

NTC Thermistors

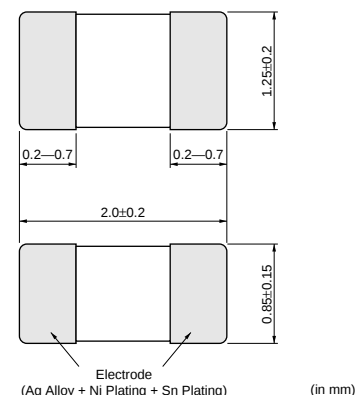
muRata

for Temperature Compensation 0805(2012) 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.

■ Features

1. Excellent solderability and high stability in environment.
2. Excellent long time aging stability.
3. High accuracy in resistance and B-constant.
4. Flow / 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. Lead is not contained in the product.



■ Applications

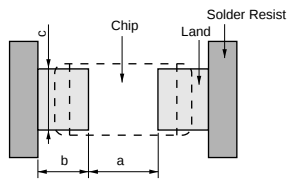
- Temperature compensation of transistor, IC, crystal oscillator of mobile communications equipments.
- Temperature sensor for rechargeable batteries.
- Temperature compensation of LCD.
- Temperature compensation and sensing of car audio equipments. (CD, MD, Tuner)
- Temperature compensation of several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

Part Number	Resistance (25°C)	B-Constant (25-50°C) (K)	Max. Operating Current(25°C) (mA)	Rated Electric Power(25°C) (mW)	Thermal Dissipation Constant(25°C) (mW/°C)	Operating Temperature Range (°C)
NCP21XM221□03RA	220ohm	3500 ±3%	3.00	200	2.0	-40 to 125
NCP21XQ471□03RA	470ohm	3650 ±3%	2.00	200	2.0	-40 to 125
NCP21XQ102□03RA	1.0k ohm	3650 ±3%	1.40	200	2.0	-40 to 125
NCP21XW222□03RA	2.2k ohm	3950 ±3%	0.90	200	2.0	-40 to 125
NCP21XW472□03RA	4.2k ohm	3950 ±3%	0.65	200	2.0	-40 to 125
NCP21XV103□03RA	10k ohm	3900 ±3%	0.44	200	2.0	-40 to 125
NCP21XW153□03RA	15k ohm	3950 ±3%	0.36	200	2.0	-40 to 125
NCP21XW223□03RA	22k ohm	3950 ±3%	0.30	200	2.0	-40 to 125
NCP21WB333□03RA	33k ohm	4050 ±3%	0.24	200	2.0	-40 to 125
NCP21WB473□03RA	47k ohm	4050 ±3%	0.20	200	2.0	-40 to 125
NCP21WF104□03RA	100k ohm	4250 ±3%	0.14	200	2.0	-40 to 125

Both flow and reflow soldering methods can be employed.

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

■ Standard Land Dimensions



Soldering Methods	a	b	c
Flow Soldering	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

(in mm)

● **Part Numbering** (The structure of the "Global Part Numbers" that have been adopted since June 2001 and the meaning of each code are described herein.)
If you have any questions about details, inquire at your usual Murata sales office or distributor.

NTC Thermistors for Temperature Compensation Chip Type

(Global Part Number)

NC	P	18	XH	103	J	03	RB
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①②③④⑤⑥⑦⑧

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

⑤ Resistance

Expressed by three figures. 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. If there is a decimal point, it is expressed by the capital letter "R". In this case, all figures are significant digits.

Ex.)

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

⑥ Resistance Tolerance

Code	Resistance Tolerance
F	±1%
J	±5%
K	±10%

⑦ Individual Specifications

Code	Individual Specifications
03	Structure, others

Please contact us for details.

⑧ Packaging

Code	Packaging
RA	Plastic Taping 8mm Pitch
RB	Paper Taping 4mm Pitch
RC	Paper Taping 2mm Pitch (10000 pcs.)
RD	Paper Taping 2mm Pitch (15000 pcs.)

Basic Characteristics

■ Basic Characteristics

1. Zero-power Resistance of Thermistor : R

$$R = R_0 \exp B (1/T - 1/T_0) \quad \dots\dots\dots (1)$$

R : Resistance in ambient temperature T (K)

(K : absolute temperature)

R₀ : Resistance in ambient temperature T₀ (K)

B : B-constant of Thermistor

2. B-Constant

as (1) formula

$$B = \frac{\ln (R/R_0)}{(1/T - 1/T_0)} \quad \dots\dots\dots (2)$$

3. Thermal Dissipation Constant

When spend electric power P (mW) in ambient temperature T₁, if Thermistor's temperature rises T₂, there is a formula as follows

$$P = C (T_2 - T_1) \quad \dots\dots\dots (3)$$

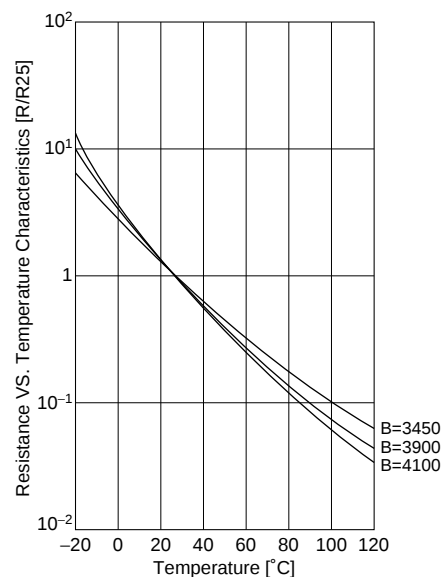
C : Thermal dissipation constant (mW/°C)

Thermal dissipation constant change by dimensions, measure, measured condition etc.

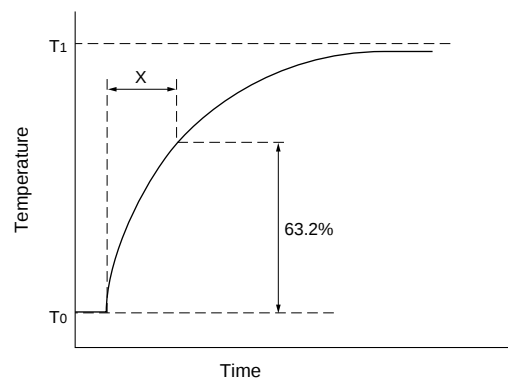
4. Thermal Time Constant

Period in which Thermistor's temperature will change 63.2% of its temperature difference from ambient temperature T₀ (°C) to T₁ (°C).

[Resistance vs. Temperature]



[Thermal Time Constant]



■ Performance

Item	Condition
Resistance	It measures by zero-power in specified ambient temperature.
B-Constant	It calculates between two specified ambient temperature by next formula. T and T ₀ is absolute temperature (K). $B = \frac{\ln (R/R_0)}{1/T - 1/T_0}$
Thermal Dissipation Constant	It shows necessary electric power that Thermistor's temperature rises 1°C by self heating. It calculates by next formula. (mW/°C) $C = \frac{P}{T - T_0}$
Rated Electric Power	It shows necessary electric power that Thermistor's temperature rises 100°C by self heating in ambient temperature 25°C.
Permissible Operating Current	It is possible to keep Thermistor's temperature rising max. 1°C

Please inquire about test condition and Ratings.

for Temperature Compensation Temperature Characteristics (Reference Value)

Temp. (°C)	NCP**XF101J type			NCP**XF151J type			NCP**XM221J type			NCP**XM331J type		
	Resistance (Ω)			Resistance (Ω)			Resistance (Ω)			Resistance (Ω)		
	Low	Center	High	Low	Center	High	Low	Center	High	Low	Center	High
-40	1588.3934	1824.1748	2089.7183	2382.5901	2736.2622	3134.5775	4281.3910	4947.9037	5703.8815	6422.0865	7421.8556	8555.8223
-35	1220.8309	1390.6851	1580.2105	1831.2464	2086.0276	2370.3158	3232.8028	3703.7546	4232.7058	4849.2043	5555.6318	6349.0587
-30	947.2895	1070.6526	1207.0558	1420.9343	1605.9790	1810.5837	2463.5987	2798.8729	3171.8255	3695.3981	4198.3094	4757.7383
-25	740.9805	831.1384	929.9356	1111.4707	1246.7076	1394.9034	1895.3406	2135.8872	2400.9454	2843.0109	3203.8309	3601.4182
-20	584.6168	650.9600	723.0199	876.9252	976.4400	1084.5298	1471.2503	1645.0366	1834.7523	2206.8755	2467.5549	2752.1285
-15	465.2849	514.4408	567.3679	697.9274	771.6612	851.0519	1151.7079	1278.0338	1414.6703	1727.5619	1917.0507	2122.0054
-10	373.0915	409.6997	448.7753	559.6372	614.5496	673.1630	908.3588	1000.6201	1099.4967	1362.5382	1500.9302	1649.2450
-5	301.4711	328.8767	357.8766	452.2066	493.3150	536.8150	721.9176	789.6120	861.4951	1082.8764	1184.4181	1292.2426
0	245.1757	265.7593	287.3508	367.7635	398.6389	431.0262	577.8973	627.7522	680.2030	866.8464	941.6283	1020.3045
5	200.3198	215.7848	231.8627	300.4797	323.6772	347.7940	465.6678	502.4737	540.8332	698.5017	753.7106	811.2498
10	164.7460	176.3948	188.3951	247.1190	264.5922	282.5927	377.7788	405.0095	433.1175	566.6681	607.5142	649.6763
15	136.3699	145.1611	154.1328	204.5548	217.7417	231.1992	308.3256	328.4797	349.0764	462.4884	492.7196	523.6146
20	113.5174	120.1519	126.8562	170.2760	180.7248	190.2843	253.1370	268.0437	283.1186	379.7056	402.0655	424.6779
25	95.0000	100.0000	105.0000	142.5000	150.0000	157.5000	209.0000	220.0000	231.0000	313.5000	330.0000	346.5000
30	79.0612	83.6687	88.3233	118.5918	125.5030	132.4850	171.5071	181.5764	191.7562	257.2606	272.3645	287.6344
35	66.1414	70.3607	74.6620	99.2122	105.5411	111.9930	141.5184	150.6681	160.0084	212.2777	226.0022	240.0126
40	55.6090	59.4560	63.4102	83.4136	89.1841	95.1154	117.4077	125.6805	134.1997	176.1116	188.5207	201.2996
45	46.9726	50.4697	54.0915	70.4590	75.7045	81.1372	97.8822	105.3357	113.0734	146.8233	158.0036	169.6100
50	39.8560	43.0286	46.3377	59.7840	64.5429	69.5065	82.0161	88.7172	95.7259	123.0241	133.0758	143.5889
55	33.9559	36.8303	39.8482	50.9338	55.2455	59.7723	69.0420	75.0585	81.3954	103.5629	112.5878	122.0932
60	29.0460	31.6485	34.3979	43.5691	47.4727	51.5968	58.3788	63.7771	69.5003	87.5683	95.6656	104.2504
65	25.0041	27.3636	29.8708	37.5062	41.0453	44.8062	49.5725	54.4149	59.5811	74.3587	81.6224	89.3717
70	21.6157	23.7560	26.0429	32.4236	35.6340	39.0644	42.2849	46.6309	51.2951	63.4274	69.9464	76.9427
75	18.7113	20.6506	22.7339	28.0669	30.9759	34.1008	36.2121	40.1147	44.3268	54.3182	60.1721	66.4903
80	16.2524	18.0106	19.9092	24.3787	27.0160	29.8637	31.1296	34.6367	38.4425	46.6944	51.9550	57.6638
85	14.2018	15.8001	17.5343	21.3026	23.7001	26.3014	26.8580	30.0126	33.4539	40.2870	45.0189	50.1808
90	12.4534	13.9081	15.4938	18.6801	20.8621	23.2407	23.2681	26.1099	29.2256	34.9021	39.1649	43.8384
95	10.9385	12.2625	13.7123	16.4078	18.3937	20.5684	20.2272	22.7904	25.6142	30.3407	34.1856	38.4213
100	9.6371	10.8435	12.1703	14.4557	16.2652	18.2555	17.6416	19.9565	22.5187	26.4624	29.9347	33.7781
105	8.5212	9.6223	10.8386	12.7819	14.4335	16.2578	15.4465	17.5411	19.8700	23.1698	26.3117	29.8050
110	7.5562	8.5625	9.6786	11.3343	12.8438	14.5179	13.5562	15.4531	17.5715	20.3343	23.1797	27.3572
115	6.7265	7.6482	8.6744	10.0897	11.4723	13.0116	11.9416	13.6629	15.5934	17.9123	20.4944	23.3900
120	6.0044	6.8497	7.7946	9.0065	10.2746	11.6918	10.5495	12.1139	13.8754	15.8243	18.1708	20.8131
125	5.3842	6.1618	7.0340	8.0763	9.2426	10.5510	9.3537	10.7784	12.3891	14.0305	16.1676	18.5837

Temp. (°C)	NCP**XQ471J type			NCP**XQ681J type			NCP**XQ102J type			NCP**XW152J type		
	Resistance (Ω)			Resistance (Ω)			Resistance (kΩ)			Resistance (kΩ)		
	Low	Center	High	Low	Center	High	Low	Center	High	Low	Center	High
-40	10195.6193	11822.4726	13674.6409	14751.1087	17104.8540	19784.5868	21.6928	25.1542	29.0950	44.2420	51.7912	60.4770
-35	7629.3548	8767.7450	10050.8064	11038.2154	12685.2480	14541.5923	16.2327	18.6548	21.3847	32.0716	37.1724	42.9768
-30	5766.8583	6570.2235	7466.7895	8343.5396	9505.8552	10803.0146	12.2699	13.9792	15.8868	23.5236	27.0048	30.9236
-25	4400.5140	4971.7838	5603.1722	6366.7012	7193.2191	8106.7172	9.3628	10.5783	11.9216	17.4452	19.8426	22.5130
-20	3387.9463	3796.9333	4244.6543	4901.7096	5493.4355	6141.2019	7.2084	8.0786	9.0312	13.0647	14.7278	16.5611
-15	2629.0453	2923.3995	3242.5836	3803.7251	4229.5993	4691.3975	5.5937	6.2200	6.8991	9.8817	11.0439	12.3118
-10	2056.6347	2269.5988	2498.3537	2975.5566	3283.6749	3614.6394	4.3758	4.8289	5.3156	7.5445	8.3617	9.2442
-5	1620.5498	1775.2252	1939.8021	2344.6253	2568.4109	2806.5222	3.4480	3.7771	4.1272	5.8112	6.3888	7.0063
0	1286.3077	1399.0503	1517.8704	1861.0410	2024.1579	2196.0679	2.7368	2.9767	3.2295	4.5122	4.9221	5.3557
5	1027.8581	1110.2196	1196.1827	1487.1139	1606.2752	1730.6473	2.1869	2.3622	2.5451	3.5327	3.8245	4.1301
10	826.9792	887.2572	949.5490	1196.4806	1283.6913	1373.8156	1.7595	1.8878	2.0203	2.7856	2.9936	3.2092
15	669.3557	713.4632	758.5760	968.4295	1032.2446	1097.5142	1.4242	1.5180	1.6140	2.2129	2.3613	2.5134
20	545.1310	577.3752	609.9977	788.7002	835.3513	882.5499	1.1599	1.2285	1.2979	1.7699	1.8756	1.9826
25	446.5000	470.0000	493.5000	646.0000	680.0000	714.0000	0.9500	1.0000	1.0500	1.4250	1.5000	1.5750
30	363.3735	384.8004	406.4720	525.7319	556.7325	588.0872	0.7731	0.8187	0.8648	1.1396	1.2074	1.2760
35	297.3779	316.7570	336.5555	430.2488	458.2867	486.9313	0.6327	0.6740	0.7161	0.9172	0.9780	1.0401
40	244.7447	262.1771	280.1490	354.0986	379.3200	405.3220	0.5207	0.5578	0.5961	0.7428	0.7969	0.8528
45	202.4473	218.0688	234.3085	292.9025	315.5038	338.9995	0.4307	0.4640	0.4985	0.6051	0.6531	0.7030
50	168.3307	182.2969	196.9284	243.5424	263.7488	284.9176	0.3582	0.3879	0.4190	0.4958	0.5382	0.5828
55	140.6799	153.1503	166.3093	203.5369	221.5791	240.6177	0.2993	0.3259	0.3538	0.4085	0.4459	0.4856
60	118.1215	129.2486	141.0702	170.8993	186.9979	204.1015	0.2513	0.2750	0.3001	0.3383	0.3713	0.4066
65	99.6242	109.5508	120.1654	144.1371	158.4991	173.8563	0.2120	0.2331	0.2557	0.2817	0.3108	0.3421
70	84.4206	93.2811	102.8140	122.1404	134.9600	148.7522	0.1796	0.1985	0.2188	0.2355	0.2613	0.2891
75	71.8361	79.7499	88.3142	103.9331	115.3828	127.7737	0.1528	0.1697	0.1879	0.1981	0.2208	0.2456
80	61.3721	68.4463	76.1450	88.7937	99.0287	110.1673	0.1306	0.1456	0.1620	0.1672	0.1873	0.2094
85	52.6633	58.9961	65.9251	76.1938	85.3560	95.3809	0.1120	0.1255	0.1403	0.1418	0.1597	0.1793
90	45.3599	51.0359	57.2785	65.6271	73.8391	82.8710	0.0965	0.1086	0.1219	0.1208	0.1367	0.1542
95	39.2354	44.3318	49.9651	56.7661	64.1397	72.2899	0.0835	0.0943	0.1063	0.1033	0.1174	0.1331
100	34.0575	38.6403	43.7302	49.2747	55.9052	63.2693	0.0725	0.0822	0.0930	0.0888	0.1013	0.1153
105	29.6631	33.7903	38.3956	42.9169	48.8881	55.5510	0.0631	0.0719	0.0817	0.0766	0.0877	0.1003
110	25.9394	29.6642	33.8390	37.5294	42.9184	48.9586	0.0552	0.0631	0.0720	0.0663	0.0763	0.0876
115	22.7557	26.1228	29.9131	32.9232	37.7947	43.2785	0.0484	0.0556	0.0636	0.0575	0.0665	0.0767
120	20.0407	23.0913	26.5397	28.9950	33.4086	38.3979	0.0426	0.0491	0.0565	0.0502	0.0582	0.0674
125	17.7029	20.4715	23.6139	25.6127	29.6183	34.1648	0.0377	0.0436	0.0502	0.0439	0.0511	0.0594

Continued on the following page. 

for Temperature Compensation Temperature Characteristics (Reference Value)

Continued from the preceding page.

Temp. (°C)	NCP**XW222J type			NCP**XW332J type			NCP**XW472J type			NCP**XW682J type		
	Resistance (kΩ)			Resistance (kΩ)			Resistance (kΩ)			Resistance (kΩ)		
	Low	Center	High	Low	Center	High	Low	Center	High	Low	Center	High
-40	64.8883	75.9605	88.6996	97.3324	113.9407	133.0495	138.6250	162.2792	189.4947	200.5638	234.7869	274.1625
-35	47.0383	54.5195	63.0326	70.5575	81.7793	94.5489	100.4910	116.4736	134.6606	145.3912	168.5150	194.8281
-30	34.5013	39.6070	45.3547	51.7519	59.4105	68.0320	73.7073	84.6150	96.8941	106.6403	122.4217	140.1871
-25	25.5863	29.1025	33.0190	38.3795	43.6537	49.5285	54.6617	62.1734	70.5406	79.0850	89.9531	102.0588
-20	19.1616	21.6008	24.2896	28.7424	32.4012	36.4344	40.9361	46.1471	51.8914	59.2268	66.7661	75.0769
-15	14.4932	16.1977	18.0573	21.7398	24.2965	27.0859	30.9628	34.6041	38.5769	44.7972	50.0655	55.8134
-10	11.0653	12.2638	13.5581	16.5979	18.3956	20.3372	23.6394	26.1999	28.9651	34.2017	37.9062	41.9069
-5	8.5230	9.3702	10.2759	12.7846	14.0554	15.4138	18.2083	20.0182	21.9531	26.3439	28.9626	31.7619
0	6.6179	7.2190	7.8551	9.9269	10.8286	11.7826	14.1383	15.4225	16.7813	20.4554	22.3134	24.2794
5	5.1813	5.6093	6.0575	7.7719	8.4140	9.0863	11.0691	11.9835	12.9410	16.0149	17.3379	18.7232
10	4.0856	4.3907	4.7068	6.1283	6.5860	7.0602	8.7282	9.3801	10.0554	12.6281	13.5712	14.5482
15	3.2456	3.4633	3.6863	4.8684	5.1949	5.5294	6.9338	7.3988	7.8752	10.0319	10.7046	11.3939
20	2.5959	2.7509	2.9079	3.8938	4.1263	4.3618	5.5458	5.8769	6.2123	8.0237	8.5028	8.9880
25	2.0900	2.2000	2.3100	3.1350	3.3000	3.4650	4.4650	4.7000	4.9350	6.4600	6.8000	7.1400
30	1.6714	1.7709	1.8715	2.5071	2.6563	2.8073	3.5707	3.7832	3.9983	5.1661	5.4735	5.7848
35	1.3453	1.4344	1.5256	2.0179	2.1516	2.2883	2.8740	3.0644	3.2591	4.1582	4.4335	4.7153
40	1.0895	1.1688	1.2507	1.6342	1.7532	1.8761	2.3275	2.4970	2.6720	3.3675	3.6126	3.8659
45	0.8875	0.9578	1.0311	1.3313	1.4367	1.5467	1.8960	2.0462	2.2028	2.7432	2.9605	3.1871
50	0.7272	0.7894	0.8548	1.0908	1.1841	1.2821	1.5536	1.6864	1.8261	2.2478	2.4400	2.6420
55	0.5991	0.6540	0.7122	0.8987	0.9811	1.0683	1.2800	1.3973	1.5215	1.8518	2.0216	2.2013
60	0.4962	0.5446	0.5963	0.7442	0.8169	0.8945	1.0600	1.1635	1.2739	1.5336	1.6834	1.8431
65	0.4131	0.4559	0.5018	0.6197	0.6838	0.7527	0.8825	0.9739	1.0720	1.2769	1.4091	1.5511
70	0.3455	0.3832	0.4240	0.5182	0.5748	0.6360	0.7380	0.8187	0.9059	1.0678	1.1845	1.3106
75	0.2905	0.3229	0.3602	0.4357	0.4858	0.5403	0.6206	0.6919	0.7695	0.8979	1.0010	1.1133
80	0.2452	0.2748	0.3071	0.3679	0.4122	0.4606	0.5239	0.5870	0.6561	0.7580	0.8493	0.9492
85	0.2080	0.2342	0.2630	0.3121	0.3513	0.3945	0.4445	0.5004	0.5619	0.6430	0.7239	0.8130
90	0.1772	0.2004	0.2261	0.2658	0.3007	0.3392	0.3786	0.4282	0.4831	0.5478	0.6196	0.6990
95	0.1516	0.1722	0.1952	0.2273	0.2583	0.2928	0.3238	0.3679	0.4170	0.4685	0.5323	0.6033
100	0.1302	0.1486	0.1692	0.1953	0.2229	0.2538	0.2782	0.3175	0.3614	0.4025	0.4593	0.5229
105	0.1123	0.1287	0.1471	0.1684	0.1930	0.2207	0.2399	0.2749	0.3144	0.3470	0.3978	0.4548
110	0.0972	0.1118	0.1284	0.1458	0.1678	0.1926	0.2076	0.2389	0.2743	0.3003	0.3457	0.3969
115	0.0844	0.0975	0.1124	0.1266	0.1463	0.1687	0.1803	0.2084	0.2402	0.2608	0.3015	0.3475
120	0.0736	0.0854	0.0988	0.1104	0.1281	0.1483	0.1572	0.1824	0.2112	0.2274	0.2639	0.3055
125	0.0644	0.0750	0.0871	0.0966	0.1125	0.1307	0.1375	0.1602	0.1862	0.1990	0.2318	0.2694

Temp. (°C)	NCP**XH103J type			NCP**XW153J type			NCP**XW223J type			NCP**WB333J type		
	Resistance (kΩ)			Resistance (kΩ)			Resistance (kΩ)			Resistance (kΩ)		
	Low	Center	High	Low	Center	High	Low	Center	High	Low	Center	High
-40	170.0056	195.6520	224.6043	442.4201	517.9122	604.7702	648.8828	759.6046	886.9963	1046.0404	1227.2628	1436.2815
-35	129.8266	148.1710	168.6845	320.7159	371.7242	429.7679	470.3834	545.1955	630.3263	752.9420	874.4491	1013.0257
-30	100.1156	113.3471	128.0065	235.2360	270.0479	309.2363	345.0129	396.0702	453.5466	548.5400	630.8514	723.7003
-25	77.9389	87.5588	98.1201	174.4523	198.4259	225.1297	255.8634	291.0246	330.1902	404.1776	460.4568	523.2611
-20	61.1957	68.2367	75.8975	130.6473	147.2781	165.6109	191.6160	216.0079	242.8960	300.9970	339.7972	382.6399
-15	48.4622	53.6496	59.2437	98.8174	110.4385	123.1178	144.9322	161.9765	180.5728	226.4171	253.3626	282.8061
-10	38.6653	42.5062	46.6117	75.4449	83.6166	92.4417	110.6525	122.6377	135.5811	171.9353	190.7661	211.1301
-5	31.0399	33.8922	36.9140	58.1116	63.8880	70.0629	85.2304	93.7024	102.7590	131.7346	144.9635	159.1220
0	25.0925	27.2186	29.4511	45.1222	49.2208	53.5574	66.1792	72.1905	78.5508	101.7587	111.0867	120.9667
5	20.4304	22.0211	23.6762	35.3270	38.2453	41.3011	51.8130	56.0931	60.5750	79.2440	85.8417	92.7563
10	16.7337	17.9255	19.1542	27.8561	29.9364	32.0916	40.8555	43.9067	47.0677	62.1868	66.8613	71.7074
15	13.7804	14.6735	15.5855	22.1292	23.6131	25.1336	32.4561	34.6325	36.8626	49.1580	52.4701	55.8655
20	11.4116	12.0805	12.7567	17.6993	18.7561	19.8264	25.9589	27.5090	29.0787	39.1283	41.4709	43.8440
25	9.5000	10.0000	10.5000	14.2500	15.0000	15.7500	20.9000	22.0000	23.1000	31.3500	33.0000	34.6500
30	7.8552	8.3145	8.7787	11.3959	12.0740	12.7605	16.7139	17.7085	18.7154	24.9421	26.4303	27.9372
35	6.5288	6.9479	7.3754	9.1724	9.7799	10.4015	13.4529	14.3438	15.2555	19.9693	21.2983	22.6589
40	5.4531	5.8336	6.2252	7.4283	7.9691	8.5278	10.8949	11.6880	12.5074	16.0869	17.2658	18.4849
45	4.5726	4.9169	5.2739	6.0512	6.5306	7.0303	8.8751	9.5782	10.3111	13.0349	14.0761	15.1626
50	3.8502	4.1609	4.4854	4.9583	5.3823	5.8279	7.2722	7.8940	8.5475	10.6207	11.5377	12.5026
55	3.2551	3.5350	3.8293	4.0850	4.4593	4.8558	5.9913	6.5403	7.1219	8.6995	9.5058	10.3608
60	2.7624	3.0143	3.2809	3.3829	3.7133	4.0657	4.9616	5.4462	5.9631	7.1620	7.8702	8.6269
65	2.3591	2.5861	2.8279	2.8166	3.1082	3.4214	4.1310	4.5587	5.0181	5.9272	6.5494	7.2187
70	2.0230	2.2275	2.4467	2.3554	2.6128	2.8911	3.4546	3.8321	4.2403	4.9285	5.4751	6.0672
75	1.7401	1.9245	2.1232	1.9806	2.2082	2.4558	2.9049	3.2387	3.6018	4.1145	4.5950	5.1187
80	1.5022	1.6685	1.8486	1.6721	1.8734	2.0938	2.4524	2.7477	3.0709	3.4514	3.8742	4.3379
85	1.3019	1.4521	1.6156	1.4185	1.5969	1.7933	2.0804	2.3421	2.6302	2.9088	3.2815	3.6926
90	1.1322	1.2680	1.4165	1.2083	1.3667	1.5419	1.7722	2.0044	2.2615	2.4600	2.7887	3.1534
95	0.9868	1.1096	1.2445	1.0334	1.1741	1.3308	1.5156	1.7221	1.9518	2.0883	2.3787	2.7026
100	0.8627	0.9738	1.0965	0.8878	1.0132	1.1534	1.3021	1.4860	1.6917	1.7805	2.0375	2.3258
105	0.7572	0.8580	0.9697	0.7655	0.8775	1.0032	1.1228	1.2870	1.4714	1.5235	1.7513	2.0082
110	0.6665	0.7580	0.8600	0.6625	0.7626	0.8756	0.9717	1.1185	1.2842	1.3071	1.5093	1.7384
115	0.5883	0.6715	0.7646	0.5753	0.6650	0.7666	0.8438	0.9753	1.1244	1.1259	1.3058	1.5106
120	0.5206	0.5964	0.6815	0.5017	0.5822	0.6739	0.7359	0.8539	0.9884	0.9738	1.1341	1.3176
125	0.4621	0.5311	0.6090	0.4390	0.5113	0.5942	0.6438	0.7500	0.8715	0.8441	0.9872	1.1517

Continued on the following page.

for Temperature Compensation Temperature Characteristics (Reference Value)

Continued from the preceding page.

Temp. (°C)	NCP**WB473J type			NCP**WD683J type			NCP**WF104J type			NCP**WM224J type		
	Resistance (kΩ)			Resistance (kΩ)			Resistance (kΩ)			Resistance (kΩ)		
	Low	Center	High	Low	Center	High	Low	Center	High	Low	Center	High
-40	1489.8151	1747.9197	2045.6131	2325.9631	2735.3593	3208.7719	3729.0380	4397.1193	5171.9295	9772.5429	11585.8840	13701.3597
-35	1072.3720	1245.4275	1442.7942	1664.5604	1937.3907	2249.3020	2647.2336	3088.5989	3594.5428	6837.3274	8016.9727	9376.6420
-30	781.2539	898.4853	1030.7247	1205.6590	1389.3445	1597.0123	1902.5755	2197.2250	2531.1628	4847.6927	5623.9311	6508.1538
-25	575.6469	655.8022	745.2507	883.2052	1008.0144	1147.5848	1383.3182	1581.8805	1804.4223	3474.9659	3990.1000	4570.1443
-20	428.6928	483.9536	544.9720	653.5386	738.9776	833.4974	1016.2022	1151.0367	1300.5024	2517.2944	2861.7839	3245.2829
-15	322.4729	360.8498	402.7844	488.5367	547.4555	611.9463	754.3293	846.5788	947.7345	1843.9098	2076.1619	2331.8235
-10	244.8776	271.6971	300.7004	368.7125	409.5999	453.8837	565.4664	628.9882	697.8966	1363.4416	1520.9094	1692.3223
-5	187.6220	206.4631	226.6283	280.7073	309.2166	339.7697	427.6799	471.6321	518.8009	1017.7304	1125.0494	1240.5760
0	144.9290	158.2144	172.2859	215.6355	235.6064	256.7833	326.4567	357.0117	389.4505	766.4841	839.9121	918.0736
5	112.8627	122.2594	132.1074	166.9555	180.9801	195.6923	251.2051	272.4995	294.8601	582.1552	632.5207	685.5255
10	88.5691	95.2267	102.1287	130.2753	140.1394	150.3734	194.8470	209.7098	225.1420	445.6263	480.1943	516.1503
15	70.0128	74.7302	79.5660	102.4068	109.3437	116.4586	152.2795	162.6506	173.2936	343.7517	367.4554	391.8117
20	55.7281	59.0647	62.4445	81.0612	85.9287	90.8607	119.8614	127.0802	134.3970	267.1098	283.3096	299.7408
25	44.6500	47.0000	49.3500	64.6000	68.0000	71.4000	95.0000	100.0000	105.0000	209.0000	220.0000	231.0000
30	35.5236	37.6431	39.7894	51.1085	54.1668	57.2645	74.7365	79.2216	83.7660	162.2097	172.0121	181.9509
35	28.4412	30.3339	32.2718	40.6980	43.4205	46.2092	59.1874	63.1671	67.2459	126.7354	135.3636	144.2178
40	22.9116	24.5907	26.3270	32.6091	35.0157	37.5059	47.1711	50.6766	54.3066	99.6651	107.1980	115.0120
45	18.5648	20.0478	21.5952	26.2879	28.4056	30.6173	37.8301	40.9035	44.1161	78.8770	85.4186	92.2716
50	15.1264	16.4325	17.8067	21.3078	23.1657	25.1226	30.5087	33.1946	36.0267	62.7810	68.4412	74.4252
55	12.3902	13.5385	14.7563	17.3695	18.9967	20.7244	24.7475	27.0909	29.5820	50.2655	55.1533	60.3652
60	10.2005	11.2091	12.2868	14.2330	15.6569	17.1803	20.1817	22.2243	24.4126	40.4494	44.6645	49.1955
65	8.4418	9.3279	10.2811	11.7211	12.9669	14.3092	16.5424	18.3225	20.2434	32.7434	36.3787	40.3166
70	7.0194	7.7979	8.6411	9.7029	10.7935	11.9765	13.6319	15.1841	16.8709	26.6276	29.7626	33.1836
75	5.8601	6.5443	7.2902	8.0657	9.0206	10.0634	11.2813	12.6354	14.1166	21.7572	24.4623	27.4350
80	4.9156	5.5178	6.1782	6.7376	7.5749	8.4949	9.3830	10.5657	11.8678	17.8683	20.2054	22.7911
85	4.1429	4.6736	5.2591	5.6522	6.3872	7.1997	7.8382	8.8726	10.0184	14.7397	16.7614	19.0126
90	3.5036	3.9717	4.4912	4.7611	5.4071	6.1255	6.5752	7.4811	8.4905	12.2108	13.9619	15.9242
95	2.9742	3.3878	3.8492	4.0288	4.5978	5.2341	5.5415	6.3365	7.2274	10.1638	11.6836	13.3972
100	2.5358	2.9019	3.3125	3.4199	3.9216	4.4856	4.6855	5.3839	6.1709	8.4879	9.8085	11.3062
105	2.1698	2.4943	2.8602	2.9156	3.3589	3.8599	3.9793	4.5942	5.2910	7.1203	8.2703	9.5820
110	1.8616	2.1496	2.4759	2.4945	2.8869	3.3326	3.3918	3.9342	4.5520	5.9950	6.9983	8.1490
115	1.6036	1.8598	2.1514	2.1415	2.4894	2.8865	2.9011	3.3804	3.9291	5.0655	5.9423	6.9534
120	1.3869	1.6153	1.8765	1.8460	2.1552	2.5098	2.4918	2.9164	3.4048	4.2983	5.0665	5.9570
125	1.2023	1.4060	1.6403	1.5950	1.8701	2.1871	2.1455	2.5220	2.9573	3.6595	4.3338	5.1195

Temp. (°C)	NCP**WM474J type			NCP**XH103F type		
	Resistance (kΩ)			Resistance (kΩ)		
	Low	Center	High	Low	Center	High
-40	20877.7053	24751.6612	29271.0867	188.0202	195.6520	203.5731
-35	14607.0177	17127.1689	20031.9170	142.7877	148.1710	153.7418
-30	10356.4343	12014.7619	13903.7832	109.5221	113.3471	117.2940
-25	7423.7909	8524.3045	9763.4901	84.8227	87.5588	90.3741
-20	5377.8563	6113.8111	6933.1044	66.2694	68.2367	70.2554
-15	3939.2618	4435.4368	4981.6229	52.2283	53.6496	55.1040
-10	2912.8070	3249.2156	3615.4158	41.4765	42.5062	43.5570
-5	2174.2421	2403.5146	2650.3214	33.1462	33.8922	34.6515
0	1637.4887	1794.3578	1961.3390	26.6780	27.2186	27.7675
5	1243.6953	1351.2943	1464.5318	21.6294	22.0211	22.4175
10	952.0198	1025.8697	1102.6846	17.6430	17.9255	18.2107
15	734.3785	785.0184	837.0523	14.4712	14.6735	14.8772
20	570.6436	605.2524	640.3553	11.9371	12.0805	12.2244
25	446.5000	470.0000	493.5000	9.9000	10.0000	10.1000
30	346.5388	367.4804	388.7133	8.2162	8.3145	8.4132
35	270.7529	289.1859	308.1016	6.8534	6.9479	7.0430
40	212.9209	229.0139	245.7074	5.7443	5.8336	5.9238
45	168.5099	182.4853	197.1257	4.8333	4.9169	5.0015
50	134.1230	146.2153	158.9993	4.0833	4.1609	4.2395
55	107.3854	117.8276	128.9620	3.4634	3.5350	3.6076
60	86.4147	95.4197	105.0996	2.9486	3.0143	3.0812
65	69.9518	77.7182	86.1309	2.5259	2.5861	2.6476
70	56.8863	63.5838	70.8922	2.1724	2.2275	2.2839
75	46.4814	52.2604	58.6111	1.8741	1.9245	1.9761
80	38.1732	43.1662	48.6902	1.6225	1.6685	1.7157
85	31.4894	35.8084	40.6179	1.4101	1.4521	1.4952
90	26.0867	29.8277	34.0200	1.2296	1.2680	1.3074
95	21.7136	24.9605	28.6212	1.0746	1.1096	1.1456
100	18.1333	20.9545	24.1541	0.9419	0.9738	1.0067
105	15.2115	17.6683	20.4706	0.8288	0.8580	0.8881
110	12.8075	14.9508	17.4092	0.7313	0.7580	0.7856
115	10.8218	12.6949	14.8550	0.6471	0.6715	0.6968
120	9.1828	10.8239	12.7263	0.5740	0.5964	0.6196
125	7.8181	9.2586	10.9371	0.5106	0.5311	0.5524

⚠ Chip Type Caution/Notice**■ ⚠ Caution (Storage and Operating Conditions)**

This product is designed for the applications under ordinary environment

(room temperature, normal humidity and atmospheric pressure).

Do not use under the following environments. Because all these factors can deteriorate the characteristics of product or can cause the failures and the burning-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 place

4. Under vacuum, reducing pressure or under high-pressure

5. Place with splashed water or under high humidity with dewing

6. Place with salt water, oils, chemical liquids or organic solvents

7. Place strongly vibrated

8. Other place, where is similar like the above-mentioned environments

■ ⚠ Caution (Others)

Be sure to provide an appropriate fail-safe function on your product to prevent a second damage 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, following storage condition is recommended.

1. Storage condition :

Temperature -10 to +40 degree 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. Handling after unpacking : After unpacking, reseal promptly this product or store it in a sealed container with a drying agent.

4. Storage place : Store this product in no corrosive gas (Sulfuric acid gas, Chlorine gas etc) nor directly under sunshine.

■ Notice (Rating)

Use this product within the specified temperature range.

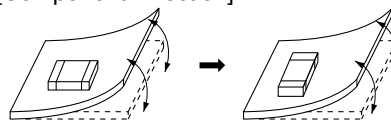
Higher temperature may cause deterioration of the characteristics or the material quality of this product.

Chip Type Notice (Soldering and Mounting)

■ Mounting Position

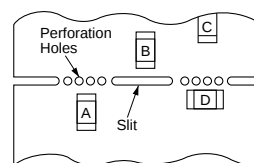
Choose a mounting position that minimize the stress imposed on the chip during flexing or bending of the board.

[Component Direction]



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

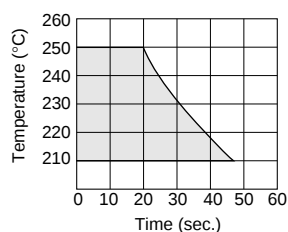
[Mounting Close to Board Swparation Line]



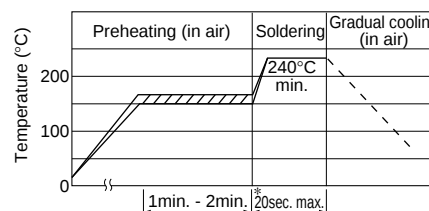
Keep this product on the PC Board away from the Separation Line.
Worst ← A-B-C-D → Better

■ Reflow Soldering Conditions

Allowable Reflow Soldering Temperature and Time



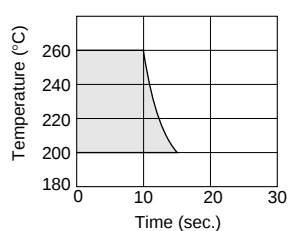
Standard Soldering Conditions



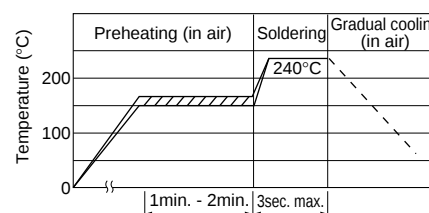
Preheating : 160±10°C, 1min. - 2min.
Soldering : 240 - 270°C, 20sec. max.

■ Flow Soldering Conditions (NCP18/21 Series only)

Allowable Flow Soldering Temperature and Time



Standard Soldering Conditions



Preheating : 160±10°C, 1min. - 2min.
Soldering : 3sec. max.

Continued on the following page.

Chip Type Notice (Soldering and Mounting)

 Continued from the preceding page.

■ Solder and Flux

1. Solder and Paste

(1) Reflow Soldering : NCP03/15/18/21 Series

Use RA/RMA type or equivalent type of solder paste for your reference, we are using solder paste, manufactured by SENJI METAL INDUSTRY CO., LTD, for any Internal tests of this product.

- SPT-70-0F-2063 (Sn:Pb:Ag = 63:35:2wt%)
- M31-221CM5 (Sn:Ag:Cu = 95.8:3.5:0.7wt%)
- M42-381F4-11 (Sn:Ag:Bi:Cu = 94.3:2.0:3.0:0.7wt%)

(2) Flow Soldering : NCP18/21 Series

Use H60 type, H63 type or equivalent type of solder paste.

2. Flux

Use Rosin-based flux.

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

■ 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
Dipping Cleaning	Less than 5min. at room temp. or Less than 2min. at 40°C max.	Less than 5min. at room temp. or Less than 2min. at 40°C max.
Ultrasonic Cleaning	Less than 5min. 20W/ℓ Frequency of 28kHz to 40kHz.	Less than 1min. 20W/ℓ Frequency of several 10kHz to several 100kHz.

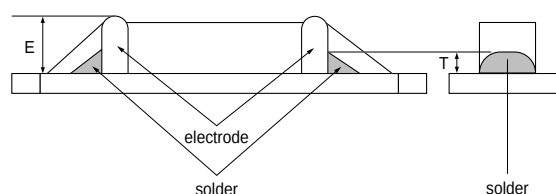
■ Drying

After cleaning, dry promptly this product.

■ Printing Conditions of Solder Paste

- The amount of solder is critical. Standard height of fillet is show in the table below.
- Too much solder gives too strong mechanical stress to this product, such stress may cause cracking, any mechanical and electronical damage.

Reference : Optimum Solder Amount



Part Number	The amount of solder paste *	The solder paste a thickness	T
NCP03	0.03mg	150μm	$1/3E \leq T \leq E$
NCP15	0.3mg	200μm	$1/3E \leq T \leq E$
NCP18/NCP21	1.0mg	200μm	$0.2mm \leq T \leq E$

* The land side

■ Adhesive Application and Curing

- Thin or insufficient adhesive may have components a loose contact with land, during flow soldering.
- Low viscosity adhesive causes chips to slip after mounting.

Chip Type Package

■ Minimum Quantity Guide

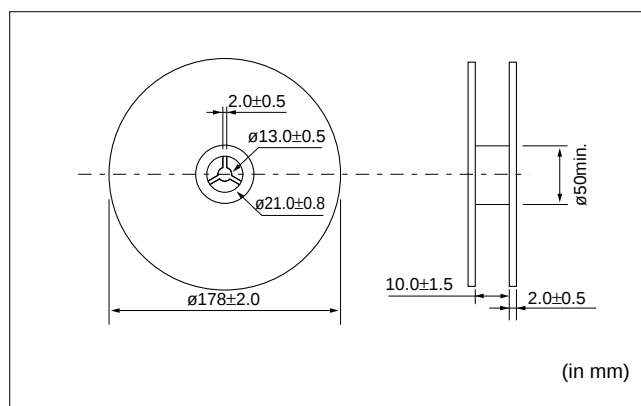
Part Number	Quantity (pcs.)	
	Paper Tape	Plastic Tape
NCP03	15000	-
NCP15	10000	
NCP18	4000	
NCP21	-	4000

■ Packaging Code

Packaging Tape	Plastic Taping	Paper Taping		
		2mm pitch		4mm pitch
Packaging Code	RA	RC	RD	RB

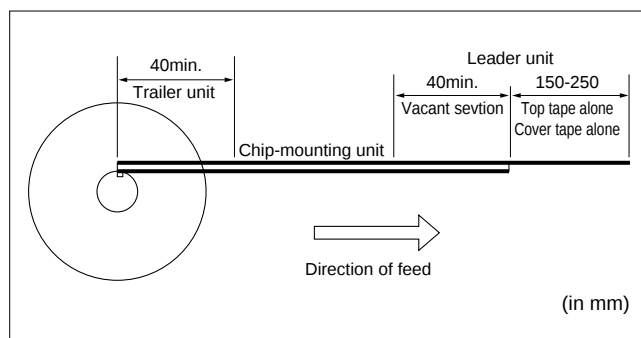
■ Tape Carrier Packaging

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 the figure right.)
- (2) The top and base tapes or, plastic and cover tape are not stucked at the first five pitches minimum.
- (3) A label shall be attached on the reel. (MURATA's part number, inspection number and quantity shall be marked on the label.)
- (4) Taping reels shall be packed in a package.

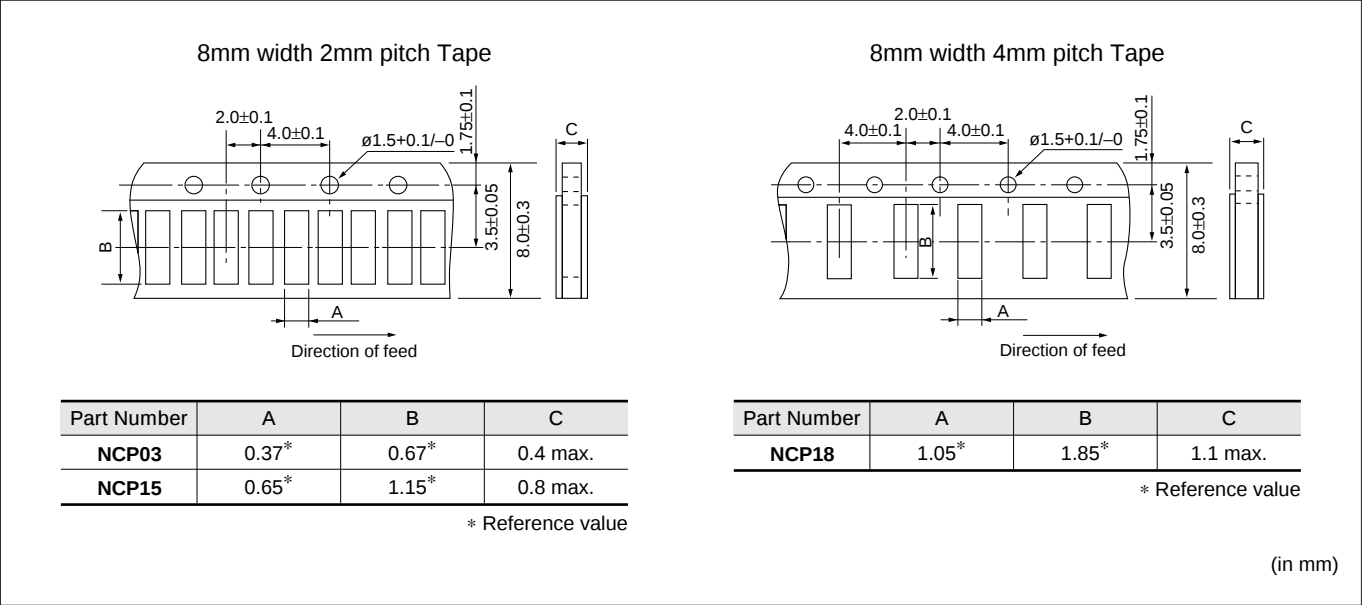


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Chip Type Package

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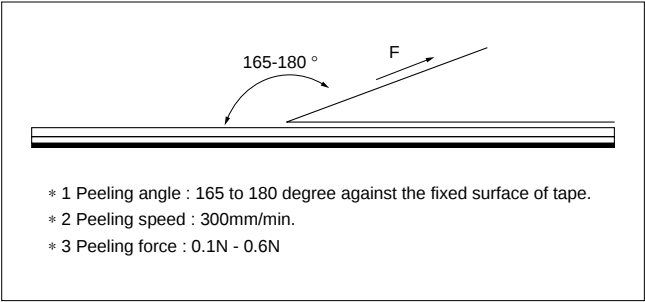
3. Paper Tape



(1) Other Conditions

- ① Packaging
- Products shall be packaged in the cavity of the base tape and sealed by top tape and bottom tape.
- ② Tape
- Top tape and bottom tape have no joints and products shall be packaged and sealed in the cavity of the base tape, continuously.

(2) Peeling force of top tape



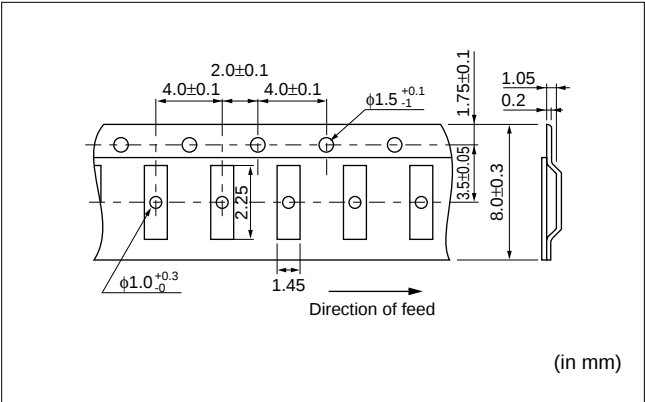
(3) Pull Strength

Pull strength of top tape and bottom tape shall be specified 5N minimum.

4. Plastic tape

(1) Other Conditions

- ① Packaging
- Products shall be packaged in the each embossed cavity of plastic tape and sealed by cover tape.
- ② Tape
- Cover tape has no joints.

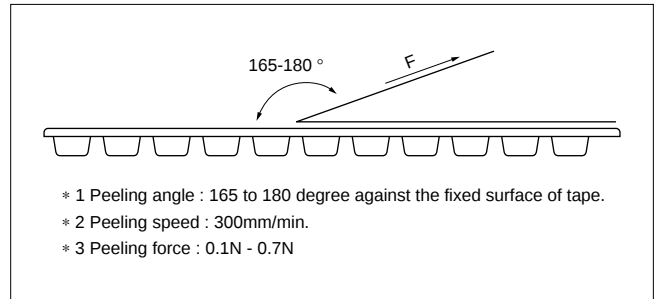


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Chip Type Package

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(2) Peeling of force cover tape



(3) Tape Strength

Pull strength of plastic tape shall be specified 5N minimum.

Pull strength of cover tape shall be specified 10N minimum.