Ditch the NTC thermistor: use an analog temp sensor

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NTC thermistors and analog temperature sensors are two commonly used temperature sensing solutions that can be used for most electronic applications. Deciding which technology is the best fit for your application can be a difficult task. However, I'm going to show you a few reasons why you should ditch the NTC thermistor and design in an analog temperature sensor.

Figure 1 shows an output voltage vs. temperature comparison. Notice that NTC thermistors require the use of a resistive network in order to help linearize their output. This is because their resistance vs. temperature characteristic is exponential. Unlike NTC thermistors, analog temperature sensors do not require any additional components as they have a virtually linear output voltage. For example, Texas Instrument's LMT87 analog temperature sensor provides a virtually linear output voltage across the devices entire operating temperature range of -50°C to 150°C.

As you can see from the three NTC thermistor curves in figure 1, you can change the value of the bias resistor to adjust the location of the linear portion of the curve. Notice that this is a limited range and that the curves start to saturate at low and high temperatures. When interfacing with an ADC, this saturation will cause temperature errors if the resolution of the ADC is not high enough to detect a change in output voltage per degree Celsius. As a result, NTC thermistors tend to be less accurate across the entire operating temperature range and often require a higher resolution ADC.

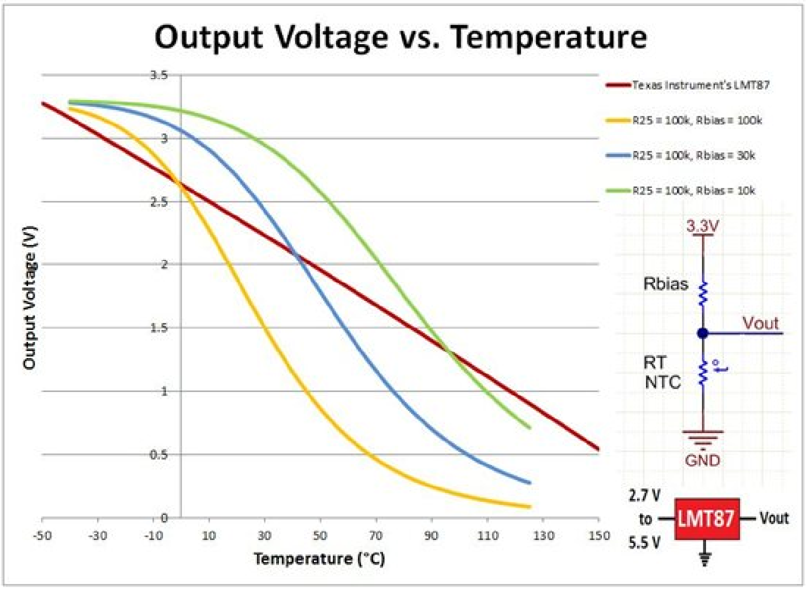

Figure 1: Output Voltage (V) vs. Temperature (°C)

Figure 2 shows a supply current vs. temperature comparison. The LMT87 has a typical value of 5.4µA and a max value of 9µA. NTC thermistor networks tend to dissipate more power as their supply currents are much higher and vary greatly over temperature. Notice that if you increase the resistance of the bias resistor, the supply current for the NTC thermistor network will decrease. But remember, the bias resistor is also chosen to ensure that the output voltage vs. temperature curve is linear for the desired temperature range. This is a tradeoff that can be ignored by using an analog temperature sensor as they have both a fairly constant low supply current and a virtually linear output voltage. Another disadvantage to NTC thermistors is that engineers must account for the self-heating effect as this will cause additional errors.

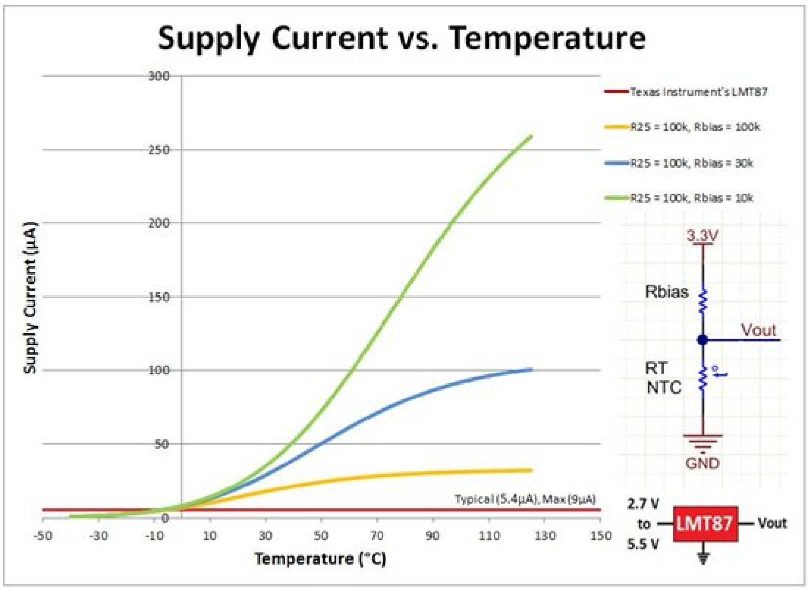

Figure 2: Supply Current (µA) vs. Temperature (°C)

You can avoid these NTC thermistor design issues by ditching them in favor of TI's easy-to-use analog temperature sensors. Check out my Engineer It video on the TI E2E community and learn more about TI's analog temperature sensors.