

National Semiconductor PowerWise® Adaptive Voltage Scaling Technology

With the emphasis on lowering power consumption a concern for system designers, National Semiconductor has pioneered a new technology for reducing the energy consumed by large-scale CMOS ASICs and other digital systems on a chip (SoCs). This technology is called Adaptive Voltage Scaling (AVS) which can reduce the overall energy consumption by *40% or more. Unlike other methods, AVS is a closed-loop control system that not only handles process variation between devices, but it also handles shifts in temperature, digital load, and process aging.

Modern CMOS processes vary in performance from die to die and wafer to wafer. The extent of the variation is not always known since designers are provided a “worse case” set of parameters to use for timing closure simulation. The parameters also provide the operating voltage which takes into account the slowest silicon (see **Figure 1**). Dynamic losses increase exponentially with supply voltage, and static losses (i.e. gate and sub-threshold leakage) are increasing with smaller geometries. By accurately controlling the supply voltage, for the actual requirements of each device, large power savings can be realized – but the system needs to know the current performance level of every device.

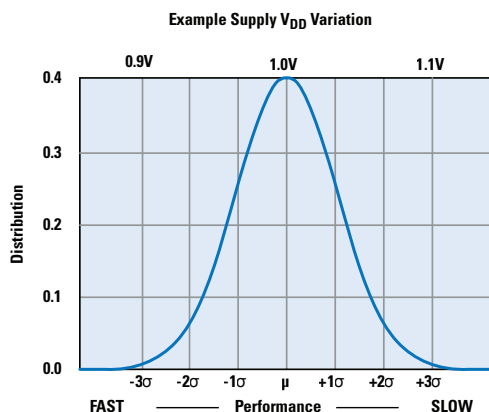


Figure 1. CMOS Processing and Distribution

*Actual power savings will vary by process, temperature, aging, and other factors.

AVS technology accomplishes this by placing fully synthesizable hardware performance monitors or HPMs into your design (see **Figure 2**). These circuits monitor the device’s process and temperature profile and report the information to an embedded controller called the Advanced Power Controller (APC). The APC determines whether a voltage optimization should be made and, if required, sends a command to an external Energy Management Unit (EMU) via an open-standard PowerWise® Interface (PWI) to adjust the voltage supplied to the digital core. AVS runs in real-time, continuous closed-loop operation and therefore maintains the minimum energy required to meet the performance level of the overall system.

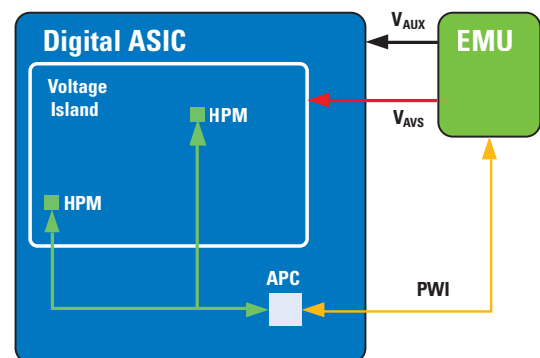


Figure 2. AVS Block Diagram

To learn more about PowerWise AVS technology from National Semiconductor, visit <http://national.com/avs> or call 408-721-8600.