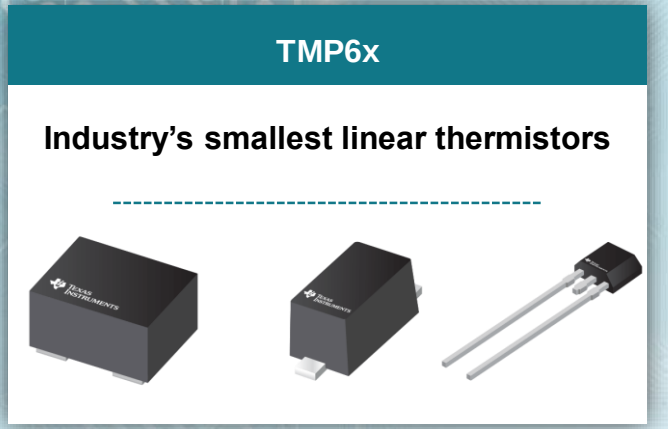
Welcome!
Texas Instruments New Product Update

- **This webinar will be recorded and available at www.ti.com/npu**
- **Phone lines will be muted**
- **Please post questions in the chat or contact your sales person or field applications engineer**

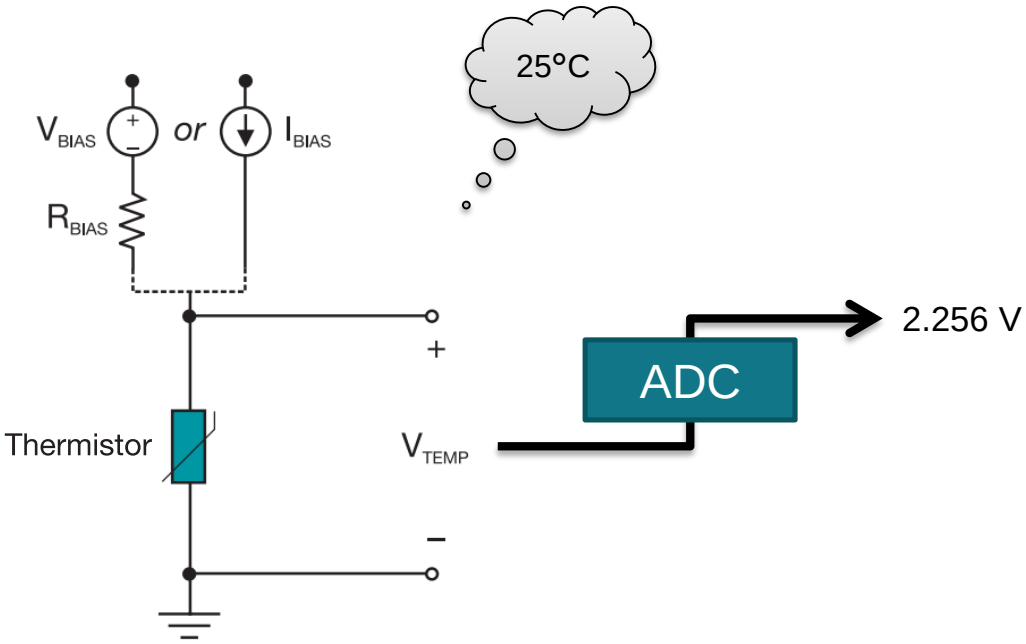
New product update: Thermistors

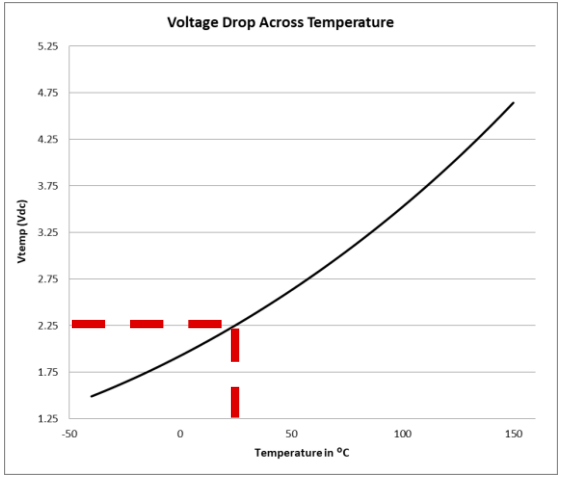
December 17th, 2020

Bryan Padilla, Product Marketing Engineer



What is a thermistor?



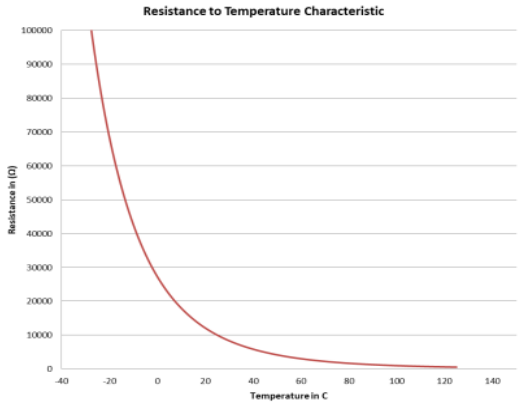


25 °C

Thermistors for temperature monitoring

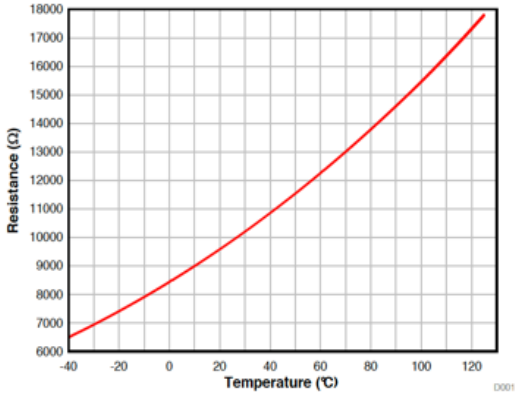
NTCs

Non-linear measurement NTCs



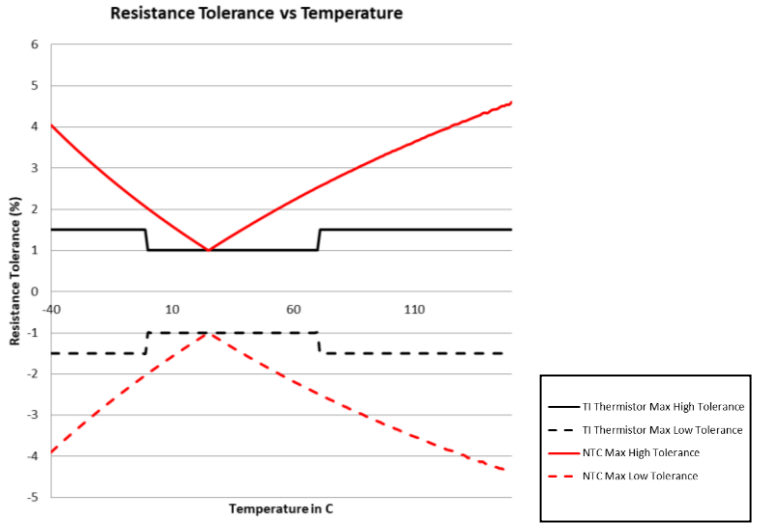
Linear PTCs

Silicon-based linear PTCs

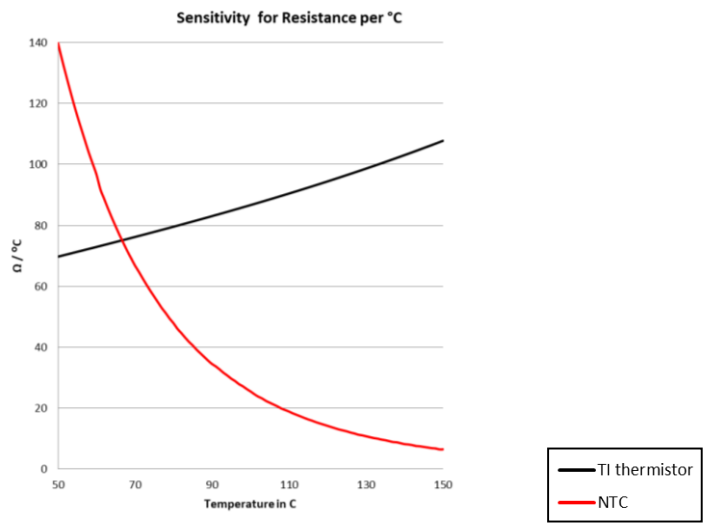


Resistance tolerance and sensitivity

Ex: 1% Rtol TMP6x vs NTC

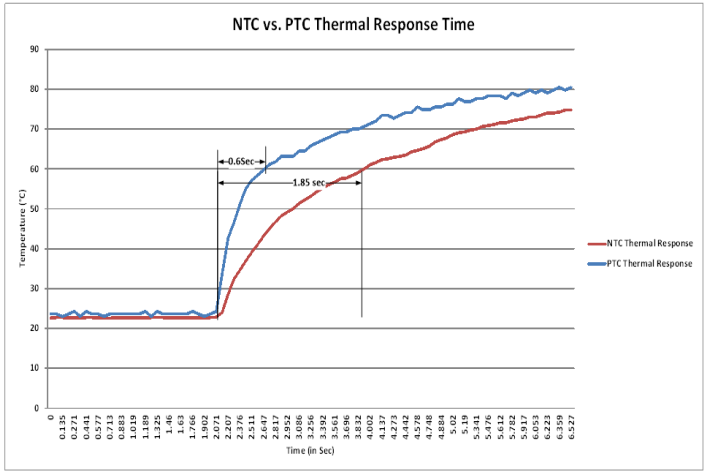


Less error spread in actual value vs stated value from manufacturer

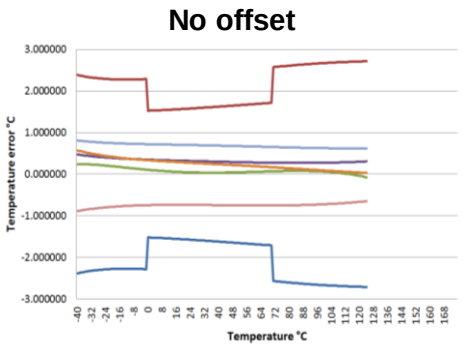


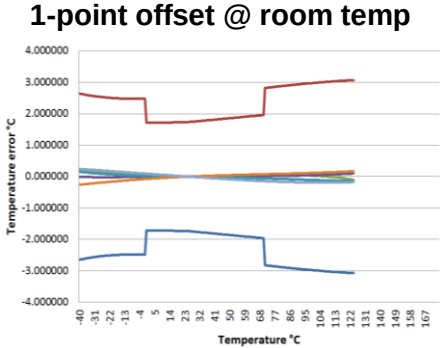
Greater change in resistance per degree C at high temperature

Thermal response & potential accuracy



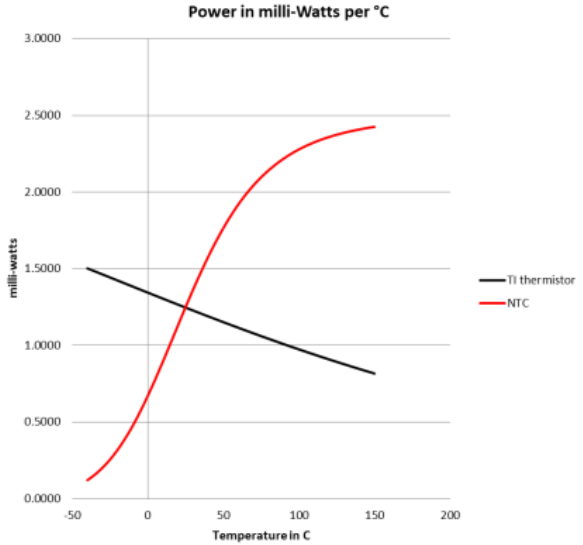
Almost 3x faster than NTCs





Achieve down to ±0.3°C with a 1-point room temperature offset

Reliability

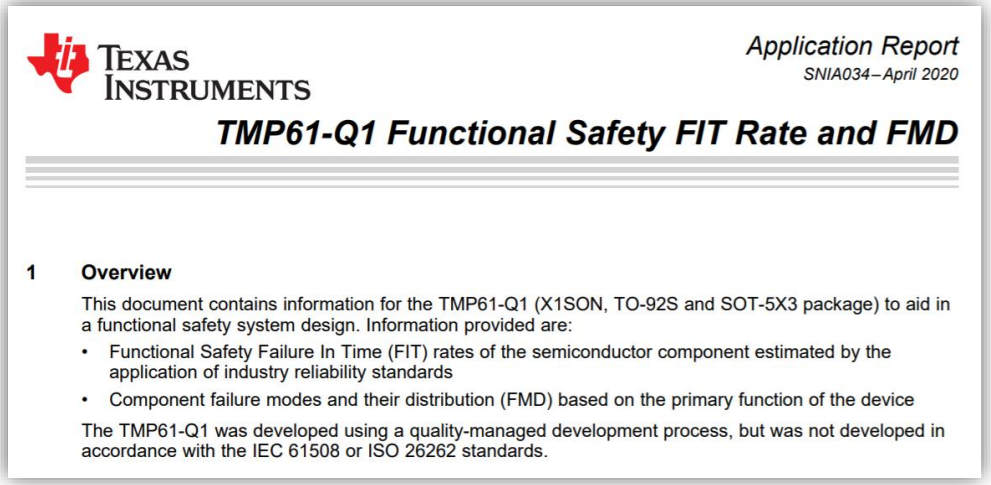


Small thermal mass, protected by IC packaging, less heat dissipation at high temp

Part Number	Drift
TI silicon-based thermistor	**Max: < 1 % Typ: < 0.5 %**
Average NTC thermistor	**Max: <5%**

Lowest sensor drift, many NTCs do not provide this spec.

Safety documentation



Texas Instruments

Application Report
SNIA034–April 2020

TMP61-Q1 Functional Safety FIT Rate and FMD

1 Overview

This document contains information for the TMP61-Q1 (X1SON, TO-92S and SOT-5X3 package) to aid in a functional safety system design. Information provided are:

- Functional Safety Failure In Time (FIT) rates of the semiconductor component estimated by the application of industry reliability standards
- Component failure modes and their distribution (FMD) based on the primary function of the device

The TMP61-Q1 was developed using a quality-managed development process, but was not developed in accordance with the IEC 61508 or ISO 26262 standards.

Streamline your functional safety system certification

TMP6x-Q1

Silicon-based linear thermistors for temperature sensing

Features

Resistance options at 25°C:

- **10kΩ** (TMP61), **100kΩ** (TMP63), **47kΩ** (TMP64)

Resistance tolerance from 0 to 70°C:

- **± 1%**

Max lifetime resistance sensor drift:

- **< 1%**: 2/3rd less than NTC thermistor competition

Fast thermal response time:

- **0.6 seconds** (DEC stirred liquid): 66% faster than NTC thermistors

Linear Positive Temperature Coefficient, TCR : 6400ppm/°C **± 0.2%**

Operating Temperatures:

Qualification	DEC (0402)	DYA (0603)	LPG (TO-92s)
Commercial	-40 to 125°C	-40 to 150°C	-40 to 150°C
Automotive AEC-Q100	-40 to 125°C	-40 to 150°C	-40 to 170°C

Applications

- Displays
- DC/DC
- Power Modules
- Inverters
- GPUs
- Motor Control
- Charging Infrastructure
- Batteries
- HVAC
- Appliances
- Speakers

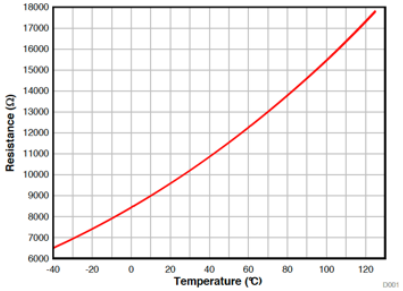
Benefits

- Smallest and most cost-effective linear thermistor in the market
- Outperforms both NTCs and linear PTC thermistors
- Enables ±0.3°C accuracy via a 1-point room temperature offset
- Small size allows for closer proximity to thermal hotpots and quicker thermal response
- Minimizes thermistor self-heating and reduces power consumption
- Eliminates linearization circuitry and simplifies software.
- **Easy switch from NTCs and linear PTCs**

Tools

- Thermistor design tool
  - Includes voltage and current biasing
  - R-T tables, code examples, NTC comparison
- TMP6x EVM
  - Detachable sensor for remote prototyping

EVM



X1SON (DEC)
0402 footprint compatible

SOT-5X3 (DYA)
0603 footprint compatible

TO-92S (LPG)
Through-hole

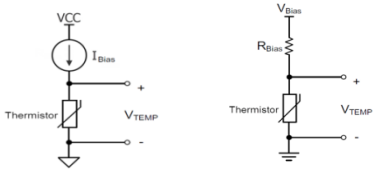
Key considerations when designing with thermistors

1. **Thermistor based solutions are discrete** Accuracy is dependent on component tolerances	1. **Use precise components & minimize BOM** (Thermistor, resistors, voltage/current source)
2. **Source variances** (Can cause error if not referenced in ADC)	2. **Implement ratiometricity** (Can increase total accuracies in a system)
3. **Component tolerance and sensitivity errors**	3. **Calibrate your thermistor to get high accuracy**
4. **Software LUT or equation errors, memory, and speed**	4. **Use accurate software conversion methods** (Minimize processing and time, helps with accuracy)
5. **ADC bit resolution**	5. **Oversample in software** (Improves resolution and SNR)

Easy to use: Thermistor design tool

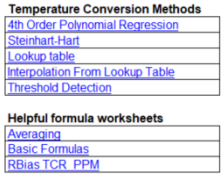
Unique resistance tables

- Choose circuit, OPN, source value, and Rbias



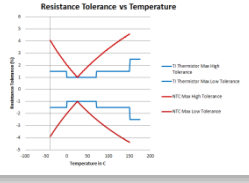
Code & examples

- Kickstart design with conversion methods and C code provided



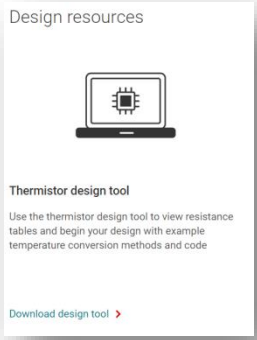
Thermistor analysis

- Input resistance tables to compare characteristics



Download now

TI.com/thermistors




Thank you
merci
gracias
danke
dziękuję
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kiitos
Xièxiè
спасибо
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tack
tänan
mahalo
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a dank
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Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265