Texas Instruments
Tech Day Austin 2010
Session Titles and Abstracts

Track and Course	Abstracts
Track 1 – Wireless Connectivity	
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 devices and tools from TI and how they fit into a typical low-power RF design.
Bringing TI's *Bluetooth*® 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 like the MSP430™ MCU. 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 health care sample application running on an MSP430F5438 experimenter board.
CC430: MCUs for Space-Constrained, Ultra-Low-Power Wireless Applications	The CC430 platform is a highly integrated, monolithic SoC based on the industry-leading MSP430™ MCU architecture and TI's ultra-low-power RF solutions. By making RF design easy, small, performance-rich and power-efficient, the CC430 platform helps advance applications including RF networking, energy harvesting, industrial monitoring and tamper detection, personal wireless networks, automatic metering infrastructure (AMI), and heat cost allocators.
Texas Instruments Wireless Products and What Works Best for Your Design	Ever wonder what wireless standard best fits into your embedded system? Texas Instruments supports a variety of wireless products from standards such as *Bluetooth*® and ZigBee to proprietary radio hardware. How the standards fit in a typical design can be confusing. This session covers the TI wireless portfolio and compares the operation of these radios and standards with the trade-offs of each. The discussion will touch on these standards: 6LoWPan, *Bluetooth*®, Bluetooth low energy, ZigBee, ANT, WiLAN, RF4CE, the SimpliciTI™ network protocol, RFID and proprietary solutions. We will also talk about what modules are available for evaluation and design support.
Designing RF Systems with Low-Power-Consumption Targets	In this session, you'll learn how to configure your RF system for low power consumption. We will cover low-power RF protocol design from scratch, including periodic transmission, polling receiver and TDMA, power optimization, protocol consideration, design, debugging, and test. We will also explore specific low-power features of LPRF chips, including wake-on radio (WOR), fast startup form sleep and low-power modes.
Track 2 – Signal Chain Design	
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 ±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 using a fully differential op amp to accomplish the task. Circuit analysis is performed to aid understanding of key design points, and a design methodology is presented for calculating the required component values. Spreadsheet examples will be shown, along with TINA-TI™ software 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 ΔΣ ADC, and the THS4521 as input amplifier to drive
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.
Understanding Clock Basics and Portfolio – the Capabilities and Limitations of Frequency Generation and Meeting Jitter/Phase Noise Requirements	Selecting a clock driver for a system consisting of single or multiple ICs should be a simple task. If only a single frequency from an oscillator or a crystal is needed, then it really is a simple matter - just select the frequency, tolerance, and signaling level. When a system becomes more sophisticated, it may require a clock driver to support various digital and analog ICs and then things can get z little complicated. As additional requirements come into play, it can become frustrating when the specifications of the receivers don't match explicitly with those of the clock driver. Some requirements are very obvious such as supply voltage, propagation delay, temperature range, etc… while others such as jitter, pulse skew or duty cycle, rise/fall time, and power dissipation can be application and configuration dependent. Even for programmable clock drivers, frequency generation and/ or jitter number can be little perplexing. If we have a basic knowledge of clock drivers and the typical parameters associated with the clocks drivers, and the system requirements then it would be easier to
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 therein lies an even bigger challenge to provide ESD immunity, as 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 performance, TI's IPD solutions and selecting the right ESD clamps for a given application.

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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 continues to increase. EMI and RFI, an undesirable byproduct 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.
Track 3 – Microcontroller Design	
Control and Drive Solutions for All Types of Motors with Stellaris® and C2000™ Piccolo™ Microcontrollers	Whether you are trying to control a 12-V brushed DC or a hundreds-of-kilowatts AC servo motor, TI offers a portfolio of microcontrollers and complementary integrated motor drivers, industrial interfaces, and high-performance analog-to-digital converters that fit your needs. In this presentation, we will discuss different motor types and control techniques, focus on the open-tooled hardware and software reference designs available for each motor type based on Stellaris® 32-bit ARM Cortex-M3 and Piccolo™ 32-bit microcontrollers, and review the appropriate power-stage and interface products. We'll also explore the overall methodology and ease-of-use features for motor control available from our microcontrollers, including start-up GUIs, modular software, hardware reference schematics/PCB/BOM, production-ready modules, advanced communications and connectivity, and integrated digital power factor correction (PFC).
FRAM: The Future of Embedded Memory for Microcontrollers	Ferroelectric random access memory (FRAM) is the next-generation, low-power, fast non-volatile memory technology for embedded microcontroller applications. Requiring no battery to retain data, it enables easy data access and features fast write capability like DRAM. In addition, its ability to perform write operations at 1.5 V eliminates the need for an expensive charge capacitor that other current non-volatile memory technologies such as flash or EEPROM require. FRAM supports practically unlimited data write cycles (unlike EEPROM or flash) and this, combined with its low power consumption and high reliability, makes it ideal for sensoring, datalogging, motor control and security applications. Texas Instruments has more than nine years of experience with FRAM and has successfully produced large FRAM memory modules up to 4 MB.
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.
Introduction to Stellaris® ARM Cortex-M3 MCUs	TI's Stellaris® MCUs pair the ARM Cortex-M3 core along with advanced communication capabilities, including 10/100 Ethernet MAC+PHY, CAN, USB On-The-Go, USB host/device, SSI/SPI, UARTs and I^2C. TI also provides an extensive range of more than 20 superb reference design, evaluation and development kits starting at $49. Stellaris MCUs are targeted at highly connected applications including monitoring, building controls, network appliances and switches, factory automation, electronic point-of-sale machines, test and measurement equipment, medical instrumentation, and gaming equipment. This presentation provides an overview of Stellaris MCUs, software tools and kits, StellarisWare™ software and applications. The session will close with a free-form Q&A session to handle your questions on the more than 140 microcontrollers in TI's Stellaris family of MCUs.
MSP430F5xx: Bigger, Faster, Lower Power – the Next Generation MSP430™ Microcontrollers	The next generation in MSP430™ MCU technology is here, delivering enhanced performance and deeper integration. This session provides an overview of the feature set and modules of the new MSP430F5xx device family. These devices feature a clocking system with new clock sources and fail-safe features, deliver increased 16-bit performance, enable new on-chip power supervision, and provide enhanced features for simpler code and lower power. The 5xx family will also enable integration of powerful new peripheral modules.

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Track 4 – Embedded Processing	
Implementing Skype Video Conferencing on the DM36x	Skype has changed the videophone industry. OEMs and manufactures are now able to directly connect to the consumer without interoperability and operator concerns. To meet this challenge, TI offers a DM365-based D1 videophone that runs Skype software stacks for encryption and streaming. This session will address some of the unique challenges facing hardware and software designers, such as how to share the hardware design with the DM365-based USB camera to maximize hardware reuse, challenges when running Skype software on the DM365, how to solve acoustic echo-cancellation issues, and audio and video synchronization.
Getting Started with Android Today and Maximizing Your Effectiveness	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.
Video Surveillance Reference Design: IPNC and DVR	In this session, we will discuss video reference designs based on TI's DM365 processors and TVP5158 analog decoders that help reduce customers' time to market. The DM365 IP camera, DVR and webcam reference designs are targetted for the video surveillance and conferencing markets, where high-quality video at low bit rates and a low system BOM are key to designing successful products. A demonstration of the DM365-based IP net cam and DVR reference designs will be shown, touching on TI's entry-level video analytics/image enhancement features such as face detection, lens distortion correction and video stabilization.
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 MPEG-2, MPEG-4, H.264 and VC1.
Linux Development Tutorial on TI Processors	This presentation will explore the various Linux development options available for TI's DaVinci™ and OMAP™ processors. We will discuss both community and commercial offerings, including the benefits of each.
Track 5 – Labs/Workshops	
Embedded Web Server-Enabled Design Made Easy with Stellaris MCUs (Parts 1 and 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. Attendees will get a good understanding of how they can start building even the most advanced applications with Stellaris microcontrollers quickly.
MSP430F5xx Hands-On Workshop (Parts 1, 2 and 3)	This hands-on workshop is intended to educate experienced MCU designers on the capabilities of the MSP430F5xx and learn firsthand how to use them. You will experience embedded design with the MSP430™ microcontroller, get familiar with an MSP430 development environment, learn where to find and how to use resources, and better understand the MSP430 low-power concept. This course if perfect for those getting started or who want a refresher on MSP430 MCUs. Basic experience with general MCUs and knowledge of assembler and C language programming is assumed.

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Track 6 – Power Supply Seminar 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. 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.
Power Factor Correction Using the Buck Topology: Efficiency Benefits and Practical Design Considerations **and** New Product Offerings from Texas Instruments	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 >0.9 over a 20- to 90-W load range and >96 percent full load efficiency over a 100-230 Vac line. 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.
Designing Magnetic Components for Optimum Performance in Low-Cost, AC/DC Converter Applications	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.
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	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. 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.