	1
NCP15XC330□03RC	33	3100 ±3%	3126	3128	3136	5.50	100	1
NCP15XC470□03RC	47	3100 ±3%	3126	3128	3136	4.60	100	1
NCP15XC680□03RC	68	3100 ±3%	3126	3128	3136	3.80	100	1
NCP15XF101□03RC	100	3250 ±3%	3282	3284	3296	3.10	100	1
NCP15XF151□03RC	150	3250 ±3%	3282	3284	3296	2.50	100	1
NCP15XM221□03RC	220	3500 ±3%	3539	3545	3560	2.10	100	1
NCP15XM331□03RC	330	3500 ±3%	3539	3545	3560	1.70	100	1
NCP15XQ471□03RC	470	3650 ±2%	3688	3693	3706	1.40	100	1
NCP15XQ681□03RC	680	3650 ±3%	3688	3693	3706	1.20	100	1
NCP15XQ102□03RC	1.0k	3650 ±2%	3688	3693	3706	1.00	100	1
NCP15XW152□03RC	1.5k	3950 ±3%	3982	3987	3998	0.81	100	1
NCP15XW222□03RC	2.2k	3950 ±3%	3982	3987	3998	0.67	100	1
NCP15XW332□03RC	3.3k	3950 ±3%	3982	3987	3998	0.55	100	1
NCP15XM472□03RC	4.7k	3500 ±2%	3539	3545	3560	0.46	100	1
NCP15XW472□03RC	4.7k	3950 ±3%	3982	3987	3998	0.46	100	1
NCP15XW682□03RC	6.8k	3950 ±3%	3982	3987	3998	0.38	100	1
NCP15XH103D03RC	10k ±0.5%	3380 ±0.7%	3428	3434	3455	0.31	100	1
NCP15XH103F03RC	10k ±1%	3380 ±1%	3428	3434	3455	0.31	100	1
NCP15XH103□03RC	10k	3380 ±1%	3428	3434	3455	0.31	100	1
NCP15XV103□03RC	10k	3900 ±3%	3930	3934	3944	0.31	100	1
NCP15XW153□03RC	15k	3950 ±3%	3982	3987	3998	0.25	100	1
NCP15XW223□03RC	22k	3950 ±3%	3982	3987	3998	0.21	100	1
NCP15WL223□03RC	22k	4485 ±1%	4537	4543	4557	0.21	100	1
NCP15WB333□03RC	33k	4050 ±3%	4101	4108	4131	0.17	100	1
NCP15WL333□03RC	33k	4485 ±1%	4537	4543	4557	0.17	100	1

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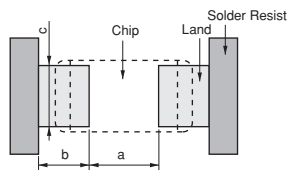
Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	B-Constant (25-80°C) (Reference Value) (K)	B-Constant (25-85°C) (Reference Value) (K)	B-Constant (25-100°C) (Reference Value) (K)	Permissive Operating Current (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Dissipation Constant (25°C) (mW/°C)
NCP15WB473D03RC	47k ±0.5%	4050 ±0.5%	4101	4108	4131	0.14	100	1
NCP15WB473F03RC	47k ±1%	4050 ±1%	4101	4108	4131	0.14	100	1
NCP15WB473□03RC	47k	4050 ±1%	4101	4108	4131	0.14	100	1
NCP15WL473□03RC	47k	4485 ±1%	4537	4543	4557	0.14	100	1
NCP15WD683□03RC	68k	4150 ±3%	4201	4209	4232	0.12	100	1
NCP15WL683□03RC	68k	4485 ±1%	4537	4543	4557	0.12	100	1
NCP15WF104D03RC	100k ±0.5%	4250 ±0.5%	4303	4311	4334	0.10	100	1
NCP15WF104F03RC	100k ±1%	4250 ±1%	4303	4311	4334	0.10	100	1
NCP15WF104□03RC	100k	4250 ±1%	4303	4311	4334	0.10	100	1
NCP15WL104□03RC	100k	4485 ±1%	4537	4543	4557	0.10	100	1
NCP15WL154□03RC	150k	4485 ±1%	4537	4543	4557	0.08	100	1
NCP15WM154□03RC	150k	4500 ±3%	4571	4582	4614	0.08	100	1
NCP15WM224□03RC	220k	4500 ±3%	4571	4582	4614	0.06	100	1
NCP15WM474□03RC	470k	4500 ±3%	4571	4582	4614	0.04	100	1

□ is filled with resistance tolerance codes (E: ±3%, J: ±5%).

Rated Electric Power shows the required electric power that causes Thermistor's temperature to rise to 125°C by self heating, at ambient temperature of 25 °C.

Operating Temperature Range: -40°C to +125°C

Temperature Sensor and Compensation Chip Type Standard Land Pattern Dimensions



Part Number	Soldering Methods	Dimensions (mm)			
		Chip (LxW)	a	b	c
NCP03	Reflow Soldering	0.6x0.3	0.25	0.3	0.3
NCP15	Reflow Soldering	1.0x0.5	0.4	0.4-0.5	0.5
NCP18	Flow Soldering	1.6x0.8	0.6-1.0	0.8-0.9	0.6-0.8
	Reflow Soldering		0.6-0.8	0.6-0.7	0.6-0.8
NCP21	Flow Soldering	2.0x1.25	1.0-1.1	0.9-1.0	1.0-1.2
	Reflow Soldering		1.0-1.1	0.6-0.7	1.0-1.2


Temperature Sensor and Compensation Chip Type Temperature Characteristics (Center Value)

Part Number	NCP□□XC220	NCP□□XC330	NCP□□XC470	NCP□□XC680	NCP□□XF101	NCP□□XF151	NCP□□XM221	NCP□□XM331
Resistance	22Ω	33Ω	47Ω	68Ω	100Ω	150Ω	220Ω	330Ω
B-Constant	3100K	3100K	3100K	3100K	3250K	3250K	3500K	3500K
Temp. (°C)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)	Resistance (Ω)
-40	355.823	533.734	760.166	1099.815	1824.175	2736.262	4947.904	7421.856
-35	273.975	410.962	585.310	846.832	1390.685	2086.028	3703.755	5555.632
-30	213.003	319.504	455.051	658.372	1070.653	1605.979	2798.873	4198.309
-25	166.943	250.415	356.652	516.007	831.138	1246.708	2135.887	3203.831
-20	131.997	197.996	281.994	407.991	650.960	976.440	1645.037	2467.555
-15	105.318	157.978	224.998	325.529	514.441	771.661	1278.034	1917.051
-10	84.670	127.005	180.886	261.707	409.700	614.550	1000.620	1500.930
-5	68.628	102.942	146.614	212.123	328.877	493.315	789.612	1184.418
0	55.981	83.972	119.596	173.033	265.759	398.639	627.752	941.628
5	45.859	68.789	97.972	141.747	215.785	323.677	502.474	753.711
10	37.819	56.728	80.794	116.894	176.395	264.592	405.010	607.514
15	31.396	47.094	67.073	97.042	145.161	217.742	328.480	492.720
20	26.211	39.317	55.997	81.016	120.152	180.228	268.044	402.066
25	22.000	33.000	47.000	68.000	100.000	150.000	220.000	330.000
30	18.560	27.840	39.651	57.368	83.669	125.503	181.576	272.365
35	15.735	23.603	33.616	48.636	70.361	105.541	150.668	226.002
40	13.403	20.104	28.633	41.426	59.456	89.184	125.681	188.521
45	11.462	17.193	24.487	35.428	50.470	75.705	105.336	158.004
50	9.842	14.763	21.026	30.421	43.029	64.543	88.717	133.076
55	8.488	12.732	18.133	26.235	36.830	55.246	75.059	112.588
60	7.348	11.022	15.698	22.712	31.649	47.473	63.777	95.666
65	6.399	9.598	13.670	19.778	27.364	41.045	54.415	81.622
70	5.595	8.392	11.952	17.293	23.756	35.634	46.631	69.946
75	4.896	7.345	10.461	15.134	20.651	30.976	40.115	60.172
80	4.299	6.448	9.184	13.288	18.011	27.016	34.637	51.955
85	3.795	5.692	8.107	11.729	15.800	23.700	30.013	45.019
90	3.360	5.040	7.179	10.386	13.908	20.862	26.110	39.165
95	2.983	4.474	6.373	9.220	12.263	18.394	22.790	34.186
100	2.656	3.983	5.673	8.208	10.844	16.265	19.957	29.935
105	2.367	3.551	5.057	7.317	9.622	14.434	17.541	26.312
110	2.116	3.173	4.520	6.539	8.563	12.844	15.453	23.180
115	1.901	2.851	4.060	5.874	7.648	11.472	13.663	20.494
120	1.712	2.568	3.657	5.291	6.850	10.275	12.114	18.171
125	1.543	2.314	3.296	4.768	6.162	9.243	10.778	16.168

Part Number	NCP□□XQ471	NCP□□XQ681	NCP□□XM102	NCP□□XQ102	NCP□□XM152	NCP□□XW152	NCP□□XM222	NCP□□XW222
Resistance	470Ω	680Ω	1.0kΩ	1.0kΩ	1.5kΩ	1.5kΩ	2.2kΩ	2.2kΩ
B-Constant	3650K	3650K	3500K	3650K	3500K	3950K	3500K	3950K
Temp. (°C)	Resistance (Ω)	Resistance (Ω)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
-40	11822.473	17104.854	21.266	25.154	31.899	51.791	46.786	75.961
-35	8767.745	12685.248	16.150	18.655	24.225	37.172	35.530	54.520
-30	6570.224	9505.855	12.347	13.979	18.520	27.005	27.162	39.607
-25	4971.784	7193.219	9.503	10.578	14.255	19.843	20.907	29.103
-20	3796.933	5493.436	7.365	8.079	11.047	14.728	16.203	21.601
-15	2923.400	4229.599	5.747	6.220	8.621	11.044	12.644	16.198
-10	2269.599	3283.675	4.516	4.829	6.773	8.362	9.934	12.264
-5	1775.225	2568.411	3.572	3.777	5.358	6.389	7.858	9.370
0	1399.050	2024.158	2.844	2.977	4.266	4.922	6.257	7.219
5	1110.220	1606.275	2.280	2.362	3.419	3.825	5.015	5.609
10	887.257	1283.691	1.839	1.888	2.758	2.994	4.045	4.391
15	713.463	1032.245	1.492	1.518	2.238	2.361	3.283	3.463
20	577.375	835.351	1.218	1.229	1.827	1.876	2.680	2.751
25	470.000	680.000	1.000	1.000	1.500	1.500	2.200	2.200
30	384.800	556.733	0.825	0.819	1.238	1.207	1.816	1.771
35	316.757	458.287	0.685	0.674	1.027	0.978	1.507	1.434
40	262.177	379.320	0.571	0.558	0.857	0.797	1.257	1.169
45	218.069	315.504	0.479	0.464	0.718	0.653	1.053	0.958
50	182.297	263.749	0.403	0.388	0.605	0.538	0.887	0.789
55	153.150	221.579	0.341	0.326	0.512	0.446	0.751	0.654
60	129.249	186.998	0.290	0.275	0.435	0.371	0.638	0.545
65	109.551	158.499	0.247	0.233	0.371	0.311	0.544	0.456
70	93.281	134.960	0.212	0.199	0.318	0.261	0.466	0.383
75	79.750	115.383	0.182	0.170	0.274	0.221	0.401	0.324
80	68.446	99.029	0.157	0.146	0.236	0.187	0.346	0.275
85	58.996	85.356	0.136	0.126	0.205	0.160	0.300	0.234
90	51.036	73.839	0.119	0.109	0.178	0.137	0.261	0.200
95	44.332	64.140	0.104	0.094	0.155	0.117	0.228	0.172
100	38.640	55.905	0.091	0.082	0.136	0.101	0.200	0.149
105	33.790	48.888	0.080	0.072	0.120	0.088	0.175	0.129
110	29.664	42.918	0.070	0.063	0.105	0.076	0.155	0.112
115	26.123	37.795	0.062	0.056	0.093	0.067	0.137	0.098
120	23.091	33.409	0.055	0.049	0.083	0.058	0.121	0.085
125	20.472	29.618	0.049	0.044	0.074	0.051	0.108	0.075

Detailed Resistance - Temperature Tables are downloadable from the following URL.

<http://search.murata.co.jp/Ceramy/CatsearchAction.do?sLang=en>

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Temperature Sensor and Compensation Chip Type Temperature Characteristics (Center Value)

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Part Number	NCP□□XM332	NCP□□XW332	NCP□□XM472	NCP□□XW472	NCP□□XH682	NCP□□XW682	NCP□□XH103D	NCP□□XH103
Resistance	3.3kΩ	3.3kΩ	4.7kΩ	4.7kΩ	6.8kΩ	6.8kΩ	10kΩ±0.5%	10kΩ
B-Constant	3500K	3950K	3500K	3950K	3380K	3950K	3380K	3380K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
-40	70.179	113.941	105.705	162.279	133.043	234.787	197.390	195.652
-35	53.295	81.779	79.126	116.474	100.756	168.515	149.390	148.171
-30	40.743	59.411	59.794	84.615	77.076	122.422	114.340	113.347
-25	31.360	43.654	45.630	62.173	59.540	89.953	88.381	87.559
-20	24.304	32.401	35.144	46.147	46.401	66.766	68.915	68.237
-15	18.966	24.297	27.303	34.604	36.482	50.066	54.166	53.650
-10	14.901	18.396	21.377	26.200	28.904	37.906	42.889	42.506
-5	11.787	14.055	16.869	20.018	23.047	28.963	34.196	33.892
0	9.386	10.829	13.411	15.423	18.509	22.313	27.445	27.219
5	7.523	8.414	10.735	11.984	14.974	17.338	22.165	22.021
10	6.067	6.586	8.653	9.380	12.189	13.571	18.010	17.926
15	4.924	5.195	7.018	7.399	9.978	10.705	14.720	14.674
20	4.019	4.126	5.726	5.877	8.215	8.503	12.099	12.081
25	3.300	3.300	4.700	4.700	6.800	6.800	10.000	10.000
30	2.724	2.656	3.879	3.783	5.654	5.474	8.309	8.315
35	2.260	2.152	3.219	3.064	4.725	4.434	6.939	6.948
40	1.885	1.753	2.685	2.497	3.967	3.613	5.824	5.834
45	1.580	1.437	2.250	2.046	3.344	2.961	4.911	4.917
50	1.331	1.184	1.895	1.686	2.829	2.440	4.160	4.161
55	1.126	0.981	1.604	1.397	2.404	2.022	3.539	3.535
60	0.957	0.817	1.363	1.164	2.050	1.683	3.024	3.014
65	0.816	0.684	1.163	0.974	1.759	1.409	2.593	2.586
70	0.700	0.575	0.996	0.819	1.515	1.185	2.233	2.228
75	0.602	0.486	0.857	0.692	1.309	1.001	1.929	1.925
80	0.520	0.412	0.740	0.587	1.135	0.849	1.673	1.669
85	0.450	0.351	0.641	0.500	0.988	0.724	1.455	1.452
90	0.392	0.301	0.558	0.428	0.862	0.620	1.270	1.268
95	0.342	0.258	0.487	0.368	0.755	0.532	1.112	1.110
100	0.299	0.223	0.426	0.318	0.662	0.459	0.976	0.974
105	0.263	0.193	0.375	0.275	0.583	0.398	0.860	0.858
110	0.232	0.168	0.330	0.239	0.515	0.346	0.759	0.758
115	0.205	0.146	0.292	0.208	0.457	0.302	0.673	0.672
120	0.182	0.128	0.259	0.182	0.406	0.264	0.598	0.596
125	0.162	0.113	0.230	0.160	0.361	0.232	0.532	0.531

Part Number	NCP□□XV103	NCP□□XH153	NCP□□XW153	NCP□□XH223	NCP□□XW223	NCP□□WL223	NCP□□WB333	NCP□□WF333
Resistance	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)	Resistance (kΩ)
-40	328.996	293.478	517.912	430.434	759.605	1073.436	1227.263	1451.049
-35	237.387	222.256	371.724	325.976	545.196	753.900	874.449	1019.238
-30	173.185	170.021	270.048	249.364	396.070	535.073	630.851	725.084
-25	127.773	131.338	198.426	192.629	291.025	383.590	460.457	522.021
-20	95.327	102.355	147.278	150.121	216.008	277.643	339.797	379.842
-15	71.746	80.474	110.439	118.029	161.977	202.813	253.363	279.371
-10	54.564	63.759	83.617	93.514	122.638	149.462	190.766	207.566
-5	41.813	50.838	63.888	74.563	93.702	111.082	144.964	155.639
0	32.330	40.828	49.221	59.881	72.191	83.233	111.087	117.814
5	25.194	33.032	38.245	48.446	56.093	62.858	85.842	89.925
10	19.785	26.888	29.936	39.436	43.907	47.831	66.861	69.204
15	15.651	22.010	23.613	32.282	34.633	36.664	52.470	53.675
20	12.468	18.121	18.756	26.577	27.509	28.304	41.471	41.937
25	10.000	15.000	15.000	22.000	22.000	22.000	33.000	33.000
30	8.072	12.472	12.074	18.292	17.709	17.214	26.430	26.143
35	6.556	10.422	9.780	15.285	14.344	13.557	21.298	20.845
40	5.356	8.751	7.969	12.834	11.688	10.744	17.266	16.723
45	4.401	7.375	6.531	10.817	9.578	8.566	14.076	13.498
50	3.635	6.241	5.382	9.154	7.894	6.871	11.538	10.954
55	3.019	5.302	4.459	7.777	6.540	5.544	9.506	8.940
60	2.521	4.521	3.713	6.631	5.446	4.498	7.870	7.334
65	2.115	3.879	3.108	5.690	4.559	3.669	6.549	6.046
70	1.781	3.341	2.613	4.901	3.832	3.009	5.475	5.011
75	1.509	2.887	2.208	4.234	3.239	2.479	4.595	4.170
80	1.284	2.503	1.873	3.671	2.748	2.052	3.874	3.487
85	1.097	2.178	1.597	3.195	2.342	1.707	3.282	2.928
90	0.941	1.902	1.367	2.790	2.004	1.426	2.789	2.469
95	0.810	1.664	1.174	2.441	1.722	1.196	2.379	2.091
100	0.701	1.461	1.013	2.142	1.486	1.008	2.038	1.777
105	0.608	1.287	0.878	1.888	1.287	0.852	1.751	1.516
110	0.530	1.137	0.763	1.668	1.119	0.724	1.509	1.298
115	0.463	1.007	0.665	1.477	0.975	0.617	1.306	1.116
120	0.406	0.895	0.582	1.312	0.854	0.528	1.134	0.962
125	0.358	0.797	0.511	1.169	0.750	0.454	0.987	0.832

Detailed Resistance - Temperature Tables are downloadable from the following URL.

<http://search.murata.co.jp/Ceramy/CatsearchAction.do?sLang=en>

Continued on the following page. 

Temperature Sensor and Compensation Chip Type Temperature Characteristics (Center Value)

Continued from the preceding page.

Part Number	NCP□□WL333	NCP15WB473D	NCP18WB473D	NCP□□WB473	NCP□□WL473	NCP□□WD683	NCP□□WF683	NCP□□WL683
Resistance	33kΩ	47kΩ	47kΩ	47kΩ	47kΩ	68kΩ	68kΩ	68kΩ
B-Constant	4485K	4050K	4030K	4050K	4485K	4150K	4250K	4485K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
-40	1610.154	1690.586	1743.085	1747.920	2293.249	2735.359	2990.041	3317.893
-35	1130.850	1215.318	1241.814	1245.428	1610.605	1937.391	2100.247	2330.237
-30	802.609	882.908	896.201	898.485	1143.110	1389.345	1494.113	1653.862
-25	575.385	647.911	654.460	655.802	819.487	1008.014	1075.679	1185.641
-20	416.464	480.069	483.172	483.954	593.146	738.978	782.705	858.168
-15	304.219	359.009	360.367	360.850	433.281	547.456	575.674	626.875
-10	224.193	270.868	271.363	271.697	319.305	409.600	427.712	461.974
-5	166.623	206.113	206.204	206.463	237.312	309.217	320.710	343.345
0	124.850	158.126	158.051	158.214	177.816	235.606	242.768	257.266
5	94.287	122.267	122.145	122.259	134.287	180.980	185.300	194.287
10	71.747	95.256	95.145	95.227	102.184	140.139	142.603	147.841
15	54.996	74.754	74.676	74.730	78.327	109.344	110.602	113.325
20	42.455	59.075	59.038	59.065	60.467	85.929	86.415	87.484
25	33.000	47.000	47.000	47.000	47.000	68.000	68.000	68.000
30	25.822	37.636	37.667	37.643	36.776	54.167	53.871	53.208
35	20.335	30.326	30.381	30.334	28.962	43.421	42.954	41.903
40	16.115	24.583	24.654	24.591	22.952	35.016	34.460	33.208
45	12.849	20.043	20.124	20.048	18.301	28.406	27.814	26.477
50	10.306	16.433	16.518	16.433	14.679	23.166	22.572	21.237
55	8.317	13.545	13.631	13.539	11.845	18.997	18.422	17.137
60	6.748	11.223	11.306	11.209	9.610	15.657	15.113	13.904
65	5.504	9.345	9.424	9.328	7.839	12.967	12.459	11.342
70	4.513	7.818	7.892	7.798	6.427	10.794	10.325	9.299
75	3.718	6.571	6.639	6.544	5.296	9.021	8.592	7.662
80	3.078	5.548	5.609	5.518	4.384	7.575	7.185	6.343
85	2.560	4.704	4.759	4.674	3.646	6.387	6.033	5.276
90	2.139	4.004	4.054	3.972	3.046	5.407	5.087	4.407
95	1.794	3.422	3.468	3.388	2.555	4.598	4.309	3.697
100	1.511	2.936	2.977	2.902	2.152	3.922	3.661	3.114
105	1.278	2.528	2.566	2.494	1.820	3.359	3.124	2.634
110	1.085	2.184	2.220	2.150	1.546	2.887	2.675	2.236
115	0.925	1.893	1.927	1.860	1.318	2.489	2.299	1.907
120	0.792	1.646	1.679	1.615	1.128	2.155	1.983	1.632
125	0.681	1.436	1.468	1.406	0.970	1.870	1.715	1.403

Part Number	NCP15WF104D	NCP18WF104D/F	NCP□□WF104	NCP□□WL104	NCP□□WL154	NCP□□WM154	NCP□□WL224	NCP□□WM224
Resistance	100kΩ±0.5%	100kΩ±1%	100kΩ	100kΩ	150kΩ	150kΩ	220kΩ	220kΩ
B-Constant	4250K	4200K	4250K	4485K	4485K	4500K	4485K	4500K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
-40	4221.283	4205.686	4397.119	4879.254	7318.881	7899.466	10734.358	11585.884
-35	2995.044	2966.436	3088.599	3426.818	5140.228	5466.118	7539.001	8016.973
-30	2146.996	2118.789	2197.225	2432.149	3648.224	3834.499	5350.729	5623.931
-25	1554.599	1531.319	1581.881	1743.590	2615.385	2720.523	3835.898	3990.100
-20	1136.690	1118.422	1151.037	1262.012	1893.018	1951.216	2776.427	2861.784
-15	839.019	825.570	846.579	921.875	1382.813	1415.565	2028.126	2076.162
-10	624.987	615.526	628.988	679.373	1019.059	1036.984	1494.620	1520.909
-5	469.678	463.104	471.632	504.919	757.379	767.079	1110.822	1125.049
0	355.975	351.706	357.012	378.333	567.499	572.667	832.332	839.912
5	272.011	269.305	272.500	285.717	428.575	431.264	628.577	632.521
10	209.489	207.891	209.710	217.414	326.121	327.405	478.310	480.194
15	162.559	161.722	162.651	166.654	249.981	250.538	366.639	367.455
20	127.057	126.723	127.080	128.653	192.979	193.166	283.036	283.310
25	100.000	100.000	100.000	100.000	150.000	150.000	220.000	220.000
30	79.222	79.439	79.222	78.247	117.370	117.281	172.143	172.012
35	63.167	63.509	63.167	61.622	92.433	92.293	135.569	135.364
40	50.677	51.084	50.677	48.835	73.252	73.090	107.436	107.198
45	40.904	41.336	40.904	38.937	58.406	58.240	85.662	85.419
50	33.195	33.628	33.195	31.231	46.846	46.665	68.708	68.441
55	27.091	27.510	27.091	25.202	37.803	37.605	55.444	55.153
60	22.224	22.621	22.224	20.448	30.671	30.453	44.984	44.665
65	18.323	18.692	18.323	16.679	25.018	24.804	36.694	36.379
70	15.184	15.525	15.184	13.675	20.513	20.293	30.085	29.763
75	12.635	12.947	12.635	11.268	16.902	16.679	24.789	24.462
80	10.566	10.849	10.566	9.329	13.993	13.776	20.523	20.205
85	8.873	9.129	8.873	7.758	11.638	11.428	17.068	16.761
90	7.481	7.713	7.481	6.481	9.721	9.520	14.258	13.962
95	6.337	6.546	6.337	5.437	8.155	7.966	11.961	11.684
100	5.384	5.572	5.384	4.580	6.869	6.688	10.075	9.809
105	4.594	4.764	4.594	3.873	5.870	5.639	8.521	8.270
110	3.934	4.087	3.934	3.289	4.933	4.772	7.236	6.998
115	3.380	3.518	3.380	2.804	4.206	4.052	6.169	5.942
120	2.916	3.040	2.916	2.400	3.601	3.454	5.281	5.067
125	2.522	2.634	2.522	2.064	3.096	2.955	4.540	4.334

Detailed Resistance - Temperature Tables are downloadable from the following URL.

<http://search.murata.co.jp/Ceramy/CatsearchAction.do?sLang=en>

Continued on the following page. ➤

Temperature Sensor and Compensation Chip Type Temperature Characteristics (Center Value)

Continued from the preceding page.

Part Number	NCP□□WM474
Resistance	470kΩ
B-Constant	4500K
Temp. (°C)	Resistance (kΩ)
-40	24751.661
-35	17127.169
-30	12014.762
-25	8524.305
-20	6113.811
-15	4435.437
-10	3249.216
-5	2403.515
0	1794.358
5	1351.294
10	1025.870
15	785.018
20	605.252
25	470.000
30	367.480
35	289.186
40	229.014
45	182.485
50	146.215
55	117.828
60	95.420
65	77.718
70	63.584
75	52.260
80	43.166
85	35.808
90	29.828
95	24.961
100	20.955
105	17.668
110	14.951
115	12.695
120	10.824
125	9.259

Detailed Resistance - Temperature Tables are downloadable from the following URL.
<http://search.murata.co.jp/Ceramy/CatsearchAction.do?sLang=en>

Temperature Sensor and Compensation Chip Type ⚠Caution/Notice

■ ⚠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 of these factors can deteriorate the product characteristics or cause failures and burn-out.

1. 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 vacuum, or under high or low pressure
5. Wet or humid locations
6. Places with salt water, oils, chemical liquids or organic solvents
7. Strong vibrations
8. Other places where similar hazardous conditions exist

■ ⚠Caution (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 conditions are recommended.

1. Storage condition:
Temperature -10 to +40 degrees C
Humidity less than 75%RH (not dewing condition)
2. Storage term:
Use this product within 6 months after delivery by first-in and first-out stocking system.
3. Storage place:
Do not store this product in corrosive gas (Sulfuric acid gas, Chlorine gas, etc.) or in direct sunlight.

■ 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 an excessive press - force or to give a shock at handling.

Such forces may cause cracking or chipping.

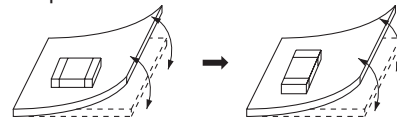
Temperature Sensor and Compensation Chip Type ⚠Caution/Notice

■ Notice (Soldering and Mounting)

1. Mounting Position

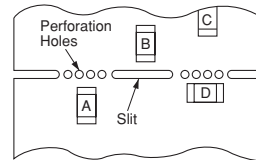
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

Component Direction



Locate this product horizontal to the direction in which stress acts.

Mounting Close to Board Separation Line



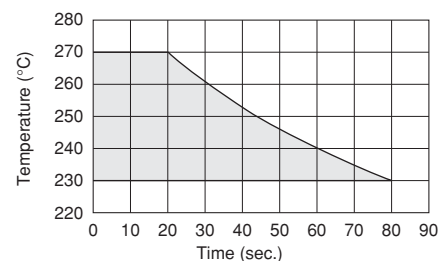
Keep this product on the PC Board away from the Separation Line.
Worst ← A-C-B-D → Better

2. Allowable Soldering Temperature and Time

- Solder within the temperature and time combinations indicated by the slanted lines in the following graphs.
- Excessive soldering conditions may cause dissolution of metallization or deterioration of solder-wetting on the external electrode.
- In case of repeated soldering, the accumulated soldering time should be within the range shown in the figure below. (For example, Reflow peak temperature: 260°C, twice -> The total accumulated soldering time at 260°C is within 30 seconds.)

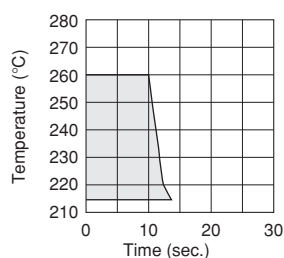
NCP03/15 Series

Allowable Reflow Soldering Temp. and Time

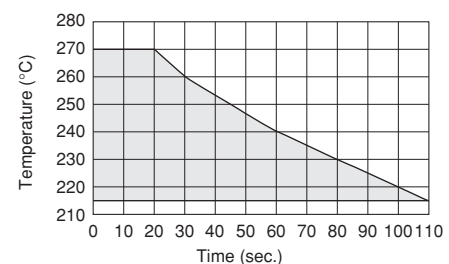


NCP18/21 Series

Allowable Flow Soldering Temp. and Time



Allowable Reflow Soldering Temp. and Time



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Temperature Sensor and Compensation Chip Type ⚠Caution/Notice

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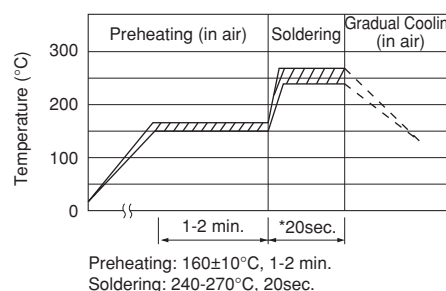
3. Recommended Temperature Profile for Soldering

- (a) Insufficient preheating may cause a crack on ceramic body. The difference between preheating temperature and maximum temperature in the profile shall be 100 °C.
- (b) Rapid cooling by dipping in solvent or by other means is not recommended.

* In case of repeated soldering, the accumulated soldering time should be within the range shown in the figure 2 above.

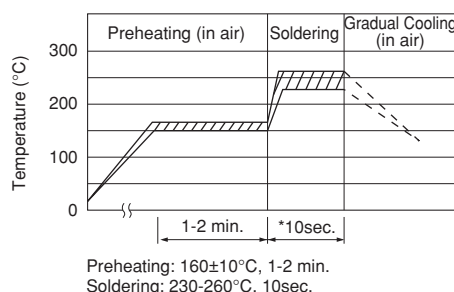
NCP03/15 Series

Reflow Soldering Conditions

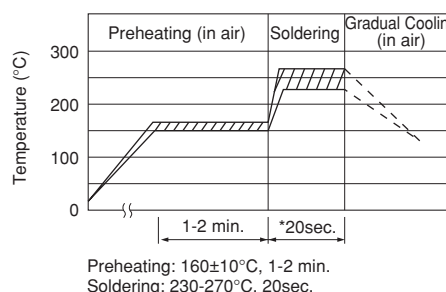


NCP18/21 Series

Flow Soldering Conditions



Reflow Soldering Conditions



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 type flux in soldering process.

If the flux listed below is used, some problems might be caused in the product characteristics and reliability.

Please do not use the following flux.

- Strong acidic flux (with halide content exceeding 0.1wt%).
- Water-soluble flux
(*Water-soluble flux can be defined as non rosin type flux including wash-type flux and non-wash-type flux.)

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.

- Please keep mounted parts and a substrate from an occurrence of resonance in ultrasonic cleaning.
- Please do not clean the products in the case of using a non-washed type flux.

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

6. Drying

After cleaning, promptly dry this product.

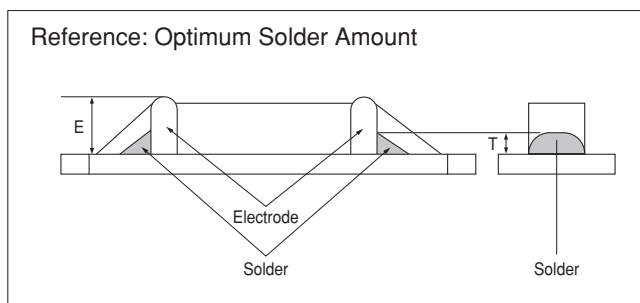
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Temperature Sensor and Compensation Chip Type ⚠Caution/Notice

☐ Continued from the preceding page.

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	T
NCP03	100μm	$1/3E \leq T \leq E$
NCP15	150μm	$1/3E \leq T \leq E$
NCP18/NCP21	200μm	$0.2\text{mm} \leq T \leq E$

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.

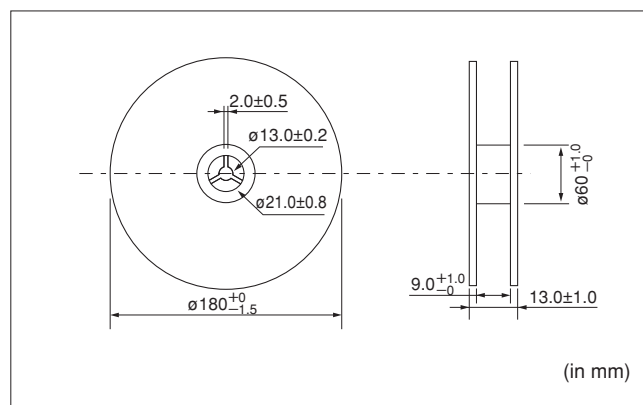
Temperature Sensor and Compensation Chip Type Package

■ Minimum Quantity Guide

Part Number	Quantity (pcs.)	
	Paper Tape	Embossed Tape
NCP03	15,000	-
NCP15	10,000	
NCP18	4,000	
NCP21	-	4,000

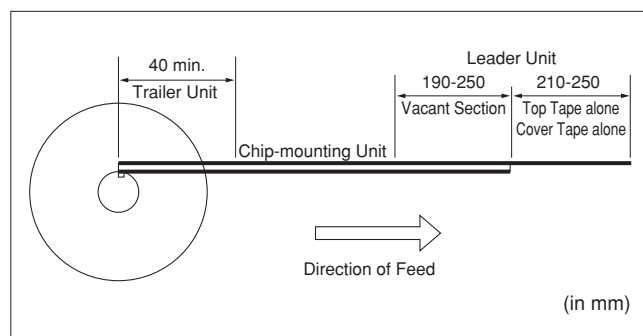
■ Tape Carrier Packaging

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 at the 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.

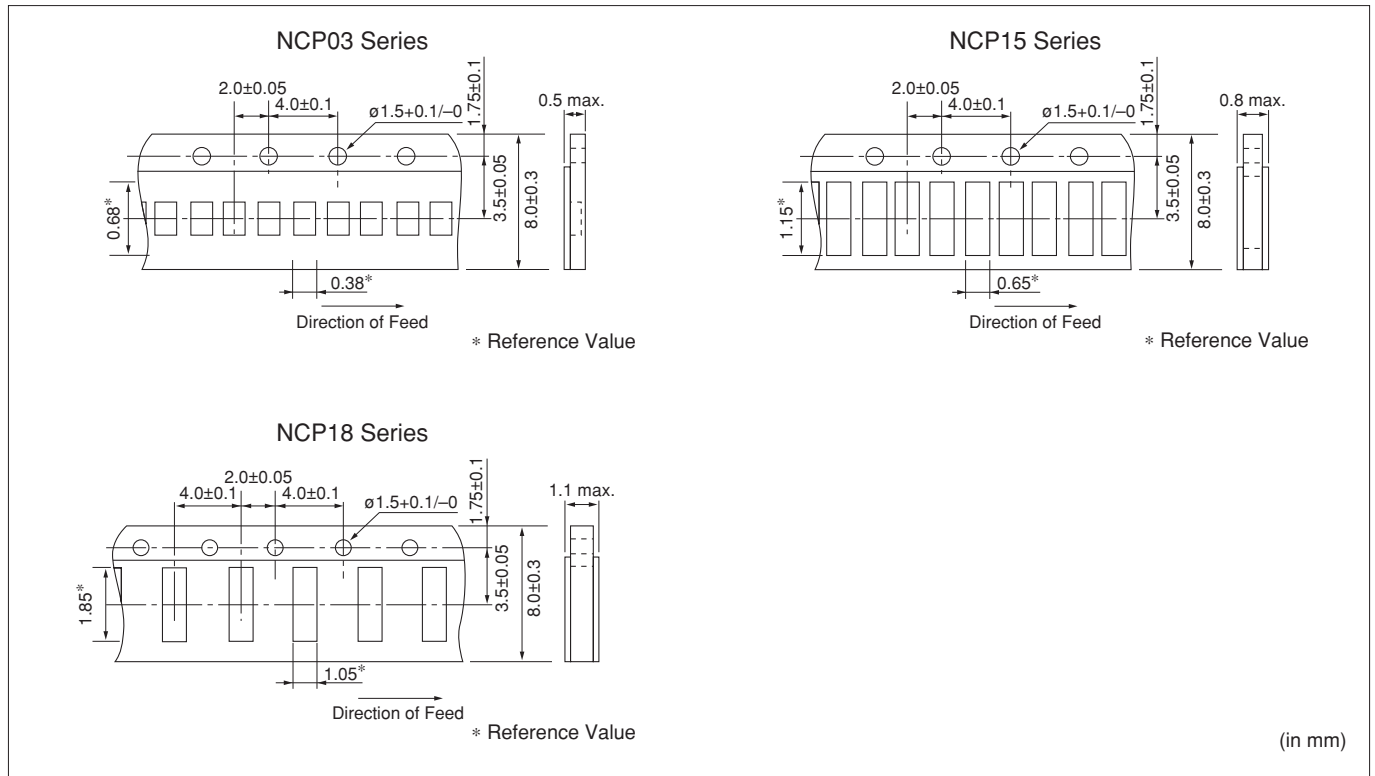


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Temperature Sensor and Compensation Chip Type Package

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



(1) Other Conditions

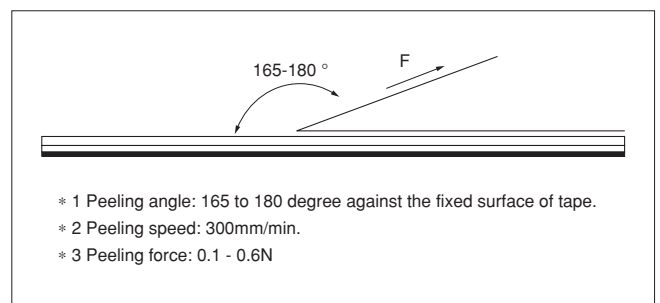
(a) Packaging

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 should be specified 5N minimum.

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Temperature Sensor and Compensation Chip Type Package

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4. Embossed Tape (NCP21 Series)

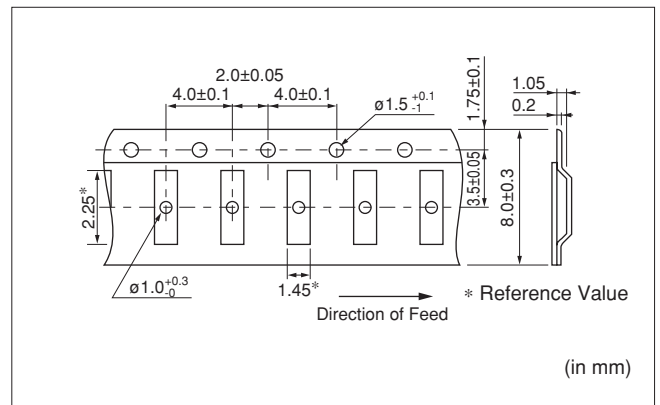
(1) Other Conditions

(a) Packaging

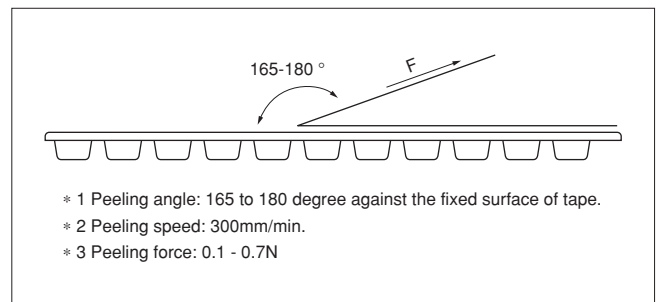
Products are packaged in the each cavity of Embossed tape and sealed by Cover tape.

(b) Tape

Cover tape has no joints.



(2) Peeling Force of Cover Tape



(3) Tape Strength

Pull strength of Embossed tape and Cover tape should be specified 10N minimum.