Mixed Analog-Digital VLSI Final Project Proposal

Sparsh Bansal, Thomas Jagielski, Qingmu Deng

February 7, 2022

1 Project Idea

For our final project, we plan to build an integrated CMOS temperature sensor. We plan to implement the simple yet highly accurate temperature sensor architecture described in a series of work by Pertijs et al. It will involve a lot of mixed-signal concepts, such as switched-capacitor circuits, bandgap reference circuits, $\Sigma\Delta$ modulators and chopper stabilization. We aim to complete this project in such a way that it can be integrated in the open shuttle run from the Skywater 130 process and inside Caravel test framework. The target shuttle run is due in June 2021.

We intend to design a sensor that falls within the $\pm$ 0.1 $^\circ$ C 3σ value, although if we find our design has a slightly higher inaccuracy that would be alright. We would be satisfied with a design that has $\pm$ 1 $^\circ$ C 3σ value as a maximum inaccuracy value.

As described in the referenced article, our temperature will have a block diagram similar to the following image.

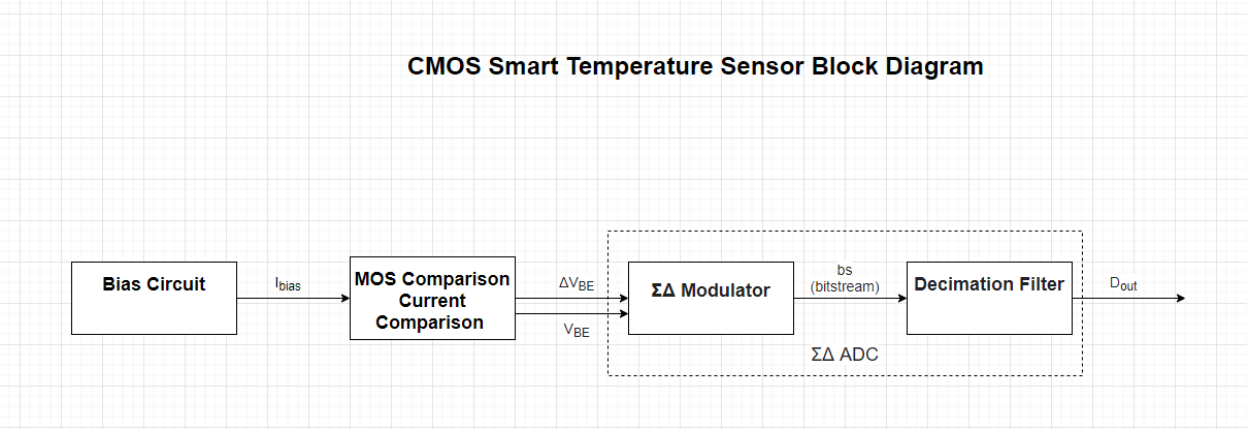

Figure 1: CMOS Temperature Sensor Block Diagram

2 References

1. A CMOS Smart Temperature Sensor With a 3σ Inaccuracy of $\pm$ 0.1° C From 55° C to 125° C
2. A 0.5-V 180-nm CMOS Switched-Capacitor Temperature Sensor with 319 nJ/measurement
3. Smart temperature sensors in standard CMOS

4. Low-Power CMOS Smart Temperature Sensor With a Batch-Calibrated Inaccuracy of ± 0.25 °C ($\pm 3\sigma$) From 70 °C to 130 °C

5. General Purpose Open Source Operational Amplifier (OpAmp)