

# **NTC Thermistors**

## Mounting instructions

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# Mounting instructions

## 1 Soldering

### 1.1 Leaded NTC thermistors

Leaded thermistors comply with the solderability requirements specified by CECC.

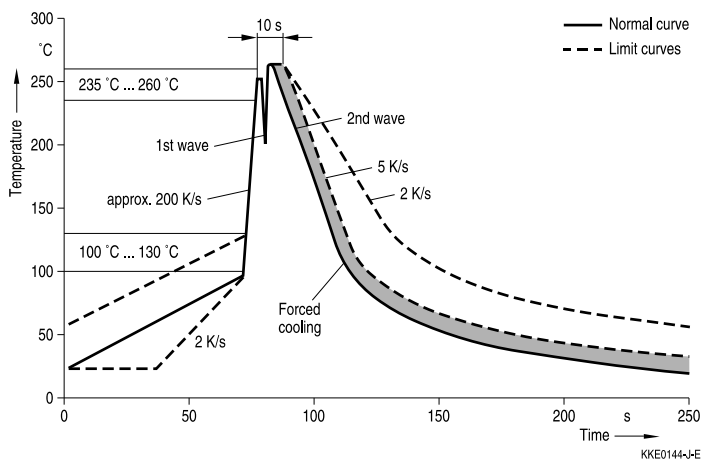
When soldering, care must be taken that the NTC thermistors are not damaged by excessive heat. The following maximum temperatures, maximum time spans and minimum distances have to be observed:

	<i>Dip soldering</i>	<i>Iron soldering</i>
Bath temperature	max. 260 °C	max. 360 °C
Soldering time	max. 4 s	max. 2 s
Distance from thermistor	min. 6 mm	min. 6 mm

Under more severe soldering conditions the resistance may change.

#### 1.1.1 Wave soldering

Temperature characteristic at component terminal with dual wave soldering



### 1.2 Leadless NTC thermistors

In case of NTC thermistors without leads, soldering is restricted to devices which are provided with a solderable metallization. The temperature shock caused by the application of hot solder may produce fine cracks in the ceramic, resulting in changes in resistance.

To prevent leaching of the metallization, solder with silver additives or with a low tin content should be used. In addition, soldering methods should be employed which permit short soldering times.

## Mounting instructions

### 1.3 SMD NTC thermistors

SMD NTC thermistors can be provided with a nickel barrier termination or on special request with silver-palladium termination. The use of no-clean solder products is recommended. In any case mild, non-activated fluxes should be used. Flux residues after soldering should be minimized.

- SMD NTCs with AgPd termination are not approved for lead-free soldering.
- Nickel barrier termination

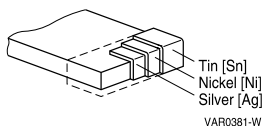


Figure 1  
SMD NTC thermistors, structure of nickel barrier termination

The nickel barrier layer of the silver/nickel/tin termination (see figure 1) prevents leaching of the silver base metallization layer. This allows great flexibility in the selection of soldering parameters.

The tin prevents the nickel layer from oxidizing and thus ensures better wetting by the solder. The nickel barrier termination is tested for all commonly-used soldering methods according to IEC 60068-2-58. Insufficient preheating may cause ceramic cracks. Rapid cooling by dipping in solvent is not recommended.

The following test and process conditions apply for nickel barrier termination.

## Mounting instructions

### 1.3.1 Solderability (test to IEC 60068-2-58)

Preconditioning: Immersion into flux F-SW 32.

Evaluation criterion: Wetting of soldering areas  $\geq 95\%$ .

Solder	Bath temperature (°C)	Dwell time (s)
SnPb 60/40	215 $\pm$ 3	3 $\pm$ 0.3
SnAg (3.0 ... 4.0), Cu (0.5 ... 0.9)	245 $\pm$ 3	3 $\pm$ 0.3

### 1.3.2 Resistance to soldering heat (test to IEC 60068-2-58)

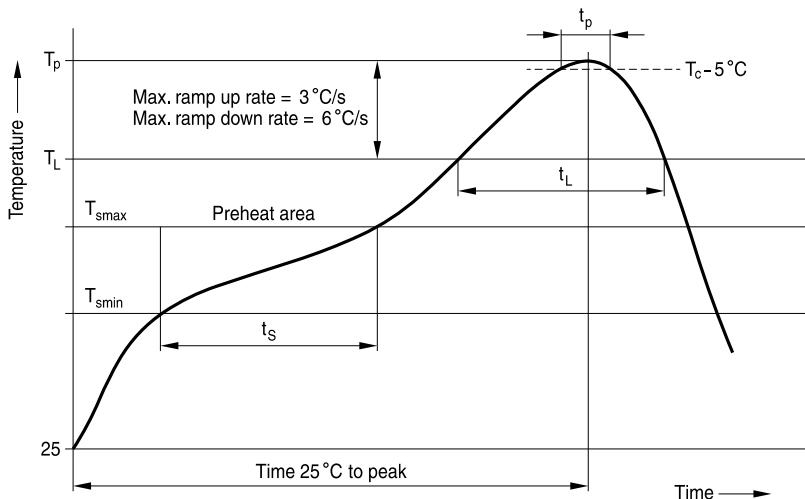
Preconditioning: Immersion into flux F-SW 32.

Evaluation criterion: Leaching of side edges  $\leq 1/3$ .

Solder	Bath temperature (°C)	Dwell time (s)
SnPb 60/40	260 $\pm$ 5	10 $\pm$ 1
SnAg (3.0 ... 4.0), Cu (0.5 ... 0.9)	260 $\pm$ 5	10 $\pm$ 1

### 1.3.3 Reflow soldering

Temperature ranges for reflow soldering acc. to IEC 60068-2-58 recommendations.



TNT0660-P-E

## Mounting instructions

Profile feature		Sn-Pb eutectic assembly	Pb-free assembly
Preheat and soak			
- Temperature min	$T_{smin}$	100 °C	150 °C
- Temperature max	$T_{smax}$	150 °C	200 °C
- Time	$t_{smin}$ to $t_{smax}$	60 ... 120 s	60 ... 120 s
Average ramp-up rate	$T_{smax}$ to $T_p$	3 °C/ s max.	3 °C/ s max.
Liquidous temperature	$T_L$	183 °C	217 °C
Time at liquidous	$t_L$	40 ... 150 s	40 ... 150 s
Peak package body temperature	$T_p$	215 °C ... 260 °C <sup>1)</sup>	235 °C ... 260 °C
Time above ( $T_p - 5$ °C)	$t_p$	10 ... 40 s	10 ... 40 s
Average ramp-down rate	$T_p$ to $T_{smax}$	6 °C/ s max.	6 °C/ s max.
Time 25 °C to peak temperature		max. 8 minutes	max. 8 minutes

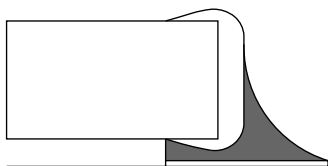
1) Depending on package thickness.

**Notes:** All temperatures refer to topside of the package, measured on the package body surface.

Number of reflow cycles: 3

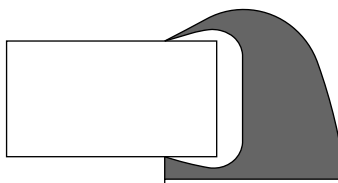
Iron soldering should be avoided, hot air methods are recommended for repair purposes.

### Solder joint profiles for silver/nickel/tin terminations



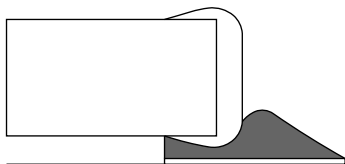
Good solder joint

TNT0565-G-E



Too much solder  
Pad geometry too large

KKE0071-A-E

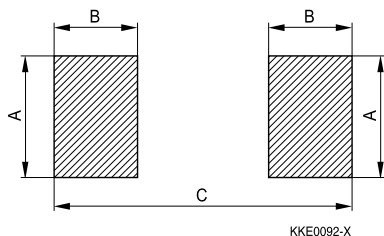


Poor wetting

KKE0072-I-E

## Mounting instructions

### 1.3.4 Recommended geometry of solder pads



Recommended maximum dimensions (mm)

Case size inch/mm	A	B	C
0402/1005	0.6	0.6	1.7
0603/1608	1.0	1.0	3.0
0805/2012	1.3	1.2	3.4
1206/3216	1.8	1.2	4.5

## 2 Conductive adhesion

An alternative to soldering for silver-palladium terminated components is the gluing of thermistors with conductive adhesives. The benefit of this method is that it involves no thermal stress. The adhesives used must be chemically inert.

## 3 Clamp contacting

Pressure contacting by means of clamps is particularly suitable for applications involving frequent switching and high turn-on powers.

## 4 Robustness of terminations (leaded types)

The leads meet the requirements of IEC 60068-2-21. They may not be bent closer than 4 mm from the solder joint on the thermistor body or from the point at which they leave the feed-throughs. During bending, any mechanical stress at the outlet of the leads must be removed. The bending radius should be at least 0.75 mm.

## Mounting instructions

Tensile strength: Test Ua1:

Value of applied force for Ua1 test:

Diameter (d) of corresponding round leads	Force with tolerance of $\pm 10\%$
$\varnothing \leq 0.25$ mm	1.0 N
$0.25 < \varnothing \leq 0.35$ mm	2.5 N
$0.35 < \varnothing \leq 0.50$ mm	5.0 N
$0.50 < \varnothing \leq 0.80$ mm	10.0 N

Bending strength: Test Ub:

Two 90°-bends in opposite directions

Value of applied force for Ub test:

Diameter (d) of corresponding round leads	Force with tolerance of $\pm 10\%$
$\varnothing \leq 0.25$ mm	0.5 N
$0.25 < \varnothing \leq 0.35$ mm	1.25 N
$0.35 < \varnothing \leq 0.50$ mm	2.5 N
$0.50 < \varnothing \leq 0.80$ mm	5 N

Torsional strength: Test Uc: severity 2

The lead is bent by 90° at a distance of 6 to 6.5 mm from the thermistor body.

The bending radius of the leads should be approx. 0.75 mm. Two torsions of 180° each (severity 2).

When subjecting leads to mechanical stress, the following should be observed:

### *Tensile stress on leads*

During mounting and operation tensile forces on the leads are to be avoided.

### *Bending of leads*

Bending of the leads directly on the thermistor body is not permissible.

A lead may be bent at a minimum distance of twice the wire's diameter +4 mm from the solder joint on the thermistor body. During bending the wire must be mechanically relieved at its outlet. The bending radius should be at least 0.75 mm.

## Mounting instructions

### 5 Sealing and potting

Sealing or potting processes can affect the reliability of the component.

When thermistors are sealed, potted or overmolded, there must be no mechanical stress caused by thermal expansion during the production process (curing / overmolding process) and during later operation. The upper category temperature of the thermistor must not be exceeded. Ensure that the materials used (sealing / potting compound and plastic material) are chemically neutral. As thermistors are temperature sensitive components it should be considered that molding can affect the thermal surrounding and may influence e.g. the response time.

Extensive testing is encouraged in order to determine whether overmolding or potting influences the functionality and/ or reliability of the component.

### 6 Cleaning

Cleaning processes can affect the reliability of the component.

If cleaning is necessary, mild cleaning agents are recommended. Cleaning agents based on water are not allowed. Washing processes may damage the product due to the possible static or cyclic mechanical loads (e.g. ultrasonic cleaning). They may cause cracks which might lead to reduced reliability and/ or lifetime.

### 7 Storage

In order to maintain their solderability, thermistors must be stored in a non-corrosive atmosphere. Humidity, temperature and container materials are critical factors.

Do not store SMDs where they are exposed to heat or direct sunlight. Otherwise, the packing material may be deformed or SMDs may stick together, causing problems during mounting. After opening the factory seals, such as polyvinyl-sealed packages, use the SMDs as soon as possible.

The components should be left in the original packing. Touching the metallization of unsoldered thermistors may change their soldering properties.

Storage temperature:  $-25\text{ }^{\circ}\text{C}$  up to  $45\text{ }^{\circ}\text{C}$

Relative humidity (without condensation):  $\leq 75\%$  annual mean

$< 95\%$ , maximum 30 days per annum

Solder the thermistors listed in this data book after shipment from EPCOS within the time specified:

SMDs with AgPd termination: 6 months

SMDs with nickel barrier termination: 12 months

Leadless components: 12 months

Leaded components: 24 months

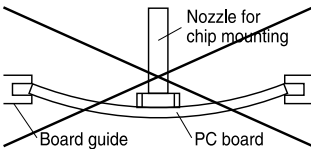


## Mounting instructions

### 8 Placement and orientation of SMD NTC thermistors on PCB

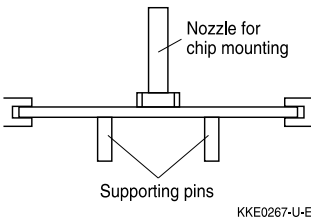
#### a) Component placement

**Incorrect**



It is recommended that the PC board should be held by means of some adequate supporting pins such as shown left to prevent the SMDs from being damaged or cracked.

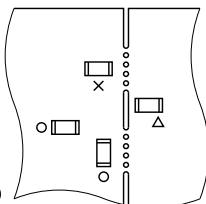
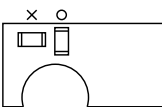
**Correct**



#### b) Cracks

SMDs located near an easily warped area

SMD breakage probability due to stress at a breakaway



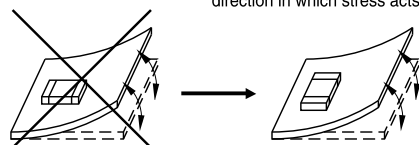
O = correct  
X = incorrect  
△ = incorrect  
(under certain conditions)

KKE0268-3-E

When placing a component near an area which is apt to bend or a grid groove on the PC board, it is advisable to have both electrodes subjected to uniform stress, or to position the component's electrodes at right angles to the grid groove or bending line (see c) Component orientation).

#### c) Component orientation

Locate chip horizontal to the direction in which stress acts



Incorrect orientation

Correct orientation

KKE0269-B-E

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