

Near-Zero Power Fully Integrated CMOS Temperature Sensor

Tech ID: 30251 / UC Case 2019-099-0

BACKGROUND

With the planned proliferation of the Internet-of-Things, billions of power limited wireless sensing devices are expected to be sold worldwide. Within that group is a large subset of applications in which temperature sensing will be important. Needed for this application space are ultra-small and ultra-low-power temperature sensors.

TECHNOLOGY DESCRIPTION

Researchers at UC San Diego have an invention which is a state-of-the-art CMOS temperature sensor operating in the sub-nanowatt regime. The design is fabricated in 65 nm CMOS and measurement from 8 samples reveal a maximum temperature error of +/-1.38 °C (+/-0.73 °C) and +0.77/-0.41 °C when operating from 0 to 100 °C after two-point (three-point) calibration without and with trimming, respectively. Operating from a 0.5 V supply, the 8 samples consumed an average power of 763 pW at 20 °C, which after a 0.3 s conversion time results in 230 pJ/conversion.

APPLICATIONS

Application areas will include food safety, pharmaceutical processing and storage, industrial, commercial and home applications as well as animal health monitoring.

ADVANTAGES

The lowest power temperature sensor developed to date that is compatible with standard CMOS processes.

STATE OF DEVELOPMENT

A working prototype in silicon has been developed and is available for evaluation.

INTELLECTUAL PROPERTY INFO

This invention is patent pending and available for licensing.

PATENT STATUS

Country	Type	Number	Dated	Case
Patent Cooperation Treaty	Published Application	WO 2020/081423	04/23/2020	2019-099

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OTHER INFORMATION

KEYWORDS

CMOS temperature sensor, fully
integrated, internet of things, near-
zero power sub-nW, temperature
sensor, ultra-low power

CATEGORIZED AS

- **Sensors & Instrumentation**
 - Environmental Sensors
 - Medical
 - Process Control
 - Scientific/Research

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