

## Automatic data extraction from CBRAM and ReRAM arrays

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Conductive Bridge RAM (CBRAM) and Resistive RAM (ReRAM) devices have excellent properties for developing PUFs (Physical Unclonable Functions) in IoT (Internet of Things) applications [1]. They operate at extremely low power, which prevents side channel attacks. We use the programming voltage of these devices, the  $V_{set}$ , to generate PUF Challenge Response Pairs (CRPs). The current technique involves manual programming of these devices using Source and Measurement Units (SMUs). The new prototype will avoid manual testing; which is slow, tedious, and prone to errors. We are proposing an automatic data extraction from these devices. For this purpose, we developed a daughter card as shown in Figure 1. The daughter card is connected to the SmartFusion FPGA board.

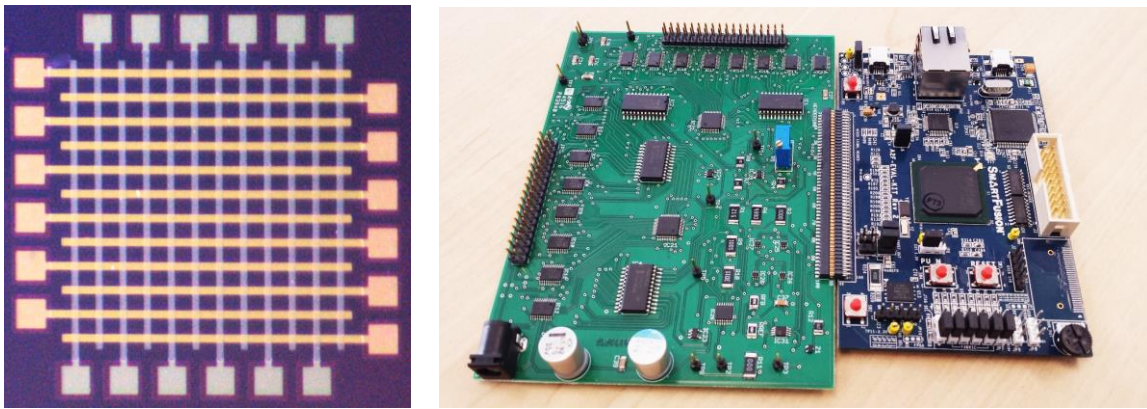


Fig 1: CBRAM array  $30\mu\text{m} \times 30\mu\text{m}$  (Left). Daughter card connected to the SmartFusion FPGA board (Right)

The setup shown above enables us to extract the programming data from the CBRAM or ReRAM array and transmit it to the PC for an in-depth analysis. The on-board DAC in SmartFusion is used to sweep the voltage with high accuracy and ADC is used to read back the analog voltage from the daughter card. PUF response generation is carried out by ARM core inside the SmartFusion. The daughter card is capable of  $32 \times 32$  array. In Figure 1 (Left), the array shown is  $12 \times 12$  devices.

In the demo, we will show the raw data extracted from packaged CBRAM array. In addition to raw data, we will also show the PUF bits and RNG bits generated by the SmartFusion. This data will be displayed on the laptop connected with a serial port to the SmartFusion.

### References:

1. Cambou. B and Orlowski. M: "PUF designed with Resistive RAM and Ternary States". Proceedings of the 11th Annual Cyber and Information Security Research Conference. Oak Ridge, TN, USA — April 05 - 07, 2016.