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muRata
INNOVATOR IN ELECTRONICS

NTC/PTC Thermistors for Automotive

EU RoHS Compliant

- All the products in this catalog comply with EU RoHS.
- EU RoHS is "the European Directive 2011/65/EU on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment."
- For more details, please refer to our website 'Murata's Approach for EU RoHS' (http://www.murata.com/en-eu/support/compliance/rohs).

Contents

Product specifications are as of August 2016.

POSISTOR®, in this catalog is the trademark of Murata Manufacturing Co., Ltd.

Please check the MURATA website (**http://www.murata.com/**) if you cannot find a part number in this catalog.

Part Numbering

NTC Thermistors for Temperature Compensation Chip Type

(Part Number)

NC	P	18	XH	103	J	0S	RB
❶	❷	❸	❹	❺	❻	❼	❽

❶Product ID

Product ID	
NC	NTC Thermistors Chip Type

❷Series

Code	Series
G	Conductive Glue Series
P	Plated Termination Series
U	High Reliability Series

❸Dimensions (L x W)

Code	Dimensions (L x W)	EIA
15	1.00 x 0.50mm	0402
18	1.60 x 0.80mm	0603

❹Temperature Characteristics

Code	Temperature Characteristics
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
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

❺Resistance

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 that follow the two figures.

Ex.)

Code	Resistance
102	1kΩ
103	10kΩ
104	100kΩ

❻Resistance Tolerance

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

❼Individual Specifications

Structures and others are expressed by two figures.

Code	Individual Specifications
□S	for Automotive

❽Packaging

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

NTC Thermistor for Temperature Sensor Thermo String Type

(Part Number)

NXF	S	15	XH	103	F	A	2	B	025
❶	❷	❸	❹	❺	❻	❼	❽	❾	❿

❶Product ID

Product ID	
NXF	NTC Thermistors Sensor Thermo String Type

❷Individual Specifications

Code	Individual Specifications
S	for Automotive

❸Chip Dimensions

Code	Dimensions (L x T)	EIA
15	1.00 x 0.50mm	0402

❹Temperature Characteristics

Code	Temperature Characteristics
WB	Nominal B-Constant 4050–4099K
WF	Nominal B-Constant 4250–4299K
XH	Nominal B-Constant 3350–3399K
XV	Nominal B-Constant 3900–3949K

❺Resistance

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

Ex.

Code	Resistance
103	10kΩ
473	47kΩ
104	100kΩ

❻Resistance Tolerance

Code	Resistance Tolerance
F	±1%

❼Lead Wire Type

Code	Lead Wire Type
A	ø0.3 Copper Lead Wire with Polyurethane Coat

❽Shape of the Lead Wire Kink

Code	Shape of the Lead Wire Kink
1	The Twist of Lead Wire Type
2	Standard Type

❾Packaging

Code	Packaging
B	Bulk

❿Dimensions (Full Length)

Code	Dimensions (Full Length)
025	25mm
030	30mm
040	40mm
050	50mm
060	60mm
070	70mm
080	80mm
090	90mm
100	100mm
110	110mm
120	120mm
130	130mm
140	140mm
150	150mm

NTC Thermistor for Temperature Sensor/Lead Type

(Part Number)

NXR	S	15	XH	103	F	A	1	B	040
❶	❷	❸	❹	❺	❻	❼	❽	❾	❿

❶Product ID

Product ID	
NXR	NTC Thermistor Sensor/Lead Type

❷Individual Specifications

Code	Individual Specifications
S	Automotive Type

❸Chip Dimensions

Code	Dimensions (L x T)
15	1.00 x 0.50mm

❹Temperature Characteristics

Code	Temperature Characteristics
XH	Nominal B-Constant 3350–3399K
XM	Nominal B-Constant 3500–3549K
XV	Nominal B-Constant 3900–3949K
WB	Nominal B-Constant 4050–4099K
WF	Nominal B-Constant 4250–4299K

❺Resistance

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

Ex.

Code	Resistance
202	2.0kΩ
103	10kΩ
104	100kΩ

❻Resistance Tolerance

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

❼Lead Wire Type

Code	Lead Wire Type
A	Lead Type: ø0.4mm Copper-clad Fe Wire, Tinned Lead Insulation Type: ø0.46mm Cu Wire with Coat

❽Shape of the Lead Wire

Code	Shape of the Lead Wire
1	Lead Spacing 2.5mm
3	Lead Spacing 5.0mm
5	Lead Spacing 2.5mm (Insulation Type)

❾Packaging

Code	Packaging
A	Ammo Pack Taping
B	Bulk

❿Dimensions (Full Length)

Code	Lead Type	Lead Insulation Type
010	10mm	–
020	20mm	–
025	–	25mm
030	30mm	30mm
035	–	35mm
040	40mm	–
016	16mm (Taping Type)	–

PTC Thermistors (POSISTOR®) for Overheat Sensing Chip Type

(Part Number)

PR	F	18	BB	471	Q	S5	RB
❶	❷	❸	❹	❺	❻	❼	❽

❶Product ID

Product ID	
PR	PTC Thermistors Chip Type

❷Series

Code	Series
F	for Overheat Sensing

❸Dimensions (L x W)

Code	Dimensions (L x W)
18	1.60 x 0.80mm

❹Temperature Characteristics

Code	Temperature Characteristics-Curie Point
AR	120°C
AS	130°C
BA	110°C
BB	100°C
BC	90°C
BD	80°C
BE	70°C
BF	60°C
BG	50°C

❺Resistance

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 that follow the two figures.

Ex.)

Code	Resistance
471	470Ω

❻Resistance Tolerance

Code	Resistance Tolerance	Sensing Temp. Tolerance
Q	Special Tolerance	±5°C
R	Special Tolerance	±3°C

❼Individual Specifications

Code	Individual Specifications
S5	for Automotive

❽Packaging

Code	Packaging
RB	Paper Taping (4mm Pitch) (4000 pcs.)

PTC Thermistors (POSISTOR®) for Overcurrent Protection Chip Type

(Part Number)

PR	G	21	AR	420	M	S1	RA
❶	❷	❸	❹	❺	❻	❼	❽

❶Product ID

Product ID	
PR	PTC Thermistors Chip Type

❷Series

Code	Series
G	for Overcurrent Protection

❸Dimensions (L x W)

Code	Dimensions (L x W)
21	2.00 x 1.25mm

❹Temperature Characteristics

Code	Temperature Characteristics
AR	Curie Point 120°C
BB	Curie Point 100°C
BC	Curie Point 90°C

❺Resistance

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 that 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
4R7	4.7Ω
420	42Ω

❻Resistance Tolerance

Code	Resistance Tolerance
M	±20%
Q	Special Tolerance

❼Individual Specifications

Ex.)

Code	Individual Specifications
S1	for Automotive

❽Packaging

Code	Packaging
RA	Embossed Taping (4mm Pitch) (4000 pcs.)
RK	Embossed Taping (4mm Pitch) (3000 pcs.)

PTC Thermistors (POSISTOR®) for Overcurrent Protection Lead Type

(Part Number)

PT	GL	4	S	AS	220	K	4B51	B0
❶	❷	❸	❹	❺	❻	❼	❽	❾

❶Product ID

Product ID	
PT	PTC Thermistors

❷Series

Code	Series
GL	for Overcurrent Protection Lead Type

❸Dimensions

Code	Dimensions
4	Nominal Body Diameter 4mm Series
5	Nominal Body Diameter 5mm Series
6	Nominal Body Diameter 6mm Series
7	Nominal Body Diameter 7mm Series
9	Nominal Body Diameter 9mm Series
A	Nominal Body Diameter 10mm Series
C	Nominal Body Diameter 12mm Series
E	Nominal Body Diameter 14mm Series

❹Individual Specifications

Code	Individual Specifications
S	for Automotive

❺Temperature Characteristics

Code	Temperature Characteristics
AR	Curie Point 120°C
AS	Curie Point 130°C

❻Resistance

Expressed by three-digit alphanumeric. The unit is ohm (Ω). The first and second figures are significant digits, and the third figure expresses the number of zeros that 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
R22	0.22Ω
2R2	2.2Ω
220	22Ω

❼Resistance Tolerance

Code	Resistance Tolerance
K	±10%
M	±20%

❽Individual Specifications

Ex.)

Code	Individual Specifications
4B51	Lead Type, others

❾Packaging

Code	Packaging
A0	Ammo Pack
B0	Bulk

Basic Characteristics of NTC Thermistor

Basic Characteristics

1. Zero-power Resistance of Thermistor: R

   Measured by zero-power in specified ambient temperatures.

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

   R: Resistance in ambient temperature T (K)

   (K: absolute temperature)

   R_0: Resistance in ambient temperature T_0 (K)

   B: B-constant of Thermistor

2. B-Constant

   as (1) formula

   $B=\ell n (R/R_0) / (1/T-1/T_0)$ ····· (2)

3. Thermal Dissipation Constant

   When electric power P (mW) is spent in ambient temperature T_1 and thermistor temperature rises T_2, the formula is as follows;

   $P=C(T_2-T_1)$ ····· (3)

   C: Thermal dissipation constant (mW/°C)

   Thermal dissipation constant varies with dimensions, measurement conditions, etc.

4. Thermal Time Constant

   Period in which Thermistor's temperature will change 63.2% of its temperature difference from ambient temperature T_0 (°C) to T_1 (°C).

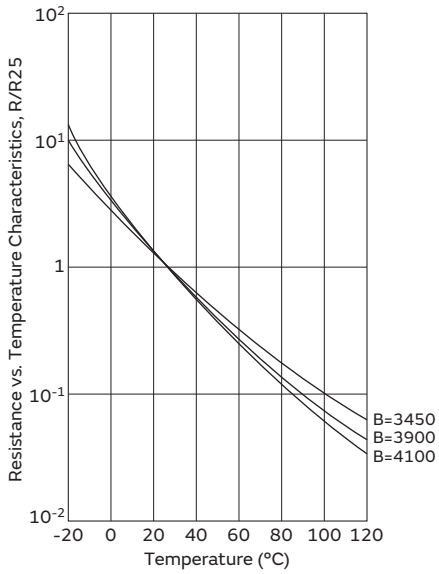
5. Rated Electric Power

   Shows necessary electric power for Thermistor's temperature to rise 100°C by self heating in ambient temperature 25°C.

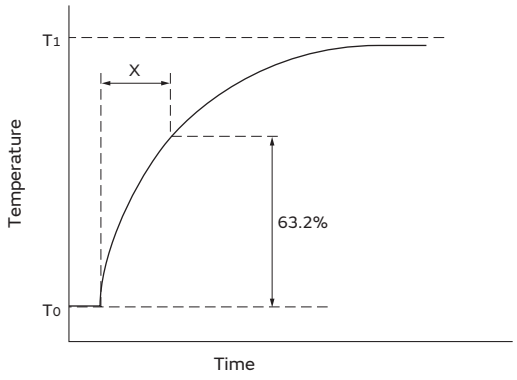
6. Permissive Operating Current

   It is possible to keep Thermistor's temperature rising max. 1˚C.

Resistance vs. Temperature



Thermal Time Constant



Basic Characteristics of POSISTOR®

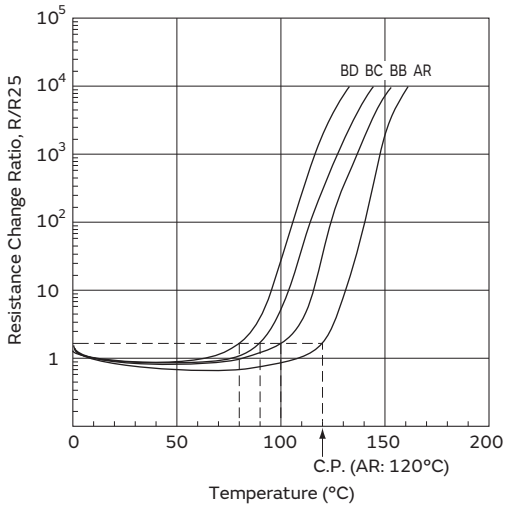
Basic Characteristics

POSISTOR® has three main characteristics.

1. Resistance-Temperature Characteristics

   Although there is a negligible difference between the normal and "Curie Point" temperature, POSISTOR® shows almost constant resistance-temperature characteristics. Yet they have resistance-temperature characteristics that cause resistance to sharply increase when the temperature exceeds the Curie Point.
   The Curie Point (C.P.) is defined as the temperature at which the resistance value is twice the one at 25 °C.

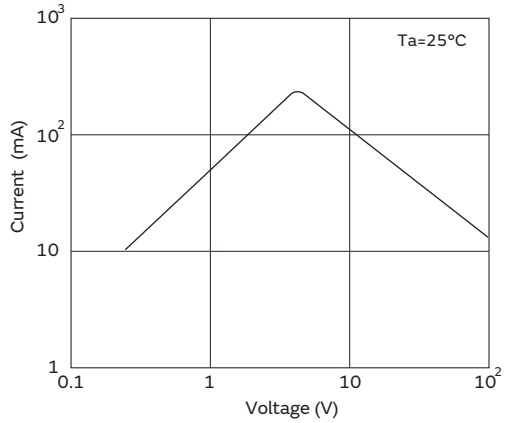
Resistance-Temperature Characteristic



2. Current-Voltage Characteristics (Static Characteristics)

   This shows the relation between applied voltage when voltage applied to POSISTOR® causes balancing of inner heating and outer thermal dissipation and stabilized current. This has both a maximum point of current and constant output power.

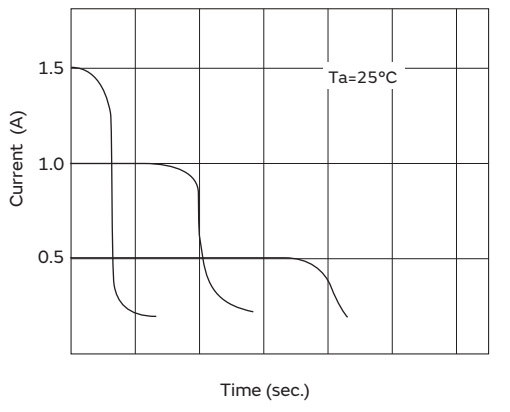
Current-Voltage Characteristics (Static Characteristics)



3. Current-Time Characteristics (Dynamic Characteristics)

   This shows the relation between current and time before inner heating and outer thermal dissipation arrive at equilibrium state. This features having large initial current and abruptly continuous attenuating portion.

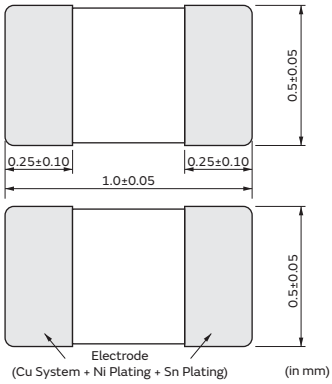
Current-Time Characteristics (Dynamic Characteristics)



NTC Thermistors for Automotive

Chip Type 0402 (1005) Size (Meet AEC-Q200 rev.D)

0402/0603 sized Chip NTC Thermistors have Ni barrier termination, provide excellent solderability and offer high stability in environment due to unique inner construction.
Available Market is Automotive market where request the high reliability.



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. Lead is not contained in the product
6. NCU series are recognized by UL/cUL. (UL1434, File No.E137188)

Detailed are accessable from the following URL.
http://www.murata.com/en-global/products/thermistor/ntc/ncu

Applications

1. Car audio, car navigation
2. Various engine control units
3. Circuits for ETC equipment
4. Various motor driving circuits
5. Temperature compensation for various circuits

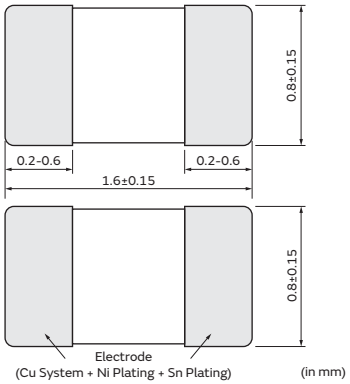
Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	B-Constant (25-80°C) (Reference Value) (K)	B-Constant (25-85°C) (Reference Value) (K)	B-Constant (25-100°C) (Reference Value) (K)	Permissive Operating Current (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Dissipation Constant (25°C) (mW/°C)
NCU15XH103D6SRC	10k ±0.5%	3380 ±0.7%	3428	3434	3455	0.31	100	1
NCU15XH103F6SRC	10k ±1%	3380 ±1%	3428	3434	3455	0.31	100	1
NCU15XH103□6SRC	10k	3380 ±1%	3428	3434	3455	0.31	100	1
NCU15WB473D6SRC	47k ±0.5%	4050 ±0.5%	4101	4108	4131	0.14	100	1
NCU15WB473F6SRC	47k ±1%	4050 ±1%	4101	4108	4131	0.14	100	1
NCU15WB473□6SRC	47k	4050 ±1%	4101	4108	4131	0.14	100	1
NCU15WF104D6SRC	100k ±0.5%	4250 ±0.5%	4303	4311	4334	0.1	100	1
NCU15WF104F6SRC	100k ±1%	4250 ±1%	4303	4311	4334	0.1	100	1
NCU15WF104□6SRC	100k	4250 ±1%	4303	4311	4334	0.1	100	1

A blank column is filled with resistance tolerance codes (E: ±3%, J: ±5%).
Rated Electric Power is necessary electric power for Thermistor's temperature to rise 100°C by self heating at 25°C in still air.
Operating Temperature Range: -40°C to +150°C
If there is any additionally electrical characteristics, please contact from close sales office or website.

NTC Thermistors for Automotive

Chip Type 0603 (1608) Size (Meet AEC-Q200 rev.D)

0402/0603 sized Chip NTC Thermistors have Ni barrier termination, provide excellent solderability and offer high stability in environment due to unique inner construction.
Available Market is Automotive market where request the high reliability.



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. Lead is not contained in the product
6. NCU series are recognized by UL/cUL. (UL1434, File No.E137188)

Detailed are accessable from the following URL.
http://www.murata.com/en-global/products/thermistor/ntc/ncu

Applications

1. Car audio, car navigation
2. Various engine control units
3. Circuits for ETC equipment
4. Various motor driving circuits
5. Temperature compensation for various circuits

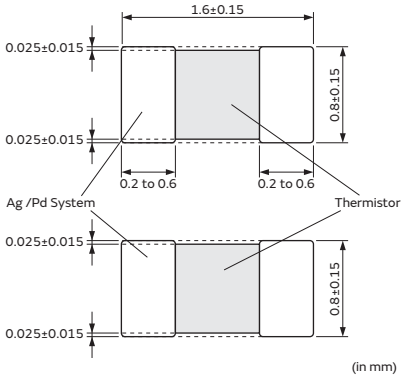
Part Number	Resistance (25°C) (ohm)	B-Constant (25-50°C) (K)	B-Constant (25-80°C) (Reference Value) (K)	B-Constant (25-85°C) (Reference Value) (K)	B-Constant (25-100°C) (Reference Value) (K)	Permissive Operating Current (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Dissipation Constant (25°C) (mW/°C)
NCU18XH103D6SRB	10k ±0.5%	3380 ±0.7%	3428	3434	3455	0.31	100	1
NCU18XH103F6SRB	10k ±1%	3380 ±1%	3428	3434	3455	0.31	100	1
NCU18XH103□6SRB	10k	3380 ±1%	3428	3434	3455	0.31	100	1
NCU18WB473D6SRB	47k ±0.5%	4050 ±0.5%	4101	4108	4131	0.14	100	1
NCU18WB473F6SRB	47k ±1%	4050 ±1%	4101	4108	4131	0.14	100	1
NCU18WB473□6SRB	47k	4050 ±1%	4101	4108	4131	0.14	100	1
NCU18WF104D6SRB	100k ±0.5%	4250 ±0.5%	4303	4311	4334	0.1	100	1
NCU18WF104F6SRB	100k ±1%	4250 ±1%	4303	4311	4334	0.1	100	1
NCU18WF104□6SRB	100k	4250 ±2%	4303	4311	4334	0.1	100	1

A blank column is filled with resistance tolerance codes (E: ±3%, J: ±5%).
Rated Electric Power is necessary electric power for Thermistor's temperature to rise 100°C by self heating at 25°C in still air.
Operating Temperature Range: -40°C to +150°C
If there is any additionally electrical characteristics, please contact from close sales office or website.

NTC Thermistors for Automotive

Chip Type 0603 (1608) Size for Conductive Glue

NCG18, 0603 sized Chip NTC Thermistor enables conductive glue mounting.



Features

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

Applications

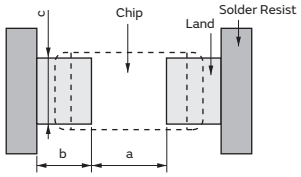
1. Various engine control units
2. ABS control unit
3. High power devices (IGBT)
4. Various circuits requiring low temperature mounting below solder melting point.
5. Temperature compensation for various circuits requiring high temperature.

Detailed are accessable from the following URL.
http://www.murata.com/en-global/products/thermistor/ntc

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)
NCG18XH103F0SRB	10k ±1%	3380 ±1%	3428	3434	3455	0.31	100	1
NCG18WF104F0SRB	100k ±1%	4200 ±1%	4255	4260	4282	0.10	100	1

Operating Temperature Range: -55°C to +150°C
Rated Electric Power is necessary electric power for Thermistor's temperature to rise 100°C by self heating at 25°C in still air.

NTC Thermistors Chip Type Standard Land Pattern Dimensions



(in mm)

Part Number	Mounting Methods	Dimensions (mm)			
		Chip (L x W)	a	b	c
NCU15	Reflow Soldering	1.0 x 0.5	0.4	0.4-0.5	0.5
NCU18	Flow Soldering	1.6 x 0.8	0.6-1.2	0.8-0.9	0.6-0.8
	Reflow Soldering		0.6-1.2	0.6-0.7	0.6-0.8
NCG18	Conductive Glue	1.6 x 0.8	0.6	0.6	1.0

NTC Thermistors Chip Type Temperature Characteristics (Center Value)

Part Number	NCU□□XH103D	NCU□□XH103	NCU□□WB473D	NCU□□WB473	NCU□□WF104D	NCU□□WF104
Resistance	10kΩ±0.5%	10kΩ	47kΩ±0.5%	47kΩ	100kΩ±0.5%	100ΩW
B-Constant	3380K±0.7%	3380K	4050K±0.5%	4050K	4250K±0.5%	4250K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
–40	197.390	195.652	1690.586	1747.920	4221.283	4397.119
–35	149.390	148.171	1215.318	1245.428	2995.044	3088.599
–30	114.340	113.347	882.908	898.485	2146.996	2197.225
–25	88.381	87.559	647.911	655.802	1554.599	1581.881
–20	68.915	68.237	480.069	483.954	1136.690	1151.037
–15	54.166	53.650	359.009	360.850	839.019	846.579
–10	42.889	42.506	270.868	271.697	624.987	628.988
–5	34.196	33.892	206.113	206.463	469.678	471.632
0	27.445	27.219	158.126	158.214	355.975	357.012
5	22.165	22.021	122.267	122.259	272.011	272.500
10	18.010	17.926	95.256	95.227	209.489	209.710
15	14.720	14.674	74.754	74.730	162.559	162.651
20	12.099	12.081	59.075	59.065	127.057	127.080
25	10.000	10.000	47.000	47.000	100.000	100.000
30	8.309	8.315	37.636	37.643	79.222	79.222
35	6.939	6.948	30.326	30.334	63.167	63.167
40	5.824	5.834	24.583	24.591	50.677	50.677
45	4.911	4.917	20.043	20.048	40.904	40.904
50	4.160	4.161	16.433	16.433	33.195	33.195
55	3.539	3.535	13.545	13.539	27.091	27.091
60	3.024	3.014	11.223	11.209	22.224	22.224
65	2.593	2.586	9.345	9.328	18.323	18.323
70	2.233	2.228	7.818	7.798	15.184	15.184
75	1.929	1.925	6.571	6.544	12.635	12.635
80	1.673	1.669	5.548	5.518	10.566	10.566
85	1.455	1.452	4.704	4.674	8.873	8.873
90	1.270	1.268	4.004	3.972	7.481	7.481
95	1.112	1.110	3.422	3.388	6.337	6.337
100	0.976	0.974	2.936	2.902	5.384	5.384
105	0.860	0.858	2.528	2.494	4.594	4.594
110	0.759	0.758	2.184	2.150	3.934	3.934
115	0.673	0.672	1.893	1.860	3.380	3.380
120	0.598	0.596	1.646	1.615	2.916	2.916
125	0.532	0.531	1.436	1.406	2.522	2.522
130	0.476	0.474	1.256	1.227	2.190	2.190
135	0.426	0.424	1.102	1.075	1.907	1.907
140	0.383	0.381	0.969	0.945	1.665	1.665
145	0.344	0.342	0.854	0.831	1.459	1.459
150	0.311	0.309	0.755	0.735	1.282	1.282

Continued on the following page.↗

NTC Thermistors Chip Type Temperature Characteristics (Center Value)

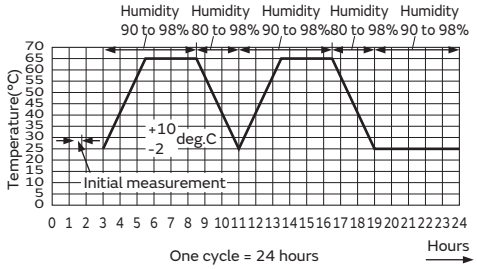
Continued from the preceding page.↘

For Conductive Glue

Part Number	NCG18XH103	NCG18WF104
Resistance	10ΩW	100ΩW
B-Constant	3380K	4200K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)
−55	481.258	13019.2917
−50	352.304	8807.8909
−45	261.060	6042.9955
−40	195.661	4205.6861
−35	148.177	2966.4355
−30	113.351	2118.7894
−25	87.562	1531.3193
−20	68.239	1118.4222
−15	53.651	825.5695
−10	42.507	615.5264
−5	33.893	463.1041
0	27.219	351.7064
5	22.021	269.3046
10	17.926	207.8907
15	14.674	161.7224
20	12.081	126.7225
25	10.000	100.0000
30	8.315	79.4390
35	6.948	63.5094
40	5.834	51.0835
45	4.917	41.3360
50	4.161	33.6281
55	3.535	27.5103
60	3.014	22.6211
65	2.586	18.6920
70	2.228	15.5246
75	1.925	12.9466
80	1.669	10.8488
85	1.452	9.1290
90	1.268	7.7128
95	1.110	6.5455
100	0.974	5.5722
105	0.858	4.7638
110	0.758	4.0868
115	0.672	3.5178
120	0.596	3.0403
125	0.531	2.6336
130	0.474	2.2902
135	0.424	1.9976
140	0.381	1.7475
145	0.342	1.5332
150	0.309	1.3491

NTC Thermistors Chip Type Specifications and Test Methods

NCU Series (For AEC-Q200 rev.D)

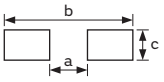
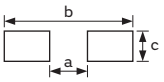
No.	AEC-Q200 Test Item	Specifications	AEC-Q200 Test Methods
1	Pre-and Post-Stress Electrical Test	-	
2	High Temperature Exposure (Storage)	(*1) · Resistance(R_{25}) change should be less than ±5%. · B-constant($B_{25/50}$) change should be less than ±2%. · No visible damage.	Leave continuously according to the following table for 1000 hours. Operating Temp. Range: -40 to +150°C Type: 150±3°C Operating Temp. Range: -40 to +125°C Type: 125±3°C Measurement at 24±2 hours after test condition.
3	Temperature Cycling	· Resistance(R_{25}) change should be less than ±5%. · B-constant($B_{25/50}$) change should be less than ±2%. · No visible damage.	Perform 1000 cycles according to the four heat treatments listed in the following table. Step: 1 / 2 / 3 / 4 Temp. (deg.C): -55+0/-3 / Room Temp. / 125+3/-0 / Room Temp. Time (min.): 15±3 / 1 / 15±3 / 1 Measurement at 24±2 hours after test condition.
4	Moisture Resistance	· Resistance(R_{25}) change should be less than ±5%. · B-constant($B_{25/50}$) change should be less than ±2%. · No visible damage.	Apply the 24-hour heat (25 to 65 °C) and humidity (80 to 98%) treatment shown below, 10 consecutive times.  Measurement at 24±2 hours after test condition.
5	Biased Humidity	(*2) · Resistance(R_{25}) change should be less than ±10%. · B-constant($B_{25/50}$) change should be less than ±2%. · No visible damage.	85±2 °C, 85%RH in air for 1000 hours with Permissive Operating Current. Measurement at 24±2 hours after test condition.
6	Operational Life	· Resistance(R_{25}) change should be less than ±5%. · B-constant($B_{25/50}$) change should be less than ±2%. · No visible damage.	85±3 °C in air for 1000 hours with Permissive Operating Current. Measurement at 24±2 hours after test condition.
7	External Visual	No defects of abnormalities.	Visual Inspection.
8	Physical Dimension	Within the specified dimensions.	Using calipers.
9	Terminal Strength (Leaded)	N/A	
10	Resistance to Solvents	· Resistance(R_{25}) change should be less than ±5%. · B-constant($B_{25/50}$) change should be less than ±2%. · No visible damage.	Per MIL-STD-202 Method 215 Solvent 1: 1 part (by volume) of isopropyl alcohol 3 parts (by volume) of mineral spirits.
11	Mechanical Shock	· Resistance(R_{25}) change should be less than ±5%. · B-constant($B_{25/50}$) change should be less than ±2%. · No visible damage.	Per MIL-STD-202 Method 213 Test Condition F 1500g's, 0.5ms, In 3 directions perpendicularly intersecting each other (total 18 times).
12	Vibration	(*1) · Resistance(R_{25}) change should be less than ±5%. · B-constant($B_{25/50}$) change should be less than ±2%. · No visible damage.	Simple harmonic motion between 10Hz to 2.0k Hz and back to 10 Hz of max. amplitude 1.5mm for 20 minutes. This motion should be applied 12 times in each of 3 mutually perpendicular directions (total of 36 times).
13	Resistance to Soldering Heat	(*1) · Resistance(R_{25}) change should be less than ±5%. · B-constant($B_{25/50}$) change should be less than ±2%. · No visible damage.	Per MIL-STD-202 Method 210 Test Condition B, 260 °C for 10 +/-1 seconds.

· The Test Condition specification (*1,*2) is applied to the follow P/N.
P/N: NCU15XH103□□SR□, NCU15WB473□□SR□, NCU15WF104□□SR□, NCU18XH103□□SR□
(*1) Resistance(R_{25}) change should be less than 1%
B-constant($B_{25/50}$) change should be less than 1%
(*2) Resistance(R_{25}) change should be less than 5%
B-constant($B_{25/50}$) change should be less than 1%

Continued on the following page.↗

NTC Thermistors Chip Type Specifications and Test Methods

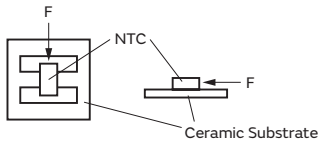
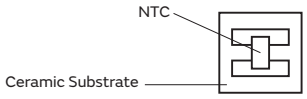
Continued from the preceding page.↘

<table>
<tr><th>No.</th><th>AEC-Q200 Test Item</th><th>Specifications</th><th>AEC-Q200 Test Methods</th></tr>
<tr><td>14</td><td>Thermal Shock</td><td>· Resistance(R25) change should be less than ±5%.
· B-constant(B25/50) change should be less than ±2%.
· No visible damage.</td><td>Perform 300 cycles according to the two heat treatments listed in the following table. (Maximum transfer time is 20 seconds.)
<table><tr><th>Step</th><th>1</th><th>2</th></tr><tr><td>Temp. (°C)</td><td>-55+0/-3</td><td>125+3/-0</td></tr><tr><td>Time (min.)</td><td>15±3</td><td>15±3</td></tr></table>
Measurement at 24±2 hours after test condition.</td></tr>
<tr><td>15</td><td>ESD</td><td>· Resistance(R25) change should be less than ±5%.
· B-constant(B25/50) change should be less than ±2%.
· No visible damage.</td><td>Per AEC-Q200-002</td></tr>
<tr><td>16</td><td>Solderability</td><td>Minimum 95% of the whole electrode surface should be covered with solder.</td><td>Per J-STD-002
SMD b) Method B @ 215 °C category 3.</td></tr>
<tr><td>17</td><td>Electrical Characterization</td><td>Within the specified tolerance.</td><td>Resistance at 25 °C.
B-constant (B25-50)</td></tr>
<tr><td>18</td><td>Flammability</td><td colspan="2">N/A</td></tr>
<tr><td>19</td><td>Board Flex</td><td>(*1)
· Resistance(R25) change should be less than ±5%.
· B-constant(B25/50) change should be less than ±2%.
· No visible damage.</td><td>Per AEC-Q200-005
Bend the board 2.0mm for 60 seconds.
Use the follow land size.
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>NCU15_SRC</td><td>0.4</td><td>1.2</td><td>0.5</td></tr><tr><td>NCU18_SRB</td><td>0.6</td><td>1.8</td><td>0.6</td></tr></table>(in mm)
  </td></tr>
<tr><td>20</td><td>Terminal Strength (SMD)</td><td>(*1)
· Resistance(R25) change should be less than ±5%.
· B-constant(B25/50) change should be less than ±2%.
· No visible damage.</td><td>Per AEC-Q200-006
Apply a *17.7N force to the side of device for 60 seconds.
Use follow land size.
*4.9N (NCP15_SRC)
<table><tr><th>Type</th><th>a</th><th>b</th><th>c</th></tr><tr><td>NCU15_SRC</td><td>0.4</td><td>1.5</td><td>0.5</td></tr><tr><td>NCU18_SRB</td><td>1.0</td><td>3.0</td><td>1.2</td></tr></table>(in mm)
  </td></tr>
</table>

· The Test Condition specification (*1,*2) is applied to the follow P/N.
P/N: NCU15XH103□□SR□, NCU15WB473□□SR□, NCU15WF104□□SR□, NCU18XH103□□SR□
(*1) Resistance(R25) change should be less than 1%
B-constant(B25/50) change should be less than 1%
(*2) Resistance(R25) change should be less than 5%
B-constant(B25/50) change should be less than 1%

NTC Thermistors Chip Type Specifications and Test Methods

NCG18 Series (For Conductive Glue)

<table>
<tr><th>No.</th><th>Item</th><th>Rating value</th><th>Method of Examination</th></tr>
<tr><td>1</td><td>Dry Heat</td><td>· Resistance (R_{25}) change should be less than ±3%
· B-constant ($B_{25\text{-}50}$) change should be less than ±1%
· No visible damage.</td><td>150±3°C in air, for 1000 +48/-0 hours without loading.</td></tr>
<tr><td>2</td><td>Cold</td><td>· Resistance (R_{25}) change should be less than ±1%
· B-constant ($B_{25\text{-}50}$) change should be less than ±1%
· No visible damage.</td><td>-40±3°C in air, for 1000 +48/-0 hours without loading.</td></tr>
<tr><td>3</td><td>Damp Heat</td><td rowspan="4">· Resistance (R_{25}) change should be less than ±3%
· B-constant ($B_{25\text{-}50}$) change should be less than ±1%
· No visible damage.</td><td>60±2°C, 90 to 95%RH in air, for 1000 +48/-0 hours without loading.</td></tr>
<tr><td>4</td><td>High Temperature Load</td><td>150±3°C in air, with Permissive Operating Current (D.C. 0.31mA) for 1000 +48/-0 hours.</td></tr>
<tr><td>5</td><td>High Temperature Humidity Load</td><td>85±2°C, 85%RH in air, with Permissive Operating Current (D.C. 0.31mA) for 1000 +48/-0 hours.</td></tr>
<tr><td>6</td><td>Thermal Shock</td><td>1000 cycles of the following sequence without loading.
<table>
<tr><th>Step</th><th>Temp. (°C)</th><th>Time (minute)</th></tr>
<tr><td>1</td><td>-55+0/-3</td><td>15</td></tr>
<tr><td>2</td><td>+150+3/-0</td><td>15</td></tr>
</table></td></tr>
<tr><td>7</td><td>Robustness of Electrode</td><td>· No peeling of the electrodes.</td><td>Mount NTC Thermistor with conductive glue on Ceramic substrate, and apply 4.90N of force as shown below.:
 
</td></tr>
<tr><td>8</td><td>Vibration Resistant</td><td>· Resistance (R_{25})
change should be less than ±1%
· B-constant ($B_{25\text{-}50}$)
change should be less than ±1%
· No visible damage.</td><td>Solder NTC Thermistor on the Glass Epoxy PCB as shown below.
Frequency: 10Hz to 2000Hz to 10Hz (20min.)
Max. amplitude: 3.0mm
Vibrated for a period of 4hrs. in three (3) directions perpendicularly intersecting each other (for total of 12hrs.).
 
</td></tr>
</table>

· NTC Thermistor should be mounted on the Ceramic substrate with "Standard Land Dimensions" by our recommendable conductive glue (PC3000: Manufactured by Heraeus) and be tested. Thickness of the conductive glue screening should be 50μm.
· R_{25} means the zero-power resistance at 25°C.
· $B_{25\text{-}50}$ is calculated by the zero-power resistances of NTC Thermistor at 25°C and at 50°C.
· After each test, NTC Thermistor should be kept for 1 hour at room temperature (normal humidity and normal atmospheric pressure). Then the resistances (R_{25} and R_{50}) should be measured and the appearance should be visually examined.
· In the case that of R_{25} or $B_{25\text{-}50}$ changes are greater than the specified value due to the method of mounting with conductive glue, these specifications should be judged by an evaluation with the chip only (not mounting).

NTC Thermistors 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 (Other)

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 the mounting nature of product from declining, the following storage conditions are recommended.

1. Storage condition:
   Temperature -10 to +40°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.

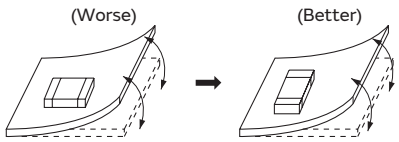
NTC Thermistors Chip Type ⚠Caution/Notice

Notice (Soldering and Mounting) NCU15/18 Series

1. Mounting Position

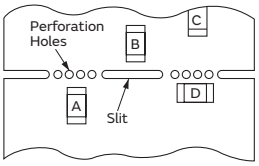
Choose a mounting position that minimizes the stress imposed on the chip during flexing or bending of the board.

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

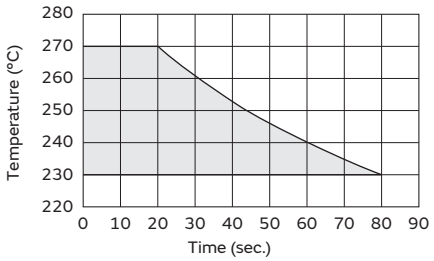
(a) Solder within the temperature and time combinations, indicated by the slanted lines in the following graphs.

(b) Excessive soldering conditions may cause dissolution of metalization or deterioration of solder-wetting on the external electrode.

(c) In the case of repeated soldering, the accumulated soldering time should be within the range shown in the following figures. (For example, Reflow peak temperature: 260°C, twice -> The total accumulated soldering time at 260°C is within 30 seconds.)

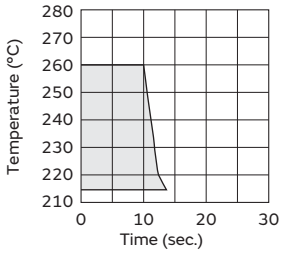
NCU15 Series

Allowable Reflow Soldering Temp. and Time

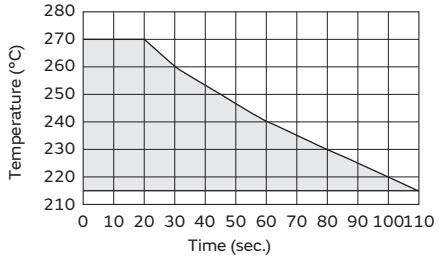


NCU18 Series

Allowable Flow Soldering Temp. and Time



Allowable Reflow Soldering Temp. and Time



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NTC Thermistors Chip Type ⚠Caution/Notice

Continued from the preceding page.↘

3. Recommendable Temperature Profile for Soldering

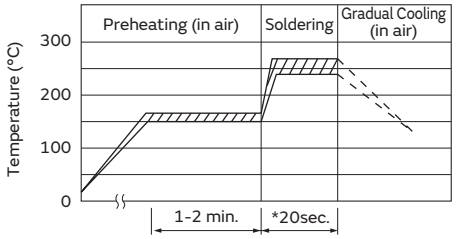
(a) Insufficient preheating may cause a crack on the ceramic body. The difference between preheating temperature and maximum temperature in the profile shall be 100 °C.

(b) Rapid cooling by dipping in solvent or by other means is not recommended.

* In the case of repeated soldering, the accumulated soldering time should be within the range shown in "2. Allowable Soldering Temperature and Time."

NCU15 Series

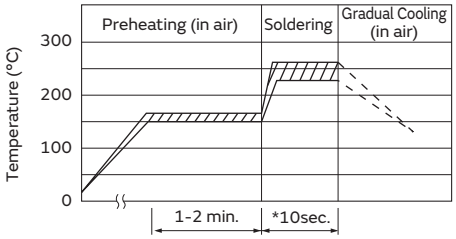
Reflow Soldering Conditions



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

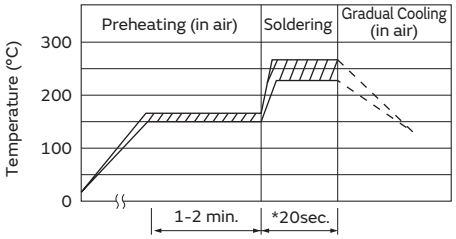
NCU18 Series

Flow Soldering Conditions



Preheating: 160±10°C, 1-2 min.
Soldering: 230-260°C, 10sec.

Reflow Soldering Conditions



Preheating: 160±10°C, 1-2 min.
Soldering: 230-270°C, 20sec.

4. Solder and Flux

(1) Solder and Paste

(a) Reflow Soldering: NCU15/NCU18 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: NCU18 Series

We are using the following solder paste 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 the soldering process.
If the flux below is used, some problems might be caused in the product characteristics and reliability. Please do not use these types of 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 the 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.

	NCU15	NCU18
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 20W/ℓ Frequency of 28 to 40kHz.	Less than 1 minute 20W/ℓ Frequency of several 10 to 100kHz.
Drying	After cleaning, promptly dry this product.	

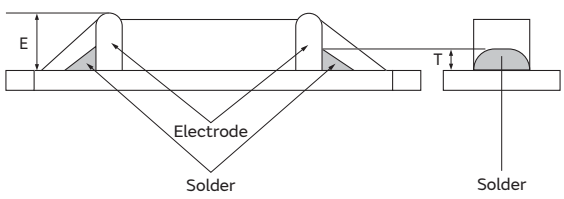
Continued on the following page.↗

NTC Thermistors Chip Type ⚠Caution/Notice

Continued from the preceding page.↘

6. 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.

Reference: Optimum Solder Amount



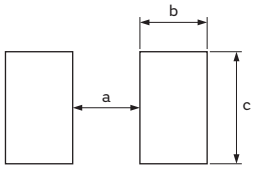
Part Number	The Solder Paste Thickness	T
NCU15	150μm	1/3E≦T≦E
NCU18	200μm	0.2mm≦T≦E

7. 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.

Notice (Mounting) NCG18 Series

In your mounting process, observe the following points in order to avoid deterioration of the characteristics or destruction of this product. The mounting quality of this product may also be affected by the mounting conditions, shown in the points below.

1. Recommendable Land Size
   Too small a land size parameter 'a' may cause an electric short mode of this product by conductive glue expanding on the surface of this product on mounting.

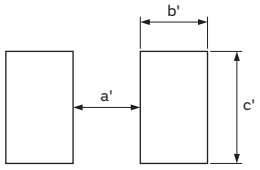


	a	b	c
Land pad size	0.6	0.6	1.0

(in mm)

2. Recommendable Conductive Glue
   · PC3000 (Manufactured by Heraeus)

3. Screening Conditions of Conductive glue
   (1) Recommendable Screening Size



	a'	b'	c'
Land pad size	0.65	0.55	0.95

(in mm)

   (2) Recommendable thickness of conductive glue screening shall be 50μm.

   (3) Too much conductive glue gives an electric short mode of this product by conductive glue expanding on the surface of this product on mounting.

4. There is a possibility of unexpected failure in your mounting process, caused by mounting conditions. Please evaluate whether this product is correctly mounted under your mounting conditions.

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.

NTC Thermistors for Automotive

Thermo String Type for Temperature Sensor

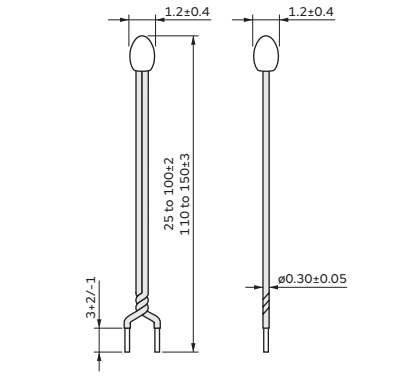
This product is a small flexible lead type NTC Thermistor with a small head and a thin lead wire.

Features

1. High accuracy and high sensibility temperature sensing is available in a small and highly accurate NTC Thermistor.
2. Narrow space temperature sensing is available from the small sensing head and the thin lead wire.
3. Flexibility and a wide variety of lengths (25 mm to 150mm)
   enables the design of flexible temperature sensing architectures.
4. This product is compatible with our 0402 (EIA) size chip Thermistor.
5. Excellent long-time aging stability
6. This is a halogen-free product.*
   * Cl= max.900ppm,
   Br=max.900ppm and Cl+Br=max.1500ppm
7. Lead is not contained in the product.

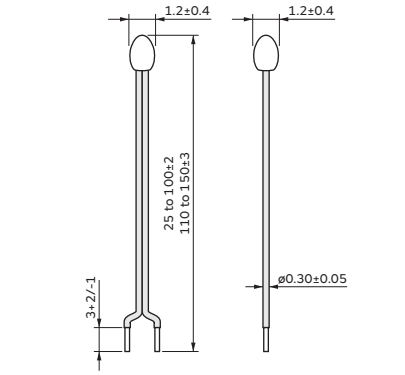
Applications

1. Car audio, car navigation
2. Various engine control units
3. Circuits for ETC equipment
4. Various motor driving circuits
5. Temperature compensation for various circuits



The full length 25mm, 30 to 150mm interval 10mm. (in mm)

NXFS15_1B Type (twist)



The full length 25mm, 30 to 150mm interval 10mm. (in mm)

NXFS15_2B Type (without twist)

Detailed are accessable from the following URL.
http://www.murata.com/en-global/products/thermistor/ntc/nxf

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)	Operating Current for Sensor (25°C) (mA)	Rated Electric Power (25°C) (mW)	Typical Dissipation Constant (25°C) (mW/°C)	Thermal Time Constant (25°C) (s)
NXFS15XH103FA□B□□□	10k ±1%	3380 ±1%	3428	3434	3455	0.12	7.5	1.5	4
NXFS15XV103FA□B□□□	10k ±1%	3936 ±1%	3971	3977	3988	0.12	7.5	1.5	4
NXFS15WB473FA□B□□□	47k ±1%	4050 ±1%	4101	4108	4131	0.06	7.5	1.5	4
NXFS15WF104FA□B□□□	100k ±1%	4250 ±1%	4303	4311	4334	0.04	7.5	1.5	4

□ is filled with lead shape (1: twist, 2: without twist).
□□□ is filled with total-length codes. (25mm, 30-150mm interval 10mm, ex. 050=50mm)
Operating Current for Sensor raises Thermistor's temperature by 0.1°C.
Rated Electric Power is necessary electric power for Thermistor's temperature to rise 5°C by self heating at 25°C in still air.
Operating Temperature Range: -40°C to +125°C

NTC Thermistors Thermo String Type Temperature Characteristics (Center Value)

Part Number	NXFS15XH103	NXFS15XV103	NXFS15WB473	NXFS15WF104
Resistance	10kΩ	10kΩ	47kΩ	100kΩ
B-Constant	3380K	3936K	4050K	4250K
Temp. (°C)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)	Resistance (kΩ)
–40	197.388	337.503	1690.590	4221.280
–35	149.395	243.332	1215.320	2995.040
–30	114.345	177.496	882.908	2147.000
–25	88.381	130.859	647.911	1554.600
–20	68.915	97.428	480.069	1136.690
–15	54.166	73.230	359.009	839.019
–10	42.889	55.529	270.868	624.987
–5	34.196	42.467	206.113	469.678
0	27.445	32.747	158.126	355.975
5	22.165	25.450	122.267	272.011
10	18.010	19.932	95.256	209.489
15	14.720	15.727	74.754	162.559
20	12.099	12.498	59.075	127.057
25	10.000	10.000	47.000	100.000
30	8.309	8.054	37.636	79.222
35	6.939	6.529	30.326	63.167
40	5.824	5.324	24.583	50.677
45	4.911	4.366	20.043	40.904
50	4.160	3.601	16.433	33.195
55	3.539	2.985	13.545	27.091
60	3.024	2.488	11.223	22.224
65	2.593	2.083	9.345	18.323
70	2.233	1.752	7.818	15.184
75	1.929	1.480	6.571	12.635
80	1.673	1.256	5.548	10.566
85	1.455	1.070	4.704	8.873
90	1.270	0.916	4.004	7.481
95	1.112	0.787	3.422	6.337
100	0.976	0.679	2.936	5.384
105	0.860	0.588	2.528	4.594
110	0.759	0.512	2.184	3.934
115	0.673	0.446	1.893	3.380
120	0.598	0.391	1.646	2.916
125	0.532	0.343	1.436	2.522