

# Low-Power Temperature Sensor with Complementary-Metal-Oxide-Semiconductor Circuits

Shu-Chung Yi\*

Department of Computer Science and Information Engineering, National Changhua University of Education, Changhua City, 500 Taiwan, R.O.C.

(Received November 5, 2012; accepted February 4, 2013)

**Key words:** CMOS sensor, PTAT, subthreshold region, temperature sensor

A low-power smart temperature sensor is proposed in this paper. The sensor was composed of a proportional-to-absolute-temperature (PTAT) circuit and a ring oscillator. The PTAT circuit was used to generate a temperature-related current. The current was used to drive the ring oscillator, which may generate a temperature-related oscillated signal. The sensor was implemented by the 0.35  $\mu\text{m}$  2P4M TSMC complementary-metal-oxide-semiconductor (CMOS) process technology. The power consumption is about 195.15 nW. The linearity of the output frequency versus temperature is marked by the  $R$ -square rule. The value of the linearity is 0.98 in the entire temperature range. The proposed sensor requires only one supply voltage of 3.3 V. The core area of the sensor is small enough for combining itself with other circuits that require temperature monitoring.

\*Corresponding author: e-mail: [scy@cc.ncue.edu.tw](mailto:scy@cc.ncue.edu.tw)