



Cutting-edge, Physical Unclonable Functions Related to **Inverter Trip Points**



The Problem

The huge amount of sensing devices found in future cars, homes, workplaces and cities require a much stricter security requirement for identification and authentication. It is essential that during hardware communication, the two parties are capable of identifying each other through secret keys and reliable authentication protocols. A technique which has recently emerged is the utilization of inherent semiconductor device mismatch to facilitate physical unclonable functions (PUFs). These PUFs are used to generate digital identifiers, unique to every chip, which are not even visible to the chip manufacturer. The quality of the security depends on the inherent uniqueness and reliability/controllability of these functions. The PUF relies on intrinsic undetectable manufacturing variations in the CMOS (complementary metal-oxide semiconductor) process. However, if their variation is small, the logical value will be determined by noise, and can vary from run to run. In this case the bit is unstable and the PUF value from this bit is unreliable.



The Solution

We present a unique, cutting-edge technique that makes the inverter trip point PUF more reliable.



The Commercial Benefit

Our novel invention offers the following benefits:

- The unstable cells can be identified easily and quickly during testing and disqualified from the array.
- This method measures the inherent variation in each PUF cell.
- The cell size is very small.
- Using this method the ECC can be drastically reduced or eliminated which enables the PUF to be more secure.



Market Potential

Increasing investments in research and development, growing demand for consumer electronics, and evolving IOT market are all contributing to the global semiconductor market growth. The market was valued at \$463.5 billion in 2016 and is projected to reach \$831.5 billion by 2024 (CAGR of 7.67%).



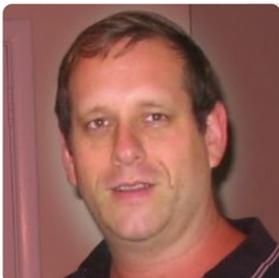
Target Markets/Industries

- Communications
- Military & civil aerospace
- Consumer electronics
- Data processing
- Automotive
- Industrial devices



Intellectual Property

Patent pending



Team: Primary Inventor

Prof. Joseph Shor

- Prof. Shor is presently an Associate Professor of Electrical Engineering at Bar Ilan University, and a Senior Member of the IEEE.
- Prof. Shor has published more than 60 papers in refereed Journals and Conference Proceedings in the areas of Analog Circuit Design and Device Physics.
- Prof. Joseph Shor holds > 40 issued patents and several pending patents.
- Prof. Shor was at Intel Corporation, as a Principal Engineer, and head of the Analog Team at Intel Yakum.



Future Research

It is planned to utilize this highly reliable PUF in security applications, such as key generation and encryption.



The Opportunity

Companies are invited to license our patent through a licensing agreement and through sponsored research.



Keywords

- Physical Uncloneable Function
- PUF
- Error Correction Codes
- ECC