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PowerWise® Adaptive Voltage Scaling (AVS) for Portable Applications

Adaptive Voltage Scaling (AVS)

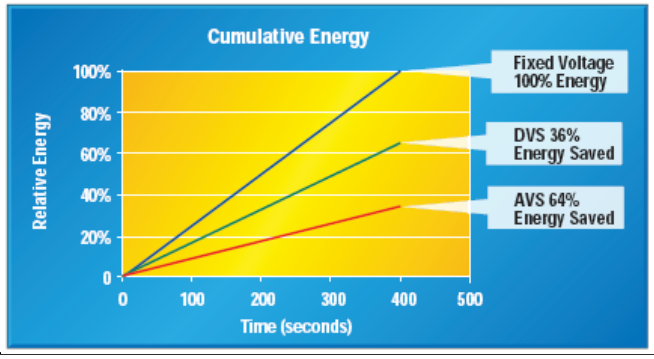
Adaptive Voltage Scaling (AVS) technology is a real-time, continuous, closed-loop power management technology. The AVS technology enables optimized power delivery to processors, ASICs, and SoCs by optimizing adaptively supply voltages over process and temperature variations in order to maximize system-level energy savings.

Portable Applications

The rapid emergence of data-intensive digital processing in smaller and lighter portable devices has created a significant dilemma for system designers. In pursuit of ever increasing functionality in form factors that appeal to customers, designers are challenged to provide more processing power for the new functions. Functions like music and video capabilities, camera, gaming, web browsing, and mobile email are now required without any increase in battery capacity. Incremental improvements in battery technology have been achieved, but these cannot fill the gap that exists. New semiconductor technologies are adding to the problem as leakage current in deep submicron processes add to the overall power consumption. Power conversion technology has also reached a plateau that offers little hope for significant advances. The situation demands rethinking of power management and a comprehensive approach to developing new systems.

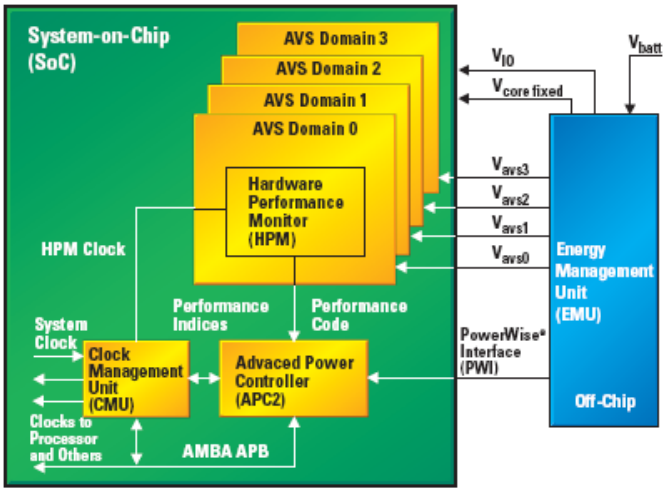
What AVS Can Do

AVS technology is a system-level approach that reduces the power consumption of digital System-on-Chip (SoC) solutions used in modern portable devices. AVS technology is ideally suited for managing multiple independent processing engines inside a SoC either when fully operational or when functions are idling, dormant, or completely turned-off. The energy savings from AVS can be seen in the example below. The system consists of the ARM CPU running with a variable frequency of 60, 120, 180, or 240MHz. With AVS, 64% energy saving is achieved compared to the fixed-voltage scheme. AVS also demonstrates 28% energy saving over Dynamic Voltage Scaling (DVS) because it compensates for process and temperature variation where DVS frequency-to-voltage look-up-tables do not.



AVS Implementation in Portable Devices

The HPM (Hardware Performance Monitor) and APC (Advance Power Controller) are embedded into the processor in order to monitor the process and temperature variation of the ASIC or SoC. A voltage command is sent by the APC via the PowerWise Interface (PWI) or System Power Management Interface (SPMI), a MIPI alliance standard bus, to the Energy Management Unit (EMU), which adaptively regulates the SoC supply voltage. Together, these components form a closed loop which automatically optimizes the voltage for the given process and temperature profile. The AVS loop is fast enough to accommodate frequency scaling, which provides even more power savings.



AVS Power Savings

In portable devices, AVS enables up to 64% power savings with frequency scaling compared to a fixed-voltage method over process and temperature variation. The power savings depends on multiple factors such as design implementation, frequency scaling, etc.

Applications

- Applications processors or SoC for smart phones
- Graphics processors for handheld devices
- Processors in personal navigation devices

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