



EDN's 2006 INNOVATOR/INNOVATION PROGRAM WINNERS

TO THE VICTOR GO THE STATUETTES

The competition for *EDN*'s 17th Annual Innovation Awards was fierce again this year. The contest drew contenders that ran the electronics-industry gamut—from digital technologies, to mixed-signal products, to processors and controllers. As always, *EDN* strives to recognize and honor the industry's most innovative technical advancements as well as the designers behind those innovations. These are the advances that touch every aspect of the way people live and work around the globe. Moreover, *EDN*, through its awards program, endeavors to foster the growth of engineering careers and the future of electronics through an annual contribution to engineering education. *EDN* awards this contribution to the Innovator of the Year, who, in turn, can donate it to the engineering school of his or her choice.

The 17th annual awards, like last year, took place at the 4th Street Summit Center in San Jose, CA, and helped kick off the busy Embedded Systems Conference week. At the April 2 shindig, *EDN* introduced some of its own innovations to the evening's program, including its new publisher, Alan Robinson, and the award-winning comedy and wizardry of Master of Ceremonies Bill Herz. Innovation winners took home (or at least back to the office) statuettes for 15 product and technology categories as well as for 2006's Best Contributed Article and Innovator of the Year.

Read on to learn who took top honors at this year's awards ceremony. *EDN* congratulates all the winners! To learn more about our Innovation program, visit www.edn.com/innovation.

◆ANALOG ICs

Symphony Class D audio amplifier, Freescale Semiconductor

Conventional Class D audio amplifiers operate the PWM-output section open-loop, which makes the amplifier susceptible to power-supply variations. Even advanced Class D amplifiers have an only -40 -dB spec on PSRR (power-supply-rejection ratio) at 60 Hz. The Freescale FSA95601 uses an innovative digital-feedback technique to achieve remarkable performance. It achieves THD (total harmonic distortion) of -120 dB and IMD (intermodulation distortion) of -110 dB. Open-loop systems require fast transitions at the output of the switching-power stage to achieve reasonable distortion performance. Fast switching transitions are detrimental to EMI (electromagnetic-interference) performance. The Freescale FSA95601 allows for slower transitions at the switching-power-stage output. Overall, this chip set represents a significant advancement in system-level Class D audio amplifiers.

Due to its immunity to power-supply variations, the first application for this chip set is in the automotive industry. The chips target applications requiring 50 to 100W (bridged) per channel. In addition, the chip set offers advanced protection features, such as undervoltage, overvoltage, and overtemperature warning, and it provides advanced turn-on/off audio click-and-pop suppression.

◆POWER ICs

IR1167 SmartRectifier IC, International Rectifier

There are relatively few ICs that manage power on the secondary side of an isolated supply. Although FETs have replaced diodes on modern synchronous buck converters, there has not been a similar effort to replace the diodes in the secondary of isolated supplies. International Rectifier's IR1167 SmartRectifier IC simplifies secondary SR (synchronous rectification) for ac/dc-power converters and improves power density for high-power flyback and resonant half-bridge converters, enabling smaller, cooler designs.

The IR1167 is independent of the

◆INNOVATOR OF THE YEAR

Steve Douglass, Suresh Menon, and the Virtex-5 LXT design team, Xilinx

A lot of product designs face a roadblock, but few face the number of obstacles that Steve Douglass, Suresh Menon, and the Xilinx Virtex-5 LXT design team did. The FPGA design included a move to a 65-nm process, necessitated a balance of programmability and hard-IP (intellectual-property) features, and realistically required a solution to ballooning dynamic-power consumption. The result is a chip that has more than 1 billion transistors, yet, according to Xilinx, it realized a 35% reduction in dynamic power relative to earlier 90-nm designs.

The Virtex-5 LXT team included more than 200 engineers organized into groups called Centers of Excellence, with each group focusing on one aspect of the new architecture. Product planners met with hundreds of system designers to get input on the new architecture. The company claims that the result is 30% higher performance and 65% higher logic density.

The Virtex-5 LXT design leads a trend of balanced programmability and fixed functions. The chip includes built-in hard-IP blocks for what Xilinx claims are the two most popular serial-I/O standards: PCIe (PCI Express) and Gigabit Ethernet. The hardened PCIe endpoint block saves users as many as 10,000 look-up tables and 2W of power compared with soft-IP-core implementations. The company points to industry research suggesting that PCIe and Gigabit Ethernet will account for approximately 80% of all I/O-port shipments in 2009, making a case for hardening these blocks on the FPGA, thus saving logic resources and consuming lower power than soft-IP approaches.



primary-side controller. It uses IR's proprietary HVIC (high-voltage-IC) technology for directly sensing and controlling secondary-side rectification. In addition to controlling high-power flyback secondary sections, the SmartRectifier is the first commercial IC for resonant half-bridge converters. Compared with discrete-current-transformer-based designs, the IR1167 increases power-subsystem efficiency by at least 1%. Independence from the primary side means that the IR1167 operates in variable-frequency mode as well as at low-power burst modes.

◆MIXED-SIGNAL ASSPs

AKU2000 digital MEMS microphone, Akustica

It may seem strange, at first glance, to

encounter a microphone as an Innovation Awards winner. After all, the materials that comprise ECMs (electret-condenser microphones) have existed since the 1920s, and Bell Laboratories unveiled the first practical ECM, basing it on thin metallized Teflon foil, in 1962. But leave it to Akustica, with the AKU2000, to bring vitality back into a moribund product category.

The core of Akustica's achievement is MEMS (microelectromechanical systems), a technology that to date has seen its broadest use in ink-jet print heads, optical switches, DLP (digital-light-processing) engines, accelerometers, gyroscopes, and pressure sensors. Unlike traditional MEMS devices, which require custom thin-film semiconductor techniques, Akustica's AKU2000 employs the



metal-dielectric layers of conventional CMOS processes.

ECMs' analog outputs are susceptible to signal corruption from nearby EMI-radiating sources, such as cell phones,

LCDs and their backlights, and Wi-Fi transceivers. As a result, engineers must often place them in nonideal locations to minimize cabling lengths to the system board and must also burden the system with the cost of shielding materials.

◆ NETWORK AND COMMUNICATIONS ICs

QSC (Qualcomm Single Chip) solutions for CDMA2000 1X, Qualcomm Qualcomm's QSC (Qualcomm Single Chip) product family includes the QSC6065, which it manufactures on a 65-nm process and designs to support gaming, multimedia, and location services. The IC supports 3M-pixel cameras with 15-frame/sec video recording and playback at QCIF (Quarter Common Intermediate Format) resolution. The 4GV dynamic voice-codec architecture allows carriers to prioritize voice quality or network capacity. Qualcomm claims that the location features it bases on a GPS (global-positioning system) allow for enhanced indoor and dense-urban-area performance by means of state-of-the-art -159-dBm GPS sensitivity. The design also supports concurrent voice and positioning operations, enabling seamless E911 calls and voice-based location services.

◆ MULTIMEDIA ICs

LSI DMN-8633 single-chip media processor, LSI Logic

LSI Logic's DMN-8633 single-chip media processor decodes multimedia feeds originating from all 18 standard- and high-definition ATSC formats and other MPEG-2 transport-stream sources, along with DV-formatted data. To that end, the DMN-8633 incorporates both FireWire and 12-Mbps USB transceivers.

The DMN-8633 lets you transcode

the audio/video streams on the fly to standard-definition video for recording onto a conventional red-laser DVD, in MPEG-4 Advanced Simple Profile, MPEG-4-derived DivX, and conventional MPEG-2 formats. Because you'd want a DMN-8633-based design to act also as a conventional DVD player, you'll be happy to know that the chip also supports the playback of DVD-Video disks with Dolby Digital 5.1, MPEG-1 Layer 2 or DTS (digital-theater-sound) audio tracks, and VCDs (video compact discs) and SVCDs (super-video CDs). The DMN-8633 also decodes JPEG images, along with DVD-Audio (Multilink Point-to-Point Protocol), WMA (Windows Media Audio), and CD-DA (compact-disc digital-audio) audio bit streams. Progressive-scan analog-video (both component and RGB) and digital-video outputs come standard. The digital-video outputs automatically scale up to high-definition resolutions. The chip's integrated video encoder also simultaneously supports S- and composite-video connections. The DMN-8633 costs \$20 (1 million); the higher end \$25 DMN-8683 supports two MPEG-2 transport-stream inputs for simultaneous record and playback applications, along with both hard-disk-drive- and DVD-stream-capture destinations.

◆ DIGITAL ICs, PROGRAMMABLE LOGIC, AND MEMORY

Virtex-5 LXT FPGAs, Xilinx

In 2006, Xilinx was the first company to implement an FPGA in 65-nm silicon. Later in the year, the company introduced the LTX version of its Virtex-5, which combines the performance, power, and cost advantages that 65-nm technology brings to a programmable-logic fabric with built-in hard-IP (intellectual-property) blocks for the two most popular serial-I/O standards: PCIe and Gigabit Ethernet. As such, Xilinx says, the Virtex-5 LXT FPGAs are poised to address the SOC (system-on-chip) requirements for the triple-play (voice-, video-, and data-services) infrastructure market and meet challenging bandwidth, power, and cost targets.

Virtex-5 LXT devices increase performance by an average of 30%, increase

capacity by 65%, and reduce dynamic power consumption by as much as 35% over previous-generation 90-nm FPGAs. The hardened PCIe endpoint block saves users as many as 10,000 look-up tables and 2W of power compared with soft-IP-core implementations.

◆ MICROCONTROLLERS AND DSCs

TMS320F28044 DSC, Texas Instruments

The TMS320F28044 DSC (digital-signal controller) can manage as many as 16 dc/dc-converter channels for multiphase control. Texas Instruments' integrated HRPWM (high-resolution pulse-width-modulation) technology supports a 150-psec resolution for each channel.

Together, the DSP core, the HRPWM, and the 80-nsec ADC support the full digital-loop control and deliver output accuracy to enable switching frequencies over a single channel as fast as 1 MHz and over 16 channels as fast as 200 kHz.

◆ MICROPROCESSORS AND DSPs

Core 2 Duo processor, Intel

Intel's 65-nm-silicon-process technology enables Intel's Core 2 Duo processors to deliver a 40% increase in performance and a more-than-40% improvement in energy efficiency versus Intel's previous best processor.

These dual-core devices benefit from a 14-stage pipeline in each core that can simultaneously complete as many as four instructions. The Smart Memory Access capability relies on "memory disambiguation," which better hides the latency of memory accesses by increasing the efficiency of out-of-order processing. It enables each core to speculatively load data for instructions that are about to execute before all previous store instructions execute.

◆ EDA: ESL, PCB, AND IC FRONT-END TOOLS

Analog FastSPICE and RF FastSPICE simulators, Berkeley Design Automation Berkeley Design Automation has come

up with an innovative approach to speed SPICE simulation and maintain SPICE accuracy. The company claims both tools provide full-SPICE accuracy, five- to 10-times better performance than SPICE, and vastly superior dc and PSS (periodic-steady-state) convergence.

◆EDA: IC BACK-END AND DFM TOOLS

Space-based Router, Cadence Design Systems

Cadence says today's conventional IC-implementation tools create an oversimplified model of interconnect and associated foundry-process rules. Cadence Space-based Router and Cadence Chip Optimizer use a patented 3-D, space-based approach to model and analyze true shapes and intervening physical spaces.

The technology allows engineers to position shapes and spaces in the exact configuration and location they need to correct subwavelength-manufacturing effects. This technology affords greater precision and flexibility when optimizing the interconnects and uses tiered design and manufacturing constraints.

◆COMPUTERS, BOARDS, AND BUSES

SkyeModule M9 embedded RFID reader, SkyeTek

Laying claim to the world's smallest globally compliant, UHF RFID-reader module, SkyeTek's SkyeModule M9 targets OEM embedded-system applications in asset tracking, access control, inventory management, and anticounterfeiting. Half the size of a typical business card, the M9 allows designers to choose the combination of tags, protocols, and hardware that best suits their applications. The M9 has fine-grain-controllable RF power from 10 to 500 mW, providing reliable read ranges beyond 2m. The module supports anticollision, dense-reader mode, and a broad array of EPC (Electronic Product Code) and ISO (International Standards Organization) tags.

SkyeTek's open-reader architecture allows upgrading of the M9 in the field to add postdeployment tags, protocols, and security through a firmware update.

◆BEST CONTRIBUTED ARTICLE

“Signal conditioning for high-impedance sensors” by Glen Brisebois, Linear Technology

Maintaining accuracy in circuits that process signals from high-impedance sensors presents unique challenges. First, you need to identify when to use special design techniques. Then, you must choose devices that buffer and protect the sensors and circuits without destroying their accuracy.

◆SENSORS AND COMPONENTS

ADIS16250/iSensor intelligent sensor, Analog Devices

Motion-, or angular-rate-, sensing functions demand a significant investment of development time and design resources and require that system designers have a full understanding of the steps necessary to embed control features into the core.

Analog Devices' ADIS16250 iSensor intelligent sensors fill the gap between ultrahigh-performance, high-cost, fully integrated gyros, which have long seen use in military applications, and more recently available sensing options that achieve lower performance, accomplish less integration, and require significant knowledge of sensing design.

The ADIS16250 is the first MEMS (microelectromechanical) gyroscope to provide both digital range scaling and embedded programmability, eliminating a significant barrier to integrating gyroscopes into industrial systems. The single-chip ADIS16250, which leverages ADI's iMEMS motion-signal-processing technology, also uses less than half the board space of multicomponent products and delivers more advanced control functions.

◆POWER SOURCES

TurboTrans point-of-load power modules, Texas Instruments

Texas Instruments introduced its T2 series in November 2005 to reduce the amount of capacitance in high-transient power designs. These second-generation plated-through-hole modules, suitable for intermediate-bus applications, employ TurboTrans technology to allow power-supply designers to dynamically “tune” the mod-

ules using a single external resistor to meet a specific transient-load requirement with as much as eight times less capacitance.

◆SOFTWARE

Nios II C-to-hardware-acceleration compiler, Altera

Claiming to reduce development time from weeks to minutes, the Nios II C2H (C-to-hardware-acceleration) compiler development tool from Altera automatically converts time-critical ANSI C subroutines into hardware accelerators and integrates them into FPGA-based Nios II subsystems. C2H runs straight ANSI C and requires no special libraries or non-standard C constructs.

◆TEST AND MEASUREMENT

Medalist bead-probe technology, Agilent Technologies

Agilent calls its bead-probe technology the industry's first proven technology for placing test targets directly on PCB (printed-circuit-board) signal traces. These beads then serve as highly reliable test points for use during ICT (in-circuit testing). This new technique dramatically improves ICT access on high-density and high-speed boards.

You create bead probes during PCB manufacturing by opening the solder mask and exposing the copper trace wherever you desire a test point. Once you apply solder paste along the trace and reflow it, you can readily probe the trace at ICT with flat-headed (not pointed) probes. The probe's spring force partially crushes the bead, removing any residual flux residue, and provides an excellent surface for electrical contact.