



Spintronic Thermal Sensor (20170082, Dr. Jian-Ping Wang)

Technology No. 20170082

IP Status: Issued US Patent; **Application #:** 15/828,976

Spin-Transfer Torque Operated Magnetic Tunnel Junction Thermal Sensor

A novel spin-transfer torque operated magnetic tunnel junction (STT-MTJ) thermal sensor device fulfills thermal detection and overheat protection on integrated circuits at a significantly smaller scale. The sensor features a lower cost of calibration and a much faster (more than tenfold) thermal transit response speed over traditional CMOS thermal sensors. The MTJ sensor shows potential not only as discrete sensor but also as an adaptive power solution for cooling IC driver temperatures.

CMOS Sensor Alternative

As complementary metal-oxide semiconductor (CMOS) technology get smaller, high power density on the die is becoming a barrier for transistor scaling and can critically impact circuit operation. This unique technology is the first ever design and fabrication of a spintronic thermal sensor based on an MTJ device, and it is the first to propose adaptive control of IC temperature. It has a large linear operation region, good linear property, wide thermal range and superfast thermal response speed.

BENEFITS AND FEATURES:

- 10x faster
- Significantly smaller scale
- Lower operating temperature than CMOS sensors
- Less correction cost
- 20% reduction in sensor construction
- Additional features as needed

APPLICATIONS:

- Thermal sensors
- CMOS technology
- Adopting MTJ-based devices as thermal sensors
- May control IC temperatures

Phase of Development - Prototype developed

Researchers

Jian-Ping Wang, PhD

Professor, Electrical and Computer Engineering

[External Link](http://www.cems.umn.edu) (www.cems.umn.edu)

Yanfeng Jiang

Researcher, Electrical and Computer Engineering

Publications

[*Fast Spintronic Thermal Sensor for IC Power Driver Cooling Down*](#)

Electron Devices Meeting (IEDM), 2016 IEEE International, 3-7 Dec. 2016

<https://license.umn.edu/product/spintronic-thermal-sensor-20170082-dr-jian-ping-wang>