



# Texas Instruments

## Dallas 2010

### Session Titles and Abstracts

#### Track and Course

#### Abstracts

#### Track 1 – Analog Design Considerations

Op Amp Stone Soup: A "Cookbook" Collection of Single-Supply Op-Amp Circuits

This presentation offers a "stone soup" collection of useful op-amp circuits to solve linear application problems on a daily basis. Each op-amp circuit (pre-built in the 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 your exact application. A sampling of the ingredients includes the following circuits: voltage-to-current conversion, drive circuits (bridge-tied load, parallel op amps, high-current cascade reference buffer), translation circuits (single ended to differential, differential to single-ended, differential in to differential out), conditioning circuits (full-wave rectifier, supply splitter, integrator amp in feedback, isolation amplifier,  $G = 1/G = -1$  amp) and comparator circuits (AC coupled, comparator with hysteresis).

Using Fully Differential Op Amps to Signal Condition High-Voltage Signals to Drive ADCs

Signal conditioning high-voltage input signals to drive ADCs from high-voltage sources can be challenging. Given a signal source that provides higher level signals (like  $\pm 10$  V) that you want to interface to a lower voltage ADC with significantly lower differential and common-mode voltage input requirements, how do you go about it? How do you attenuate and level-shift the voltage levels of the signal to match the input requirements of the ADC? In this session, we will propose an architecture utilizing a fully differential op amp to accomplish the task. Circuit analysis is performed to aid in understanding the key design points and a design methodology is presented for calculating the required component values. Spreadsheet examples will be shown along with TINA-TI™ SPICE model examples to show how to implement the design methodology using computer-aided tools. This topic will also include a short presentation of test procedure and performance results using the THS4521 as input amplifier to drive the ADS1278 24-bit  $\Delta\Sigma$  ADC, and the THS4521 as an input amplifier to drive the ADS8324 16-bit SAR ADC.

Op-Amp Noise Calculation, Simulation and Measurement

This presentation covers calculation, simulation and measurement of intrinsic noise. Intrinsic noise is noise generated by resistors, op amps and other active devices in the circuit. The presentation does not cover extrinsic noise (e.g. RFI and EMI pick-up) but will cover specific real-world examples where the peak-to-peak output noise is predicted and measured.

High-Speed Layout Considerations

This topic will discuss the high-speed models of common components and the key points to address in high-speed layout. We will discuss when to use ground planes and when to clear them, along with optimum circuit routing; bypass capacitors; and avoiding ground loops, vias and controlling impedance with transmission-line techniques. In addition, many high-speed signal chains will involve a mixed-signal boundary where the analog domain will cross into the digital domain. This seminar will provide guidance as to the factors you need to consider when crossing domains, with steps on creating a successful data converter layout for your high-speed design.

Digital Isolation Techniques and Implementations

Multiple options are now available to electronics designers to implement galvanic isolation. Apart from isolation technologies like capacitive, optical and inductive/magnetic to choose from, they must also contend with the various isolation standards regarding voltage ratings and creepage/clearance distances. This discussion intends to simplify the decision-making associated with choosing the right isolation solution.

#### Track 2 – System Design

The Complex IF Transmitter

The complex IF transmitter is an alternative radio architecture using high-speed DACs and IQ modulators. Complex radio architectures have been traditionally used with the IQ modulator input signal centered at 0 Hz. This paper will present the complex IF transmitter architecture, where the baseband signal is first digitally quadrature modulated to a complex intermediate frequency (IF) using a high-speed DAC before being input to an IQ modulator. This architecture has the advantage of perfect IQ balance within the baseband signal (similar to a real IF radio) with the added benefits of sideband, LO and DAC image suppression at the modulator output. This allows the complex IF architecture to be implemented in most cases without IF filtering and relaxed RF filtering, resulting in reductions in components, size and power.

How to Overcome EMI Problems by Using Clock Generators Equipped with SSC

EMI is the most common reason for redesign nowadays. Spread-spectrum clocking (SSC) is a common way to overcome EMI issues that some applications tolerate. This presentation provides a detailed view of the principles behind SSC. It also includes practical considerations about why, when and how to use the SSC. When SSC is included early in the design process, it can reduce the redesign cycle and drastically decrease the cost of new product development.

Essential Concepts in SoC System Design

Learn how to successfully develop with TI's ARM MPU, OMAP™ and DaVinci™ devices. This session will provide a hardware overview as well as provide a dissection of software architecture. Attendees will gain an understanding of TI-delivered software components (OSs, LSP, codecs), use cases, collateral and support paths, and system integration. Program management best practices will also be covered.



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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 continue to increase. EMI and RFI, an undesirable by-product of electrical systems, produce a wide range of frequency spectra that can affect otherwise properly operating circuits. During this seminar hour, we will review the fundamental principles of radiated interference and coupled interference, along with the respective allowed limits for both of these interference sources. In this discussion, we will describe transmitters and receivers along with techniques to mitigate the effects of both culprits. The solutions we will cover will be 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. With this seminar you will see some basic methods that will help reduce sources and receptors of EMI and RFI events in and near your circuits.
ESD Protection: Protecting the Complete System	System-level ESD protection at the interface connector is particularly challenging. Semiconductor chips based off advanced low-voltage, small-geometry process nodes enable miniaturization, more power savings and better economy of scale. But it poses an even bigger challenge to provide ESD immunity, since it becomes more difficult to design robust ESD solutions as the process geometry gets smaller. External ESD clamp circuits or integrated protection devices are popular choices to enhance system-level ESD protection. This presentation will cover key system-level ESD challenges, common techniques to improve overall system-level ESD performances, TI's IPD solutions and selecting the right ESD clamps for a given application.
<b>Track 3 – Wireless Design</b>	
RF Basics, Tools and Getting Started	Have you been told by your manager to go remove the wires from the design? Not sure where to start? This presentation serves as an overview of the parameters and considerations a designer would use to select a low-power wireless (LPW) solution. It also highlights the devices and tools from TI and how they fit in a typical low-power RF design.
So You Want Wi-Fi? On-Board vs. Module WLAN Using TI's WL1271 by LSR	This session discusses Wi-Fi from a developer's point of view. Topics covered include WLAN standards overview, hardware design considerations including antenna design and EMC testing, and TI's WiLink™ 6.0 chipset-based solution implemented using TI's OMAP3530 and WL1271. We will also explore the module that LSR has developed for TiWi solutions to help your design get to production faster. This session will be led by LS Research.
Improving the Range of Your Low-Power RF Designs	How far can it go? This course will go through the standard calculations for estimating the range of an RF system. The course will also discuss a variety of enhancements and trade-offs that can be made to a design to improve the range and throughput of a RF system. The course will review link budgets, LNA and PA solutions, and will touch on modulation schemes, forward error correction, path loss and network topologies.
Designing RF Systems with Low-Power Consumption Targets	In this session, you'll learn how to configure your RF system for low power consumption, creating a low-power RF protocol design from scratch including periodic transmission, polling receiver and TDMA, power optimization, protocol consideration, design, debug and test. Specific low-power features of LPRF chips are explored: wake-on radio, fast startup from sleep and low-power modes.
Bringing TI's <i>Bluetooth</i> ® Technology to Embedded MCU Platforms	As TI expands the reach of our connectivity platforms, we are putting new tools in the hands of customers to quickly and easily add connectivity to products based on TI embedded processors such as MSP430™ MPUs. In this session, we will introduce the newest platform offering that integrates TI's BlueLink™ product family with the MSP430 solution. You will learn about the platform's features, capabilities, differentiators and how to position this offering with your customers. You will also get to see the platform in action as we demonstrate a gaming and a health care sample application running on an MSP430F5438 experimenter board.
<b>Track 4 – Embedded Platform Design</b>	
Using TI's Applications Processors for Industrial Automation	Learn how to use TI's OMAP-L138 and AM1808 application processors for industrial control and automation applications. This session will include information on how to provide hardware support for industrial protocols such as CAN bus, Profibus and RS-485. This session will also address uses for an FPGA in industrial applications, as well as techniques for interfacing an FPGA to the applications processor. In addition to illustrating how these features can be accomplished in your own design, this session will show how the MityDSP-L138 and MityARM-1808 system-on-modules and industrial interface board from Critical Link can be used to speed the development of systems for industrial applications.
C2000™ Digital Power Solutions: AC/DC and DC/DC	Digitally controlled power conversion is the enabling force of efficiency and performance improvement in today's power-supply and power-conversion designs. Texas Instruments' digital power conversion controllers are the recognized leaders in this market. This presentation will focus on introducing TI's latest development solutions for both AC/DC rectifier power supply and DC/DC converters, including power factor correction (PFC), phase-shifted DC/DC, and highly efficient resonant DC/DC. An introduction of basic power conversion concepts and topologies such as PFC, DC/DC, interleaved PFC and DC/DC, and resonant DC/DC will also be presented. Attendees will learn basic and advanced digital power-conversion concepts and gain an understanding of TI's digital power solutions.



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Video Fundamentals	The world of video is filled with its own terminology, which can make it difficult to get started. Terms such as D1, NTSC, YUV, BT.656, etc. can be very intimidating. This session is aimed at engineers looking to become familiar with the terminology and concepts involved in image/video processing. It will cover concepts such as resolution, bit-depth, color space and common hardware interfaces. Video compression standards have become a very hot topic. This session is aimed at engineers looking to learn more about these standards in order to choose the best codec for their application. It will cover the elements of a video encoder, overview of compression standards such as MPEG-2 and H.264, choosing a video codec and software integration.

Designing Lighting Power Solutions from TI	This training will present an overview of the LED general lighting solutions available from Texas Instruments for residential, commercial, outdoor and infrastructure lighting. Both AC/DC and DC/DC solutions in the forms of reference designs, EVMs and products will be discussed from both analog and embedded processing.
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Getting Started with Android Today and Maximizing Your Effectiveness by Mentor Graphics	With the availability of Android for the Texas Instruments OMAP35x, developers are now able to utilize the unique power of the Android application framework to create new, compelling designs. Attend this session to learn about the fundamentals of the Android architecture, the advantages of Android for designs relative to Linux, Mentor developer tools to assist Android developers, and how Android and TI OMAP35x work together.
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**Track 5 – Low-Power Systems**

Battery Management Basics	This session will cover charging, protection, chemistries, gas gauging and TI's portfolio, along with a technology overview, advantages and hot products (roadmap).
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Charging System Concerns and Solutions	This session will focus on system-level design concerns and solutions for single cell and multicell, with an emphasis on lessons learned and solving customer typical questions/issues. This session assumes attendance of the Battery Management Basics session or equivalent knowledge level.
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Designing for Ultra-Low Power with MSP430™ MCUs	Realizing a low-power system design when every microampere counts is rarely an easy task to achieve. Such an effort requires detailed knowledge of everything your MCU offers in the way of enabling ULP as well as the features of any external components. This course gives practical instructions of how to realize an ultra-low-power application using the MSP430™ MCU family. Special focus is given to specific ULP features, how to select components for ULP applications and coding techniques that reduce the power consumption of your embedded application.
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Energy Harvesting by Cymbet	This session provides an overview of how to design autonomous wireless sensors using various energy harvesting transducers, energy conversion circuits, energy storage with permanent thin-film battery technology, sensors and the TI MSP430™ MCU, CC2500 and TI CC430. Various configurations of autonomous self-power sensors based on energy harvesting will be detailed. Low-power EH RF system architectures will be discussed and design examples will be shown. An example of a zero-power wireless sensor will be demonstrated using the eZ430-RF2500-SEH Demo Kit and the new DigiKey self-powered CC430 weather station reference design.
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Integrated USB Connectivity with MSP430™ MCUs	Modern MSP430™ MCUs have integrated USB peripherals, allowing for serial communication over a single plug-and-play cable, intelligent human interface devices like mice and keyboards that don't require driver installation, or mass storage devices for data retention. MSP430 devices that feature a USB peripheral will be discussed as well as the software USB stacks required to create USB applications.
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**Track 6 – Power Supply Design – SEM1900**

Incorporating Active-Clamp Technology to Maximize Efficiency in Flyback and Forward Designs and Under the Hood of Flyback SMPS Designs	For telecom and PoE applications up to 25 W, single-ended forward and flyback topologies offer the lowest potential cost; however, utilizing active-clamp technology can increase the efficiency of both, particularly when synchronous rectification is appropriate for the outputs. Subjects to be addressed in this topic include obtaining zero-voltage switching; selection and driving of synchronous rectifier FETs; optimizing transformer design; and a side-by-side comparison of equivalent forward and flyback solutions, emphasizing the performance benefits of each topology that can be achieved as a trade-off against circuit complexity and cost.
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A basic review of the flyback switching topology as applied to low-voltage DC/DC converters will be presented in the second part of the session, with an emphasis on not-so-obvious design issues, including the effects of parasitics, fault protection and EMI mitigation. Modeling and analysis will be demonstrated and compared with physical hardware measurements. A major subtopic will be the understanding and characterization of the flyback transformer, considering leakage inductance, cross regulation, parasitic capacitance and other performance-defin

Designing an LLC Resonant Half-Bridge Power Converter	Although half-bridge power stages have commonly been used for isolated, medium-power applications, efficiency requirements with high-voltage inputs encourage the use of resonant switching, an improvement that comes with added design complexity. However, the LLC half-bridge converter topology offers several performance benefits. This session provides detailed design information on its implementation, eased with a unique analysis tool for frequency modulation control, that of first harmonic approximation (FHA). This FHA method is used to define circuit parameters and predict performance, which is then verified through comprehensive laboratory measurements.
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Power Factor Correction Using the Buck Topology: Efficiency Benefits and Practical Design Considerations and New Product Offerings from Texas Instruments	<p>Although active power factor correction is typically accomplished with a boost power topology, this topic will show that there are significant efficiency advantages offered by a buck power stage, particularly when universal line operation is required. Specific design and performance issues such as bus voltage choice, achievable total harmonic distortion and power factor, control algorithms, and design practicalities will be discussed. Design choices and their implications will be illustrated with a practical buck PFC design example based on a 90-W high-density notebook power adapter demonstrating a PF &gt;0.9 over a 20- to 90-W load range and &gt;96 percent full load efficiency over a 100-230 Vac line.</p> <p>In the second part of this session, information on significant new power control products will be solicited from TI business managers, with the criteria for selection that a data sheet and samples will be available by September 2010.</p>
Designing Magnetic Components for Optimum Performance in Low-Cost, AC/DC Converter Applications	<p>With the assumption that the attendee is familiar with basic magnetic design theory, this session provides design guidance to achieve high efficiency, low EMI and ease of manufacturing for the magnetic components found in typical offline power converters. Magnetic component designs for a 90-W notebook adapter and a 300-W "silver-box" power supply are used as examples. Applications to be considered include the input EMI filter, PFC inductor, high-voltage level-shifting gate drives, and single- and multiple-output forward-mode transformers in both wound and planar formats. The techniques are also applied to flyback transformers and will enable lower profile designs with lower intrinsic common-mode noise generation.</p>
A New Dual Half-Bridge DC/DC Converter with Wide-Range ZVS and Zero Circulating Current and Designing a Solar-Cell-Driven LED Outdoor Lighting System: A Comparison of Digital and Analog Power Control Solutions	<p>A new digitally controlled high-power converter topology combines two half-bridge inverters to operate as a full-bridge power stage using phase-shifting control, but with zero circulating current. Each power switch operates with a nominal 50 percent duty cycle to achieve zero-voltage switching over a widely varying load, but can also function in PWM mode for increased voltage range. A 1-kW, 400-V/48-V converter designed to validate the concept will be shown achieving a 96+ percent efficiency and a high power density.</p> <p>The second part of this session will use a medium-power solution to illustrate the many considerations of designing a complete solar-powered LED light, homing in on the unique demands of both the solar array and LED lamps and integrating them with a storage battery, charger and control circuitry. Both analog and digital solutions will be proposed and compared on the basis of functionality, complexity and cost.</p>
<b>Track 7 – Analog and Stellaris® Tools</b>	
SwitcherPro™ Software Training	<p>In this hands-on training session, you'll learn to generate custom power solutions in minutes with SwitcherPro™ software from Texas Instruments. SwitcherPro software allows you to select TI parts and real-world components and analyze designs for efficiency, stability, size and other design factors. You can modify designs to meet your needs with "design options," "what if analysis" and "user-defined parts." Review your designs in the design report complete with a full bill of materials and notes for layout. Laptops will be provided, but bring your own if you want.</p>
Evaluating Analog-to-Digital Converters with ADCPro	<p>When you consider an analog-to-digital converter (ADC) for a new design, you can get a rapid assessment of the device with an evaluation board (EVM). If you intend to view collected time-domain, histogram or FFT data, ADCPro software from Texas Instruments will ease your evaluation. During this session, we will identify the appropriate test equipment for your EVM and introduce basic ADC evaluation test methods. We will show how ADCPro simplifies the tasks of collecting and analyzing ADC data.</p>
TINA-TI™ Software: Analog Circuit Simulation Made Easy	<p>Design cycles are shorter than ever and you have to be sure your design works the first time. Today, circuit simulation plays an important role in assuring that design effort succeeds. Having the right simulator is an important element in that effort. Several years ago TI and DesignSoft teamed up to provide our customers a powerful, yet easy to learn and use tool called TINA-TI™ software. TINA-TI software has a highly intuitive graphical interface that allows most users to be up and simulating their first circuits in 15 to 20 minutes. TINA-TI software provides many of the capabilities and power of DesignSoft's TINA Pro and industrial versions, but is provided free of charge to TI customers. This session will introduce you to TINA-TI software, how to connect circuits in TINA-TI software, and how to fully utilize the analysis capabilities the program provides. DC, AC, transient, noise and Fourier analyses will be explored in detail using actual circuit simulation results. Interactive examples will be demonstrated as time permits. Don't miss this opportunity to learn about TINA-TI software and what this simulator can do for your next design.</p>
Embedded Web Server-Enabled Design Made Easy with Stellaris® MCUs (Part 1 of 2)	<p>This presentation will demonstrate 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 using an RTOS or not. The attendees will get a good understanding of how they can start building even the most advanced applications with Stellaris microcontrollers quickly and easily.</p>



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Embedded Web Server-Enabled Design Made Easy with Stellaris® MCUs (Part 2 of 2)	This presentation will demonstrate 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 using an RTOS or not. The attendees will get a good understanding of how they can start building even the most advanced applications with Stellaris microcontrollers quickly and easily.
<b>Track 8 – DSP Tools Workshops</b>	
Code Composer Studio™ v4.0 Software Hands-On Workshop (Part 1 of 2)	Code Composer Studio v4.0 software is a major new release of that is based on the Eclipse open-source software framework. Eclipse is becoming very popular in the embedded development community and is now becoming a standard in development environments. Join this hands-on session to get started today.
Code Composer Studio™ v4.0 Software Hands-On Workshop (Part 2 of 2)	Code Composer Studio v4.0 software is a major new release of that is based on the Eclipse open-source software framework. Eclipse is becoming very popular in the embedded development community and is now becoming a standard in development environments. Join this hands-on session to get started today.
Introduction to Linux for ARM Cortex-A8 Hands-On Workshop (Part 1 of 3)	This is a combined lecture and hands-on lab session. The discussion starts with an overview of TI's devices and software development kits (SDKs). The heart of the presentation examines TI's Linux options, from an overview of Linux itself to where you can get versions of Linux for TI platforms (including Arago, TI's open embedded Linux distro) and finally how to build within the Linux environment. The session's discussion ends with a brief, practical examination into using Linux on embedded platforms. After booting the system with an SD/MMC card, the lab gets you working with the Linux graphical user environment, just as if you were working on a desktop computer. If you have time after exploring the GUI environment, there are further, optional exercises to explore Linux's networking applications and boot environment and mounting various file systems.
Introduction to Linux for ARM Cortex-A8 Hands-On Workshop (Part 2 of 3)	This is a combined lecture and hands-on lab session. The discussion starts with an overview of TI's devices and software development kits (SDKs). The heart of the presentation examines TI's Linux options, from an overview of Linux itself to where you can get versions of Linux for TI platforms (including Arago, TI's open embedded Linux distro) and finally how to build within the Linux environment. The session's discussion ends with a brief, practical examination into using Linux on embedded platforms. After booting the system with an SD/MMC card, the lab gets you working with the Linux graphical user environment, just as if you were working on a desktop computer. If you have time after exploring the GUI environment, there are further, optional exercises to explore Linux's networking applications and boot environment and mounting various file systems.
Introduction to Linux for ARM Cortex-A8 Hands-On Workshop (Part 3 of 3)	This is a combined lecture and hands-on lab session. The discussion starts with an overview of TI's devices and software development kits (SDKs). The heart of the presentation examines TI's Linux options, from an overview of Linux itself to where you can get versions of Linux for TI platforms (including Arago, TI's open embedded Linux distro) and finally how to build within the Linux environment. The session's discussion ends with a brief, practical examination into using Linux on embedded platforms. After booting the system with an SD/MMC card, the lab gets you working with the Linux graphical user environment, just as if you were working on a desktop computer. If you have time after exploring the GUI environment, there are further, optional exercises to explore Linux's networking applications and boot environment and mounting various file systems.

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