USF Available Technologies

Technology Transfer Office

Non-Volatile Flip-Flop with Enhanced-Scan Capability to Sustain Sudden Power Failure

Researchers at the University of South Florida have developed non-volatile flip-flops (NVFFs) that incorporate magnetic tunnel junction (MTJ) to ensure fast data storage and restoration from power outages.

Mobile devices such as smartphones, laptops and tablets demand ultra-low power and instant-ON (ION) user experience after hibernation or power failure. The quick recovery of data from power down condition is of critical importance to provide ION experience. Conventional volatile systems store processor states and cached data in non-volatile memory. NVFFs are used to retain the current logic state of a flip-flop even during power down stage. However, conventional NVFFs only store the logic state prior to power down. Which means, under unforeseen power outages, this approach fails to work.

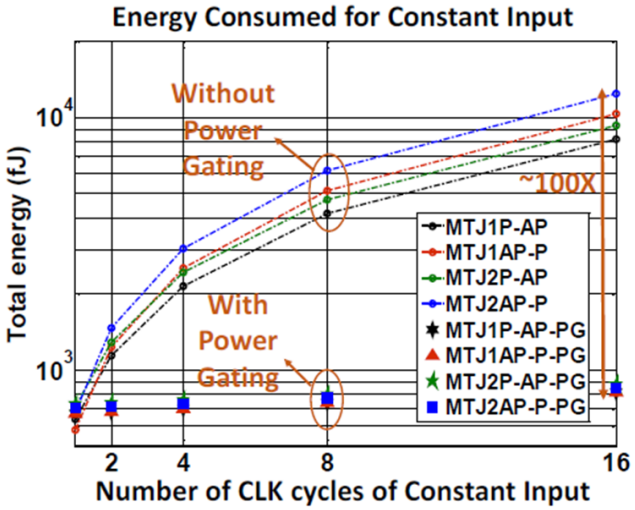
USF inventors have developed a technique, with two NVFFs, which offers fast data storage and restoration from intentional and unintentional power outages. The two NVFFs are capable of backing up data per cycle while maintaining a moderately long delay. The design also eliminates the need for an external control and driver circuitry. Furthermore, the technology also analyzes the effect of supply voltage scaling and the impact of static leakage power.

Compared to existing techniques, this technology incorporates enhanced testing capability for the delays. Additionally, by using data-dependent power gating, the device mitigates high static current during retention. Thus, this invention demonstrates an excellent alternative to present day flip-flop based storage elements which neither have power gating nor other test capabilities.

ADVANTAGES:

- **Ability to sustain sudden power outage**
- **Faster storage and data restoration**
- **Eliminates external control and driver circuitry requirement**
- **Requires low power**

A Flip-Flop Design That Can Sustain Sudden Power Failures



Demonstrating How Power Gating Helps Cut Down Unnecessary Static Power Efficiently

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