

AIOT (Artificial Intelligence of Things) design using Ultra-Low Voltage in GF 22FDX

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Market forces and advances in technology drive a trend to migrate AI workloads from data centers to the edge: billions of handheld devices or independently operating 'intelligent things'. Designs for 'Artificial Intelligence of Things' require technology platforms that offer features for connectivity, data collecting, processing and storage optimized for energy efficiency. Energy efficiency becomes a key design metric for these battery-powered devices.

The talk discusses design elements, analysis approaches, and a design framework to achieve optimal energy efficiency at ultra-low operating voltage using GF 22FDX technology.

Optimizing energy efficiency searches for minimal energy to complete a characteristic workload within a latency requirement. Characteristic AI workloads normally exhibit very high activity and consequently the dynamic power dominates the total power. The minimal energy point for such workloads requires a design at ultra-low supply voltages.

GlobalFoundries 22FDX is an FDSOI technology that offers adaptive body bias to dynamically tune the device threshold voltage. For instance, a dynamic reduction of the threshold voltage allows to reduce the dynamic power at the cost of higher leakage, thus reducing the energy consumption for a high activity AI workload. Adaptive body bias also mitigates large variation at ultra-low voltages and therefore enables the usage of standard CMOS logic library architectures.

The talk introduces a methodology to search for the design specific minimal energy point optimizing target frequency, supply and body bias voltages.