Important Information on the Use of NTCLE Leaded NTC Thermistors

MOUNTING INSTRUCTIONS

1. SOLDERING

Leaded thermistors comply with the solderability requirements outlined in IEC 60068-2-20. To prevent damage when soldering leaded NTC thermistors, care must be taken to prevent excessive heat from being conducted through the leadwires or directly to the thermistor body. The maximum process temperatures, the maximum time of exposure, and the minimum distances that need to be respected also depend on the material used for the leadwires. For dip, wave, and iron soldering of RoHS-compliant NTC thermistors, the combined solder conditions listed below should be followed:

LEADED NTC THERMISTORS: NTCLE		
	WITH Cu WIRES Ø < 0.65 mm	**WITH Ni OR STEEL WIRES Ø < 0.55 mm**
Wave or Dip Soldering		
Maximum bath or wave temperature	260 °C	260 °C
Maximum soldering time	3 s	5 s
Minimum distance from thermistor body	6 mm	3 mm
Solder Iron (Manual or Robot)		
Maximum solder tip temperature	340 °C	340 °C
Maximum soldering iron wattage	30 W	30 W
Maximum soldering time	2 s	3 s
Minimum distance from thermistor body	6 mm	3 mm
PiP / PiH Reflow Soldering	**Not recommended**	**Not recommended**
Maximum thermistor body temperature T_p	Toper. Maximum +15 °C	Toper. Maximum +25 °C
Maximum exposure time to T_p max.	30 s	30 s

The use of resin-type flux or non-activated flux is recommended. Failure to follow the above soldering conditions may result in thermal-electrical damage to material and permanent resistance changes. NTCLE thermistors are not designed for reflow soldering processes. If a heat shrink tube is applied to an NTCLE thermistor, the heating temperature of the shrink tube must not exceed the mentioned reflow soldering temperatures and times. Use of the coating outlets as product stops should be avoided, as lacquer may enter the PCB holes and prevent solder flow and the minimum distance required between the solder joint and thermistor body cannot be reached. Excessive heating can cause the internal solder junction to melt.

2. COLD JOINING AND WIRE BENDING

Cold joining techniques such as crimp splicing can be applied to NTCLE thermistors for connector applications and making cable wire extensions. When crimp splicing, care should be taken to avoid causing intermittent contacts. The robustness of the termination leads meet the requirements of IEC 60068-2-21. During bending or separating of the leads, there should be no mechanical stress at the outlet of the coated sensor, and the leads may not be bent closer than 4 mm from the outlet of the coated body. The bending radius should be at least 3 x the wire diameter or a minimum of 5 x the insulated wire diameter. The part should not be exposed to mechanical stresses, including tensile, torsion or vibration forces, during normal operation in the application. For shrink tube fixation of the thermistor body and wires, see the “Soldering” section (1) of this document.

3. STORAGE - SHELF LIFE

NTCLE thermistors need to be stored in their original packing containers. The storage location and package containers need to be maintained within following limits:

Storage temperature: 10 °C to 40 °C
Relative humidity (without condensation): 10 % to 70 %

Thermistors must not be stored in corrosive or deoxidizing atmospheres (Cl_2, H_2S, NH_3, NO_x, SO_x, etc.). Avoid storage in heat or direct (UV) sunlight. The presence of ozone or ionizing radiation must be avoided all times. Humidity, temperature, and container materials are critical factors that can influence the solderability of the parts. Touching the exposed metal leadwires may change their soldering properties.

Shelf life: properly packaged and stored NTCLE thermistors have a minimum shelf life of 24 months after their manufacturing date (DC). Thermo-electrical functionality will not be influenced after longer storage time under the conditions described above. The solderability of exposed leads should be checked before using parts that have been stored for more than 24 months storage after their manufacturing date.

4. HANDLING

NTCLE thermistors must not be dropped. When handling the devices, chip-offs or any other damage must be avoided. Do not touch components with bare hands; gloves are recommended to prevent contamination of thermistor surface during handling. Rough handling of NTCLE thermistors may result in coating adhesion failures or coating cracks. For non-insulated NTCLE thermistors, please refer to the “Visual” paragraph of “Inspection Measuring” section (7) of this document.

5. SEALING AND POTTING

NTCLE thermistors may only be sealed, potted, or overmolded in suitable resins if it is clearly mentioned and allowed in their respective datasheets. The following series cannot be potted: the NTCLE100 standard precision, and NTCLE101 and NTCLE203 accuracy lines. Sealing or potting can affect the reliability of the component. The potting material must be compatible with the use of electronic components, electrically non-conductive, and chemically stable across the whole operating temperature range. Potting or overmolding in polyamide-based resins is not recommended. When sealing, potting, or overmolding is permitted according to the datasheet, there must be no mechanical stress exerted on the component due to thermal expansion or compression during the production process (curing / overmolding) or in the final application. There must be no residual forces or stress on the device during normal operation. The upper category operating temperature of the thermistor must not be exceeded. Ensure that the materials used are chemically neutral and stable at the maximum operating temperature. If using a ceramic adhesive / potting or filling material, avoid phosphate-based binders. As thermistors are temperature-sensitive components, molding and sealing will affect the thermal surrounding and will influence the response time, power dissipation, and thermal gradient. 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. Intensive spraying may lead to coating damage.

7. INSPECTION MEASURING

Resistance Versus Temperature

NTC thermistors exhibit a large resistance change depending on the changing surrounding temperature. The change of resistance can be as high as -8 % per degree Celsius. When measuring or inspecting resistance values of precision NTC thermistors, it is advisable to immerse the thermistor body and its connecting leads in a good thermal conductive homogeneous medium. Such a medium is preferably silicone oil or PFPEs non-reactive, per-fluorinated liquid polymers. Water is not recommended, because of its electrical conductivity. In any case, the measured parts should be cleaned and dried before further use or be discarded. The liquid medium should be measured with a calibrated thermometer and referenced close to the NTC thermistor body. Measuring NTC thermistors in air can and will be influenced by many parameters, including radiated heat and cold / heat flows from surrounding bodies. Measuring currents that can be applied to the NTC thermistor should be low enough to prevent any self-heating or be limited in time. Preferably, electrical power induced by the measuring current should be lower than 10 % of the specified dissipation factor, or generate a temperature increase of less than 0.1 °C. For many NTCLE thermistors, a measuring current of 10 µA to 100 µA will not induce any self-heating. Some ohm meters or DMMs measure resistance values with measuring currents of 1 mA or higher. These currents can heat up some NTCLE thermistors by more than 10 °C.

Dimensional

All production batches of NTC thermistors are controlled dimensionally on a statistical basis in order to guarantee compliance with specifications. When designing an NTC in your application, please verify that the application conditions will not induce any compression stress on the coated thermistor body. For example, if the component must be inserted into a tube, the tube’s minimum inner diameter must be larger than the specified maximum thermistor body dimension. Bulk packed NTCLE thermistors have no fixed pitch between the wires and the wires can be in a deviating position.

Visual

Small vesicles — sharp edges or micro-cracks on the coated leadwires of liquid epoxy coated, non-insulated NTCLE100, NTCLE101, and NTCLE203 series thermistors — are cosmetic and do not impact the reliability of the parts.

8. OPERATION

Use thermistors only within the specified operating temperature range. Never use NTC thermistors in constant voltage mode or outside the specified maximum or derated power. Overpowering a NTC thermistor can cause thermal runaway and fire ignition, short circuits, or open circuit failures. Environmental conditions must not harm the thermistors. Avoid operation of NTCLE thermistors in corrosive or deoxidizing atmospheres (Cl_2, H_2S, NH_3, NO_x, SO_x, etc.) unless specified. Only use the thermistors under normal atmospheric conditions or within the specified conditions. NTCLE thermistors may not be used in vacuums, or at very low or high air pressure. Avoid any contact with water or electrically conductive liquids, unless specified in their respective datasheets. It must be ensured that no water enters the NTC thermistors (e.g. through terminals). For measurement purposes, see the “Inspection Measuring” section (7). Avoid dew formation and condensation unless the thermistor is specified for these conditions. During operation, any bending, twisting or movement of the cables or wires should be prevented.

NTCLE thermistors are non-insulated unless a minimum insulation dielectric withstanding voltage is clearly specified in the datasheet. For non-insulated thermistors, any contact with a metallic or conductive surface could result in a leakage current, disruption, short circuit, or a malfunctioning of the component. Insulated thermistors should not be used above their specified dielectric withstanding voltages. The following series are non-insulated and not recommended for applications in which they are exposed to thermal shocks: NTCLE100 standard precision, and NTCLE101 and NTCLE203 accuracy lines.

9. FAILURE MODES

For safety critical applications, be sure to provide an appropriate fail-safe or redundancy function in the circuit to prevent secondary (product) damage caused by a malfunctioning or failed NTC thermistor. For every use of Vishay thermistors, it is the customer’s responsibility to consult and respect the Vishay disclaimer notice, which is part of every Vishay product datasheet. If you have any doubt as to the possible failure modes in your application, consult Vishay.

This list of guidelines and information does not claim to be complete, but represents the experiences of Vishay and may be supplemented, adapted, or enhanced at any time.