

NTC Thermistor Terminology

NTC Thermistor

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A "thermistor" is a "thermally sensitive resistor" whose primary function is to exhibit a change in electrical resistance with a change in body temperature. NTC thermistor is one in which the zero-power resistance decreases with an increase in temperature.

Factors for Thermistor Characteristics

1. Zero-Power Resistance : $R(\Omega)$

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

where R : Resistance value at Kelvin temperature $T(K)$
 R_0 : Resistance value at Kelvin temperature $T_0(K)$
 B : B constant

2. B Constant : K

$$B(T_1/T_2) = (\ln R_1 - \ln R_2) / (1/T_1 - 1/T_2)$$

where R_1 : Resistance value at the Kelvin temperature $T_1(K)$
 R_2 : Resistance value at the Kelvin temperature $T_2(K)$
 T_1, T_2 : Kelvin temperature ($K = ^\circ C + 273.15$)

3. Dissipation Constant : δ (mW/ $^\circ C$)

Dissipation constant(δ) is power in milliwatts required to raise thermistor temperature $1^\circ C$. Measured with thermistor suspended by its leads in a specified environment.

$$\delta = P / \Delta t \text{ (mW/}^\circ C\text{)}$$

where P : Power

Δt : Raise temperature ($^\circ C$)

4. Thermal Time Constant : τ (sec)

Thermal time constant(τ) is the time required by a thermistor change 63.2% of the difference between its initial and final temperature. Measure with thermistor suspended by its leads in a specified environment.

5. Temperature Coefficient of Resistance : α (%/ $^\circ C$)

Temperature coefficient of resistance(α) is expressed in the following equation :

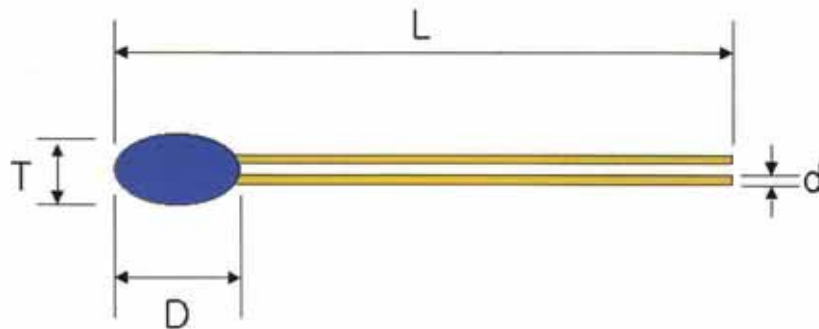
$$\alpha = - (B / T_2) \times 100$$

Chip in Glass Thermistor



- High quality and high precision thermistor
- Chip type
- Stability, reproducibility and no aging characteristic
- High responsibility
- Mass productibility

Features



Designation		T	D	L	d
CB-1	Size(mm)	2.15	3.20	65.0	0.30
	Tol.(mm)	±0.35	±0.80	±5.00	±0.05
CB-3	Size(mm)	1.25	2.30	65.0	0.20
	Tol.(mm)	±0.25	±0.70	±5.00	±0.05
CB-5	Size(mm)	0.75	1.60	65.0	0.15
	Tol.(mm)	±0.15	±0.60	±5.00	±0.05
CB-7	Size(mm)	0.55	1.20	65.0	0.10
	Tol.(mm)	±0.10	±0.50	±5.00	±0.05

Physical Characteristics

Type	Dissipation Factor(mW/ °C)	Time Constant(63.2%)(sec)	
	In still Air	In still Air	In stirred Oil
CB-1	1.2 ~ 1.3	10 ~ 11	0.9 ~ 1.1
CB-3	0.7 ~ 0.8	4.0 ~ 5.0	0.3 ~ 0.4
CB-5	0.4 ~ 0.5	2.0 ~ 3.0	0.18 ~ 0.20
CB-7	0.2 ~ 0.3	0.5 ~ 1.0	0.07 ~ 0.10

Chip in Glass Thermistor

Temperature-Resistance Characteristics

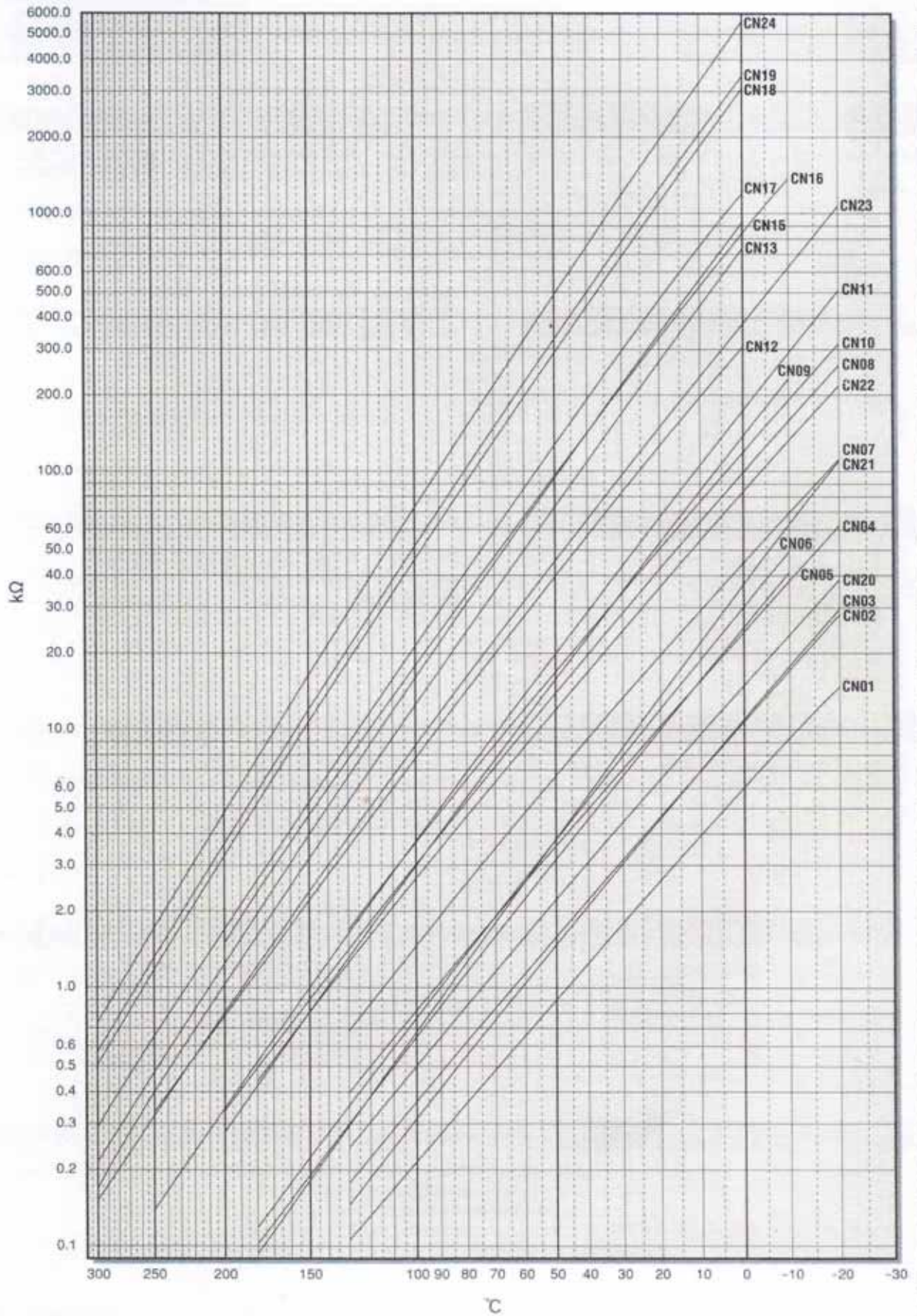
Class	Std. Resistance	R25 (k Ω)	B(K)	B25/85	Operating Temp
1	6.000k Ω /0 $^{\circ}$ C	2.1757	3390/0~100 $^{\circ}$ C	3416.5	-20~200 $^{\circ}$ C
2	11.00k Ω /0 $^{\circ}$ C	3.9165	3450/0~100 $^{\circ}$ C	3475.9	-20~200 $^{\circ}$ C
3	11.00k Ω /0 $^{\circ}$ C	3.7402	3600/0~100 $^{\circ}$ C	3627.3	-20~200 $^{\circ}$ C
4	24.00k Ω /0 $^{\circ}$ C	8.5428	3450/0~100 $^{\circ}$ C	3475.6	-20~200 $^{\circ}$ C
5	25.00k Ω /0 $^{\circ}$ C	8.1518	3735/0~100 $^{\circ}$ C	3762.3	-20~200 $^{\circ}$ C
6	30.00k Ω /0 $^{\circ}$ C	9.7821	3735/0~100 $^{\circ}$ C	3762.2	-20~200 $^{\circ}$ C
7	45.00k Ω /0 $^{\circ}$ C	16.150	3480/0~100 $^{\circ}$ C	3495.8	-20~200 $^{\circ}$ C
8	100.0k Ω /0 $^{\circ}$ C	34.643	3550/0~100 $^{\circ}$ C	3576.4	-20~200 $^{\circ}$ C
9	3.000k Ω /100 $^{\circ}$ C	43.678	3920/0~100 $^{\circ}$ C	3954.0	-20~200 $^{\circ}$ C
10	3.600k Ω /100 $^{\circ}$ C	41.151	3570/0~100 $^{\circ}$ C	3596.3	-20~200 $^{\circ}$ C
11	7.800k Ω /100 $^{\circ}$ C	101.94	3750/100~200 $^{\circ}$ C	3790.4	-20~250 $^{\circ}$ C
12	1.000k Ω /200 $^{\circ}$ C	215.57	4500/100~200 $^{\circ}$ C	4165.8	-20~300 $^{\circ}$ C
13	1.250k Ω /200 $^{\circ}$ C	271.49	4500/100~200 $^{\circ}$ C	4175.8	-20~300 $^{\circ}$ C
14	18.00k Ω /100 $^{\circ}$ C	266.63	4300/100~200 $^{\circ}$ C	3975.4	-20~300 $^{\circ}$ C
15	1.700k Ω /200 $^{\circ}$ C	369.11	4400/100~200 $^{\circ}$ C	4074.6	-20~300 $^{\circ}$ C
16	3.200k Ω /200 $^{\circ}$ C	874.05	4700/100~200 $^{\circ}$ C	4343.0	-20~300 $^{\circ}$ C
17	3.600k Ω /200 $^{\circ}$ C	984.66	4700/100~200 $^{\circ}$ C	4345.3	-20~300 $^{\circ}$ C
18	15.00k Ω /0 $^{\circ}$ C	5.3407	3450/0~100 $^{\circ}$ C	3475.9	-20~200 $^{\circ}$ C
19	37.00k Ω /0 $^{\circ}$ C	10.899	4080/0~100 $^{\circ}$ C	4114.8	-20~200 $^{\circ}$ C
20	2.700k Ω /100 $^{\circ}$ C	29.351	3500/0~100 $^{\circ}$ C	3522.9	-20~200 $^{\circ}$ C
21	0.810k Ω /200 $^{\circ}$ C	122.48	4200/100~200 $^{\circ}$ C	3891.3	-20~250 $^{\circ}$ C
22	4.800k Ω /200 $^{\circ}$ C	1534.9	4850/100~200 $^{\circ}$ C	4448.5	-20~300 $^{\circ}$ C
23	4.800k Ω /200 $^{\circ}$ C	1534.9	4850/100~200 $^{\circ}$ C	4448.5	-20~300 $^{\circ}$ C
24	10.00k Ω /25 $^{\circ}$ C	10.000	3435/25~85 $^{\circ}$ C	3435.0	-20~300 $^{\circ}$ C
25	10.00k Ω /25 $^{\circ}$ C	10.000	3450/0~100 $^{\circ}$ C	3480.0	-20~200 $^{\circ}$ C
26	30.00k Ω /0 $^{\circ}$ C	10.740	3434/25~50 $^{\circ}$ C	3470.0	-20~200 $^{\circ}$ C
27	3.485k Ω /50 $^{\circ}$ C	8.5080	3450/0~100 $^{\circ}$ C	3480.0	-20~200 $^{\circ}$ C
28	5.000k Ω /25 $^{\circ}$ C	5.0000	3930/25~50 $^{\circ}$ C	3970.0	-20~200 $^{\circ}$ C
29	10.00k Ω /25 $^{\circ}$ C	10.000	3930/25~50 $^{\circ}$ C	3970.0	-20~200 $^{\circ}$ C
30	49.12k Ω /25 $^{\circ}$ C	49.120	3900/25~50 $^{\circ}$ C	3950.0	-20~200 $^{\circ}$ C
31	100.0k Ω /25 $^{\circ}$ C	100.00	3950/25~50 $^{\circ}$ C	4000.0	-20~300 $^{\circ}$ C
32	500.0k Ω /25 $^{\circ}$ C	500.00	4145/0~100 $^{\circ}$ C	4200.0	-20~300 $^{\circ}$ C
33	15.44k Ω /75 $^{\circ}$ C	100.00	3918/25~100 $^{\circ}$ C	3890.0	-20~300 $^{\circ}$ C

* Suggest us other Spec. customer wanted



Chip in Glass Thermistor

Temperature-Resistance Curve

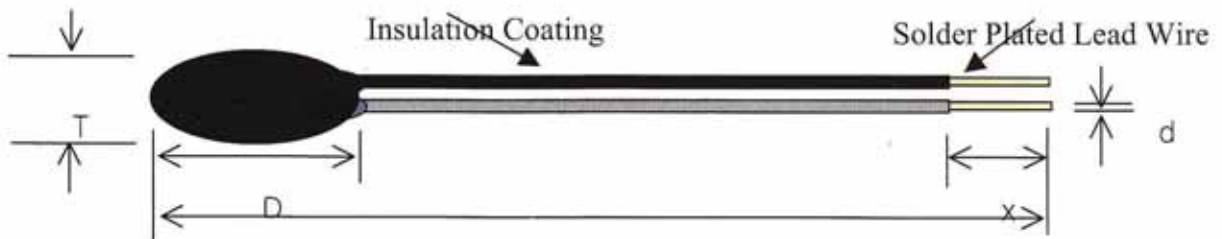


Small Head Epoxy Thermistor



- Chip inside
- Epoxy sealing
- Very small size epoxy type thermistor
- Fast responsibility
- High reliability
- Medical equipment and thermometers

Features



	Dimension	Tolerance
T	1.25	±0.25
D	3.00	±1.5
L	87.0	±3.00
d	0.20	±0.1
X	15.00	±5.00

Unit : mm

Type	Dissipation Factor(mW/ °C)		Time Constant(63.2%)(sec)	
	In still Air		In still Air	In stirred Oil
CE-3	0.7 ~ 1.0		4 ~ 6	0.3 ~ 0.5

Temperature-Resistance Characteristics

Class	R25 (kΩ)	B25/85(K)	Operating Temp
1	10.00	3250	-40~90°C
2	50.00	3950	-40~90°C
3	83.00	4000	-40~90°C
4	100.0	4000	-40~90°C
5	10.00	3420	-40~90°C

Chip in Epoxy Thermistor

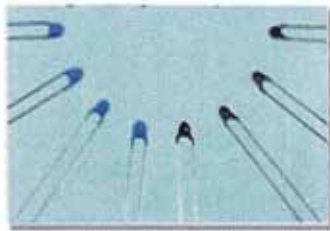
Application

- Temperature compensation
- Temperature sensing
- Home application
- Industrial equipments
- Test, analysis of R&D

Features

- Compact size and space reservation
- Precision characteristics for thermal and electrical action

Figures



Lead wire type



Lead frame type

Electrical Characteristics

- Operating temperature range : $-30^{\circ}\text{C} - +120^{\circ}\text{C}$
- Thermal time constant : Max. 2sec (in stirred oil)
- Dissipation constant : Min. $0.5\text{mW}/^{\circ}\text{C}$ (in still air)

Part No.	Resistance(R25,k Ω)	Constant B25/85(K)
1	5.0k Ω	3324K
2	5.0k Ω	3470K
3	5.0k Ω	3950K
4	10.0k Ω	3435K
5	10.0k Ω	3970K
6	15.0k Ω	4100K
7	20.0k Ω	3970K
8	30.0k Ω	3950K
9	50.0k Ω	3950K
10	100.0k Ω	4000K

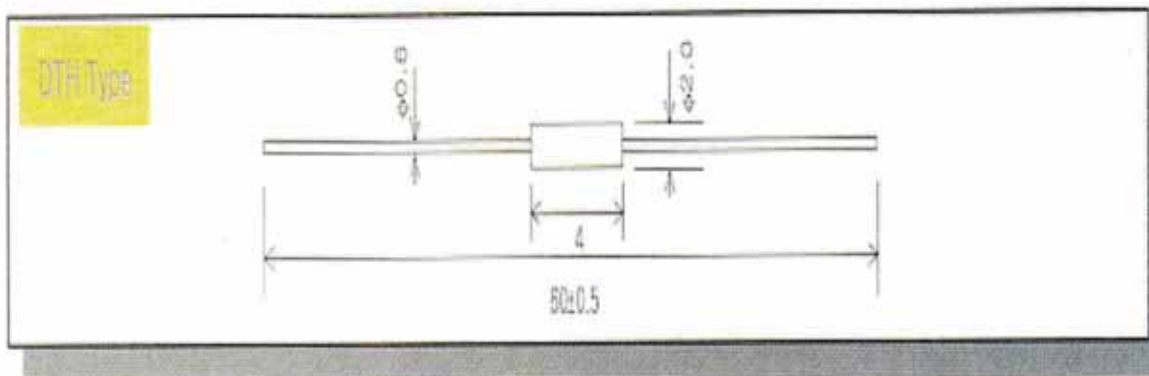
1. Resistance tolerance(Marked O): F($\pm 1\%$), G($\pm 2\%$), H($\pm 3\%$), J($\pm 5\%$)
2. "B" constant Tolerance : F($\pm 1\%$), G($\pm 2\%$), H($\pm 3\%$)
3. Other than the thermistors mentioned above are available on request.

Diode Type Thermistor



- Glass sealing.
- Strong in high temp. & humid environment.
- Semiconductor process applied
- Automatic insertion.

Features

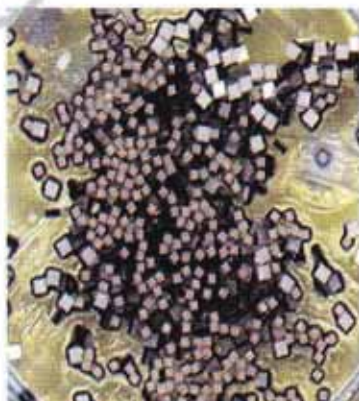


Temperature-Resistance Characteristics

CLASS	Std	B25/85	Operating Temp
1	5k Ω /25 $^{\circ}$ C	3450	-30~90 $^{\circ}$ C
2	10k Ω /25 $^{\circ}$ C	3450	-20~120 $^{\circ}$ C

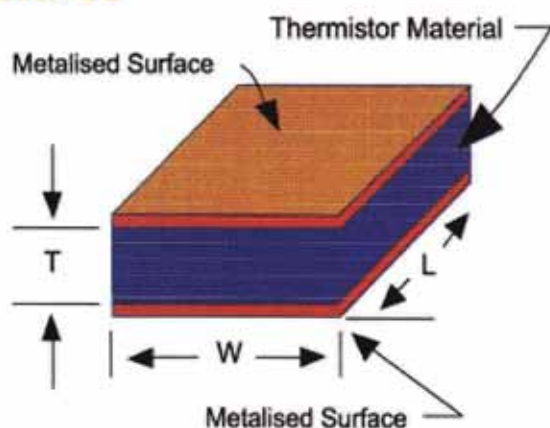
* Suggest us other spec. customer wanted

Bare Chip



The basic configuration of "chip" thermistor elements is shown in Figure. The thermistor material is metalized on the top and bottom surfaces for electrical contact. Metalization of the thermistor material is performed by dipping or screen printing with conductive ink based on materials such as silver or gold. The ink is fired to the wafers of the thermistor material. The wafers are then diced by mechanical saw or by laser scribing to produce chips of specific sizes. The length, width and thickness are controlled dimensions for specific chip element products. Typical chip dimensions are 1mm x 1mm x 0.5mm thick

Features



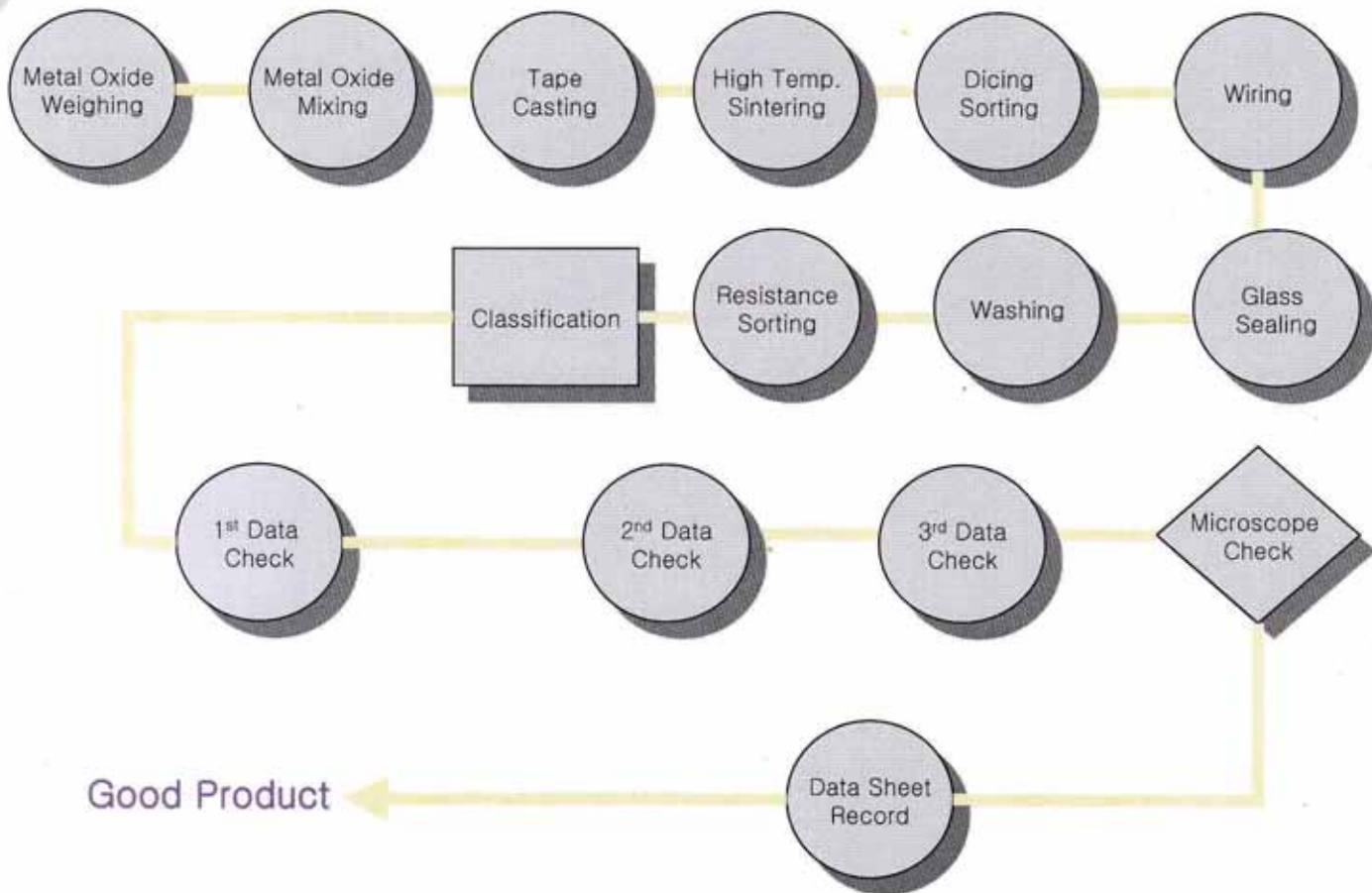
	L	W	T
Size(mm)	0.2 ~ 2.0	0.2 ~ 2.0	0.2 ~ 0.8
Tolerance (mm)	±0.1	±0.1	±0.1

Electrical Characteristics

Part No.	Resistance(R25,kΩ)	Constant B25/85(K)
UNC O_332_	Customer wanted	3324K
UNC O_347_		3470K
UNC O_397_		3970K
UNC O_343_		3435K
UNC O_375_		3750K
UNC O_410_		4100K
UNC O_405_		4055K
UNC O_400_		4000K

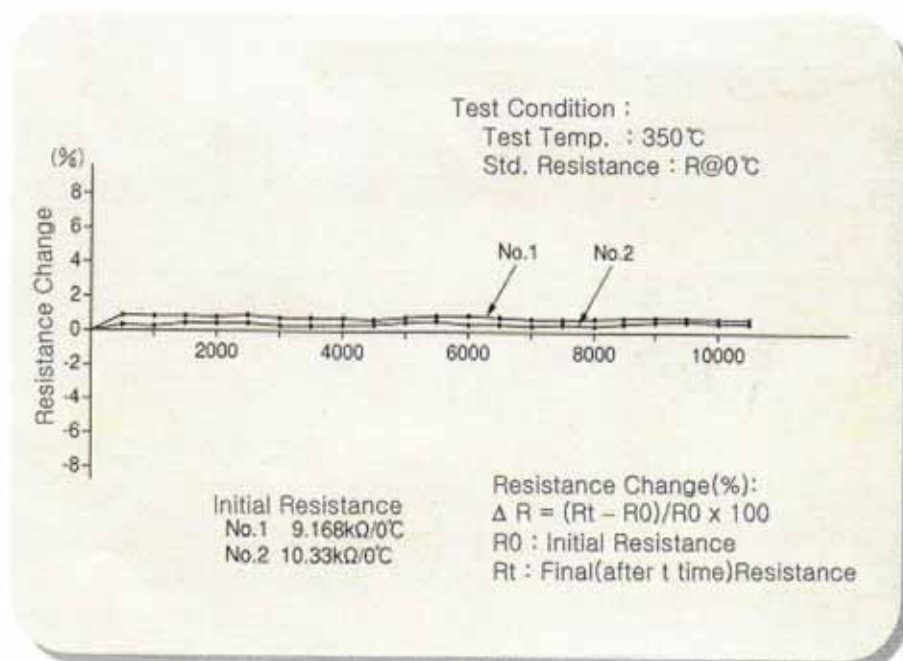
1. Resistance (Marked O): 1kΩ ~ 100kΩ
2. Resistance Tolerance(Marked _): F(±1%), G(±2%), H(±3%), J(±5%)
3. "B" constant Tolerance : F(±1%), G(±2%), H(±3%)
4. Other than the thermistors mentioned above are available on request.

Thermistor Making Process



Stability and Reliability of Thermistor

The issue of long term stability of components is a critical one in most temperature sensing applications. Systems designers are usually concerned with developing circuitry and thermistor sensor specifications which assure accurate, long-term measurement capability. It is extremely important therefore that the resistance versus temperature characteristics of the thermistors used in such critical applications do not change or drift over time



White Goods Sensor Assembly

Air Conditioner Sensor



- Temperature sensing for air conditioner
- Strong in humid environment
- Strong in high voltage
- Stability and reproducibility
- Operating temp. range: $-10 \sim 70^{\circ}\text{C}$
- Thermal time const. is about 5 sec.

Refrigerator Sensor



- Temperature sensing for refrigerator
- Strong in humid environment
- Strong in high voltage
- Stability and reproducibility
- Operating temp. range : $-40 \sim 150^{\circ}\text{C}$
- Thermal time const. is about 8 sec.

Clean Water M/C Sensor



- Temperature sensing for clean water system
- Perfect in humid environment
- Strong in high voltage
- Stability and reproducibility

Boiler Sensor



- Temperature sensing for boiler
- Strong in humid environment
- Strong in high temperature
- Stability and reproducibility
- Operating temp. range : $\text{RT} \sim 230^{\circ}\text{C}$
- Thermal time const. is about 10 sec.

OA Sensor Assembly

Copy M/C Sensor



- Temperature sensing for copy M/C
- Control temperature in surface of feed roller
- Fast in thermal responsibility
- Stability and reproducibility
- Operating temp. range : 100 ~ 230 °C
- Thermal time const. is about 2 sec.

Fax Sensor

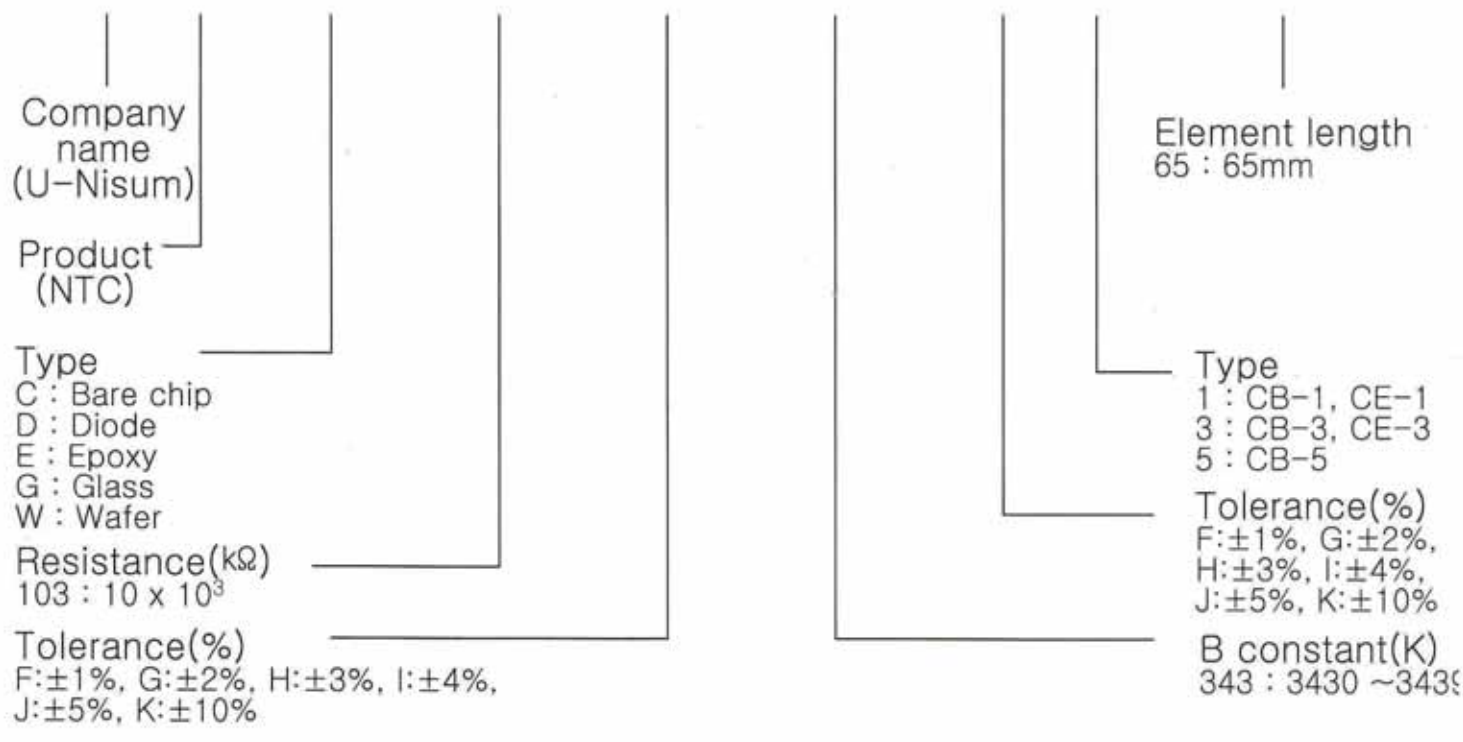


- Temperature sensing for fax
- Stability and reproducibility
- Operating temp. range : 0 ~ 90 °C
- Thermal time const. is about 6 sec.

Part Number (P/N)

Thermistor Element

U N G 103 F 343 F 1 - 65



Thermistor assembly

U N A 103 F 343 F 300 H S

