Texas Instruments
Tech Day Dallas 2009 - Analog
Session Titles and Abstracts

June 16th

Track & Course	Abstracts
Track 1 – Power	
Battery Characteristics, Safety, Selection, and Applications	The lithium-ion (Li-Ion) battery has gained great popularity in recent years as the market for battery-powered portable devices has grown rapidly. Li-Ion batteries have superior characteristics, including high gravimetric and volumetric energy density, low self-discharge, and no memory effect. On the other hand, a Li-Ion battery pack requires mandatory safety features because of the battery's sensitivity to overcharge and high temperature. This session will cover the characteristics and safety of rechargeable batteries and introduce emerging battery chemistries such as $LiFePO_4$ and $LiMn_2O_4$. It will also cover application-design considerations for connecting the battery cells in parallel or in series. New trends toward designing safer battery solutions with longer battery life, such as advanced cell-balancing technologies and cell-based thermal monitoring, will be discussed.
3-MHz Synchronous Switching Charger with USB On-The-Go (OTG) Capability	Charging a single-cell lithium-ion (Li-Ion) battery through a universal serial bus (USB) interface has become very popular in portable devices. With their high power demand and need for small size and better thermal management, battery-powered portable devices must efficiently and fully use the power available from the USB port or adapter to safely and quickly charge the battery. These requirements have challenged system designers. This session will cover the design challenges of using a 3-MHz synchronous switching battery charger with an integrated MOSFET that minimizes the inductor size. This type of charger can reduce the battery charging time by over 10% compared with a linear charger. In addition, communication between mobile devices, which requires a boost converter for generating 5 V from a Li-Ion battery, has become another challenge for supporting USB On-The-Go (OTG). This presentation addresses how to achieve and optimize a bidirectional DC/DC converter as a battery charger and boost converter. A design example and test results are provided as well.
Optimizing Power-Save-Mode Performance of Synchronous Buck Converters in Portable Applications	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 with pulse frequency modulation (PFM mode) and provides automatic transition into pulse width modulation (PWM mode) at medium to heavy loads. This topic discusses different PFM mode techniques such as time or current controlled PFM operation as well as single or dual thresholds 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, frequency and transitioning point between PFM and PWM operation is often a concern. By selecting the appropriate PFM control scheme and external components, buck converters can be fine tuned to meet these specific application requirements.
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.
Minimizing High-Frequency Noise from Switch-Mode Power Supplies	With high efficiency, small size, and ease of use, power supplies are now finding a place in virtually every application. However, some of these applications may be noise-sensitive or require regulatory testing for high-frequency emissions. In these cases, the switch-mode power supply may produce conducted or radiated noise that interferes with surrounding circuits. This session covers sources of high-frequency noise, common system-level noise problems, and methods to reduce high-frequency noise in switching power supplies.
Track 2 – Wireless Infrastructure	
The Complex IF Transmitter	The complex intermediate-frequency (IF) transmitter is an alternative radio architecture using high-speed DACs and I/Q modulators. Complex radio architectures have traditionally been used with the I/Q-modulator input signal centered at 0 Hz. This session will present a complex IF transmitter where a high-speed DAC is used to first digitally quadrature modulate the baseband signal to a complex IF before the signal is input to an I/Q modulator. This architecture has the advantage of perfect I/Q 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 with relaxed RF filtering, reducing the number of components, the size, and the power requirements.

Digital Signal Processing in High-Speed DACs	Digital functions in high-speed DACs simplify the digital baseband in the transmit signal chain including interpolation filters, digital complex mixers, I/Q and DC balance, and SINX/X filters. The use of interpolation filters eases data-rate requirements on the input side while retaining the spectral advantages of the faster DAC output because real and complex images fall further away, which eases RF filter requirements. I/Q DACs with complex, fine NCO and coarse mixers allow IF channel selection in the DAC, eliminating the need for IF modulation in the digital baseband and consequently reducing the required data rates. DC offset control as well as I/Q magnitude and phase-balance circuits can be employed in some feedback-correction schemes to improve LO and sideband suppression on the analog circuits following the DAC output. SINX/X filters can be used to compensate for droop caused by the SINX/X response of the DAC output.
Solving Common Design Issues in High-Speed Data Converters	This session examines and offers solutions for some of the real-world, practical issues that commonly plague the application of ADCs. This session is for designers who already have a working understanding of data-conversion fundamentals. We will treat subjects such as clocking and jitter, driving the analog input, driving/capturing digital data effectively, and layout considerations.
Designing the Appropriate System Around High-Speed Data Converters	Most applications engineers and designers of high-speed analog circuits know that to truly get the advertised performance from a high-speed data converter, the system is as important as the converter itself. Without the appropriate clocking, power, and analog front end, even the most advanced device will fall short of expectations. This session will highlight three of TI's data converters—the ADS5463, the ADS6425, and the DAC568—and examine what parameters need to be considered in designing a system around them.
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.
Track 3 – Low-Power Design	
Understanding and Choosing Antennas	This session is for engineers responsible for RF design and layout. A number of antenna designs for both sub-1-GHz and 2.4-GHz operation will be discussed, including the pros and cons of each design. You will also learn how to implement the proposed antennas in your own design.
Switch-Mode Power Conversion Issues for Portable Applications	This session provides an introduction to DC/DC converters for portable applications and is especially useful for beginners or novices of power-supply design. Practical issues and implementations for charger circuits (bqSWITCHER™ design examples, thermal considerations, etc.) are also provided.
System Power Considerations with Discrete Logic	With the proliferation of portable, battery-powered equipment, total system power consumption has become a major concern. DSP and microprocessor vendors do a good job of providing power-consumption information, but this type of data is not as readily available for discrete components such as standard logic, which are often added at the latter stages of the design. With a little understanding of how discrete logic devices work and of the parameters specified on their data sheets, we can make a much more informed choice when selecting these often overlooked components. There are a number of power-consumption scenarios that can be considered during the design phase; however, only two of the most common ones will be discussed here.
RF Hardware System Design	In this session you will learn how to deal with key challenges in RF hardware design, such as the balun, decoupling, crystals, power, PCB layout, regulations, and debugging/testing.
Designing, Prototyping, and Deploying Embedded Designs with NI LabVIEW™ *by National Instruments*	NI LabVIEW is a powerful, graphical software-development environment that can be used in various aspects of a design application. NI LabVIEW can be used to help design a hardware system, prototype a design, develop embedded code, and test the end product. During this session we will focus on integration with the Circuit Design and Capture tools for rapid validation; rapid prototyping of systems; embedded software development on TI DSPs and ARM® processors; and automated test and measurement with NI LabVIEW.
Track 4 – Precision Analog	
Circuit-Isolation Techniques and Implementations	Multiple options for implementing galvanic isolation are now available to electronics designers. Apart from having capacitive, optical, and inductive/magnetic isolation technologies to choose from, designers must also comply with the various isolation standards regarding voltage ratings and creepage/clearance distances. This session aims to simplify the decision making associated with choosing the right isolation solution.
Features and Benefits of Various Industrial Networks	An important trend in factory automation is the continual increase in networked interconnection between sensors, controls, actuators, and other system components. Automation designers face many challenges and trade-offs in the development of a successful network solution. This session is for system designers who will be developing networked automation but who may not be familiar with the details of data-transmission design. We will discuss how to select the network technologies that are appropriate for various specific applications. Technical constraints of several common field buses will be compared, and guidelines for selecting media and protocol will be discussed. You should come away with a general idea of the common field buses available and with some knowledge of the kinds of questions to consider when choosing an architecture, a protocol, and an implementation.

Op Amp Stability Analysis and Fixes	Any system that has gain is subject to stability issues. The basic conditions necessary for extended ringing and even sustained oscillation are connected with phase shift and gain. With information from the product data sheet, a TINA-TI™ simulation, and bench tests, a stable system can be realized.
Op Amp Noise: Correct Analysis Techniques, Conversions Between Different Nomenclatures and Measurements	One of the more confusing areas in amplifier applications is the amplifier's noise characteristics. Part of this confusion comes from numerous simplified treatments of noise that eliminate terms or assume certain conditions to simplify the equations. In this session, the full expression for op-amp output noise will be developed, with the typical simplified forms explained. Noise extraction and modeling methods for op amps will be shown to link back to this full model. Conversions between different types of noise descriptions will be developed and examples shown. Low-frequency effects and how to capture them will be discussed, and the broadband conversion between spot noise and integrated noise will be explained. Paths to improving the noise performance in typical applications will then be illustrated.
Exploit the ADC to Your Advantage	In this session we will discuss 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 you can implement in your systems. The output of every sensor circuit included in this presentation will be suitable for conversion to a digital signal. You will leave this session fully armed to tackle many onboard or remote sensor challenges.
Track 5 – Analog Video/Audio Design Considerations	
High-Speed Amplifiers—Video Tips and Tricks	In this session, we will present tips and tricks for designing with TI's new integrated video line-driver devices. We will focus on some common issues that arise when customers use TI's new video amplifiers with built-in filters (the THS73xx family). A discussion of known issues and solutions will include work-arounds for I^2C bugs; frequency response; interfacing with a DAC/encoder; and replacing passive filters with TI devices. Using the industry-standard VM700 and VM5000 test systems, we will also provide an overview of key video tests.
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.
Moving Video in Mobile Devices with FlatLink3G™	What do children's toys, cell phones, navigation equipment, cameras, printers, and MP3 players have in common? Answer: a graphic display. This session will explore the challenges of today's display technology, trends, and architecture. Various methods of alleviating display-interface bottlenecks will be contrasted, and the advantages and drawbacks of each approach will be highlighted. TI's FlatLink3G technology will be introduced as a potential fit, showing how TI has the customer in mind when inventing technologies.
PurePath™ Studio for Audio Codes	This session will provide a description of the capabilities and use of the TLV320AIC3254 control software. It will also provide an overview of audio-application development that uses the PurePath tool set and will discuss the Linux and WinCE drivers and host platforms available.
DLP® Products—Introduction and Overview of New Applications	DLP Cinema® technology has become well-known and is used in digital-cinema projection systems for theaters and conference rooms around the world. At the core of DLP technology are millions of tiny mirrors used to modulate light at very high speeds, accuracy, and resolution. This unique ability to modulate light in the UV, visible, and IR spectrums is spurring hundreds of new applications for everyday life. This session provides an overview of how the DLP mirrors work and how DLP products are being used in some exciting new applications.
Track 6 – Portable Embedded Design Considerations	
Breaking the mW/MHz Mindset: How to Navigate TI's Processor Portfolio	This session will explain how TI's low-power processors map to end-application needs. Topics such as fixed-floating-point decisions, performance benchmarks, peripheral throughputs, driver availability and features, and getting started with evaluation modules will be covered. Detailed, high-level block diagrams and side-by-side comparisons of TI's new and legacy processors will help you understand which ones are right for your application(s) and how to get started today.
High-Speed Board-Design Considerations for OMAP™ Applications	The OMAP35x BGA package was designed to simplify board layout but they can be sensitive to certain hardware-design pitfalls when a designer tries to maximize performance. This session will provide a primer for and offer recommendations on routing a BGA package. Also outlined are issues common to high-speed applications, and recommendations are given for avoiding common problems. Specific examples will be given using TI's OMAP35x and will address memory interfacing, camera interfacing, and USB support.
OMAP-L1 Hands-on Lab ***(Three hour class)***	The OMAP-L137 is a low-power applications processor based on an ARM926EJ-S™ and a TMS320C674x DSP core. The OMAP-L137 supports robust operating systems and features rich user interface and a long life of high performance through the maximum flexibility of a fully integrated mixed-processor solution. This hands-on workshop will provide a detailed technical overview of the device's architecture and will cover supporting hardware and software such as the Linux boot process and Codec Engine/DSPLink functionality.
Track 7 – Microcontroller Hands-On Labs	

TMS320F28027 Piccolo™ Mini Workshop ***(Two hour class)***	In this workshop, you will be using the F28027 Piccolo ControlSTICK to perform initialization of the MCU and program some of the key peripherals. You will gain a key understanding of the F28027 architecture and its peripherals and how to use the pre-defined peripheral register structures to efficiently program the device in a real application. During the labs, you will practice using some of these structures and also observe the debugging features in Code Composer Studio. You will experiment with the watchdog, interrupts, ADC, and generate and graph a PWM waveform.
MSP430F5xx Hands-on Workshop ***(Two hour class)***	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.
Integrated USB Connectivity with MSP430 MCUs	Modern MSP430s have integrated USB peripherals such as a single plug-and-play cable for serial communication, 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.
Track 8 – Video Processing	
Leveraging Adobe® Flash® Technology on DaVinci™ and OMAP™ Processors by DigiLink Software, Inc.	Adobe Flash player is very popular on the PC platform for rich-media online applications. Recently, Flash technology has also found a home for embedded platforms in a stripped-down version called Flash Lite®. One popular use of Flash Lite is developing graphical user interfaces (GUIs), which eliminate the need for writing low-level graphics code. This approach has two main benefits: (1) It greatly reduces the time for GUI development, and (2) it empowers graphic designers with more control over the look and feel of the resulting GUI. Flash technology has also been adopted by most of the online video sites. TI's DaVinci and OMAP technologies both support Flash Lite and their TMS320C64x+™ cores can be used to greatly improve the Flash video performance. In this session, we will discuss the work flow of GUI development with TI's DaVinci and OMAP technologies, as well as how to use the C64x+™ core for Flash video playback.
Implementing High-Definition Codecs Using DM6467 w/Demo	TI's DM6467 is finely tuned to handle complex video applications. The DM6467 can off-load video encoding/decoding tasks from the DSP core to the HD video imaging coprocessor (HD-VICP), allowing more DSP MIPS to be available for common video and imaging algorithms. This session will cover encoding/decoding HD content and will provide information on available libraries that reduce time to market for video applications. A demo will be shown during this session.
HD On-Screen Display Using DM6467 and DM6437	TI's DM6467 is finely tuned to handle complex video applications. The DM6467 can off-load video encoding/decoding tasks from the DSP core to the HD video imaging coprocessor (HD-VICP), allowing more DSP MIPS to be available for common video and imaging algorithms. This session will cover encoding/decoding HD content and will provide information on available libraries that reduce time to market for video applications. A demo will be shown during this session.
Image Pipe (IPIPE) Overview (DM365)	IPIPE is a programmable hardware image-processing module on DM35x that generates image data in YCbCr-4:2:2 format from raw CCD/CMOS data. This session will provide an overview of the IPIPE and explain how to use and optimize it for your image sensor and application.
The Ins and Outs of TI's Video Interfaces	TI has several embedded-processor solutions tailored for digital video applications. They consist of integrated processors, software, tools, and support to aid in simplifying the design process and to accelerate innovation. In this session, you will learn how to interface the video ports on digital media devices with popular video displays.

June 17th

Track 1 – Power

High Power Factor or High Efficiency—You **Can** Have Both/Reducing EMI from SMPS by Applying Spread-Spectrum Techniques	Although improving a power supply's power factor (PF) can offer significant and necessary reductions in distribution losses, adding an active PF-correction (PFC) stage has been thought to negatively impact a supply's internal efficiency. It doesn't have to be this way. By understanding the differences between PF and total harmonic distortion (THD) and the implications for universal AC line-voltage ranges, the designer can create several new system architectures that minimize system power losses while still meeting power-quality requirements. A down side to the many benefits of switch-mode power supply (SMPS) conversion has always been the potential for noise generation from the high dv/dt and di/dt of the power pulses. If the many techniques for mitigating the generation of EMI still fail to provide the necessary noise margin, the application of spread-spectrum frequency dithering may well provide a solution. This session explores modulation techniques, models the behavior in SPICE, and examines real-world behavior with two practical examples.
Under the Hood of DC/DC Boost-Converter Design/Improving System Efficiency with a New Intermediate-Bus Architecture	Despite having the same number of significant power components as the well understood buck converter, the boost converter has a reputation for lower performance and a more complicated design. This session presents the boost converter in practical terms, describing both continuous- and discontinuous-mode operation, and presents an easy-to-use mathematical model for analyzing both voltage-mode and current-mode feedback control. The ever-growing demand for efficient and high-quality data-transfer and telecommunication power systems has driven the replacement of centralized power supplies with distributed architectures. Recently, a new intermediate-bus design has gained popularity by providing lower cost, superior power quality, and higher efficiency while taking advantage of the newest advances in power components. This session provides a brief overview of the historical evolution of high-reliability power systems and focuses on the benefits and design challenges of the intermediate-bus architecture, with an example illustrating control requirements and practical solutions.
High-Voltage Energy Storage—The Key to Efficient Holdup/Using a PMBus for Improved System-Level Power Management	This session provides a tutorial for designing a high-voltage energy storage (HVES) system in order to minimize the cost and size of a storage-capacitor bank. First we will use energy storage principles to demonstrate the benefits and limitations of high-voltage storage, with quantitative illustrations of volumetric reduction and energy density. Then we will describe the critical aspects of an HVES design, comparing possible topologies and control techniques. We will also examine the challenges of designing the recharge and holdup modes, and the impact of these modes on power losses. We'll provide guidelines for a practical design example with both simulated and measured test results. This session provides a brief, high-level introduction to the power-management bus (PMBus) standards, which defines the use of an enhanced serial interface to control a power supply. Then we will describe the more common PMBus commands. We'll present several system-level tasks and several ways to implement them via a PMBus-enabled converter or controller. Finally, we will provide an example specification and the PMBus commands required for its implementation, with an application incorporating a suitable controller.
Applying Digital Technology to PWM-Control-Loop Designs	In this session we will discuss the application of digital control to DC/DC switching converters and how to model a digitally controlled system. We'll discuss the main components found in almost every digital controller—the error ADC, the compensator, and the digital pulse-width modulation (PWM) engine—that are used to model small-signal characteristics such as frequency response, stability criteria, and quantization effects. We'll also address the impact of the sampling rate and delay introduced by the digital controller. This model is extended to include nonlinear gain. Finally, we will introduce and demonstrate a graphical user interface for the design of a two-phase synchronous buck converter.
An Introduction to New Products for More Effective Power Solutions	This session will highlight some of TI's recently introduced power-solution products, emphasizing their most significant performance characteristics, their cost-effectiveness, and their easier-to-design implementations.

Track 2 – Analog

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.

Lessons Learned from TI Power Designs	This session will cover some unique applications and circuits. Specific topics will include paralleling power-over-Ethernet (POE) powered-device (PD) power supplies, synchronous-rectifier drive methods, the green-mode UCC28600, and LED drivers and multiphase boosts with the TPS40090. In addition, design methods and lab hints will be provided for designing isolated power supplies, audio amplifier power supplies, and single- and multiple-phase buck converters.
Component Selection, Layout, and Thermal-Design Considerations for DC/DC Converters	DC/DC converters with internal transistors and compensation have become very popular due to their relative ease of use. This session covers how to select the external components and properly lay out the circuit to achieve the maximum performance of the converter. Several examples of good and bad layouts are provided to show how layout impacts sensitive circuits. Thermal layout for linear regulators is also explored.
Li-Ion Technology and Battery Management	In this session, we will discuss Li-Ion and Li-Polymer technologies and take a look at future development trends. We will also cover the theory and concepts of battery gas-gauge systems, including an introduction to Impedance Track™ technology.
Track 3 – OMAP™ Applications Processors	
OMAP35x Hardware and Software Overview	This session will provide a detailed software- and hardware-architecture tutorial for TI's OMAP35x devices. OMAP35x applications processors offer a variety of combinations of the ARM ® Cortex®-A8 core, multimedia-rich peripherals, OpenGL® ES 2.0 compatible graphics engine, video accelerators, and TMS320C64x+™ DSP core. You will also learn more about the TI software Framework, which supports the ARM, DSP, and ARM+DSP-based processors available from TI. Using application programming interfaces (API's) for I/O (drivers) and the video, imaging, speech, and audio (VISA) algorithms, you can easily access the potential of TI's DSP processors and hardware accelerators within your Linux/ARM programs. This session includes a Linux review, an introduction to TI's Codec Engine along with its VISA classes, and an explanation of the purpose of xDAIS/xDM algorithm interfaces. TI processor options supported by the framework will be discussed, along with an overview of how the Codec Engine supports remote procedure calls (RPCs) from the ARM to the DSP.
OMAP™ Graphics Overview	This session will provide a detailed overview of the programmable 3D graphics core that is coupled with the ARM® Cortex®-A8.
OMAP3 Hands-On Lab ***(Three hour class)***	The OMAP-L137 is a low-power applications processor based on an ARM926EJ-S™ and a TMS320C674x DSP core. The OMAP-L137 supports robust operating systems and features rich user interface and a long life of high performance through the maximum flexibility of a fully integrated mixed-processor solution. This hands-on workshop will provide a detailed technical overview of the device's architecture and will cover supporting hardware and software such as the Linux boot process and Codec Engine/DSPLink functionality.
Track 4 – Microcontrollers	
FRAM: The Future of Embedded Memory for Microcontrollers	Ferroelectric random access memory (FRAM) is the next-generation, low-power, fast nonvolatile-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 nonvolatile-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 sensing, data logging, motor control, and security applications. TI has over nine years of experience with FRAM and has successfully produced large FRAM memory modules of up to 4 Mbytes.
Perpetually Powered Energy-Harvesting Systems Using the MSP430 MCU	Modern ultra-low-power microcontrollers such as the TI MSP430 consume so little energy that batteries aren't necessary even for sampling various sensors or 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 present various methods of energy harvesting, including the use of vibration, solar energy, and heat. Also covered will be tips and tricks to enable an existing application to run from harvested energy.
Delfino™ Floating-Point-Series Overview	The Delfino TMS320F2833x and TMS320C2834x MCUs bring floating-point processing to performance-hungry, real-time control applications. The 150-MHz F2833x devices are the first floating-point devices in the TMS320C2000™ portfolio with up to 512KB of Flash and an on-chip, 12-bit ADC module. The C2834x devices double performance to 300 MHz and include 516KB of high-speed RAM memory. A brief technical overview of the Delfino floating-point families will be presented. Additionally, we will demonstrate how Delfino fits into a variety of applications and will discuss the development tools available to help you get started with your designs.
TMS320C2000™ Digital Power Solutions: AC/DC and DC/DC	Digitally controlled power conversion is providing improved efficiency and performance in today's power-supply and power-conversion designs. This session will introduce TI's latest development solutions, both for AC/DC-rectifier power supplies and DC/DC converters, including power-factor correction (PFC), phase-shifted DC/DC, and highly efficient resonant DC/DC, etc. Basic power-conversion concepts and topologies such as PFC, DC/DC, interleaved PFC and DC/DC, and resonant DC/DC will also be presented. You will learn basic and advanced concepts of digital power conversion 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 I2C. TI also provides an extensive range of over 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.
Track 5 – High Performance Embedded Processing	
Moving to Multicore DSP: Architecture, Benefits, and Tools	Today's performance-hungry applications demand multicore architectures in order to meet performance and density requirements. TI's multicore DSP architectures provide an effective means to meet this challenge without compromising on cost or power. This session will compare the single- and multicore DSP architectures and focus on the benefits of using multicore DSP in specific scenarios. In addition to example communications applications, this session will present examples of critical embedded-processing applications where multicore DSPs are applicable. Development tools for the multicore environment will be addressed, along with some approaches to splitting applications across multiple cores.
DSPs for Femto to Macro Base Stations	There is a new breed of DSPs that has been developed specifically to target the base-station market. This session will focus on TI's DSP solutions for all types of base transceiver stations (BTS)—including femto, pico, and macro—that are used in various wireless protocols such as GSM/EDGE, WCDMA, WiMAX, and LTE). It will also provide an overview of the various software libraries that are available to help jump-start any base-station development.
Tips and Tricks for Increasing Performance with TI's Multicore Embedded Processors	Multicore DSP architectures provide the resources needed to manage today's real-time performance density demands. TI's multicore DSP architectures cost less and use less power and board space than multiple single-core solutions. This session will provide a technical primer for navigating these complex environments. You will learn how to run multiple instances of an application while taking advantage of shared resources. Using development tools for the multicore environment will also be addressed, along with tips for effectively splitting an application across multiple cores.
Understanding Virtualization for TI's TMS320C64x™ Devices	Virtualization technology is reducing the cost of servers in the IT industry and has been extended on TI DSPs for embedded applications. VLX for embedded systems allows Linux and TI DSP/BIOS™ to run on a single core concurrently so the user can implement real-time applications on TI DSP/BIOS and general-purpose applications on VLX Linux. VLX virtualization allows each operating system to run independently of the other and uses its own scheduling, drivers, and memory management without sacrificing real-time performance. This session will present practical tips for using this technology to lower the cost of embedded systems.
Open-Source Software Development for OMAP35x Devices with Beagle Board and Foundation	The Beagle Board is a low-power, low-cost, 3 x 3-inch single-board computer designed with open-source development in mind to demonstrate TI's OMAP3530. In this session you will learn more about the Beagle Board, community resources and the participation process, and open-source software development for TI's OMAP35x devices.
Track 6 – Keys to successful Software Development	
Linux Quick Boot: How to Shorten OS Boot Times to 2 Seconds or Less	One of the most common complaints about Linux in the world of embedded is that it takes too long to boot the processor and get it ready to do something useful. With just a few savvy software tweaks and build options, Linux boot time can be reduced. This session will provide helpful hints on how to get up and going faster.
Linux Development Tutorial on TI Processors	This session will explore the various Linux development options available for TI's embedded processors such as DaVinci™ and OMAP™. Both community and commercial offerings will be discussed, including the benefits of each
Open-Source Software Development for OMAP35x Devices with Beagle Board and Foundation	The Beagle Board is a low-power, low-cost, 3 x 3-inch single-board computer designed with open-source development in mind to demonstrate TI's OMAP3530. In this session you will learn more about the Beagle Board, community resources and the participation process, and open-source software development for TI's OMAP35x devices.
Easing the SOC Software Maze: A Primer to Successful Codec Engine and Framework Implementation with Examples	This session presents a programming model for the Codec Engine framework on DaVinci™ processors and provides an overview of its purpose and features. The framework allows applications developers to greatly reduce time to market for multimedia products that include fully-embedded features by reducing the integration effort required for an xDM-compliant algorithm via TI's Authorized Service Provider network.
Exploring Windows® Embedded CE 6.0	In this session you will learn how to build an OS image using Platform Builder and Visual Studio® 2005. The presentation will also cover some of the unique attributes of the OMAP™ 3 platform as it relates to the DSP and graphics accelerator, all running under Windows CE. Each participant will receive an evaluation copy of Platform Builder with Visual Studio 2005.
Track 7 – Low-Power Wireless	
MSP430 in Low-Power RF Network Solutions	With a flexible peripheral mix and ultra-low-power architecture, the MSP430 is an ideal fit for mobile RF applications such as those supported by TI's Low- Power RF devices. The MSP430 and CCxxxx hardware pairing, software protocols, example applications, and the complete tool chain will be discussed for various markets including industrial (sub-1 GHz), consumer (2.4 GHz), and IEEE 802.15.4/ZigBee®.

Single-chip Wireless System Using the CC430	The CC430 platform is a highly integrated, monolithic SoC based on the industry-leading MSP430 MCU architecture and TI's ultralow-power RF solutions. By making RF designs 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 infrastructures (AMIs); and heat cost allocators.
Creating a Custom Portable SimpliciTI™ Project	Many customers who have evaluated SimpliciTI now want to design their own project using the Stack. This session covers the necessary design files required to build a SimpliciTI application and how to design a board support file that will operate with a custom-designed board and the SimpliciTI minimal RF interface (MRFI) driver layer.
Designing a Typical Master/Slave Network Using SimpliciTI™	In this hands-on session we will use a common template and the SimpliciTI data-hub configuration to build an address-based master/slave network . A wireless RS-485 network will be demonstrated as the target application. Power calculations and data-rate considerations will also be covered.
SimpliciTI™ Network-Coexistence Considerations	This hands-on session uses radio settings, frequency agility, and token exchange to set up a SimpliciTI-based network that can coexist near other SimpliciTI networks. The RS-485 network used in Lab 2 will be modified for multiple network support.
Track 8 – Low-Power Design Considerations	
Protocol Design Considerations for Low-Power RF Systems from Wavetrix ***(Two hour class)***	Proper protocol design for low-power RF systems requires consideration of several unique factors. This session will examine key trade-offs between battery life, message latency/frequency, reliability, range, and compatibility as well as how these factors affect the design of a protocol. An overview of existing wireless protocols (ZigBee ®, *Bluetooth* ™, SimpliciTI™, mesh, custom/proprietary, etc.) is given in the context of these design trade-offs. An example of an IEEE 802.15.4 sensor network based on the CC2420 and the MSP430 is provided to highlight the benefits of protocol customization for a specific set of requirements.
Designing for Ultra-low-Power with MSP430	It is rarely easy to realize a low-power system design when every microampere counts. A designer must have detailed knowledge of the external components and must know whether an MCU will support ultralow power (ULP) requirements. This session gives practical instructions on how to design a ULP application with the MSP430 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 embedded applications.
Understanding the Elements of On-Chip Power	Power requirements of embedded power circuitry can vary widely depending on how the on-chip resources are used. Thus, to obtain an accurate estimate of power consumption for power-supply and thermal analysis, the designer must know what components are in use and the usage patterns for those components. This session provides a detailed discussion of on-chip resources and how they impact overall chip power. Participants will also be provided with an overview of TI's power-estimation spreadsheet.
OMAP™ Power-Management Techniques	The OMAP35x is a high-performance multimedia and applications processor that also introduces a highly flexible combination of power-management features that provide large savings in system power consumption. A unique on-chip power-reset and clock-management architecture enables drastic optimizations of power consumption in the device's full-on and sleep states. This session will present an overview of the OMAP power-management architecture and explain details of the OMAP35x processor's power-saving features such as adaptive voltage scaling (SmartReflex™), dynamic voltage and frequency scaling, standby leakage management, and dynamic power switching. This presentation will also explain how to interface various power-regulator options—from highly integrated power-manager ICs to discrete I²C-programmable switch-mode power supplies (SMPSs)—available from TI's OMAP35x portfolio to meet diverse design requirements.

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