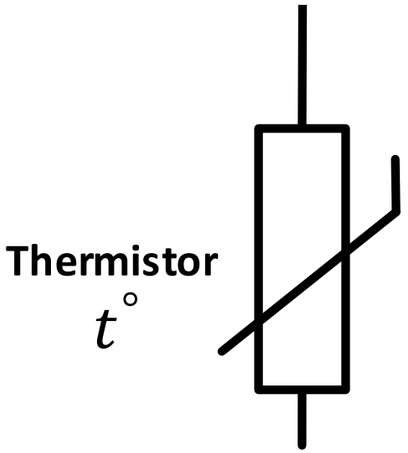
# Introduction to thermistors

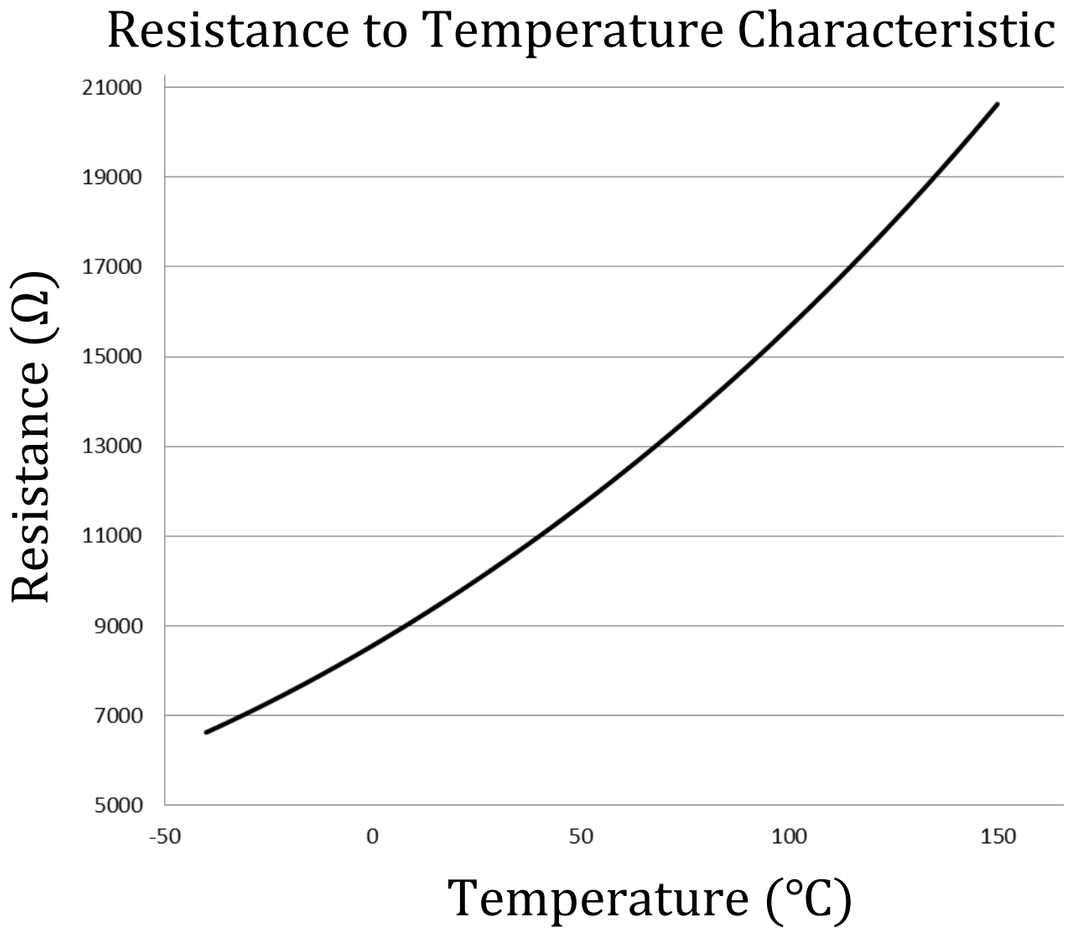
## TI Precision Labs – Thermistors

**Presented and prepared by Bryan Padilla**

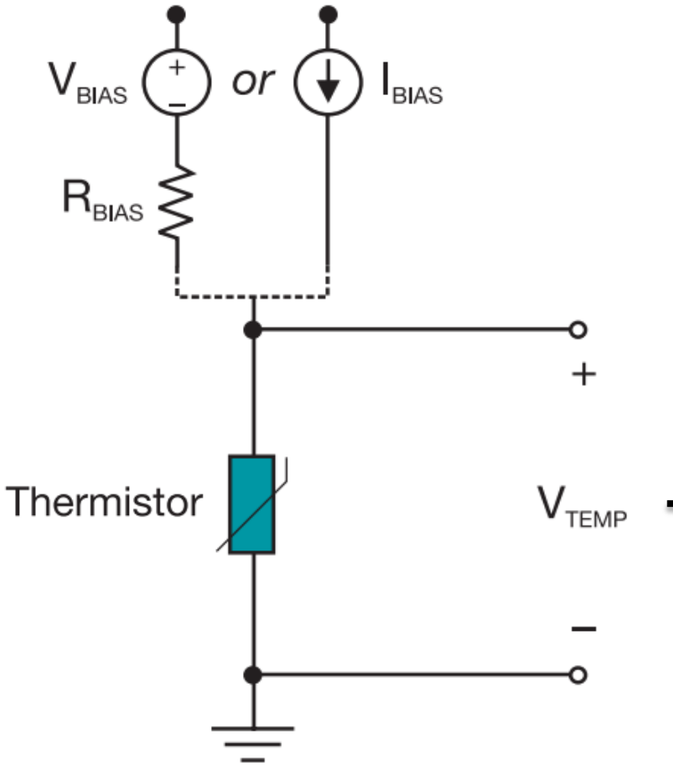
# What is a thermistor?

Two-terminal devices that changes its effective resistance with temperature.



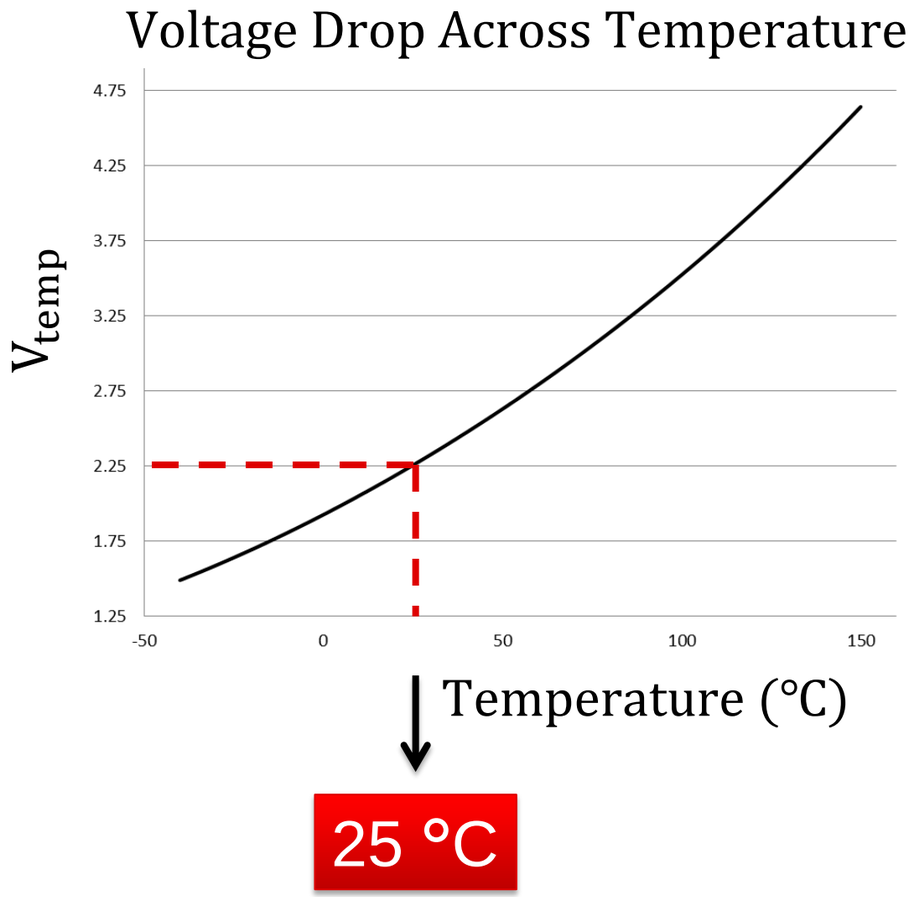



# What is a thermistor?




2.256 V

ADC




25 °C

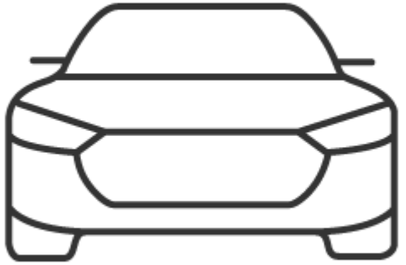
# Thermistors today

**Pro**

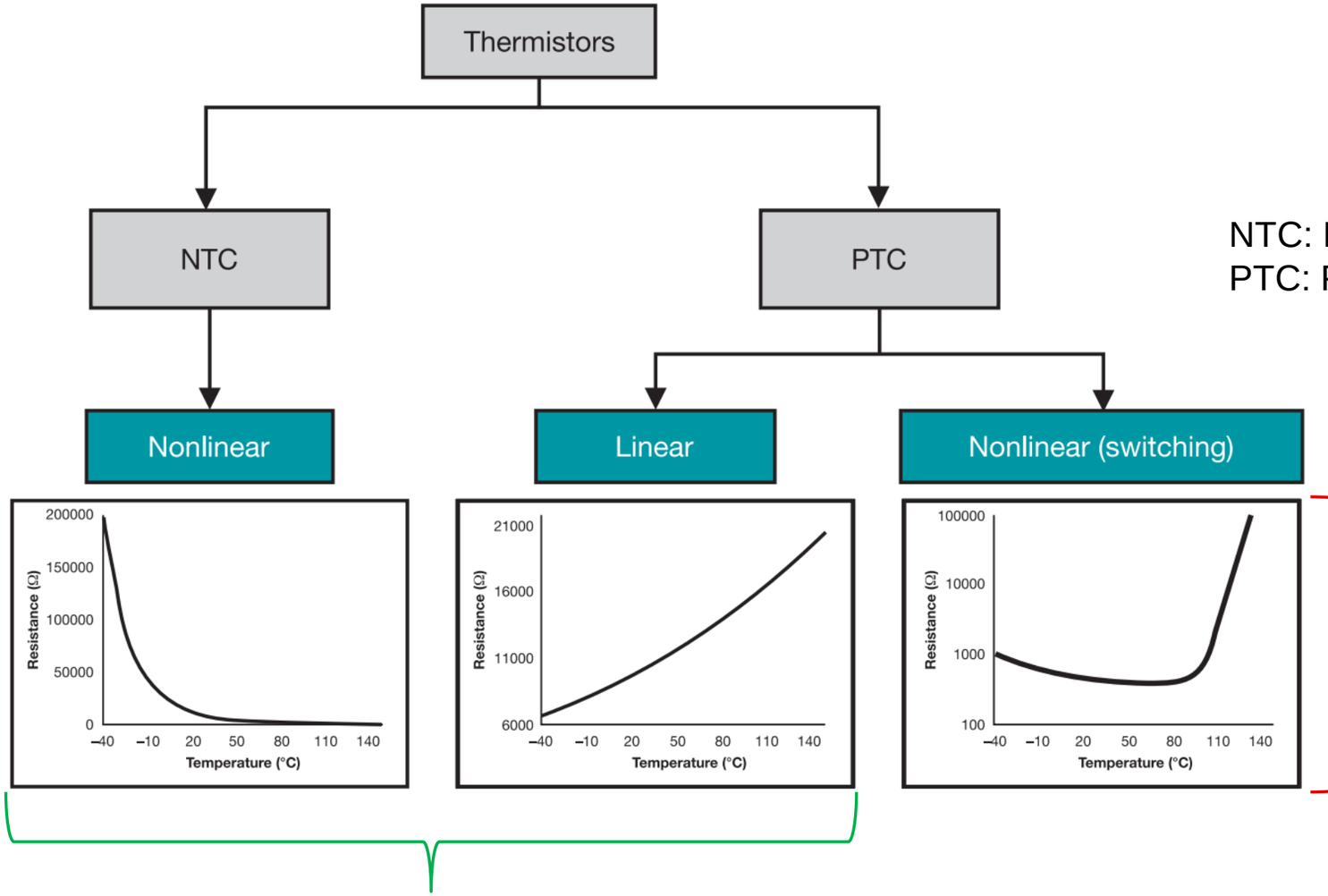
- Small size
- Package variety
- Low cost

**Con**

- Accuracy highly influenced by external components
- More sensor drift (vs integrated solutions)



# Thermistor family tree



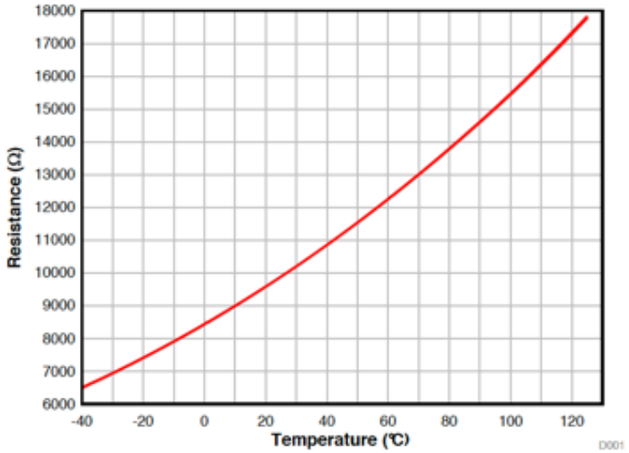

NTC: Negative temperature coefficient
PTC: Positive temperature coefficient

Used for current-limiting applications

Used for temperature sensing

# Thermistors for temperature sensing

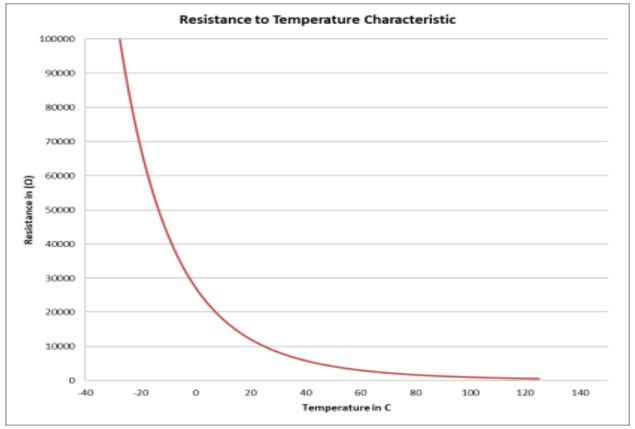
## Linear PTCs




### Made from Silicon

- ✓ Low drift
- ✓ Small thermal mass
- ✓ Less process variation
- X Less dynamic range
- X Fewer package/probe options

## NTCs




### Made from Ceramic metal oxides

- ✓ Large change in resistance at cold temp
- ✓ Many probe/package options
- X Non-linear output
- X Higher drift
- X Loses sensitivity at high temp

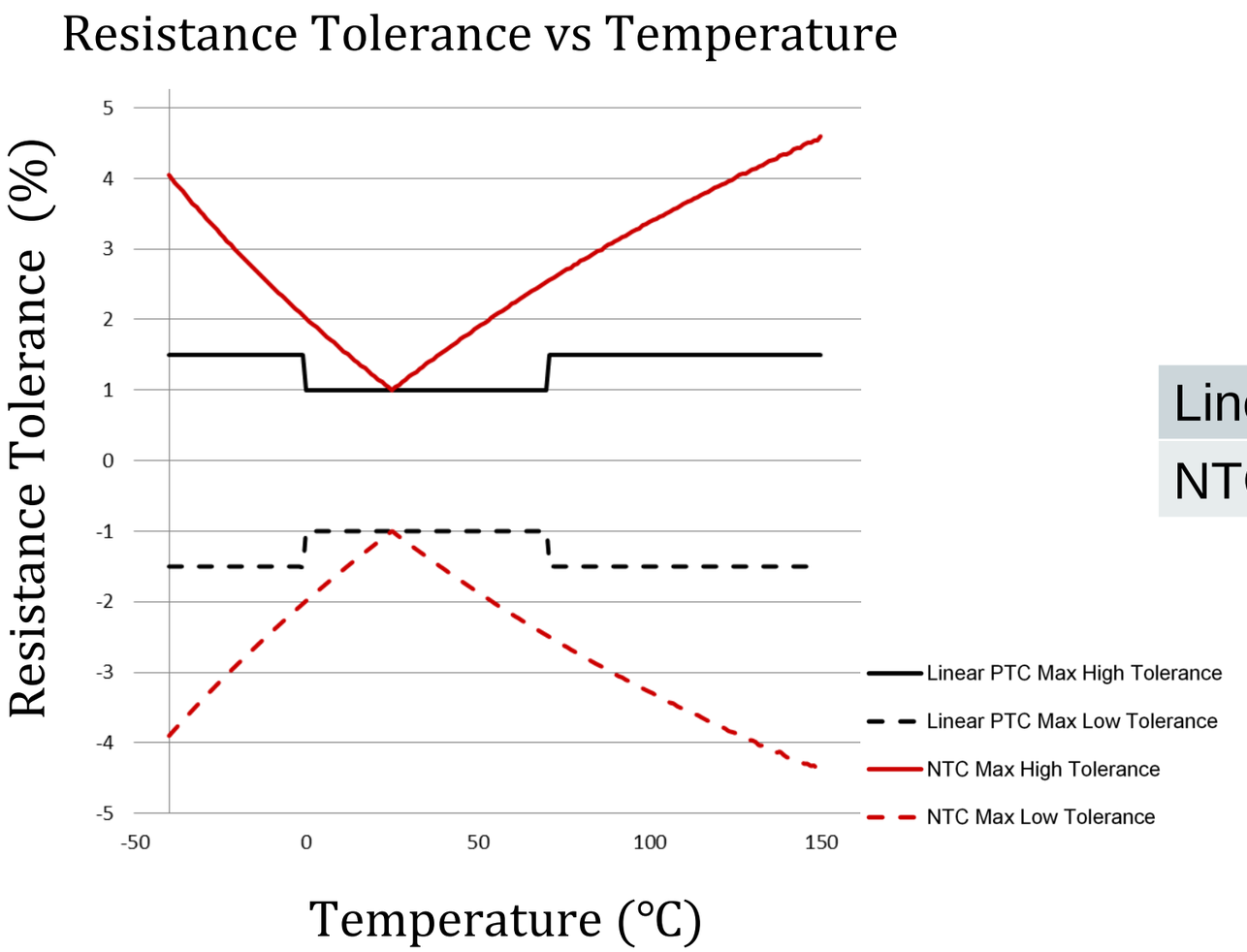
# Resistance tolerance

***Resistance Tolerance:***

*Error between the thermistor's actual effective resistance value and the typical value provided by the manufacturer, often represented at 25 °C.*

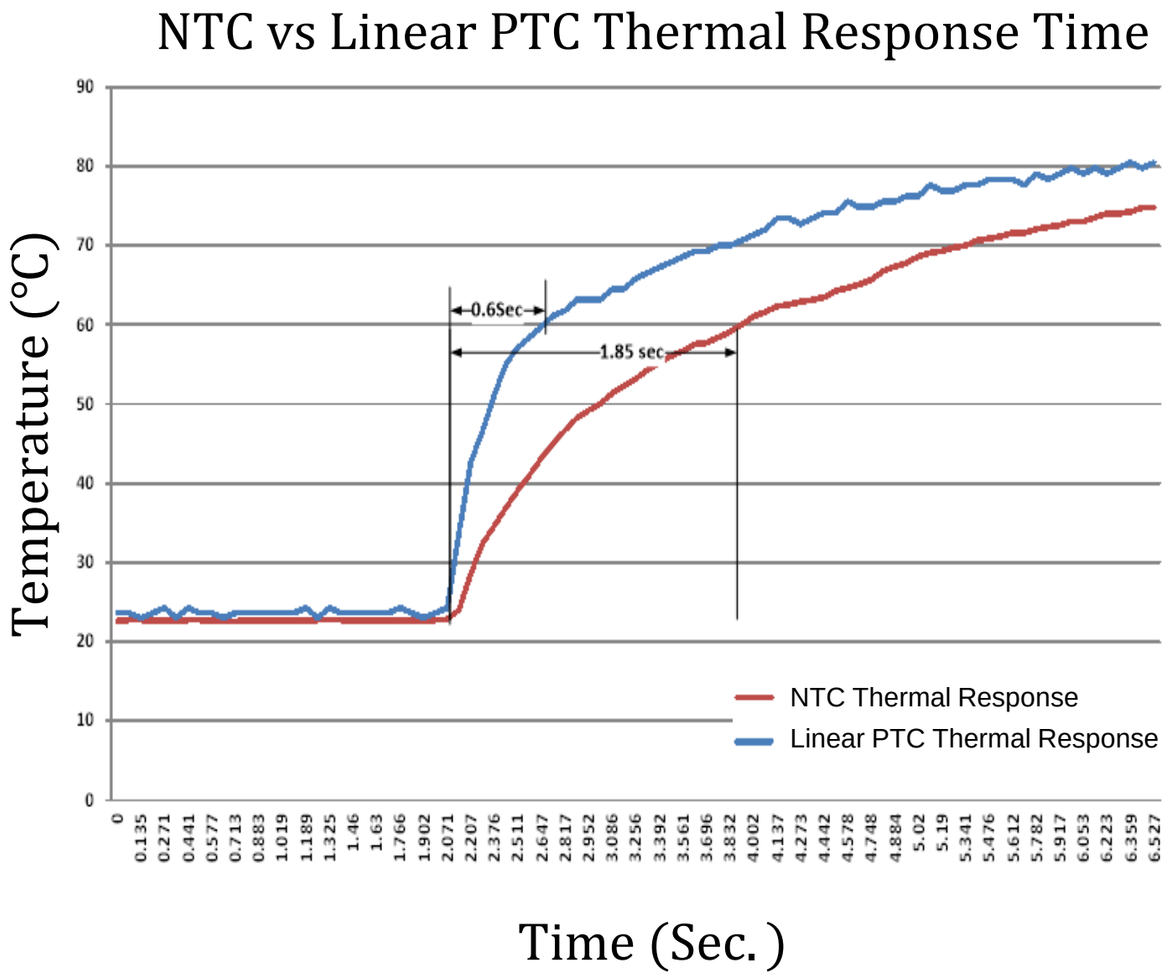
| Temperature (°C) | Min Resistance (Ω) | Typical Resistance (Ω) | Max Resistance (Ω) | Rtol |
|---|---|---|---|---|
| -40 | 6501 | 6600 | 6699 | ±1.5% |
| ⋮ | | | | |
| 25 | 9861 | 9961 | 10060 | ±1% |
| ⋮ | | | | |
| 150 | 19897 | 20200 | 20503 | ±1.5% |

# Resistance tolerance




| | $R_{Tol}$ @ 25°C | $R_{Tol}$ – 40 to 150°C |
|---|---|---|
| Linear PTC | ±1% | ±1.5% |
| NTC | ±1% | ±4.25% |

# Drift and response time

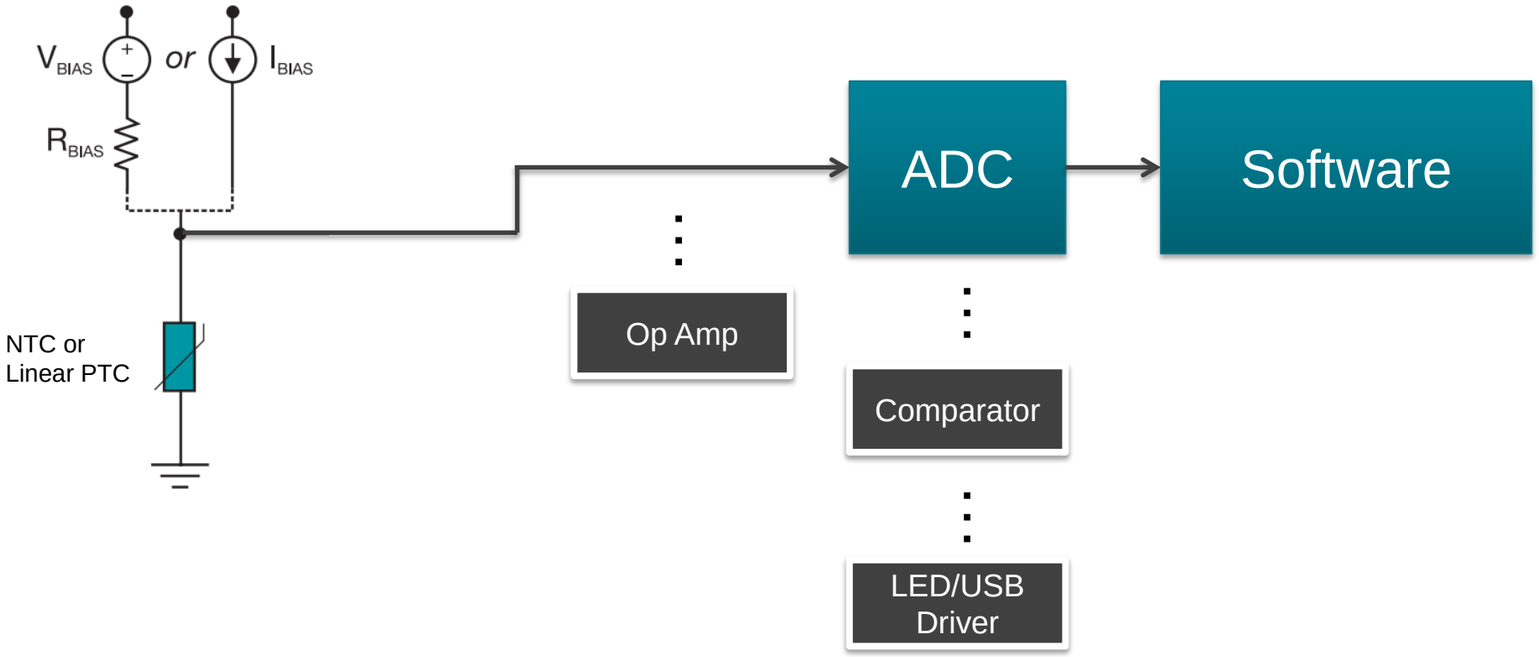



| Thermistor Type | Drift at 25 °C |
|---|---|
| Linear PTC | < 1 % |
| NTC | < 4 % |

# Summary

1. A thermistor changes its effective resistance with temperature

2. Two different technologies, same design implementation



# Thank you!

**To find more thermistor resources and products visit ti.com/thermistors**