Sensors

Temperature Sensors
NTC Thermistors

NTCCM Series NTCCM1005, 1608, 2012 Types

PHYSICAL PROPERTIES OF NTC THERMISTORS

INITIAL RESISTANCE

Thermistor resistance is a function of absolute temperature as indicated by the following relationship:

$$R=R_0 \cdot \exp B\left(\frac{1}{T}-\frac{1}{T_0}\right) \quad \cdots\cdots (1)$$

Here R_0, R(kΩ) are the respective resistance values when the surrounding temperature is T_0, T(K). B is the thermistor constant(B constant below).

B constant

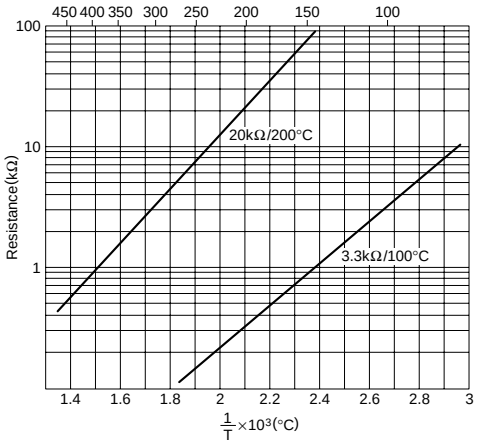
The B constant is found from the following equation:

$$R=\frac{2.3026(\log R-\log R_0)}{\frac{1}{T}-\frac{1}{T_0}} \quad \cdots\cdots (2)$$

This B characteristic is indicated by the slope of the linear plot of log R vrs inverse absolute temperature.

The B constant value is generally in the vicinity of 2500K to 5000K. B constant values of 3000K to 4000K are frequently used for measurements.

Resistance-temperature characteristics (Fig.1)



TEMPERATURE COEFFICIENT

The relationship between temperature coefficient α and B becomes:

$$\alpha=\frac{1}{R}\cdot\frac{dR}{dT}=-\frac{1}{T^2}\times 100(\%/°C) \quad \cdots\cdots (3)$$

The negative sign of the temperature coefficient indicates that the temperature coefficient decreases as both thermistor resistance and temperature rise. If B is taken as 3400K, the temperature coefficient found at 20°C (293.15K) becomes –4%/°C.

HEAT DISSIPATION COEFFICIENT

Temperature rises due to thermal energy formed as electrical current flows through the thermistor. The thermistor temperature T_0 is then related to the surrounding temperature Ta and the electrical input W:

$$W=k(T_0-Ta)=V\cdot I(mW) \quad \cdots\cdots (4)$$

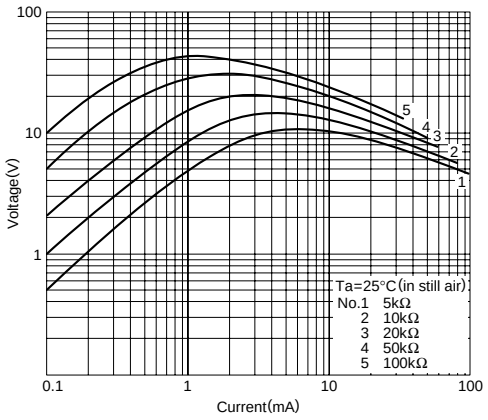
$$k=\frac{W}{T_0-Ta}\ W(\%/°C) \quad \cdots\cdots (5)$$

This k value is the heat dissipation coefficient, which represents the additional electrical power (mW/°C) needed to raise the thermistor temperature by 1°C. This heat dissipation coefficient varies with changes in the measurement and environmental conditions. When a thermistor is used for temperature measurement, it is naturally important to lower the applied electrical current as much as possible in order to reduce measurement error resulting from self heating.

VOLTAGE - CURRENT CHARACTERISTIC

The voltage - current characteristic indicates the drop in voltage as electrical current through the thermistor is gradually increased.

Voltage-current characteristics (Fig.2)



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HEATING TIME CONSTANT

The time period required to heat up a thermistor from a certain temperature T_0 over a target temperature rise is called the heating time constant. Various types of heating time constants are indicated by the symbols shown in Table 1 as determined by the percent change from T_0 toward the target temperature. The standard change is typically taken to be 63.2%.

Thermal time constants (Fig.3)

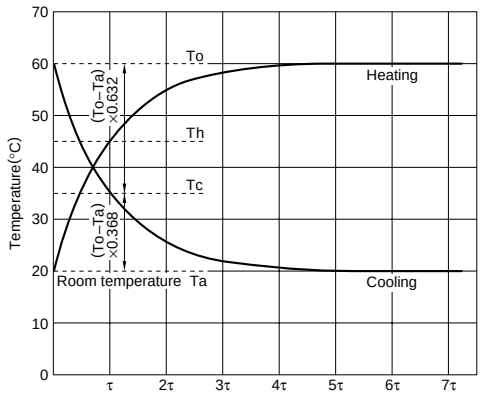

Table 1 Heating time constant and temperature change ratio

Code	Rate of change (%) for T_0 -Ta
τ	63.2
2τ	86.5
3τ	95.0
4τ	98.2
5τ	99.4
6τ	99.8
7τ	99.9

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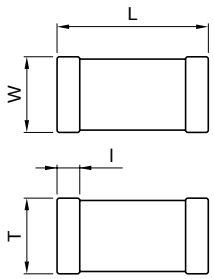
FEATURES

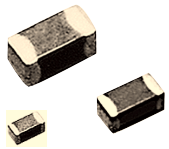
- Small sized 1005 type (L1×W0.5×T0.5mm) series are available.
- Terminal electrodes using electrolytic plating (Ni-Pb/Sn).
- Good solderability.
- Layered internal electrode structure.
- Product series provides a wide range of resistances and B constants.
- Good stability of resistance value after soldering.
- The 1608 and 1005 types provide two different shapes with identical resistance-temperature characteristics.
- Attains less that 3 pF floating capacitance (using TCXO) in the high frequency region.

APPLICATIONS

- Equipment related to mobile communication
  TCXOs (temperature compensated type quartz oscillator)
  RF circuits (power amp circuits, temperature monitoring circuits)
  LCD panel temperature compensation circuits
  Battery pack temperature compensation circuits
- Computer related equipment
  CPU periphery temperature monitoring circuits
  LCD panel temperature compensation circuits
- Video camcorder
  Auto-focus circuits
  Plunger peripheral circuits
  Battery pack temperature control circuits
- Equipment related to car audio
  Various types of pickup temperature compensation circuits
  Temperature compensation for various types of circuits
- Optical communication related equipment
  Laser transmission circuit temperature compensation

SHAPES AND DIMENSIONS



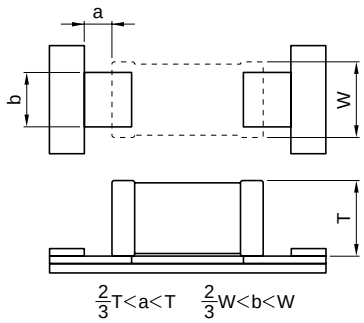


Electrode material
Internal:Pd
External:Ag/Ni/Sn-Pb

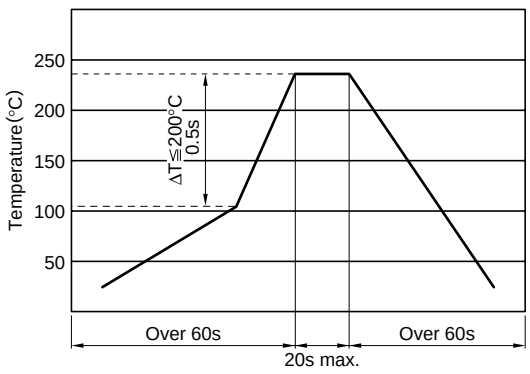
Dimensions in mm

Type	L	W	T	l
1005	1±0.05	0.5±0.05	0.5±0.05	0.15min.
1608	1.6±0.1	0.8±0.1	0.8±0.1	0.2 min.
2012	2±0.2	1.2±0.2	0.7±0.2	0.2 min.

RECOMMENDED PC BOARD PATTERN



RECOMMENDED REFLOW SOLDERING CONDITIONS



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PRODUCT IDENTIFICATION

NTCCM	1005	3E	H	300	_	C
(1)	(2)	(3)	(4)	(5)	(6)	(7)

(1) Series name

(2) Dimensions L×W

1005	1.0×0.5mm
1608	1.6×0.8mm
2012	2.0×1.25mm

(3) Constant B

This code indicates the value of constant B using a combination of one numeric character and one alphabetic character.

Example

Code	Constant B(K)
3E	3201 to 3250
3N	3601 to 3650
4L	4501 to 4550
4Q	4701 to 4750

Code	Constant B(K)
3	3000
4	4000

Code	Constant B(K)
A	0 to 50
B	51 to 100
C	101 to 150
E	201 to 250
F	251 to 300
J	401 to 450
L	501 to 550
N	601 to 650
Q	701 to 750
S	801 to 850

(4) Constant B tolerance

Code	Tolerance(%)
H	±3

(5) Nominal resistance

The resistance is expressed in three digit codes and in units of Ω.

The first and second digits: Effective number

The third digit: Number of 0 which following the effective number.

300	30Ω
101	100Ω
102	1000Ω(1kΩ)
103	10000Ω(10kΩ)

(6) Nominal resistance tolerance

Code	Tolerance(%)
G	±2
H	±3
J	±5
K	±10

(7) Ambient temperature of nominal resistance

Code	Ambient temperature(°C)
C	25

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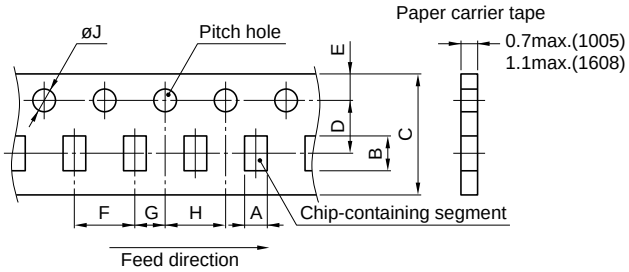
1005, 1608 TYPES

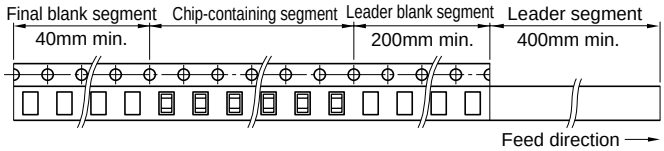
ELECTRICAL CHARACTERISTICS

No.	Part No.	Normal resistance value [25°C]	B constant [+25 to +85°C]	Operating temperature range
1	NTCCM_ _ _ _3EH220_C	22Ω	3250K±3%	
2	NTCCM_ _ _ _3EH300_C	30Ω	3250K±3%	
3	NTCCM_ _ _ _3EH330_C	33Ω	3250K±3%	
4	NTCCM_ _ _ _3EH400_C	40Ω	3250K±3%	
5	NTCCM_ _ _ _3EH470_C	47Ω	3250K±3%	–40 to +125°C
6	NTCCM_ _ _ _3EH680_C	68Ω	3250K±3%	
7	NTCCM_ _ _ _3EH101_C	100Ω	3250K±3%	
8	NTCCM_ _ _ _3EH131_C	125Ω	3250K±3%	
9	NTCCM_ _ _ _3EH151_C	150Ω	3250K±3%	
10	NTCCM_ _ _ _3NH221_C	220Ω	3650K±3%	
11	NTCCM_ _ _ _3NH331_C	330Ω	3650K±3%	
12	NTCCM_ _ _ _3NH471_C	470Ω	3650K±3%	
13	NTCCM_ _ _ _3NH681_C	680Ω	3650K±3%	–40 to +125°C
14	NTCCM_ _ _ _3NH102_C	1kΩ	3650K±3%	
15	NTCCM_ _ _ _3NH152_C	1.5kΩ	3650K±3%	
16	NTCCM_ _ _ _4BH102_C	1kΩ	4100K±3%	
17	NTCCM_ _ _ _4BH152_C	1.5kΩ	4100K±3%	
18	NTCCM_ _ _ _4BH182_C	1.8kΩ	4100K±3%	
19	NTCCM_ _ _ _4BH202_C	2kΩ	4100K±3%	
20	NTCCM_ _ _ _4BH222_C	2.2kΩ	4100K±3%	–40 to +85°C
21	NTCCM_ _ _ _4BH252_C	2.5kΩ	4100K±3%	
22	NTCCM_ _ _ _4BH282_C	2.8kΩ	4100K±3%	
23	NTCCM_ _ _ _4BH302_C	3kΩ	4100K±3%	
24	NTCCM_ _ _ _4KH202_C	2kΩ	4500K±3%	
25	NTCCM_ _ _ _4KH222_C	2.2kΩ	4500K±3%	
26	NTCCM_ _ _ _4KH252_C	2.5kΩ	4500K±3%	–40 to +125°C
27	NTCCM_ _ _ _4KH282_C	2.8kΩ	4500K±3%	
28	NTCCM_ _ _ _4BH332_C	3.3kΩ	4100K±3%	
29	NTCCM_ _ _ _4BH352_C	3.5kΩ	4100K±3%	
30	NTCCM_ _ _ _4BH402_C	4kΩ	4100K±3%	
31	NTCCM_ _ _ _4BH472_C	4.7kΩ	4100K±3%	–40 to +125°C
32	NTCCM_ _ _ _4BH682_C	6.8kΩ	4100K±3%	
33	NTCCM_ _ _ _4BH103_C	10kΩ	4100K±3%	
34	NTCCM_ _ _ _4BH153_C	15kΩ	4100K±3%	
35	NTCCM_ _ _ _4LH223_C	22kΩ	4550K±3%	
36	NTCCM_ _ _ _4LH333_C	33kΩ	4550K±3%	
37	NTCCM_ _ _ _4LH473_C	47kΩ	4550K±3%	
38	NTCCM_ _ _ _4LH683_C	68kΩ	4550K±3%	–40 to +125°C
39	NTCCM_ _ _ _4LH104_C	100kΩ	4550K±3%	
40	NTCCM_ _ _ _4LH154_C	150kΩ	4550K±3%	
41	NTCCM_ _ _ _4QH224_C	220kΩ	4750K±3%	
42	NTCCM_ _ _ _4QH334_C	330kΩ	4750K±3%	
43	NTCCM_ _ _ _4QH474_C	470kΩ	4750K±3%	–40 to +125°C
44	NTCCM_ _ _ _4QH684_C	680kΩ	4750K±3%	
45	NTCCM_ _ _ _4QH105_C	1MΩ	4750K±3%	
46	NTCCM_ _ _ _2QH300_C	30Ω	2750K±3%	
47	NTCCM_ _ _ _2QH330_C	33Ω	2750K±3%	
48	NTCCM_ _ _ _2QH400_C	40Ω	2750K±3%	
49	NTCCM_ _ _ _2QH470_C	47Ω	2750K±3%	
50	NTCCM_ _ _ _2QH680_C	68Ω	2750K±3%	–40 to +85°C
51	NTCCM_ _ _ _2QH101_C	100Ω	2750K±3%	
52	NTCCM_ _ _ _2QH131_C	125Ω	2750K±3%	
53	NTCCM_ _ _ _2QH151_C	150Ω	2750K±3%	
54	NTCCM_ _ _ _2QH181_C	180Ω	2750K±3%	
55	NTCCM_ _ _ _3JF103_C	10kΩ	3435K±1%	–40 to +125°C
56	NTCCM_ _ _ _3LH472_C	4.7kΩ	3545K±3%	–40 to +125°C

PACKAGING STYLE AND QUANTITIES

TAPING SPECIFICATION





• Cumulative pitch hole shift is within ±0.3mm over a 10-pitch interval.

Dimensions in mm

Type	1005	1608
A	0.65+0.05, –0.1	1.1±0.2
B	1.15+0.05, –0.1	1.9±0.2
C	8±0.3	8±0.3
D	3.5±0.05	3.5±0.05
E	1.75±0.1	1.75±0.1
F	2±0.05	4±0.1
G	2±0.05	2±0.05
H	4±0.05	4±0.1
J	1.5+0.1, –0	1.5+0.1, –0

• Packaging quantities
10000 pieces/reel(1005 type), 4000 pieces/reel(1608 type)

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1005, 1608 TYPE

RESISTANCE vs. TEMPERATURE CHARACTERISTICS TABLE (CONUERSION TABLE)

Temp.	No.1 to 9		No.10 to 15		No.16 to 23		No.24 to 27		No.28 to 34		No.35 to 40		No.41 to 45		No.46 to 54		No.55		No.56	
(°C)	R	B (25/T)	R	B (25/T)	R	B (25/T)	R	B (25/T)	R	B (25/T)	R	B (25/T)	R	B (25/T)	R	B (25/T)	R	B (25/T)	R	B (25/T)
–40	19.59	3182	26.37	3499	41.78	3991	58.88	4358	38.44	3903	50.89	4203			12.090	2665	18.850	3140	22.830	3345
–35	14.79	3188	19.48	3514	29.45	4003	40.29	4374	27.34	3915	35.49	4224			9.560	2672	14.429	3159	17.045	3356
–30	11.28	3193	14.53	3528	21.01	4014	27.92	4389	19.68	3928	25.03	4245			7.625	2678	11.133	3176	12.862	3367
–25	8.685	3199	10.94	3540	15.17	4024	19.59	4402	14.33	3939	17.85	4264			6.131	2683	8.656	3194	9.798	3377
–20	6.753	3204	8.313	3552	11.07	4033	13.90	4415	10.54	3951	12.86	4284	13.55	4371	4.969	2689	6.779	3210	7.534	3387
–15	5.298	3208	6.371	3563	8.168	4041	9.976	4426	7.837	3962	9.353	4302	9.833	4398	4.056	2694	5.346	3226	5.843	3397
–10	4.192	3213	4.923	3573	6.087	4049	7.236	4436	5.883	3972	6.869	4320	7.197	4424	3.334	2700	4.245	3241	4.570	3406
–5	3.343	3217	3.836	3583	4.581	4056	5.303	4446	4.456	3982	5.090	4337	5.309	4449	2.759	2705	3.393	3256	3.602	3415
0	2.687	3220	3.011	3591	3.480	4062	3.925	4454	3.406	3992	3.805	4353	3.947	4473	2.297	2709	2.728	3270	2.862	3425
5	2.176	3224	2.382	3599	2.667	4068	2.933	4462	2.625	4001	2.868	4369	2.957	4496	1.924	2714	2.207	3283	2.289	3434
10	1.774	3227	1.898	3606	2.062	4073	2.212	4469	2.039	4010	2.179	4384	2.232	4518	1.621	2718	1.796	3296	1.843	3441
15	1.456	3230	1.523	3613	1.607	4077	1.683	4475	1.596	4018	1.669	4399	1.696	4539	1.373	2723	1.470	3308	1.494	3449
20	1.203	3233	1.230	3618	1.263	4081	1.292	4480	1.259	4026	1.287	4412	1.298	4559	1.169	2726	1.209	3320	1.219	3458
25	1.000	3235	1.000	3623	1.000	4084	1.000	4485	1.000	4034	1.000	4426	1.000	4577	1.000	2730	1.000	3332	1.000	3464
30	0.8360	3237	0.8181	3628	0.7976	4088	0.7801	4488	0.7997	4041	0.7823	4439	0.7755	4596	0.860	2733	0.831	3343	0.825	3470
35	0.7029	3239	0.6734	3632	0.6407	4090	0.6133	4492	0.6437	4048	0.6160	4451	0.6052	4614	0.742	2737	0.694	3353	0.685	3480
40	0.5941	3241	0.5576	3636	0.5182	4092	0.4857	4494	0.5213	4055	0.4882	4463	0.4753	4630	0.644	2739	0.583	3363	0.571	3487
45	0.5047	3243	0.4643	3639	0.4218	4094	0.3875	4497	0.4248	4061	0.3893	4474	0.3754	4646	0.561	2742	0.491	3373	0.479	3494
50	0.4309	3244	0.3887	3642	0.3455	4096	0.3112	4498	0.3481	4067	0.3123	4485	0.2983	4661	0.491	2744	0.416	3382	0.403	3501
55	0.3697	3246	0.3272	3644	0.2847	4097	0.2516	4500	0.2869	4072	0.2520	4496	0.2384	4676	0.431	2746	0.354	3390	0.341	3506
60	0.3185	3247	0.2768	3646	0.2360	4098	0.2048	4501	0.2377	4078	0.2044	4506	0.1916	4690	0.380	2747	0.302	3399	0.290	3513
65	0.2757	3248	0.2353	3647	0.1967	4099	0.1677	4501	0.1979	4083	0.1667	4515	0.1548	4703	0.336	2749	0.259	3407	0.247	3520
70	0.2396	3248	0.2010	3648	0.1648	4099	0.1381	4501	0.1657	4087	0.1367	4524	0.1257	4716	0.298	2749	0.223	3414	0.212	3525
75	0.2091	3249	0.1724	3649	0.1388	4100	0.11439	4501	0.1393	4092	0.1126	4533	0.1026	4728	0.266	2750	0.192	3422	0.182	3533
80	0.1832	3250	0.1486	3650	0.1175	4100	0.09528	4501	0.1177	4096	0.09325	4542	0.08412	4739	0.238	2750	0.167	3428	0.157	3539
85*	0.1610	3250	0.1286	3650	0.0999	4100	0.07978	4500	0.09989	4100	0.07757	4550	0.06933	4750	0.213	2750	0.145	3435	0.136	3546
90	0.1421	3250	0.1118	3650	0.0853	4100	0.06714	4499	0.08513	4104	0.06482	4558	0.05740	4760	0.192	2749	0.127	3441	0.119	3553
95	0.1258	3251	0.09751	3650	0.0732	4100	0.05679	4498	0.07286	4107	0.05440	4565	0.04773	4770	0.173	2748	0.111	3447	0.103	3558
100	0.1118	3251	0.08539	3650	0.0630	4100	0.04826	4497	0.06260	4110	0.04584	4573	0.03987	4780	0.157	2747	0.098	3453	0.090	3565
105	0.09960	3251	0.07505	3650	0.05451	4100	0.04119	4495	0.05400	4114	0.03879	4580	0.03344	4789	0.143	2745	0.086	3458	0.079	3571
110	0.08903	3251	0.06619	3649	0.04731	4100	0.03532	4493	0.04675	4116	0.03295	4586	0.02817	4797	0.130	2743	0.076	3463	0.070	3578
115	0.07981	3251	0.05857	3649	0.04121	4101	0.03041	4491	0.04063	4119	0.02810	4593	0.02382	4806	0.119	2740	0.067	3468	0.062	3582
120	0.07175	3251	0.05198	3648	0.03602	4101	0.02629	4489	0.03543	4122	0.02425	4599	0.02022	4813	0.109	2737	0.060	3473	0.054	3591
125	0.06468	3251	0.04628	3648	0.03159	4101	0.02282	4487	0.03099	4124	0.02066	4606	0.01723	4821	0.100	2734	0.053	3478	0.048	3597

Ex.1) R25=1.000×30=30Ω
R85=0.1610×R25(30Ω)=4.83
(listed *)

Ex.2) R25=1.000×3.3=3.3kΩ
R85=0.09989×R25(3.3kΩ)=0.330kΩ
(listed *)

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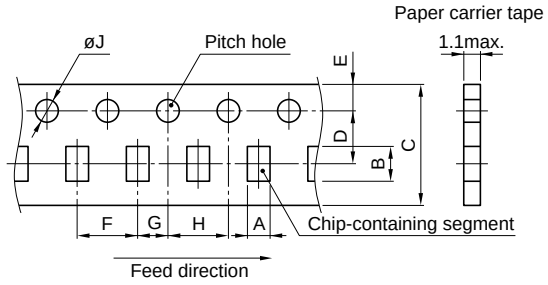
2012 TYPE

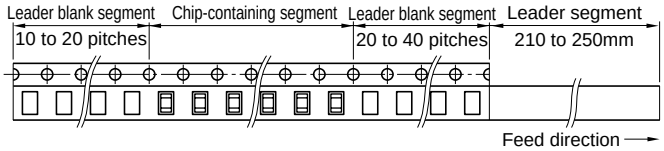
ELECTRICAL CHARACTERISTICS

No.	Part No.	Normal resistance value [25°C]	B constant [+25 to +85°C]	Operating temperature range
1	NTCCM20123EH471_C	470Ω	3250K±3%	–40 to +125°C
2	NTCCM20123EH681_C	680Ω	3250K±3%	
3	NTCCM20123BH102_C	1kΩ	3100K±3%	–40 to +125°C
4	NTCCM20123BH152_C	1.5kΩ	3100K±3%	
5	NTCCM20123FH222_C	2.2kΩ	3300K±3%	–40 to +125°C
6	NTCCM20123FH332_C	3.3kΩ	3300K±3%	
7	NTCCM20123JH472_C	4.7kΩ	3450K±3%	–40 to +125°C
8	NTCCM20123JH682_C	6.8kΩ	3450K±3%	
9	NTCCM20123NH103_C	10kΩ	3650K±3%	–40 to +125°C
10	NTCCM20123NH153_C	15kΩ	3650K±3%	
11	NTCCM20123SH223_C	22kΩ	3850K±3%	–40 to +125°C
12	NTCCM20123SH333_C	33kΩ	3850K±3%	
13	NTCCM20124AH473_C	47kΩ	4000K±3%	–40 to +125°C
14	NTCCM20124AH683_C	68kΩ	4000K±3%	
15	NTCCM20124CH104_C	100kΩ	4150K±3%	–40 to +125°C
16	NTCCM20124CH154_C	150kΩ	4150K±3%	

PACKAGING STYLE AND QUANTITIES

TAPING SPECIFICATION





• Cumulative pitch hole shift is within ±0.3mm over a 10-pitch interval.

Dimensions in mm

Type	2012
A	1.5±0.2
B	2.3±0.2
C	8±0.3
D	3.5±0.05
E	1.75±0.1
F	4±0.1
G	2±0.05
H	4±0.1
J	1.5+0.1, –0

• Packaging quantities
2000 pieces/reel

Sensors

NTCCM Series NTCCM1005, 1608, 2012 Types

Temperature Sensors
NTC Thermistors

2012 TYPE

RESISTANCE vs. TEMPERATURE CHARACTERISTICS TABLE (CONUERSION TABLE)

Temp. (°C)	No.1 or 2		No.3 or 4		No.5 or 6		No.7 or 8		No.9 or 10		No.11 or 12		No.13 or 14		No.15 or 16	
	R	B (25/T)	R	B (25/T)	R	B (25/T)	R	B (25/T)	R	B (25/T)	R	B (25/T)	R	B (25/T)	R	B (25/T)
–40	17.74	3076	15.18	2909	17.65	3070	19.80	3193	23.36	3370	27.76	3554	31.77	3699	35.34	3813
–35	13.62	3091	11.78	2919	13.52	3082	15.00	3205	17.42	3382	20.43	3570	23.02	3712	25.28	3822
–30	10.54	3105	9.217	2928	10.45	3094	11.47	3216	13.13	3394	15.18	3585	16.88	3725	18.33	3834
–25	8.226	3118	7.273	2936	8.150	3104	8.853	3227	9.994	3406	11.39	3599	12.50	3738	13.47	3848
–20	6.466	3131	5.786	2944	6.405	3115	6.894	3238	7.679	3419	8.618	3613	9.357	3751	10.01	3864
–15	5.119	3142	4.639	2953	5.073	3125	5.413	3249	5.952	3432	6.582	3626	7.070	3763	7.520	3882
–10	4.081	3152	3.746	2961	4.048	3134	4.283	3261	4.650	3445	5.073	3640	5.391	3777	5.697	3900
–5	3.277	3163	3.047	2969	3.254	3144	3.415	3273	3.661	3458	3.937	3652	4.147	3790	4.352	3919
0	2.647	3171	2.494	2977	2.633	3154	2.740	3284	2.903	3472	3.080	3665	3.215	3804	3.349	3937
5	2.153	3180	2.054	2985	2.145	3163	2.215	3297	2.317	3484	2.427	3677	2.511	3817	2.596	3956
10	1.762	3188	1.702	2993	1.757	3173	1.800	3307	1.862	3499	1.926	3690	1.975	3830	2.026	3974
15	1.450	3195	1.418	3000	1.449	3184	1.471	3319	1.505	3512	1.539	3702	1.564	3843	1.591	3989
20	1.201	3203	1.188	3011	1.200	3194	1.210	3329	1.223	3519	1.237	3715	1.247	3856	1.258	4012
25	1.000	3207	1.000	3017	1.000	3202	1.000	3339	1.000	3532	1.000	3727	1.000	3868	1.000	4024
30	0.837	3211	0.846	3023	0.837	3211	0.831	3350	0.822	3546	0.813	3738	0.807	3881	0.800	4036
35	0.704	3218	0.719	3031	0.704	3223	0.694	3361	0.679	3557	0.665	3748	0.654	3895	0.644	4049
40	0.596	3224	0.613	3046	0.595	3232	0.582	3372	0.564	3568	0.546	3762	0.534	3907	0.521	4062
45	0.506	3227	0.526	3047	0.505	3240	0.490	3383	0.470	3579	0.451	3772	0.438	3919	0.424	4074
50	0.432	3232	0.452	3060	0.430	3248	0.415	3392	0.394	3590	0.375	3782	0.361	3931	0.347	4085
55	0.371	3235	0.391	3062	0.369	3255	0.352	3402	0.332	3599	0.313	3793	0.299	3940	0.285	4096
60	0.320	3237	0.339	3070	0.316	3266	0.301	3411	0.280	3609	0.262	3803	0.249	3951	0.235	4106
65	0.276	3241	0.295	3077	0.273	3271	0.257	3420	0.238	3618	0.220	3813	0.208	3963	0.195	4115
70	0.240	3243	0.258	3080	0.236	3279	0.221	3427	0.203	3626	0.186	3823	0.174	3973	0.163	4126
75	0.209	3246	0.226	3087	0.205	3285	0.191	3436	0.174	3635	0.158	3832	0.147	3982	0.137	4134
80	0.183	3248	0.199	3091	0.179	3292	0.166	3443	0.149	3642	0.134	3841	0.124	3991	0.115	4142
85*	0.161	3250	0.175	3102	0.156	3302	0.144	3451	0.129	3650	0.115	3850	0.106	4000	0.0971	4150
90	0.142	3252	0.155	3105	0.137	3308	0.126	3457	0.111	3657	0.0986	3858	0.0901	4008	0.0824	4158
95	0.126	3253	0.138	3106	0.121	3313	0.110	3461	0.0967	3663	0.0850	3866	0.0772	4016	0.0702	4165
100	0.111	3255	0.123	3109	0.107	3318	0.0966	3467	0.0842	3671	0.0734	3874	0.0664	4023	0.0601	4172
105	0.0992	3256	0.110	3111	0.0945	3324	0.0851	3472	0.0737	3675	0.0637	3881	0.0573	4030	0.0515	4179
110	0.0886	3257	0.0980	3122	0.0841	3327	0.0751	3479	0.0646	3682	0.0554	3888	0.0496	4036	0.0444	4186
115	0.0793	3258	0.0880	3125	0.0750	3331	0.0666	3484	0.0569	3686	0.0484	3895	0.0431	4042	0.0384	4193
120	0.0713	3259	0.0790	3132	0.0668	3339	0.0594	3485	0.0502	3691	0.0424	3901	0.0376	4047	0.0333	4199
125	0.0642	3260	0.0720	3123	0.0600	3340	0.0530	3487	0.0445	3695	0.0372	3906	0.0329	4053	0.0289	4206

Ex.1) R25=470Ω
R85=0.161×R25(470Ω)=75.67Ω
(listed *)

Ex.2)R25=3.3kΩ
R85=0.156×R25(3.3kΩ)=0.514
(listed *)

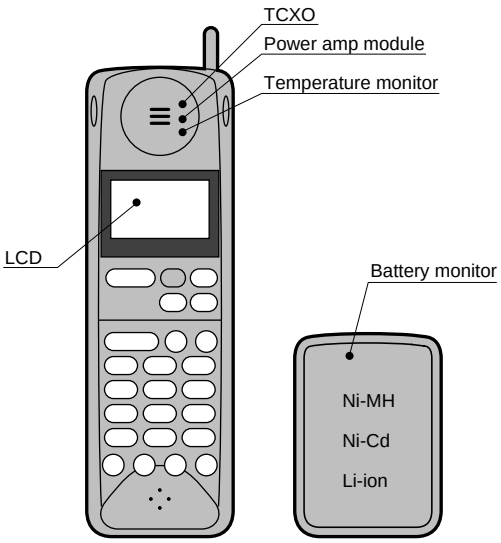
Sensors

Temperature Sensors
NTC Thermistors

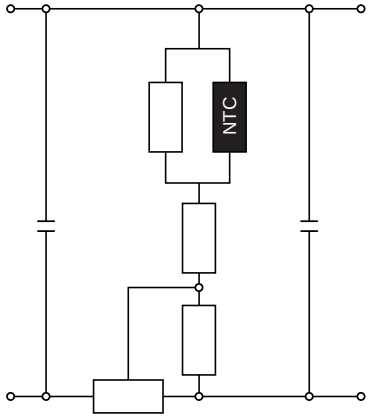
NTCCM Series NTCCM1005, 1608, 2012 Types

CIRCUIT EXAMPLES

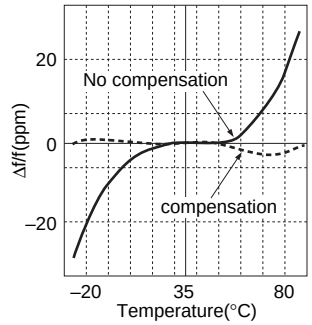
1. CELLULAR PHONE

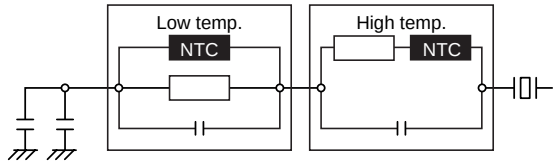


LCD, Adjustment of contrast

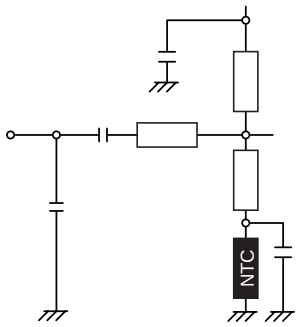


TCXO, Frequency compensation of crystal

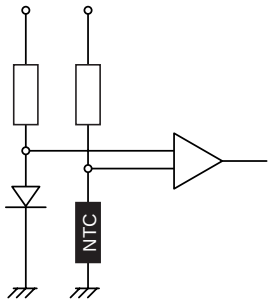




Power amp. module, Control of voltage

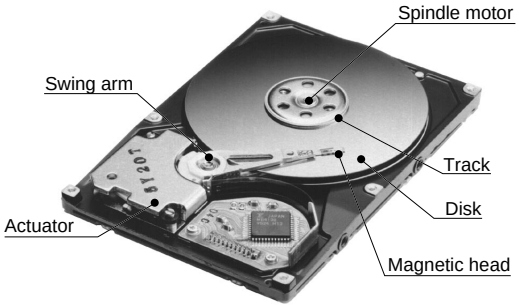


Temperature monitor

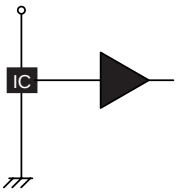


2.HARD DISK DRIVE

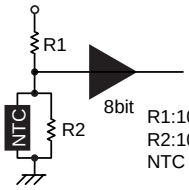
Chip NTC thermistor
NTCCM1005, 1608 types
Resistance tolerance: ±3 to ±5%
Constant B tolerance: ±2 to ±3%



TEMPERATURE SENSOR IC (Cost:¥20 to 25)



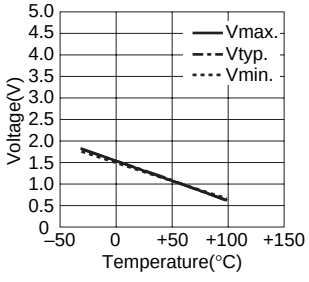
NTC THERMISTOR (Cost: 50% down)



R1:10kΩ±5%
R2:10kΩ±5%
NTC R25:10kΩ±5%
B25/85:4100K±3%

VOLTAGE vs. TEMPERATURE CHARACTERISTICS

TEMPERATURE SENSOR IC



NTC THERMISTOR