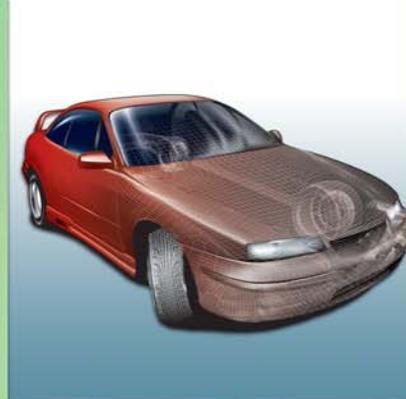


PowerWise® Solutions

Enabling Energy-Efficient Designs

www.national.com/powerwise



 *National
Semiconductor*

PowerWise Solutions

In electronic design, power is a finite commodity. Much of the power that runs electronics ends up as wasted heat. Yet worldwide there is an increased demand for more electricity. Engineers have historically worked toward conserving these resources. Today, it is a design requirement.

 For the growing number of designs where energy-efficiency is a primary consideration, National Semiconductor has developed the PowerWise® product line. With National's PowerWise ICs, design engineers can create products and systems that consume less power, extend battery life and generate less heat. PowerWise devices and subsystems, found in every National product family from interface products to high-speed data converters, from thermal management to power regulators, can help solve our customers' design challenges.

PowerWise Devices for Energy-Efficient Designs

The PowerWise portfolio includes more than 300 of National's top energy-efficient analog and mixed-signal semiconductor devices that meet or exceed a set of stringent performance-to-power metrics.

As the first company to benchmark analog ICs for energy efficiency, National's strict metrics help designers evaluate and compare analog components and subsystems across manufacturers.

Efficiency Ratings for PowerWise Products (4 out of 25 categories shown)

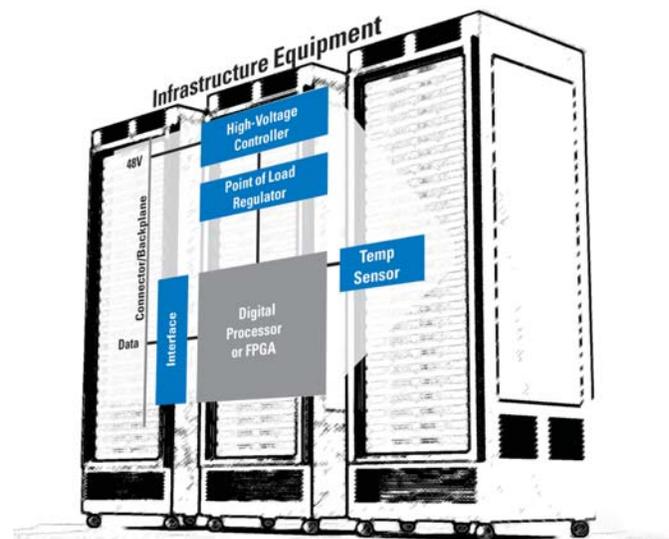
Product Family	Metric	Threshold	Units
Switching Regulators	Peak Efficiency	≥ 95	%
High-Speed ADCs	$\frac{P}{2^{\text{ENOB}} \cdot F_s \cdot ch}$	≤ 2.5	pJ/ conversion
Equalizers	$\frac{P}{T_r \cdot ch}$	≤ 20	pJ/bit
Timing Solutions	$\frac{P \cdot t_j}{ch}$	≤ 120	mW·pS

Depending on the type of IC, National's device-specific, practical formulas with commonly used engineering measurements determine each efficiency specification for more than 25 product families.

PowerWise Systems

By understanding our customers and their system challenges, National is re-defining system-level approaches through collaboration with global semiconductor companies and design houses. Using National's unique, low-power process and packaging technologies, our product designers developed several integrated chips, or PowerWise subsystems, that work together to actively reduce power and heat dissipation.

Designers can more easily create energy-efficient products using National's growing collection of reference designs. Building on the knowledge gained from helping customers create high-performance analog systems, National's proven reference designs help with proper component selection and placement, layout, and routing in a design-ready package.



PowerWise Architectures

PowerWise components, subsystems, and systems solve customer system-level problems by uniquely combining selected devices and arranging them in a system to significantly lower power consumption while boosting performance. National is collaborating with its customers and other industry leaders to redefine system architectures for optimized energy efficiency.

In some cases, the architectural design requires a move away from a traditional method. For example, National developed an Analog-to-Digital Converter (ADC) that replaces traditional switched-capacitor modulators/filters with tunable continuous-time versions to avoid switching losses found in conventional delta-sigma ADCs. National's PowerWise subsystems combine complementary devices to significantly reduce power consumption, allowing other devices to deliver the exact output power required by the application. In a broadcast video distribution system, National's devices can actively sense the loss of a cable, alerting the system microcontroller to power down sections of the system.

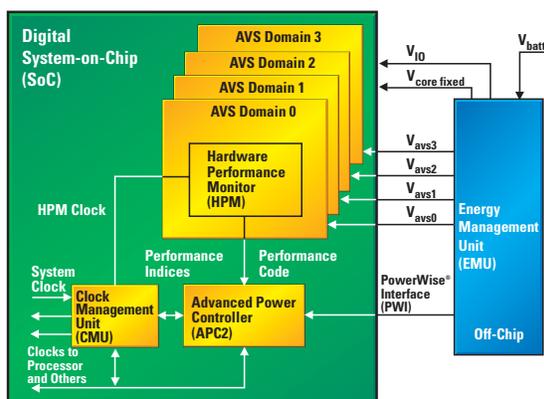
The focus in the past few years on data-intensive, ultra-portable consumer products has meant a rapid decrease in available energy at the system level due to battery size reduction. Add to that the leakage currents that are experienced in deep submicron process technologies. This situation demanded a radical rethinking of power, a complete view of all the components of the system, and a deep understanding of the dependencies of each part.

Developed by National Semiconductor in collaboration with ARM, PowerWise Adaptive Voltage Scaling (AVS) technology enables longer battery life, more features, and improved user experience by reducing the energy consumption in digital processors by up to 70%. AVS and threshold scaling automatically minimize active and leakage power in digital logic ICs with minimal system overhead. PowerWise AVS technology is the only advanced system-level energy management solution available to all IC developers as comprehensive and well-documented intellectual property packages.

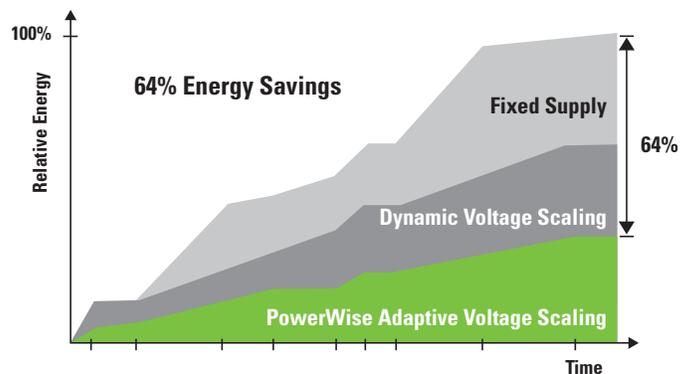
The use of simple, standard hardware interfaces and National's collaboration with industry leaders such as ARM, TSMC, UMC, and Synopsys ensures that this technology can be used on any CMOS process, with standard design tools and flows. It also can be integrated with any operating system or application, resulting in exceptional energy efficiency.

Take Your Design to the Next Level

If balancing performance with power consumption is a primary consideration of your system design, talk to your local sales representative. Learn more about metrics, compare devices, explore subsystems, and work with National's team to creatively improve your architecture for better energy efficiency at national.com/powerwise.



PowerWise Adaptive Voltage Scaling Architecture



Energy Savings with PowerWise Adaptive Voltage Scaling

PowerWise Solutions



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The World is Entering an Unprecedented Energy Crisis... How Will Your Designs Perform with Less Energy?

Read National Semiconductor's energy blog

National Semiconductor offers The Energy Blog, a weekly column of insightful commentary, statistics, and discussion on energy-efficient design. The first blog entry examines units of measure for efficiency in analog semiconductor components. With all the emphasis on making energy-consuming devices more efficient, it makes sense to look at the components that make up these systems. Other blog topics include automotive, energy harvesting, interface, lighting, solar energy, thermal management, system-level power reduction and more.

Join the growing number of engineers who are exploring the challenges of low-power design. Take a few moments to share your views with our blog master at national.com/powerwise.

PowerWise Solutions Help Solve Design Problems

- Decreased heat
- Longer battery life
- Smaller form factor
- Lower energy costs
- Extended product life

