



PowerWise® Adaptive Voltage Scaling (AVS) for Converged Network Adapter (CNA) Cards

Adaptive Voltage Scaling (AVS)

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

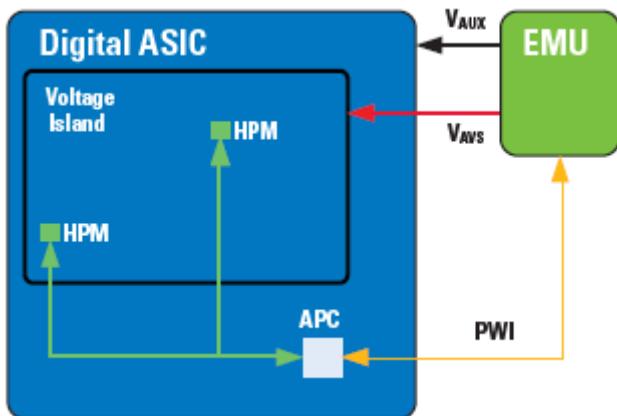
Converged Networks

Modern data centers face significant challenges of balancing escalating computation needs with power and cooling constraints. The wide adoption of virtualization in blade servers enabled consolidation for computation tasks. To reach the next level of energy efficiency and cost effectiveness IT managers are moving towards a unified data center fabric based on Enhanced Ethernet and Fiber Channel over Ethernet (FCoE). Combining LAN and SAN hardware simplifies network interconnect.

Converged Network Adapter (CNA) is an effective way to consolidate server I/O ports. In addition to providing a common connection to the physical media, the CNA can process network traffic, increasing CPU utilization allocated for virtual machines on a server. Protocol offloading is a digital intensive process which generally consumes significant amount of power. Energy efficiency can be significantly enhanced with AVS technology.

AVS Implementation in CNA

CNAs come in standard PCI Express add-in card form factors. Power is provided (3.3V and 12V) by the host through dedicated connector pins, and is converted by on-board regulators to useful ASIC voltages. AVS is effective in minimizing power consumption of digital circuits.

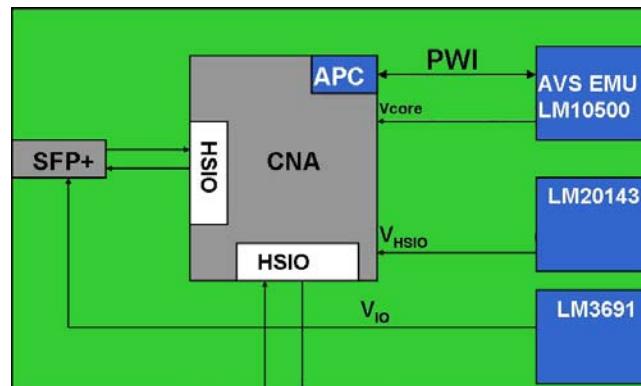


To realize the benefits of AVS, the HPM (Hardware Performance Monitor) and APC (Advance Power Controller) are embedded into the CNA ASIC to monitor the process and temperature variation of the ASIC.

The voltage optimization command is sent by the APC via the PowerWise Interface (PWI) to the Energy Management Unit (EMU) forming a closed loop that continually optimizes the supply voltage based on system conditions. AVS runs in parallel with the core ASIC, adding no additional overhead to internal critical paths.

AVS Power Savings

Table 1 illustrates representative AVS benefits for a generic CNA system. Note that AVS does not reduce the power to the small form-factor pluggable (SFP+) module, or the high-speed SERDES circuits. The power consumption of the digital circuits will be reduced, by 35% on average, for fixed frequency operation, translating to a system level power reduction of over 20%.



Supply Domain	Standard System			AVS Enabled System		
	Voltage	Current	Power	Voltage	Current	Power
SFP+	3.3V	0.5A	1.7W	3.3V	0.5A	1.7W
High Speed I/O	1.1V	1.6A	1.8W	1.1V	1.6A	1.8W
Core Logic	1.1V	6A	6.6W	0.9V	5A	4.4W
Total Power:			10W	Total Power:		
			7.8W			

Table 1: Typical AVS Power Savings

Applications

- Fiber Channel over Ethernet (FCoE)
- Enhanced Ethernet
- Unified Fabrics

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Mobile Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

[TI E2E Community Home Page](#)

[e2e.ti.com](#)

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2012, Texas Instruments Incorporated