WHITE PAPER

T150 SERIES STABILITY AND DRIFT

QTI Sensing Solutions Engineering Department

Sensors and electronic components generally exhibit a phenomenon called drift, a gradual, predictable change in certain properties over time. The stability of a thermistor is a measure of its ability to retain specified characteristics after being subjected to designated environmental or electrical test conditions. Typically, an end-user is interested in knowing if the thermistor will remain within its original manufacturing specifications while operating under a certain set of conditions over a specified period of time. For example, long term exposure to high temperatures above 105 °C or cycling above 105 °C may cause a standard epoxy or phenolic coated NTC thermistor to drift out of its original manufactured tolerance. A thermistor's stability may be affected by thermal shock, mechanical stresses, and/or moisture. However, when operating within normal conditions, NTC thermistors show excellent stability. For example, a standard QTI Curve D thermistor exhibits less than 0.02 °C drift per year at normal room ambient temperature. When continuous temperature exposure or cycling exceeds 100 °C, QTI T150 series thermistors are the low cost solution to a design engineer's problem. For instance, the T151D103.CA thermistor typically shows less than 0.3% [0.07 °C] drift after 12,000 hours at 100 °C or 4,500 hours at 150 °C.

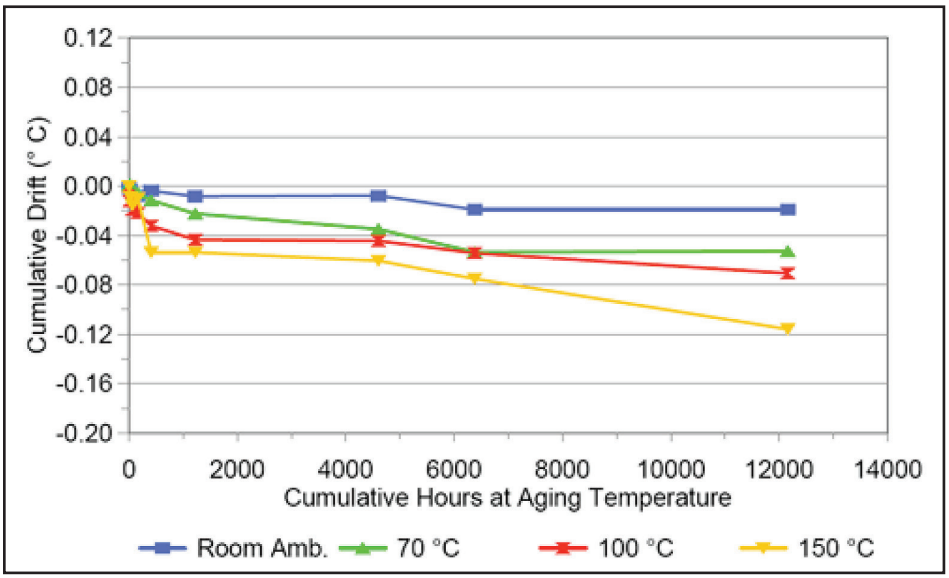

Figure 1. This graph illustrates the typical temperature drift characteristics of a group of QTI T151D103.CA NTC thermistors. Each of the four groups of thermistors was maintained continuously in an air environment at one of the following temperatures: room ambient, 70 °C, 100 °C, and 150 °C, respectively. The cumulative drift is the average of the three thermistors in each group.

Achieving the highest possible stability has been an ongoing endeavor at QTI. Ultimately, the stability of QTI thermistor products is a result of over a decade of research and development efforts to continually improve thermistor technology and maintain excellent control of materials and processes throughout the manufacturing operations. When long term stability is a concern, there are ways to estimate the drift characteristics of a thermistor by subjecting it to a short term aging study. An NTC thermistor is read and recorded at 25 °C. It is then subject to an elevated temperature for an extended time, from twenty-four hours to a week. After the exposure to the elevated temperature, the thermistor is read and recorded again. The equation on the right can be used as means of estimating the long term drift characteristics of the tested thermistor.

$$\frac{R_T - R_1}{R_1} x100 = a + b \log T$$

where:

R1 = the initial resistance (ohms)
RT = The resistance at time T
T = the aging time (hours)
a = the intercept at T = 1
b = the slope (% ΔR per decade of time T)

Figure 2. An equation for the Approximation of Drift Characteristics of NTC Thermistors.

ABOUT QTI SENSING SOLUTIONS

QTI Sensing Solutions was founded in 1977 to meet the increasing demand for high quality electronic components for the aerospace industry. Since then, QTI has exceeded the requirements of some of the most stringent high cost of failure applications, changing the landscape of the supply chain for the entire industry.

Today, QTI continues to maintain its leadership position for mission-critical applications as well as for medical and industrial applications by supplying the world's top companies with innovative products and services. In fact, QTI developed the highest standard for surface mount thermistors with the introduction of qualified surface mount parts to MIL-PRF-32192; supplying design engineers with fully qualified Defense Logistics Agency options for two PTC and three NTC surface mount package styles. Additionally, QTI has partnered with the NASA Goddard Space Flight Center for surface mount thermistors qualified to S311-P827, an industry first!

In addition to QTI's accomplishments, our ISO:09001:2000 and AS9100 certified manufacturing and testing facilities in Idaho enhances our ability to meet the needs of today's challenging temperature measurement and control applications.

LEARN MORE

If you would like to learn more about how QTI can help you, please contact us today. We would be happy to discuss your project with you and help with the product selection process. Additionally, if you are unable to find the item you need, our engineers may be able to produce a custom component for your individual application.