THERMISTOR'S

EMERGING TECHNOLOGIES

(TECH8020)
(Embedded Systems Development)
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ASSIGNMENT - 1

SUBMITTED BY:

Sai Teja Anaparthy (8696855)

LOW-POWER LINEAR ACTIVE THERMISTOR (MCP 9700/9700A)

INTRODUCTION:

To begin with **thermistors or thermally sensitive resistors** is a resistor based on the temperature as the Temperature value increases the resistance value increase's and vice versa, which we convert it our required engineering units of temperature. As the name suggests it's a low power and linear type thermistor its one most compact in size and takes less power and has the very good accuracy and low cost comparing from various types of temperature sensors. Thermistors are also known as **Temperature Sensors**. This type of temperature sensors normally converts the temperature to analog voltage. There are many different types of shapes in thermistors like Radial leaded, probe, threaded etc. The thermistor we are discussing now is a Radial leaded. There mainly two types of thermistors they are **Positive Temperature Coefficient (PTC)** and **Negative Temperature Coefficient (NTC).** They have great range of sizes varies from tiny resistor to much bigger sizes. This kind of temperature sensors are specially optimized to drive large number of capacitive loads.

THEORY OF OPERATION:

"The Linear Active Thermistor™ IC uses an internal diode to measure temperature. The diode electrical characteristics have a temperature coefficient that provides a change in voltage based on the relative ambient temperature from -40°C to 150°C. The change in voltage is scaled to a temperature coefficient of 10.0 mV/°C (typical) for the MCP9700/9700A.

The output voltage at 0°C is also scaled to 500 mV."

[Anonymous, 2014, P-8]

Sensor Transfer Function:

$$V_{OUT} = T_C \bullet T_A + V_{0°C}$$

[Formula src: Anonymous, 2014, P-8]

The linear thermistors they don't require an extra conditioning signal. They are effective to the effects of capacitance by that we can keep the sensor away from the micro controller. We don't really require an extra capacitor at the output to improve the output stability but if we add an extra capacitor it helps in output transient response.

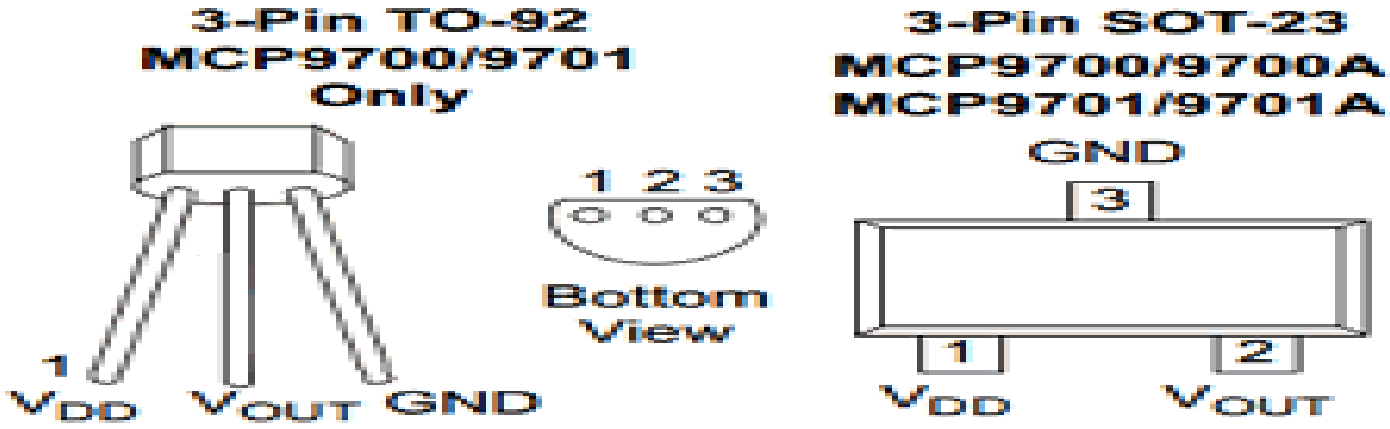
CALIBRATION AND ACCURACY:

We can do the calibration of sensor by comparing to the calibrated temperature sensor or we can use it in where there is fixed point of temperature or else, we can do 2 – point calibration. "The MCP9700/9700A accuracy can be improved by performing a system calibration at a specific temperature. For example, calibrating the system at +25°C ambient improves the measurement accuracy to a ±0.5°C (typical) from 0°C to +70°C.Therefore, when measuring relative temperature change, this family measures temperature with higher accuracy. [Anonymous, 2014, P-8]". I could suggest give the V_{DD} as specified and for more accuracy keep doing the calibration of sensor in long run and don't keep it in either too hot or cold place which can affect the sensor working.

INTERFACE:

The MCP 9700/9700A has mainly three pins

Pin-1: $V_{DD,}$
Pin – 2: $V_{out,}$
Pin – 3: GND



[Img Src: Anonymous (July 2014), Low – Power Linear Active Thermistor ICs, MCP 9700/9700A Datasheet, (Revision F), Printed in U.S.A, Microchip Technology Incorporated]

The First Pin which give supply to the sensor the V_{DD} ranges from 2.3 V to 5.5 V, the Pin – 2 is connected to ADC (Analog to Digital Converter) and Pin 3 is connected to the GND of the microcontroller. "The MCP9700/ 9700A temperature coefficients are scaled to provide a 1°C/bit resolution for an 8-bit ADC with a reference voltage of 2.5V and 5V, respectively. The MCP9700/9700A output 0.1°C/bit for a 12- bit ADC with 4.096V reference. [Anonymous, 2014, P-1]". The Interfacing of sensor to the microcontroller is straight forward and only difficulty was which facing you need to start your connection just keep in mind that flat surface facing towards you will where you start your connections.

CONCLUSION:

The temperature sensors are everywhere they are used Industries, factories, etc. They have become one of most important factors to consider in any industry or factory and it's a must for most of our current technologies because we need to keep monitoring them all day long and even in our daily life, they are much important. Now a days they are at size of tiny

resistors as time progresses, they might become even smaller and most of the sensors these days very accurate and they have so many different techniques to calibrate them to get the accurate value.

REFERENCE:

https://www.microchip.com/en-us/product/MCP9700A?utm_source=YouTube&utm_medium=Video&utm_content=MSLD&utm_campaign=Q100MSLD