

## NTC Thermistor SPECIFICATION

**Scope**

This product specification is applied to NTC Thermistor used for temperature sensor and temperature compensation.  
Please contact us when using this product for any other applications than described in the above.

**\*Safety Standard**

All products except NCP15WL \*\*\*\*\* are approved by UL certification.  
UL : File No. E137188 , Standard No. UL1434

**1.Part No.**

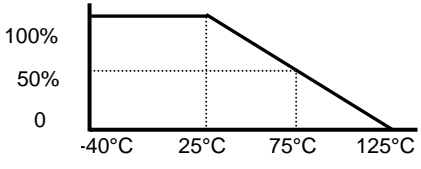
**NCP15 SERIES**

**2.Ratings**

**2.1 F SERIES**

P/N	Resistance (ohm) at 25°C	B-constant (K) 25/50°C	Permissive Operating Current (mA) (*1,*2)	Rated Electric Power (mW) (*1,*3)	Thermal Dissipation Constant (mW/°C) (*1)	Operating Temperature Range (°C)
NCP15XH103F03RC	10k±1%	3380±1%	0.31	100	Approx. 1.0	-40 ~ +125
NCP15WB473F03RC	47k±1%	4050±1%	0.14			
NCP15WF104F03RC	100k±1%	4250±1%	0.10			

- \*1 : NTC thermistor is measured at 25°C in still air, as a single unit without mounting.
- \*2 : Permissive Operating Current raises NTC thermistor's temperature by 1°C.  
The current less than 1/10 of the Permissive Operating Current value is recommended in order to prevent self heating of the NTC thermistor.
- \*3 : When Rated Electric Power (100mW) is applied to NTC thermistor at 25°C in still air, NTC thermistor's temperature rises by approx.100°C. However unexpected failuares might be caused in NTC thermistor by rapid temperature rise.  
Please do not apply more than 10mW of electric power in short time. (10mW of power makes NTC Thermistor approx.10°C of temperature rising.)  
The electric power is related with operating temperature in shown in the graph right.



2.2 E SERIES

P/N	Resistance (ohm) at 25°C	B-constant (K) 25/50°C	Permissive Operating Current (mA) (*1,*2)	Rated Electric Power (mW) (*1,*3)	Thermal Dissipation Constant (mW/°C) (*1)	Operating Temperature Range (°C)
NCP15XC220E03RC	22±3%	3100±3%	6.70	100	Approx. 1.0	-40 ~ +125
NCP15XC330E03RC	33±3%	3100±3%	5.50			
NCP15XC470E03RC	47±3%	3100±3%	4.60			
NCP15XC680E03RC	68±3%	3100±3%	3.80			
NCP15XF101E03RC	100±3%	3250±3%	3.10			
NCP15XF151E03RC	150±3%	3250±3%	2.50			
NCP15XM221E03RC	220±3%	3500±3%	2.10			
NCP15XM331E03RC	330±3%	3500±3%	1.70			
NCP15XQ471E03RC	470±3%	3650±2%	1.40			
NCP15XQ681E03RC	680±3%	3650±3%	1.20			
NCP15XQ102E03RC	1.0k±3%	3650±2%	1.00			
NCP15XW152E03RC	1.5k±3%	3950±3%	0.81			
NCP15XW222E03RC	2.2k±3%	3950±3%	0.67			
NCP15XW332E03RC	3.3k±3%	3950±3%	0.55			
NCP15XM472E03RC	4.7k±3%	3500±2%	0.46			
NCP15XW682E03RC	6.8k±3%	3950±3%	0.38			
NCP15XH103E03RC	10k±3%	3380±1%	0.31			
NCP15XV103E03RC	10k±3%	3900±3%	0.31			
NCP15XW153E03RC	15k±3%	3950±3%	0.25			
NCP15XW223E03RC	22k±3%	3950±3%	0.21			
NCP15WL223E03RC	22k±3%	4485±1%	0.21			
NCP15WB333E03RC	33k±3%	4050±3%	0.17			
NCP15WL333E03RC	33k±3%	4485±1%	0.17			
NCP15WB473E03RC	47k±3%	4050±1%	0.14			
NCP15WL473E03RC	47k±3%	4485±1%	0.14			
NCP15WD683E03RC	68k±3%	4150±3%	0.12			
NCP15WL683E03RC	68k±3%	4485±1%	0.12			
NCP15WF104E03RC	100k±3%	4250±1%	0.10			
NCP15WL104E03RC	100k±3%	4485±1%	0.10			
NCP15WM154E03RC	150k±3%	4500±3%	0.08			
NCP15WL154E03RC	150k±3%	4485±1%	0.08			
NCP15WM224E03RC	220k±3%	4500±3%	0.06			
NCP15WM474E03RC	470k±3%	4500±3%	0.04			

\*1 : NTC thermistor is measured at 25°C in still air, as a single unit without mounting.

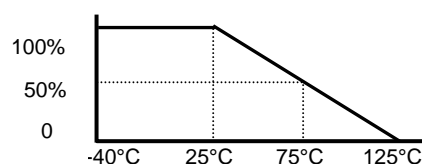
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Please do not apply more than 10mW of electric power in short time. (10mW of power makes NTC Thermistor approx.10°C of temperature rising.)

The electric power is related with operating temperature in shown in the graph right.



2.3 J SERIES

P/N	Resistance (ohm) at 25°C	B-constant (K) 25/50°C	Permissive Operating Current (mA) (*1,*2)	Rated Electric Power (mW) (*1,*3)	Thermal Dissipation Constant (mW/°C) (*1)	Operating Temperature Range (°C)
NCP15XC220J03RC	22±5%	3100±3%	6.70	100	Approx. 1.0	-40 ~ +125
NCP15XC330J03RC	33±5%	3100±3%	5.50			
NCP15XC470J03RC	47±5%	3100±3%	4.60			
NCP15XC680J03RC	68±5%	3100±3%	3.80			
NCP15XF101J03RC	100±5%	3250±3%	3.10			
NCP15XF151J03RC	150±5%	3250±3%	2.50			
NCP15XM221J03RC	220±5%	3500±3%	2.10			
NCP15XM331J03RC	330±5%	3500±3%	1.70			
NCP15XQ471J03RC	470±5%	3650±2%	1.40			
NCP15XQ681J03RC	680±5%	3650±3%	1.20			
NCP15XQ102J03RC	1.0k±5%	3650±2%	1.00			
NCP15XW152J03RC	1.5k±5%	3950±3%	0.81			
NCP15XW222J03RC	2.2k±5%	3950±3%	0.67			
NCP15XW332J03RC	3.3k±5%	3950±3%	0.55			
NCP15XM472J03RC	4.7k±5%	3500±2%	0.46			
NCP15XW682J03RC	6.8k±5%	3950±3%	0.38			
NCP15XH103J03RC	10k±5%	3380±1%	0.31			
NCP15XV103J03RC	10k±5%	3900±3%	0.31			
NCP15XW153J03RC	15k±5%	3950±3%	0.25			
NCP15XW223J03RC	22k±5%	3950±3%	0.21			
NCP15WL223J03RC	22k±5%	4485±1%	0.21			
NCP15WB333J03RC	33k±5%	4050±3%	0.17			
NCP15WL333J03RC	33k±5%	4485±1%	0.17			
NCP15WB473J03RC	47k±5%	4050±1%	0.14			
NCP15WL473J03RC	47k±5%	4485±1%	0.14			
NCP15WD683J03RC	68k±5%	4150±3%	0.12			
NCP15WL683J03RC	68k±5%	4485±1%	0.12			
NCP15WF104J03RC	100k±5%	4250±1%	0.10			
NCP15WL104J03RC	100k±5%	4485±1%	0.10			
NCP15WM154J03RC	150k±5%	4500±3%	0.08			
NCP15WL154J03RC	150k±5%	4485±1%	0.08			
NCP15WM224J03RC	220k±5%	4500±3%	0.06			
NCP15WM474J03RC	470k±5%	4500±3%	0.04			

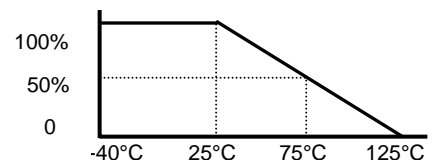
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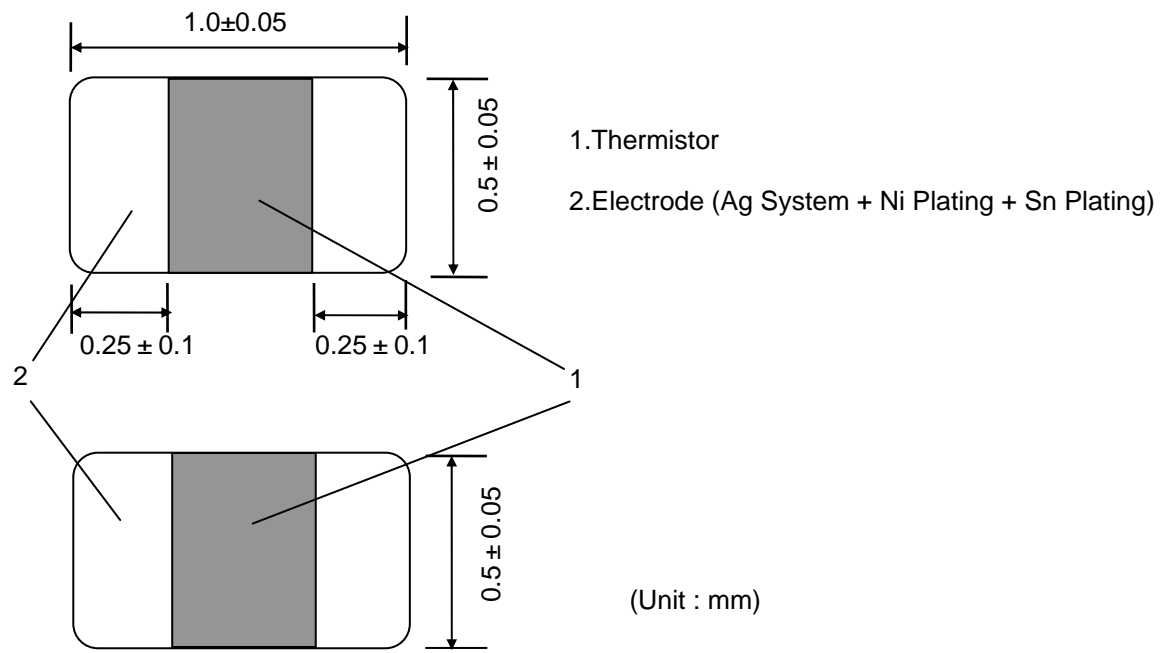
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Please do not apply more than 10mW of electric power in short time. (10mW of power makes NTC Thermistor approx.10°C of temperature rising.) The electric power is related with operating temperature in shown in the graph right.



3. Dimensions



4. Marking  
No Marking

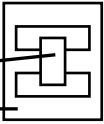
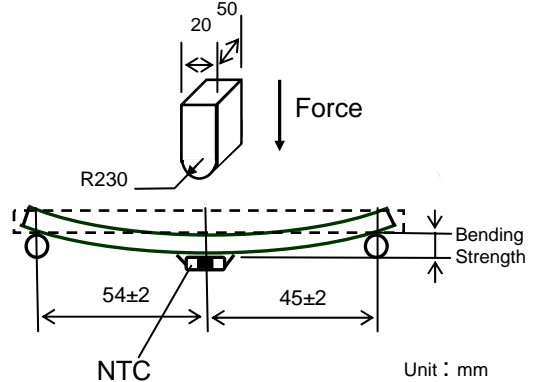
5. Climatic performance

No.	Item	Criteria	Test Condition															
5.1	Dry Heat	(*4) •Resistance( $R_{25}$ ) change shall be less than $\pm 5\%$ •B-constant( $B_{25/50}$ ) change shall be less than $\pm 2\%$ •No visible damage.	125 $\pm$ 3°C in air, for 1000 +48/-0 hrs. without loading.															
5.2	Cold		-40 $\pm$ 3°C in air, for 1000 +48/-0 hrs. without loading.															
5.3	Damp Heat		60 $\pm$ 2°C, 90~95%RH in air, for 1000 +48/-0 hrs. without loading.															
5.4	Change of Temperature		5 cycles of following sequence without loading. <table border="1"> <thead> <tr> <th>Step</th> <th>Temp.(°C)</th> <th>Time (min.)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-40 +0/-3</td> <td>30</td> </tr> <tr> <td>2</td> <td>room temp.</td> <td>10~15</td> </tr> <tr> <td>3</td> <td>+125 +3/-0</td> <td>30</td> </tr> <tr> <td>4</td> <td>room temp.</td> <td>10~15</td> </tr> </tbody> </table>	Step	Temp.(°C)	Time (min.)	1	-40 +0/-3	30	2	room temp.	10~15	3	+125 +3/-0	30	4	room temp.	10~15
Step	Temp.(°C)		Time (min.)															
1	-40 +0/-3	30																
2	room temp.	10~15																
3	+125 +3/-0	30																
4	room temp.	10~15																
5.5	High Temperature Load	85 $\pm$ 2°C in air, with Permissive Operating Current for 1000 +48/-0 hrs.																

- NTC Thermistor shall be soldered on the glass epoxy PCB with "Recommendable Land Size" (See Notice 6. (2)) and be tested.
- $R_{25}$  means the zero-power resistance at 25°C.
- $B_{25/50}$  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  $R_{50}$ ) shall be measured and the appearance shall be visually examined.

\*4 : The parts below have criteria;  
 Resistance( $R_{25}$ ) change shall be less than 1%  
 B-constant( $B_{25/50}$ ) change shall be less than 1%  
 P/N: NCP15XH103\*\*\*R\*, NCP15WL223\*\*\*R\*, NCP15WL683\*\*\*R\*  
 NCP15WB473\*\*\*R\*, NCP15WL333\*\*\*R\*, NCP15WL104\*\*\*R\*  
 NCP15WF104\*\*\*R\*, NCP15WL473\*\*\*R\*, NCP15WL154\*\*\*R\*

6. Mechanical performance

No.	Item	Criteria	Test Condition
6.1	Solderability	Minimum 95% of the whole electrode surface shall be covered with solder.	Soldering Temp. : 235±5°C Solder : Sn60%/Pb40% Immersion Time : 2±0.5sec. NTC Thermistor shall be immersed completely under the solder meniscus.
6.2	Soldering Heat Resistant	(*4) •Resistance( $R_{25}$ ) change shall be less than ±5% •B-constant( $B_{25/50}$ ) change shall be less than ±2% •No visible damage.	Soldering Temp. : 260±5°C Solder : Sn60%/Pb40% Immersion Time : 10±0.5sec. NTC Thermistor shall be immersed completely under the solder meniscus. Preheating Temp.: 150±5°C Preheating Time : 3min.
6.3	Vibration Resistant	(*4) •Resistance( $R_{25}$ ) change shall be less than ±5% •B-constant( $B_{25/50}$ ) change shall be less than ±2% •No visible damage.	Solder NTC Thermistor on the Glass Epoxy PCB as shown below. Frequency : 10Hz~55Hz~10Hz(1min.) Amplitude : 1.5mm Vibrated for a period of 2hrs. in three (3) directions perpendicularly intersecting each other (for total of 6hrs.). 
6.4	Resistance to Bending of Substance	(*4) •Resistance( $R_{25}$ ) change shall be less than ±5% •B-constant( $B_{25/50}$ ) change shall be less than ±2% •No visible damage.	Solder NTC Thermistor on Test Board, and apply force on back side of Test Board as shown below: Bending Speed : 1.0 mm/s Bending Strength : 1.0mm Hold Time : 5+/-1 sec Board Dimension : 100*40*0.8t mm Board Material : Glass Epoxy 

- NTC Thermistor shall be soldered on the glass epoxy PCB with "Recommendable Land Size" (See Notice 6. (2)) and be tested. ( 6.3,6.4 )
- $R_{25}$  means the zero-power resistance at 25°C.
- $B_{25/50}$  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  $R_{50}$ ) shall be measured and the appearance shall be visually examined.

\*4 : The parts below have criteria;

Resistance( $R_{25}$ ) change shall be less than 1%

B-constant( $B_{25/50}$ ) change shall be less than 1%

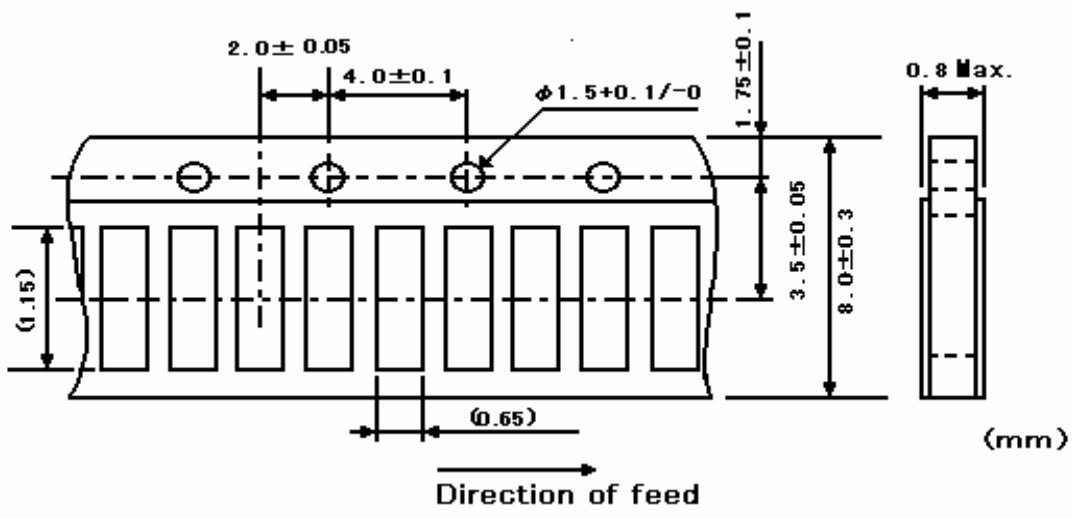
P/N:NCP15XH103\*\*\*R\*,NCP15WL223\*\*\*R\*,NCP15WL683\*\*\*R\*

NCP15WB473\*\*\*R\*,NCP15WL333\*\*\*R\*,NCP15WL104\*\*\*R\*

NCP15WF104\*\*\*R\*,NCP15WL473\*\*\*R\*,NCP15WL154\*\*\*R\*

7. Taping Specification

7.1 Dimensions of paper tape



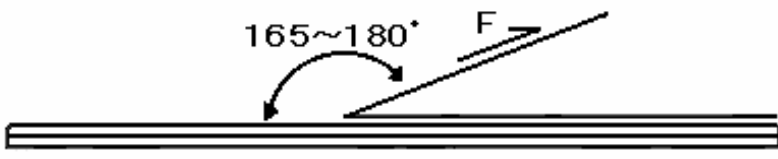
- (1) Products shall be packaged in the cavity of the base tape and sealed by top tape and bottom tape.
- (2) Top tape and bottom tape have no joints and products shall be packaged and sealed in the cavity of the base tape, continuously.

7.2 Tape strength

- (1) Pull strength of top tape and bottom tape shall be specified as follows:

Top tape	Bottom tape
10N minimum	5N minimum

- (2) Peeling force of top tape



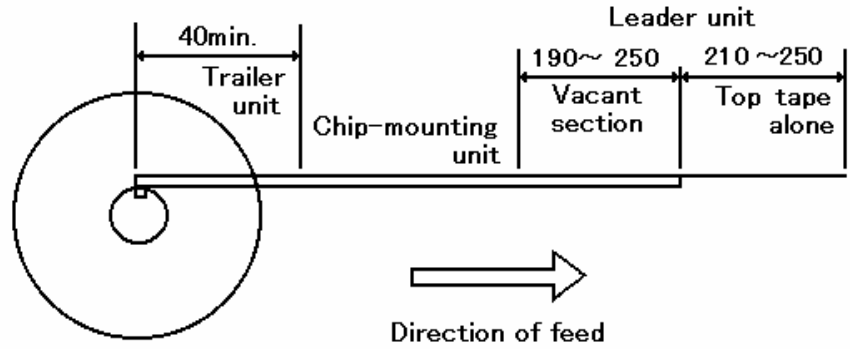
- \*1 Peeling angle : 165 to 180 degree against the fixed surface of tape.
- \*2 Peeling speed : 300mm/min.
- \*3 Peeling force : 0.1 ~ 0.6 N

7.3 Reeling

(1) Quantity (Standard Quantity)

Products quantity in a reel
10,000 pcs./1 reel

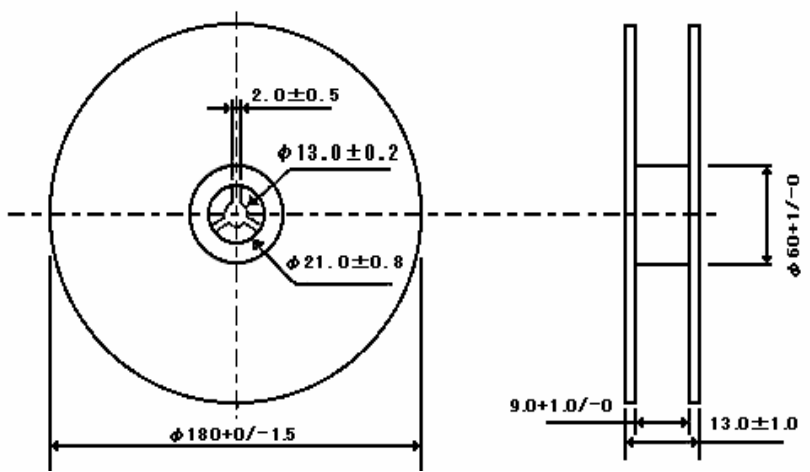
(2) A tape in a reel contains Leader unit and Trailer unit where products are not packed.  
(See the following figure.)



(mm)

The reeling specification above shall not be applied for the order less than 10,000pcs.

- (3) The top tape and base tape are not attached at the end of the tape (Vacant section) for a minimum of 5 pitches.
- (4) A label shall be attached on the reel. (MURATA's part number, inspection number and quantity shall be marked on the label.)
- (5) Dimensions of reel



(mm)

8. Packaging

The reeling shall be packed in a package.  
The label shall be attached on the package.  
(Customer's name, order number, customer's part number, MURATA's part number and quantity shall be marked on a label.)

9. Production

- (1) Country of origin : Japan
- (2) Product factory : YOKAICHI MURATA MFG. CO., LTD. (HIGASHIOMI CITY SHIGA PREFECTURE)

## for users

**⚠ CAUTION**

1. Applying the power exceeding the specified 'Rated Electric Power' may causes deterioration of the characteristics or destruction of this product. Do not apply the power exceeding the 'Rated Electric Power'.
2. 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 (Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>x</sub>, NO<sub>x</sub>, 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
3. Please contact us before using this product for the under-mentioned applications requiring, especially high reliability, in order to prevent defects which might directly cause damage to other party's life, body or property. (Listed below.)
  - (1) Aircraft equipment
  - (2) Aerospace equipment
  - (3) Undersea equipment
  - (4) Power plant control equipment
  - (5) Medical equipment
  - (6) Transportation equipment (automobiles, trains, ships, etc.)
  - (7) Traffic signal equipment
  - (8) Disaster prevention / Crime prevention equipment
  - (9) Data-processing equipment
  - (10) Applications of similar complexity or with reliability requirements comparable to the applications listed in the above
4. 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**

1. Use this product within the specified temperature range. Higher temperature may cause deterioration of the characteristics or the material quality of this product.
2. Following conditions should be kept in order to avoid deterioration of solderability of external electrodes and the characteristics of this products.
  - (1) Storage Condition : Temperature: -10°C to +40°C  
Humidity: less than 75 %RH, without dewing.
  - (2) Storage Term : Use this product within 6 months after delivery. If 6 months or more elapsed, please check the solderability before use.
  - (3) Storage Place : Store this product in no corrosive gas (SO<sub>x</sub>, Cl, etc.), nor directly under sunshine.



3. Solder and Flux

(1) Solder Paste

Reflow Soldering : 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 Metals Industry Co., Ltd.)

(2) Flux

: Use rosin-based flux.  
Do not use strong acidic flux (with halide content exceeding 0.1wt% Cl).

4. 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.

(1) Cleaning Conditions

Solvent	Dipping Cleaning	Ultrasonic Cleaning
Isopropyl Alcohol	Less than 5 min. at room temp. or Less than 2 min. at 40°C max.	Less than 5 min. 20W/L Frequency of 28 KHz to 40 KHz.

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

(2) Drying : Please fully perform cleaning and keep flux and cleaner components from remaining. After cleaning, dry promptly this product.

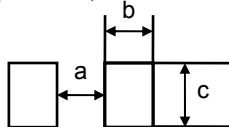
5. Do not give this product a strong press-force nor a mechanical shock. Because such mechanical forces may cause cracking or chipping of this ceramic product.

6. 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 the points below.

(1) Please mount this product by soldering. When mounted by other methods, such as conductive adhesives, please contact us in advance.

(2) Recommendable Land Size

Too big land size gives too much solder paste on the land. It may cause destruction of this product, because of the mechanical stress especially in the case of board bending.

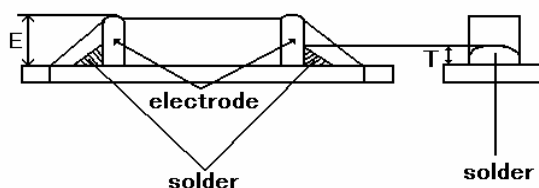


	a	b	c
Reflow Soldering	0.4	0.4 - 0.5	0.5

(Unit : mm)

(3) Printing Conditions of Solder Paste

- i. Recommendable thickness of solder paste printing shall be 150 μm.
- ii. After soldering, the solder fillet shall be a height from 1/3E to the thickness of this product. (See the figures below.)

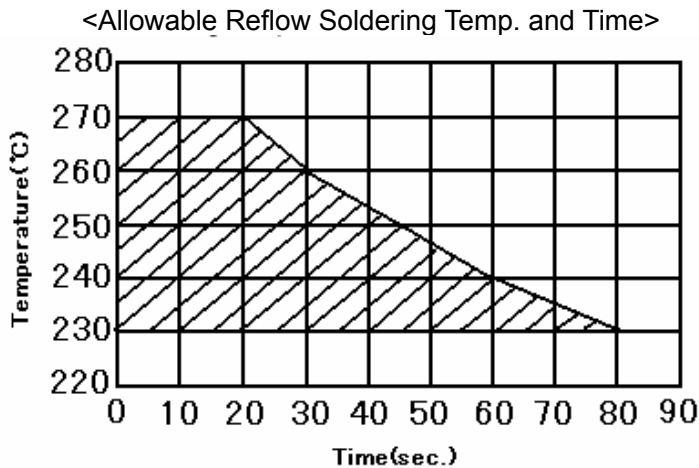


$$1/3E \leq T \leq E$$

- iii. Too much solder gives too strong mechanical stress to this product, such stress may cause cracking or any mechanical damage. And also, it can destroy the electrical performance of this product.

(4) Allowable Soldering Temperature and Time

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

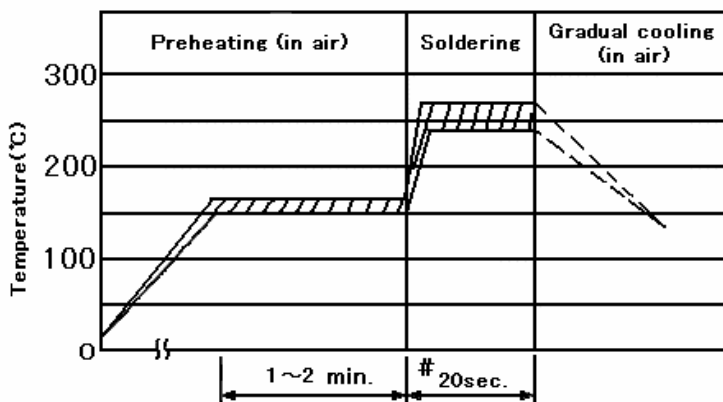


(5) Recommendable Temperature Profile for Soldering

- i. Insufficient preheating may cause a crack on ceramic body. The difference between Preheating temperature and soldering temperature shall be less than 100°C.
- ii. Insufficient soldering temperature may cause deterioration of solder-wetting on the External electrode. The soldering temperature of reflow soldering shall be from 240°C to 270°C.
- iii. Rapid cooling by dipping in solvent or by other means is not recommended.

If you can not use the above-mentioned conditions, please evaluate if this product is correctly mounted under your mounting and soldering conditions.

Recommended Soldering Condition  
<Reflow Soldering Condition>



Preheating : 160 +/- 10 °C  
1min. ~ 2 min.  
Soldering : 240 °C~270°C  
20sec.

#: In case of repeated soldering, the total accumulated soldering time should be within the range shown above figure (4).

(6) There is a fear of unexpected failures (tombstone, insufficient solder-wetting, etc.) in your mounting process, caused by the mounting conditions. Please evaluate if this product is correctly mounted under your mounting conditions.

(7) Reworking Conditions with Soldering Iron

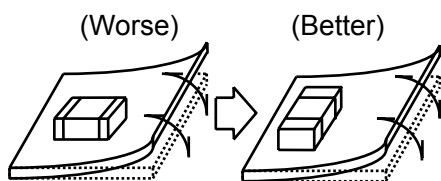
The following conditions must be strictly followed using a soldering iron.  
Preheating at 150deg.C for 1 minute is recommended, before the reworking.

Item	Conditions
Temperature of Iron-tip	280 °C max.
Soldering Iron Wattage	20W max.
Diameter of Iron-tip	3mm dia. max.
Soldering Time	10sec. max.
Caution	Do not allow the iron-tip to directly touch the ceramic body.

7. Location on Printed Circuit Board(PC Board)

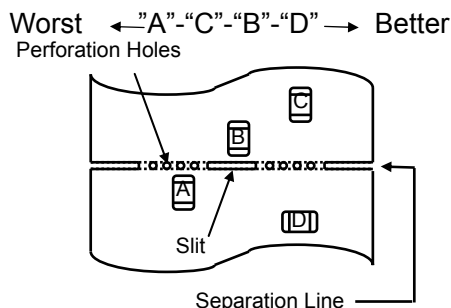
<Component Direction>

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



<Mounting Close to Board Separation Line>

Put this product on the PC Board near the Slit, not near the Perforation Holes. Keep this product on the PC Board away from the Separation Line.



NOTE

1. Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.
2. You are requested not to use our product deviating from this product specification.
3. Please return one duplicate of this product specification to us with your signature to acknowledge your receipt. If the duplicate is not returned by appointed day, the product specification will be deemed to have been received by you.
4. We consider it not appropriate to include any terms and conditions with regard to the business transaction in the product specifications, drawings or other technical documents. Therefore, if your technical documents as above include such terms and conditions such as warranty clause, product liability clause, intellectual property infringement liability clause, or export control clause, they will be deemed to be invalid.