FAQ on Temperature Sensing and NTC Thermistors

WHY SHOULD I USE A NTC THERMISTOR AS A TEMPERATURE SENSOR INSTEAD OF ANY OTHER TYPE OF CONTACT TEMPERATURE SENSOR?

- NTC thermistors provide the highest available degree of sensitivity to temperature changes. NTC thermistors have a temperature coefficient of - 3 %/°C to - 5 %/°C, compared to just 0.7 %/°C for a silicon-based sensor, 0.385 %/°C for a platinum-based sensor, and 0.3 %/°C to 0.55 %/°C for a nickel-based sensor.
- NTC resistance values can be high to very high, which means that low-current, two-point measurements can be done with a high level of precision.
- NTC thermistors offer the best performance/price ratio of the available temperature sensors.
- NTC thermistors can be supplied in a variety of different packages. Options include surface-mount (SMD) and through-hole (leaded) versions and assembly probes for fluid, gas, or contact surface temperature measurement.

IS THE NON-LINEARITY OF A NTC THERMISTOR A PROBLEM FOR PROPER USE?

- For the temperature detection of one or several threshold values, the non-linearity does not play a role in the accurate measurement.
- For proper temperature evaluation based on a measured resistance value, the resistance versus temperature relation can be stored in the form of a look-up table with easy interpolation, or as an algorithm which can be programmed to give an exact matching temperature based on a resistance value.
- All the R-T curves of the Vishay NTC thermistors are available on the Vishay web site as downloadable files, for easy calculation of values and limits.
  www.vishay.com/resistors-non-linear/curve-computation-list/ and www.vishay.com/resistors-non-linear/ntc-curve-list/

I NEED A LINEAR VOLTAGE DEPENDANCE IN FUNCTION OF THE TEMPERATURE.

- By combining several NTC thermistors (3 or even 4) with fixed resistors in one network, it's often possible to generate such linearity with a sensitivity of for example 20 mV/°C on a temperature range from -50 °C to 150 °C.
  Just send your request to edesign.ntc@vishay.com.

I WANT TO BUILD A VOLTAGE DIVIDER PROVIDING A THERMAL VOLTAGE VARIATION FROM X TO Y VOLTS OVER A TEMPERATUR RANGE: CAN YOU GIVE ME THE REFERENCES OF THE THERMISTOR AND OF THE FIXED RESISTORS NEEDED TO ACHIEVE MY GOAL?

- Vishay provides a web tool which performs such computation.
  Just go to www.vishay.com/resistors-non-linear/resistor-thermistor-netsim/.

I NEED A NTC THERMISTOR MATCHING SEVERAL TEMPERATURE/RESISTANCE POINTS, WITH VALUES AND TOLERANCES GIVEN. HOW DO I OBTAIN SUCH A DEVICE?

- Point-matched or curve-tracked interchangeable NTC thermistors are usually installed in automotive applications.
- Please send your requirements directly to your Vishay office or to nlr@vishay.com. A proposal will be made based on types that optimally match your request.
- Please provide as much detail as possible about the application, including temperature range, type of medium, accuracy needed, reaction time, mounting considerations, etc.
- We propose as well a program for design-in of NTC thermistors which can guide you to the right product selection. You can look to a video presentation of how this software operates:
  www.vishay.com/videos/resistors/edesign-demonstration-for-ntc-thermistors.
  This software can be obtained by emailing to edesign.ntc@vishay.com.

CAN I USE A STANDARD THERMISTOR FROM THE AVAILABLE RANGES, OR DO I NEED SPECIAL DEVICE TYPE?

- Our standard series types withstand standard conditions of use (95 % relative humidity at 40 °C) and are not insulated. If there is any possibility of the components coming in contact with conductive surfaces having different potentials, leakage currents can result, deteriorating the measured resistance value. If the component must be insulated, please contact your Vishay representative or use insulated parts from the NTCLE300, NTCLE301, NTCLE201 series.

WHERE CAN I FIND AN OVERVIEW OF THE R-T TABLES OF THE VISHAY NTC THERMISTORS?

- Look on the Vishay website under R/T computation files at www.vishay.com/resistors-non-linear/curve-computation-list/ and www.vishay.com/resistors-non-linear/ntc-curve-list/.

I WANT TO OBTAIN A SPREADSHEET OF THE RESISTANCE TEMPERATURE DEPENDENCY OF MY VISHAY NTC THERMISTOR REFERENCE.

- Just go to “My VISHAY NTC curve” (www.vishay.com/resistors-non-linear/ntc-curve-list/), download the file, open the file following the instructions, indicate your P/N, temperature range and step and all R/T data of the requested part will be showed.

I NEED TO MATCH A THERMISTOR CURVE DEFINED BY A R_{25} OR R AT ANOTHER TEMPERATURE AND A B-VALUE, BUT THE B-VALUES I HAVE ARE DEFINED BETWEEN TEMPERATURES OTHER THAN 25 °C AND 85 °C. HOW CAN I GET THE CORRELATION WITH THE VISHAY SPECIFIED $B_{25/85}$?

- Some suppliers have B-values specified between other temperatures. The correlation between these B-values and Vishay values depends on the form of the curve and can change from one type of product to another. Please contact your Vishay representative or submit your question online here: nlr@vishay.com.
- We propose as well a program for design-in of NTC thermistors which can guide you to the right product selection. You can look to a video presentation of how this software operates:
  www.vishay.com/videos/resistors/edesign-demonstration-for-ntc-thermistors.
  This software now on a flash drive can be obtained by emailing to edesign.ntc@vishay.com.

DOES VISHAY HAVE COMPONENTS WITH A TEMPERATURE RANGE UP TO 900 °C?

- Yes, the reference NTCV101E4964HMB0 (high temp. glass encapsulated component) is specified up to 900 °C). (www.vishay.com/doc?29150)

ARE VISHAY THERMISTORS RoHS COMPLIANT?

- Yes, RoHS compliance is indicated and by the codes e2, e3 and e4 in the clear code SAP part numbers. (On old 12NC type numbers the first 4 digits “2381” indicate RoHS compliance as well.)

HOW CAN I TELL WHAT TYPE OF TERMINATION FINISH THE DEVICE HAS BY LOOKING AT THE PART NUMBER?

- In the ordering part number, e2 means Sn alloys; e3 means pure tin (Sn); and e4 means noble metal is used as the termination finish. You can find the general Vishay Material Category Definitions and Policy here: www.vishay.com/doc?99902.

WHAT DO I DO IF I NEED A COMPONENT WITH MAXIMUM PRECISION AT SOME TEMPERATURE VALUE OTHER THAN THE 25 °C INDICATED IN THE PRODUCT DATASHEET?

- Consult the R/T computation programs: A central reference temperature other than 25 °C can be chosen along with a tolerance at www.vishay.com/resistors-non-linear/curve-computation-list/.

WHAT IF I WANT MY TEMPERATURE DATA EXPRESSED IN DEGREES FAHRENHEIT INSTEAD OF CELSIUS?

- Look in the R/T computation programs: Download the files where R/T tables are expressed in °F at www.vishay.com/resistors-non-linear/curve-computation-list/ or visit “My Vishay NTC curve” at www.vishay.com/resistors-non-linear/ntc-curve-list/

IN MY APPLICATION, THE COMPONENTS ARE POTTED INTO THERMO-CONDUCTIVE EPOXY. WHICH COMPONENTS ARE BEST COMPATIBLE WITH THIS PROCESS?

- Select the NTCLE203….SB0, NTCLE201, NTCLE300 or NTCLE301 series with a flexible top-coating.

I NEED A SENSOR FOR SURFACE TEMPERATURE MEASUREMENT. WHERE CAN I FIND THIS?

- Select the ring tongue sensors or LUG type NTC A LUG… series on the Vishay NTC thermistor selector pages at www.vishay.com/resistors-non-linear/ntc/.
- Vishay has one of the smallest and most accurate and fast NTC-lug sensors on the market:
  You can verify its performance in the mini-Lug demo video:
  www.vishay.com/videos/resistors/vishay8217-s-ntc-mini-lug-sensor-features-fast-response-time-and-accurate-temperature-sensing.

ARE THERE SURFACE-MOUNT EQUIVALENTS FOR ALL THROUGH-HOLE (LEADED) THERMISTORS?

- Not for all the R_{25} values. Vishay offers equivalents for standard R_{25} values (10K, 100K with $B_{25/85}$ = 3435K and 3977K). Consult the R/T computation programs for the SMD series and choose the low, medium, or high B-values. The program will give you the appropriate part number.

DOES VISHAY TRIM ITS NTC THERMISTORS FOR HIGHER-PRECISION PERFORMANCE?

- Whenever possible, Vishay will not trim the parts. The stability and homogeneity of the NTC ceramic material, together with the precise dimensioning of the NTC chip, allow us to achieve low tolerance parts without trimming. We use a trimming process only for some very tight tolerances in point-matched or curve-tracked interchangeable parts. In such cases, we only trim off a small percentage of the chip area to achieve the desired value and accuracy.

I NEED THE FASTEST SENSOR EVER FOR MY APPLICATION, OR THE SMALLEST AVAILABLE.

- When speaking about through hole components, Vishay presents its NTCLE305 series with minimal outside head dimension.

CAN I DEDUCE PRODUCT INFORMATION FROM THE SAP PART NUMBER?

- Yes look in part number order information, and choose your execution (Leaded: www.vishay.com/doc?33032, SMD: www.vishay.com/doc?33034, or Assemblies: www.vishay.com/doc?33036).

I NEED THE UTMOST STABILITY AND PRECISION FOR MY APPLICATION. WHICH COMPONENT SHOULD I CHOOSE?

- It all depends on the type of mechanical executions that you want to use.
- If SMD is needed, then use NTCS0805E3104SMT, NTCS0603E3124SMTor NTCS0402E3224SMT. (www.vishay.com/doc?29151)
- If a leaded component is required, then we suggest NTCLE203E3103SB0. (www.vishay.com/doc?29118)

WHICH DEVICE SHOULD I CHOOSE IF LOW PRICE IS MORE IMPORTANT THAN STABILITY OR PRECISION?

- In this case choose a ± 5 % tolerance part with copper leads like the NTCL100E3103JB0. It's a low priced component with fair precision and good stability.
- For an SMD implementation, a part like the NTCS0805E3103JMT (a 10 kΩ ± 5 % device in the 0805 package) will do the job perfectly.