Texas Instruments
Tech Day Orlando 2009
Session Titles and Abstracts

Track & Course	Abstracts
Track 1 – Innovations in Analog 1	
Op Amp Stone Soup: A "Cookbook" Collection of Single-Supply Op Amp Circuits	This session offers a "stone soup" collection of useful op amp circuits to solve linear application problems on a daily basis. Each op amp circuit (shown in an included TINA-TI™ SPICE schematic) is presented as a definition by example, with a brief overview of its functionality, applicable transfer function and/or waveforms, and key equations for rescaling the function to the exact application. A sampling of the "ingredients" includes the following circuits: • Voltage-to-current conversion • Drive circuits: Bridge-tied-load circuits, parallel op amps, high-current cascade reference buffers • Translation circuits: Single-ended to differential, differential to single-ended, differential input to differential output • Conditioning circuits: Full-wave rectifier, supply splitter, integrator amp in feedback, isolation amplifier, G = 1/G = –1 amp • Comparator circuits: AC-coupled circuits, comparator with hysteresis
NexFET™, How To Design with Highly Efficient MOSFETs	TI's NexFET devices represent a breakthrough in low-voltage power MOSFETs, with incredibly low gate charge and resistance. These devices enable high-efficiency and high-frequency DC/DC converter designs. This session will cover the structure and characteristics of these MOSFETs and provide layout and gate-drive recommendations.
Power-Supply Layout Considerations	This session will address methods for keeping circuit parasitic components from degrading the operation of your designs. Techniques to minimize the impact of the parasitic inductance and capacitance of filter components and PWB traces will be discussed, together with a description of the impact that PWB trace resistance can have on power-supply regulation and current capacity. A general overview of thermal design is also included, as well as sample temperature-rise calculations in natural and forced-air environments. Finally, some practical examples of power-stage and control-IC layouts are reviewed.
Tackling EMI and RFI at the Board and System Level	Electromagnetic interference (EMI) and radio frequency interference (RFI) can affect any system in an undesirable manner as the proliferation of unintentional radiators and receptors continues to increase. EMI and RFI, which are undesirable by-products of electrical systems, produce a wide range of frequency spectra that can affect otherwise properly operating circuits. This session will review the fundamental principles of radiated interference and coupled interference along with the respective limits allowed for each. Techniques to mitigate the effects of interference on transmitters and receivers will be discussed, and other solutions covered will include effective power-line filtering, proper filtering for input signals of high-gain circuits, and details on key components. Finally, we will discuss the common rules of thumb for wire and PCB routing to minimize EMI and RFI effects. This session will provide some basic methods that will help reduce sources and receptors of EMI and RFI events in and near your circuits.
Designing Mixed-Signal Systems with Noise-Reduction Techniques in Mind	Sensor applications often have low-level signals. A peaceful coexistence of the sensor signal, analog circuitry, and processor requires careful attention to layout and noise-reduction techniques. In this session we will discuss three sources of noise, the paths where noise travels, and how to reduce noise to tolerable levels. We will discuss the proper selection and placement of components that isolate and limit analog and digital noise to keep it out of sensitive input circuits.

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Track 2 – Innovations in Analog 2	
Sensors and the Analog Interface	This session will cover how to monitor many different physical phenomena, such as temperature, air flow, humidity and power. We will discuss numerous sensor characteristics and the various styles of sensor signal conditioning that can be implemented in a system. The output of every sensor circuit discussed will be suitable for conversion to a digital signal. You will leave this session fully armed to tackle your onboard or remote-sensor challenges.
Why Use a 24-bit Converter When You Only Need 12 Bits?	Many times a lower-cost, higher-performance system can be built by using a 24-bit converter rather than a combination of amplifiers and 12-bit solutions. The wide dynamic range of the 24-bit solution provides a lower-noise approach that may not require any external amplification and that can usually be done at a lower cost. This session will evaluate some typical applications for load-cell and temperature transducers and compare the 12-bit and 24-bit approaches.
Understanding and Protecting Against Electrical Overstress (EOS) of Operational Amplifiers	This session will discuss EOS and show ways to design systems that are reliable and easy to manufacture and that have few latent field failures. A common concern about applications with multiple power supplies is that EOS may occur if the op amp's signal inputs exceed the power-supply rails. EOS may also occur if a signal comes from an internal or external system with a different power supply. Other candidates for EOS events are common ESD cells and the circuitry connected to the input, output, and power-supply pins. We will also discuss ESD stress models such as the human-body model, machine model and charged-device model. By the end of this session, you will understand the op amp's input/output circuit structure so you can design a robust system that prevents EOS problems.
High-Speed Layout Considerations	In this session we will discuss models of common components used in high-speed data converters and will offer guidance on the key points to address in creating a successful layout. We will also discuss when to use ground planes and when to clear them; optimum circuit routing; bypass capacitors; avoiding ground loops; vias; and controlling impedance with transmission-line techniques. In addition, many high-speed signal chains involve a mixed-signal boundary where the analog domain crosses into the digital domain. This session will help you know what factors to consider when domains cross.
Benefits and Trade-offs of Using Programmable PLLs to Configure Frequencies and Reduce EMI	Designers look for not only higher system speed but also flexibility to reduce development time and to find cost-effective solutions. TI's new programmable family of clock generators allows designers to generate multiple frequencies from one clock source, customize a device via the EEPROM, modify the system clock without redesigning the board, or use only one device configuration for several boards.

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Track 3 – Innovations in Embedded Processing	
Embedded Web Server-Enabled Design Made Easy— Hands-On Lab (Part 1 of 2)	This session will demonstrate how to use the Stellaris® LM3S6965 Ethernet Evaluation Kit with Code Red Technologies' Red Suite™ tools to set up embedded Web solutions for a remote-control application. The Stellaris LM3S6965 is an ARM® Cortex™-M3 microcontroller with integrated 10/100 Ethernet MAC+PHY. The Stellaris LM3S6965 Ethernet Evaluation Kit features several different implementations of embedded Web servers. The fully functional Red Suite evaluation tools also feature real-time code and interrupt trace capability with the Red Trace™ feature. The Web-server application will demonstrate how the provided royalty-free Stellaris libraries make it painless to have networking up and running in minutes, whether a real-time operating system (RTOS) is used or not. You will get a good understanding of how to start building even the most advanced applications with Stellaris microcontrollers quickly and with low risk.
Embedded Web Server-Enabled Design Made Easy— Hands-On Lab (Part 2 of 2)	This session will demonstrate how to use the Stellaris LM3S6965 Ethernet Evaluation Kit with Code Red Technologies' Red Suite tools to set up embedded Web solutions for a remote-control application. The Stellaris LM3S6965 is an ARM Cortex-M3 microcontroller with integrated 10/100 Ethernet MAC+PHY. The Stellaris LM3S6965 Ethernet Evaluation Kit features several different implementations of embedded Web servers. The fully functional Red Suite evaluation tools also feature real-time code and interrupt trace capability with the Red Trace feature. The Web-server application will demonstrate how the provided royalty-free Stellaris libraries make it painless to have networking up and running in minutes, whether a real-time operating system (RTOS) is used or not. You will get a good understanding of how to start building even the most advanced applications with Stellaris microcontrollers quickly and with low risk.
Energy Harvesting Embedded Systems using MSP430™	Modern ultra-low-power microcontrollers such as the TI MSP430 consume so little energy that they don't require batteries even while sampling various sensors and communicating wirelessly. By properly managing low-power modes and adjusting your activity profile, you can scavenge energy from the environment to achieve infinite system uptime without the need for a battery. This session will discuss methods of harvesting energy from various sources such as vibration, solar power and thermal energy. Tips and tricks to enable an existing application to run from harvested energy will also be presented.
MSP430F5xx Hands-On Workshop (Part 1 of 2, No Break)	This hands-on workshop is for the experienced MCU designer who wants to learn firsthand the capabilities of the MSP430F5xx and how to use them. You will experience embedded design with the MSP430, get familiar with an MSP430 development environment, learn where to find and how to use resources, and better understand the MSP430 low-power concept. The session is perfect for those getting started or wanting a refresher on the MSP430. Basic experience with general MCUs and knowledge of assembler and C-language programming is assumed.
MSP430F5xx Hands-On Workshop (Part 2 of 2)	This hands-on workshop is for the experienced MCU designer who wants to learn firsthand the capabilities of the MSP430F5xx and how to use them. You will experience embedded design with the MSP430, get familiar with an MSP430 development environment, learn where to find and how to use resources, and better understand the MSP430 low-power concept. The session is perfect for those getting started or wanting a refresher on the MSP430. Basic experience with general MCUs and knowledge of assembler and C-language programming is assumed.

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Track 4 — Innovations in Portable Power Supply Solutions	
Optimizing High-Frequency Synchronous Switching Buck Converter Performance	External components, including inductors and capacitors, have a large influence on converter performance. If the recommended components from the data sheet are used, the promised performance can be expected. However, designers often need to deviate from these recommendations for various reasons, including preferred BOM parts, size constraints, and performance optimization. This session covers the key design points for selecting external components and helps the designer understand the trade-offs involved. This understanding is especially critical in the design of a high-frequency, integrated power supply. Measured data to show the effects of changing external components in the power supply is also provided.
Optimizing Power-Save-Mode Performance in Low-Power Synchronous Buck Converter	Modern synchronous buck converters for portable applications provide so-called "power-save-mode" operation to maintain high efficiency over the entire load range. At light loads, the converter operates in pulse-frequency-modulation (PFM) mode, and at medium to heavy loads provides an automatic transition into pulse-width-modulation (PWM) mode. This session discusses different PFM-mode techniques, such as time- or current-controlled PFM operation and single- or dual-threshold PFM-regulation schemes. In applications requiring fast load transients out of light-load operation, the load-transient response of the buck converter can be improved with the help of features like fast-PFM mode or dynamic voltage positioning. In audio applications, the PFM output ripple voltage, the PFM frequency and the transitioning point between PFM and PWM operation are often a concern. Selecting the appropriate PFM-control scheme and external components permits buck converters to be fine-tuned to meet these specific application requirements.
Minimizing High-Frequency Noise from Switch-Mode Power Supplies	With high efficiency, small size and ease of use, switching power supplies are now finding a place in virtually every application. However, switching power supplies may produce conducted or radiated noise that interferes with surrounding circuits in some applications that are noise-sensitive or that require regulatory testing for high-frequency emissions. This session discusses sources of high-frequency noise, common system-level noise problems, and methods to reduce noise in switching power supplies.
Battery Characteristics, Safety, Cell Balancing and Cell-based Thermal Sensing	The lithium-ion (Li-Ion) battery has gained great popularity in recent years as the market for battery-powered portable devices has rapidly grown. The Li-Ion battery has superior characteristics, including high gravimetric and volumetric energy density, low self-discharge and no memory effect. On the other hand, it requires mandatory safety features because of its sensitivity to overcharging and high temperature. In this session we will discuss the characteristics and safety of rechargeable batteries; emerging battery chemistries such as $LiFePO_4$ and $LiMn_2O_4$; and design considerations for connecting battery cells in parallel or in series in applications. New trends toward designing safer battery solutions with longer battery life, such as advanced cell-balancing technologies and cell-based thermal monitoring, will also be discussed.
ABCs of LEDs	Light-emitting diodes (LEDs) are found everywhere—in faceplate indicators, LCD panels, photo flashes, video walls and general lighting. This session will review LED basics and discuss key terms and parameters like forward current, forward voltage, luminous efficacy and lumen depreciation. Common LED types and packages along with thermal requirements for higher-current LEDs will be discussed. The session will also cover LED applications and their particular characteristics, including examples of drive, dimming and control circuits for LEDs.

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Track 5 – Innovations in Application Processors	
Linux Development Tutorial on TI Processors	This session will explore the various Linux development options available for TI's embedded processors that use DaVinci™ and OMAP™ technologies. Both community and commercial offerings will be discussed, including the benefits of each.
Introduction to Code Composer Studio™ (CCS) v4.0	Code Composer Studio (CCS) v4.0 is a major new release based on the Eclipse™ open-source software framework. Eclipse is very popular in the embedded-software development community and is now becoming a standard in development environments. This session will provide an overview of CCS v4.0 and explain the advantages of using it.
Video Codecs - What, How, and Which	Our investigation of video codecs begins with examining how they work. Next, we'll see how these codecs are implemented on TI's OMAP and DaVinci processors. Finally, we will compare and contrast many of the popular codec standards such as: MPEG2, MPEG4, H.264 and VC1.
BIOS 6: The Next Generation BIOS Supporting Both DSPs and MCUs	With the introduction of Code Composer Studio (CCS) v4.0, a new BIOS is also available that will support both TI's MCU and DSP devices. We will cover the roadmap for adding MSP430 and ARM Cortex M3 to the existing support for DSP devices. Then we will summarize new tool and kernel features, including greatly reduced interrupt latency for C28x™ and ARM Cortex M3 devices, faster, flexible dynamic memory management, the event object, SWI and HWI hook functions, and enhancements for system debug and analysis.
Open-Source Software Development on the ARM Cortex™-A8	In this session, developers of open-source software will learn how to use TI's BeagleBoard, which is a compact, low-cost, fanless, single-board computer that delivers Cortex-A8 and DSP performance. BeagleBoard provides the expandability of today's desktop machines but without the bulk, expense or noise. It is an open-source software-development board with a facilitated open-source community of software developers for collaboration and exchange of innovative ideas and support. Learn how to develop on the BeagleBoard and how to use OpenEmbedded, the build framework for embedded Linux, for cross compilation.