



White Paper WP17

Integrated Isolation for Digital Power

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INTRODUCTION

Traditional power supply designs have been highly discrete implementations with “bag of chips” approach and point solutions. These approaches have relied on power system designers to pull together different components from a wide range of vendors to create a cohesive design. However with constant cost pressures and short development cycles of electronic equipments, power designers can rarely afford the luxury of creating an optimal system solution from discrete components and point products. This has led to carryover of many old and discrete designs that are inadequate and inefficient in energy usage, space usage and cost requirements.

With world-wide focus on energy saving initiatives, power subsystems play an increasingly value-added and strategic role in overall system design. Electronic equipment designs and buyers cannot avoid this growing demand for more efficient usage and intelligent management of power to reduce the overall energy footprint, while at the same time keeping design and development costs manageable.

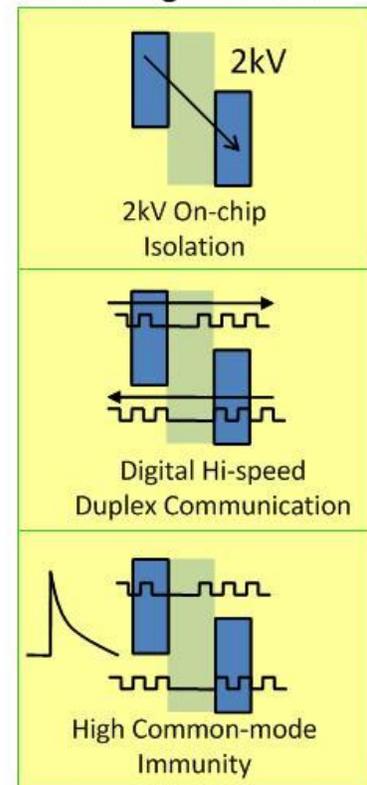
This emphasis on power efficiency provides opportunities for silicon innovation – to create system level Power System-on-a-Chip (SoC) solutions to meet above demands. Akros Silicon has responded to this market need with release of the new AS1454 family of Power SoCs that integrate Akros’ field-proven and patented [GreenEdge™](#) digital isolation technology to substantially reduce design footprint, increase power system efficiency and manageability.

AKROS’ GREENEDGE TECHNOLOGY

Akros GreenEdge Technology is a high-speed, high-voltage, bi-directional digital isolation technology that can be easily integrated in high-volume bulk CMOS process (US Patents 7732889, 7864546, 7923710). It provides 2kV of on-chip, high-voltage isolation that enables system-level integration of all power-subsystem components between the primary (high-voltage line/source) side to the secondary (low-voltage electronics/client) side, eliminating all traditional discrete isolation components like opt-isolators and pulse transformers. Today the power system architecture is constrained by the use of very-low-speed and bulky discrete isolation components. This approach limits the performance of the primary power-conversion subsystem (high voltage to low voltage conversion). It also inhibits the functionality and feature set that system designers are able to implement in a cost effective way. In comparison, Akros’ GreenEdge™ technology frees the system designers from both of these constraints.

It enables integration of multiple bi-directional data link in silicon across the isolation barrier for command and control. This data link channel allows Akros’ primary-side power controller to adapt to load changes on the secondary-side while maintaining high efficiency across all loads. In addition, the data link channel allows the secondary side to receive live monitoring information from the primary side, resulting in increased power supply reliability, remote management and diagnostics monitoring – thereby enabling high-performance energy management across isolated power domains.

GreenEdge™ Isolation



AS1454 PRODUCT FAMILY FEATURES AND BENEFITS

The AS1454 is an isolated quad-output digital power SoC that sets a new integration benchmark for the isolated power converters that are used in a wide range of industrial, datacom, automotive, medical, residential gateway, display and other distributed power applications. The AS1454 integrates a wide input range (9V-72V) isolated primary converter, a 2kV isolation barrier, a high-current-capable buck or boost PWM controller, and two 2A buck regulators into a single device. Its wide-input voltage range allows it to be used in 12VDC/24VDC/24VAC distributed power applications in industrial, building management, analog surveillance camera and automotive systems, as well as 48V distributed power applications in telecom, datacom, industrial and medical equipment requiring a 36V-72V input voltage range. The AS14x4 product family consists of the AS1454, AS1444, AS1434 and AS1424 devices that cover the gamut of system power and feature requirements. The AS1454/34 are I²C-capable with advanced system diagnostics and programmability features. AS14x4 products are available in footprint-compatible, 64-pin 9x9 QFN, Reduction of Hazardous Substance (RoHS)-compliant packages.

Integration of on-chip GreenEdge Isolation allows the AS1454 product family to offer following unique system level features and benefits.

SUPERIOR POWER SYSTEM EFFICIENCY

- ⊕ Built-in cross-isolation PWM timing management and digital power control eliminates primary-secondary switching FET timing-related losses (Figure 1)
- ⊕ Delivers excellent Light-load to Full-load Efficiency compared to traditional transformer winding based-sync rectification techniques
- ⊕ Examples: 92% efficiency delivered in core 48VDC application (Figure 2)

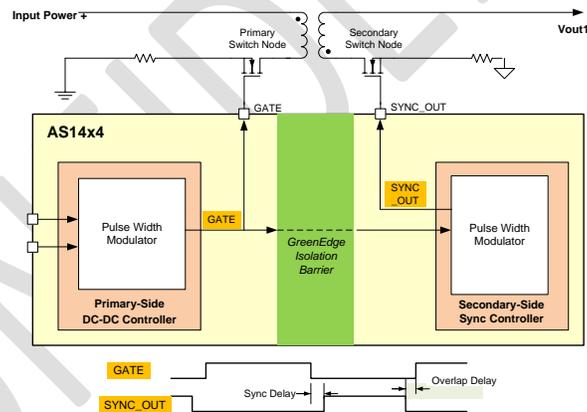


Figure 1: AS14x4 Cross-Isolation Timing Management

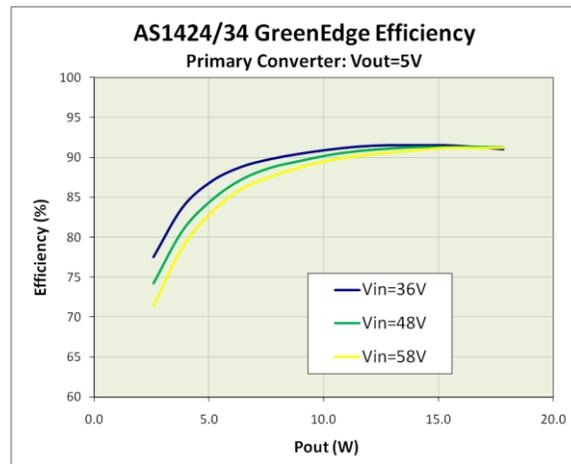


Figure 2: GreenEdge Efficiency Performance

ISOLATED POWER MANAGEMENT

- ⊕ Enables software monitoring and control of primary side power subsystem, via secondary I²C interface
- ⊕ Advance supports for EuP Energy Efficiency directive implementations
- ⊕ Example: Input power bus voltage monitoring, input power profiling, isolated power control

COST-EFFECTIVE SYSTEM-ON-A-CHIP INTEGRATION

- ⊕ Single chip solution, replaces 8-10 separate ICs and many passives
- ⊕ Typical >25% System BOM savings, >40-60% board area savings compared to traditional designs

LOWER NOISE AND EMC PERFORMANCE

- ⊕ All four PWMs synchronized to single system clock to reduce clock inter-modulation and for lower power supply noise, including primary PWM across the isolation barrier (Figure 3)
- ⊕ Clock phasing to reduce power supply noise
- ⊕ Spread-spectrum modulation on the clock to reduce spectral noise on all power supplies – reduced interference with other system clocks and lower EMI spectrum (US Patent 8400230)
- ⊕ Synchronization available to external system clock
- ⊕ Example: Spread-spectrum support on primary PWM, lowers power supply spectral noise >15dB (Figure 4)

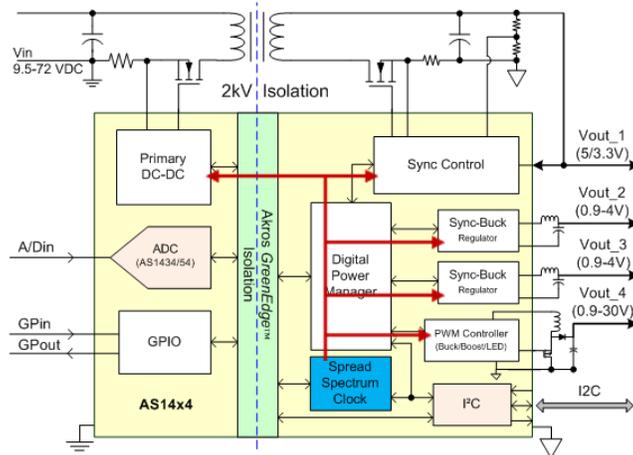


Figure 3: PWM timing synchronization across GreenEdge Isolation barrier

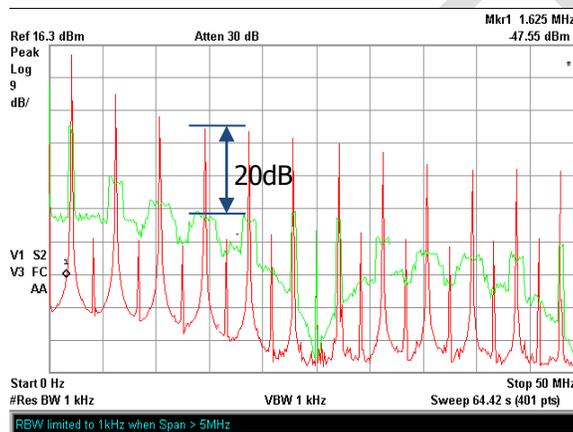


Figure 4: Effect of Spread-Spectrum Clocking on Power Supply Spectrum

IMPROVED POWER SYSTEM RELIABILITY

- ✦ Eliminates bulky, low-speed opto-couplers and pulse transformers. These components are generally the biggest contributor to power supply MTBF (Mean Time Between Failure) ratings
- ✦ Example: Opto-couplers are replaced with high-reliability semiconductor components that eliminate drift and aging issues common with opto-couplers.

VALUE ADDED FEATURE SET AT LOWER DEVELOPMENT COST

- ✦ Isolated GPIO, Isolated ADC, I²C programming enable system level features implementation without incurring addition external components
- ✦ These features reduce product development cycle, Improves TTM
- ✦ Example: Isolated GPIOs can be used for monitoring and control of high-side bus commands in many industrial and distributed power applications
- ✦ Example: I2C based voltage margining on each rail can be used for faster product validation

LOWER COST OF OPERATION

- ✦ Advance power management and direct efficiency improvements deliver energy savings for end equipment operation and end customers

- ⊕ Built-in advance diagnostic features and high-voltage telemetry features improve remote IT servicing of devices, reducing IT “truck rolls” and service costs for end customers

THE BOTTOM LINE

Akros Silicon’s introduction of the AS14x4 Power System-on-a-Chip (SoC) product family with integrated 2kV isolation means unprecedented cost and energy savings from the OEM down to the end customer. Akros’ AS14x4 family with GreenEdge technology provides direct—and significant—cost benefits to OEMs by allowing them to design a wide range of cost-effective products that capitalize on energy-efficiency market trends. This technology enables them to create differentiated feature set for their customers who, in turn, pass-on the benefits of recurring operating cost savings to the end customer.

The AS14x4 products are a strong fit for a wide range of industrial, datacom/telecom, infotainment, surveillance cameras, building management systems, automotive, medical, residential gateway, display and other distributed power applications.

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SUBSTANCE COMPLIANCE

With respect to any representation by Akros Silicon that its products are compliant with RoHS, Akros Silicon complies with the Restriction of the use of Hazardous Substances Standard ("RoHS"), which is more formally known as Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. To the best of our knowledge the information is true and correct as of the date of the original publication of the information. Akros Silicon bears no responsibility to update such statements.