

# NTC SMD Thermistors



## NC 12 – NC 20

Chip thermistors are a high quality and low cost device especially developed for surface mounting applications. They are widely used for temperature compensation but can also achieve temperature control of printed circuits. Its silver -

palladium - platinum metallization provides a high degree of resistance to dewetting of the terminations during soldering (typically 260°C / 30 s).

| Types                                   | NC 12<br>IEC SIZE : 0805                    | NC 20<br>IEC SIZE : 1206 |
|-----------------------------------------|---------------------------------------------|--------------------------|
| <b>DIMENSIONS: millimeters (inches)</b> |                                             |                          |
| Terminations                            | Silver – palladium – platinum metallization |                          |
| Marking                                 | On packaging only                           |                          |
| Climatic category                       | 40/125/56                                   |                          |
| Operating temperature                   | -55°C to +150°C                             |                          |
| Tolerance on R <sub>n</sub> (25°C)      | ±5%, ±10%, ±20%                             |                          |
| Maximum dissipation at 25°C             | 0.12 W                                      | 0.24 W                   |
| Thermal dissipation factor              | 2 mW/°C                                     | 4 mW/°C                  |
| Thermal time constant                   | 5 s                                         | 7 s                      |

Resistance - Temperature characteristics: pages 36 to 40.

## APPLICATIONS

- LCD compensation
- Battery packs
- Mobile phones
- CD players
- Heating systems
- Air-conditioning systems
- Temperature control of Switch Mode Power Supplies
- Compensation of pressure sensors
- Protection of power transistors in various electronic circuits

## HOW TO ORDER

**NC 20**

Type

**K 0**

Material Code  
K

(See tables pages 11, 36-40)

**0103**

Resistance  
10,000 Ω

**M**

Tolerance  
M (±20%)  
J (±5%)  
K (±10%)

**BA**

Suffix: Packaging

– : Bulk  
BA: Plastic tape  
(180mm diam. reel)  
BE: Plastic tape (1/2 reel)  
BC: Plastic tape  
(330mm diam. reel)  
BB: Cardboard tape  
(180mm diam. reel)  
BF: Cardboard tape (1/2 reel)  
BD: Cardboard tape  
(330mm diam. reel)

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## NC 12 – NC 20

### TABLE OF VALUES

| NC 12<br>IEC SIZE : 0805                                                                                                                                                                                                                                                                                                         |                                                                                                                                          |                  |                                                             |                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------------------------------------------------|----------------------------|
| Types                                                                                                                                                                                                                                                                                                                            | Rn at 25°C<br>(Ω)                                                                                                                        | Material<br>Code | B (K)<br>( $\Delta B/B$<br>(1) $\pm 5\%$<br>(2) $\pm 3\%$ ) | $\alpha$ at 25°C<br>(%/°C) |
| NC 12 KC 0 180<br>NC 12 KC 0 220<br>NC 12 KC 0 270<br>NC 12 KC 0 330<br>NC 12 KC 0 390<br>NC 12 KC 0 470<br>NC 12 KC 0 560<br>NC 12 KC 0 680<br>NC 12 KC 0 820<br>NC 12 KC 0 101                                                                                                                                                 | 18<br>22<br>27<br>33<br>39<br>47<br>56<br>68<br>82<br>100                                                                                | KC               | 3470 $\pm$ 5%                                               | – 3.9                      |
| NC 12 MC 0 121<br>NC 12 MC 0 151<br>NC 12 MC 0 181<br>NC 12 MC 0 221<br>NC 12 MC 0 271<br>NC 12 MC 0 331<br>NC 12 MC 0 391<br>NC 12 MC 0 471<br>NC 12 MC 0 561<br>NC 12 MC 0 681<br>NC 12 MC 0 821<br>NC 12 MC 0 102<br>NC 12 MC 0 122<br>NC 12 MC 0 152<br>NC 12 MC 0 182<br>NC 12 MC 0 222<br>NC 12 MC 0 272<br>NC 12 MC 0 332 | 120<br>150<br>180<br>220<br>270<br>330<br>390<br>470<br>560<br>680<br>820<br>1,000<br>1,200<br>1,500<br>1,800<br>2,200<br>2,700<br>3,300 | MC               | 3910 $\pm$ 3%                                               | – 4.4                      |
| NC 12 J 0 0332<br>NC 12 J 0 0392<br>NC 12 J 0 0472<br>NC 12 J 0 0562                                                                                                                                                                                                                                                             | 3,300<br>3,900<br>4,700<br>5,600                                                                                                         | J                | 3480 $\pm$ 3%                                               | – 3.9                      |
| NC 12 K 0 0682<br>NC 12 K 0 0822<br>NC 12 K 0 0103<br>NC 12 K 0 0123                                                                                                                                                                                                                                                             | 6,800<br>8,200<br>10,000<br>12,000                                                                                                       | K                | 3630 $\pm$ 3%                                               | – 4.0                      |
| NC 12 L 0 0153<br>NC 12 L 0 0183                                                                                                                                                                                                                                                                                                 | 15,000<br>18,000                                                                                                                         | L                | 3790 $\pm$ 3%                                               | – 4.2                      |
| NC 12 M 0 0223<br>NC 12 M 0 0273<br>NC 12 M 0 0333<br>NC 12 M 0 0393                                                                                                                                                                                                                                                             | 22,000<br>27,000<br>33,000<br>39,000                                                                                                     | M                | 3950 $\pm$ 3%                                               | – 4.4                      |
| NC 12 N 0 0473<br>NC 12 N 0 0563                                                                                                                                                                                                                                                                                                 | 47,000<br>56,000                                                                                                                         | N                | 4080 $\pm$ 3%                                               | – 4.6                      |
| NC 12 L 2 0683<br>NC 12 N 0 0823                                                                                                                                                                                                                                                                                                 | 68,000<br>82,000                                                                                                                         | L2<br>N          | 3805 $\pm$ 3%<br>4080 $\pm$ 3%                              | – 4.1<br>– 4.6             |
| NC 12 P 0 0104<br>NC 12 P 0 0124<br>NC 12 P 0 0154<br>NC 12 P 0 0184                                                                                                                                                                                                                                                             | 100,000<br>120,000<br>150,000<br>180,000                                                                                                 | P                | 4220 $\pm$ 3%                                               | – 4.7                      |
| NC 12 Q 0 0224                                                                                                                                                                                                                                                                                                                   | 220,000                                                                                                                                  | Q                | 4300 $\pm$ 3%                                               | – 4.7                      |

| NC 20<br>IEC SIZE : 1206                                                                                                                                                                                                                                 |                                                                                                      |                  |                                                             |                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------------------|-------------------------------------------------------------|----------------------------|
| Types                                                                                                                                                                                                                                                    | Rn at 25°C<br>(Ω)                                                                                    | Material<br>Code | B (K)<br>( $\Delta B/B$<br>(1) $\pm 5\%$<br>(2) $\pm 3\%$ ) | $\alpha$ at 25°C<br>(%/°C) |
| NC 20 KC 0 100<br>NC 20 KC 0 120<br>NC 20 KC 0 150<br>NC 20 KC 0 180<br>NC 20 KC 0 220<br>NC 20 KC 0 270<br>NC 20 KC 0 330<br>NC 20 KC 0 390<br>NC 20 KC 0 470<br>NC 20 KC 0 560<br>NC 20 KC 0 680<br>NC 20 KC 0 820<br>NC 20 KC 0 101                   | 10<br>12<br>15<br>18<br>22<br>27<br>33<br>39<br>47<br>56<br>68<br>82<br>100                          | KC               | 3470 $\pm$ 5%                                               | – 3.9                      |
| NC 20 MC 0 121<br>NC 20 MC 0 151<br>NC 20 MC 0 181<br>NC 20 MC 0 221<br>NC 20 MC 0 271<br>NC 20 MC 0 331<br>NC 20 MC 0 391<br>NC 20 MC 0 471<br>NC 20 MC 0 561<br>NC 20 MC 0 681<br>NC 20 MC 0 821<br>NC 20 MC 0 102<br>NC 20 MC 0 122<br>NC 20 MC 0 152 | 120<br>150<br>180<br>220<br>270<br>330<br>390<br>470<br>560<br>680<br>820<br>1,000<br>1,200<br>1,500 | MC               | 3910 $\pm$ 3%                                               | – 4.4                      |
| NC 20 I 0 0182<br>NC 20 I 0 0222<br>NC 20 I 0 0272<br>NC 20 I 0 0332                                                                                                                                                                                     | 1,800<br>2,200<br>2,700<br>3,300                                                                     | I                | 3250 $\pm$ 5%                                               | – 3.7                      |
| NC 20 J 0 0392<br>NC 20 J 0 0472<br>NC 20 J 0 0562<br>NC 20 J 0 0682                                                                                                                                                                                     | 3,900<br>4,700<br>5,600<br>6,800                                                                     | J                | 3480 $\pm$ 3%                                               | – 3.9                      |
| NC 20 K 0 0822<br>NC 20 K 0 0103<br>NC 20 K 0 0123<br>NC 20 K 0 0153                                                                                                                                                                                     | 8,200<br>10,000<br>12,000<br>15,000                                                                  | K                | 3630 $\pm$ 3%                                               | – 4.0                      |
| NC 20 L 0 0183<br>NC 20 L 0 0223                                                                                                                                                                                                                         | 18,000<br>22,000                                                                                     | L                | 3790 $\pm$ 3%                                               | – 4.2                      |
| NC 20 M 0 0273<br>NC 20 M 0 0333<br>NC 20 M 0 0393<br>NC 20 M 0 0473                                                                                                                                                                                     | 27,000<br>33,000<br>39,000<br>47,000                                                                 | M                | 3950 $\pm$ 3%                                               | – 4.4                      |
| NC 20 N 0 0563<br>NC 20 N 0 0683<br>NC 20 N 0 0823<br>NC 20 N 0 0104                                                                                                                                                                                     | 56,000<br>68,000<br>82,000<br>100,000                                                                | N                | 4080 $\pm$ 3%                                               | – 4.6                      |
| NC 20 P 0 0124<br>NC 20 P 0 0154<br>NC 20 P 0 0184<br>NC 20 P 0 0224                                                                                                                                                                                     | 120,000<br>150,000<br>180,000<br>220,000                                                             | P                | 4220 $\pm$ 3%                                               | – 4.7                      |
| NC 20 Q 0 0274<br>NC 20 Q 0 0334<br>NC 20 Q 0 0394<br>NC 20 Q 0 0474                                                                                                                                                                                     | 270,000<br>330,000<br>390,000<br>470,000                                                             | Q                | 4300 $\pm$ 3%                                               | – 4.7                      |
| NC 20 R 0 0564<br>NC 20 R 0 0684<br>NC 20 R 0 0824<br>NC 20 R 0 0105                                                                                                                                                                                     | 560,000<br>680,000<br>820,000<br>1,000,000                                                           | R                | 4400 $\pm$ 3%                                               | – 4.8                      |

# Packaging for Automatic Insertion



## NTC Chip Thermistors / NC/NB Series

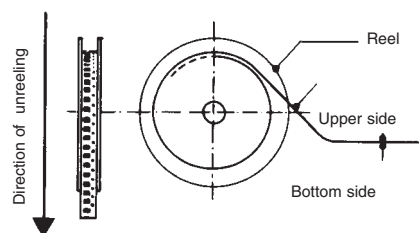
### AUTOMATIC INSERTION

#### Super 8 Plastic Tape Packaging:

The mechanical and dimensional reel characteristics are in accordance with the IEC publication 286-3.



| Designation                                               | Symbol | Value     | Tolerance                                       |
|-----------------------------------------------------------|--------|-----------|-------------------------------------------------|
| Tape width                                                | W      | 8         | ±0.2                                            |
| Tape thickness                                            | T      | 0.4 max.  |                                                 |
| Pitch of the sprocket holes                               | P0     | 4         | ±0.1                                            |
| Diameter of the sprocket holes                            | D0     | 1.5<br>-0 | ±0.1                                            |
| Distance                                                  | E      | 1.75      | ±0.1                                            |
| Distance (center to center)                               | F      | 3.5       | ±0.05                                           |
| Distance (center to center)                               | P2     | 2         | ±0.1                                            |
| Sizes of the cavities<br>NC 12 (0805)<br><br>NC 20 (1206) | A0     | 1.5       | ±0.1                                            |
|                                                           | B0     | 2.4       | ±0.1                                            |
|                                                           | K      | 1.4 max.  | K ±0.1<br>(size is adjustable)<br>(K = t1 +0.2) |
|                                                           | A0     | 1.95      | ±0.1                                            |
|                                                           | B0     | 3.55      | ±0.1                                            |
|                                                           | K      | 1.5 max.  | K ±0.1<br>(size is adjustable)<br>(K = t1 +0.2) |



### QUANTITY PER REEL

| Type          | Suffix | Qty Per Reel |
|---------------|--------|--------------|
| NC - NB 12    | BA     | 4000         |
|               | BE     | 2000         |
| NC 20 - NB 20 | BA     | 3000         |
|               | BE     | 1500         |

# Packaging for Automatic Insertion



## NTC Chip Thermistors / NC/NB Series

### AUTOMATIC INSERTION

#### 8mm Paper Tape Packaging:

The mechanical and dimensional reel characteristics are in accordance with the IEC publication 286-3.



| Designation                    | Symbol | Value            | Tolerance   |
|--------------------------------|--------|------------------|-------------|
| Tape width                     | W      | 8                | $-0.1/+0.3$ |
| Tape thickness                 | T      | 1.1 max.         |             |
| Pitch of the sprocket holes    | $P_0$  | 4                | $\pm 0.1$   |
| Diameter of the sprocket holes | $D_0$  | 1.5<br>$-0/+0.1$ | $\pm 0.1$   |
| Distance                       | $E_1$  | 1.75             | $\pm 0.1$   |
| Distance (center to center)    | F      | 3.5              | $\pm 0.05$  |
| Distance (center to center)    | $P_2$  | 2                | $\pm 0.05$  |
| Cover tape thickness           | $T_1$  | 0.10 max.        |             |
| Distance                       | $E_2$  | 6.25 min.        |             |
| Distance                       | G      | 0.75 min.        |             |
| Component pitch                | $P_1$  | 4                | $\pm 0.1$   |
| 0805/0603<br>0402              |        | 2                | $\pm 0.1$   |



### QUANTITY PER REEL

| Type       | Suffix | Qty Per Reel |
|------------|--------|--------------|
| NB - NC 12 | BB     | 4000         |
| NB 21      | BF     | 2000         |
| NB 23      | BB     | 10000        |
|            | BF     | 5000         |



# Surface Mounting Guide

## Chip Thermistor – Application Notes



### STORAGE

Good solderability is maintained for at least twelve months, provided the components are stored in their “as received” packaging at less than 40°C and 70% RH.

### SOLDERABILITY / LEACHING

Terminations to be well soldered after immersion in a 60/40 tin/lead solder bath at  $235 \pm 5^\circ\text{C}$  for  $2 \pm 1$  seconds.

Terminations will resist leaching for at least the immersion times and conditions recommendations shown below.

| P/N | Termination Type | Solder Tin/Lead | Solder Temp °C | Immersion Time Seconds |
|-----|------------------|-----------------|----------------|------------------------|
| NC  | AgPdPt           | 60/40           | $260 \pm 5$    | 15 max                 |
| NB  | Nickel Barrier   | 60/40           | $260 \pm 5$    | $30 \pm 1$             |

NB products are compatible with a wide range of soldering conditions consistent with good manufacturing practice for surface mount components. This includes Pb free reflow processes with peak temperatures up to  $270^\circ\text{C}$ . Recommended profiles for reflow and wave soldering are shown below for reference.

NC products are recommended for lead soldering application or gluing techniques.

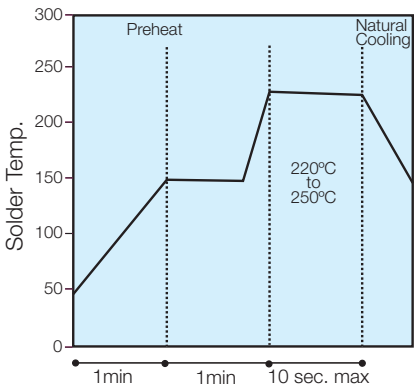
### Wave



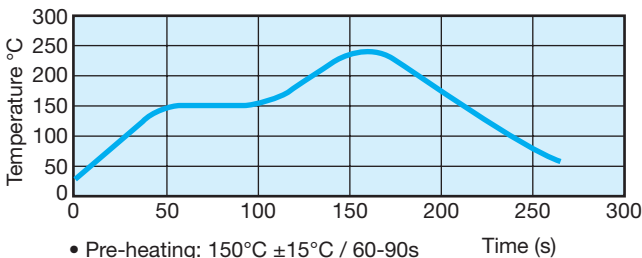
(Preheat chips before soldering)  
T/maximum  $150^\circ\text{C}$

- The visual standards used for evaluation of solder joints will need to be modified as lead free joints are not as bright as with tin-lead pastes and the fillet may not be as large.
- Resin color may darken slightly due to the increase in temperature required for the new pastes.
- Lead-free solder pastes do not allow the same self alignment as lead containing systems. Standard mounting pads are acceptable, but machine set up may need to be modified.

### Reflow



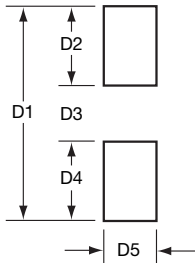
(Minimize soldering time)



- Pre-heating:  $150^\circ\text{C} \pm 15^\circ\text{C}$  / 60-90s
- Max. Peak Gradient:  $2.5^\circ\text{C/s}$
- Peak Temperature:  $245^\circ\text{C} \pm 5^\circ\text{C}$
- Time at  $>230^\circ\text{C}$ : 40s Max.

### RECOMMENDED SOLDERING PAD LAYOUT

Dimensions in mm (inches)



### REFLOW SOLDERING

| Case Size | P/N  | D1             | D2             | D3             | D4             | D5             |
|-----------|------|----------------|----------------|----------------|----------------|----------------|
| 0402      | NB23 | 1.70<br>(.067) | 0.60<br>(.024) | 0.50<br>(.020) | 0.60<br>(.024) | 0.50<br>(.020) |
| 0603      | NB21 | 2.30<br>(.091) | 0.80<br>(.031) | 0.70<br>(.028) | 0.80<br>(.031) | 0.75<br>(.030) |
| 0805      | NB12 | 3.00<br>(.118) | 1.00<br>(.039) | 1.00<br>(.039) | 1.00<br>(.039) | 1.25<br>(.049) |
| 1206      | NB20 | 4.00<br>(.157) | 1.00<br>(.039) | 2.00<br>(.079) | 1.00<br>(.039) | 2.50<br>(.098) |

### WAVE SOLDERING

| Case Size | P/N  | D1             | D2             | D3             | D4             | D5             |
|-----------|------|----------------|----------------|----------------|----------------|----------------|
| 0603      | NB21 | 3.10<br>(.122) | 1.20<br>(.047) | 0.70<br>(.028) | 1.20<br>(.047) | 0.75<br>(.030) |
| 0805      | NB12 | 4.00<br>(.157) | 1.50<br>(.059) | 1.00<br>(.039) | 1.50<br>(.059) | 1.25<br>(.049) |
| 1206      | NB20 | 5.00<br>(.197) | 1.50<br>(.059) | 2.00<br>(.079) | 1.50<br>(.059) | 1.60<br>(.063) |