Texas Instruments
Tech Day Minnesota 2009
Session Titles and Abstracts

Track & Course	Abstracts
Track 1 – Portable Power	
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, sensors and the TI MSP430 and CC2500. 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.
Introduction to DC/DC Converter Topologies for Portable Applications	The wide varriety of power management solutions available to the designer keeps growing, particularly in integrated devcies. The simplicity of the integrated converter may raise questions on how to properly test your solution; all of these questions are addressed in this session. After a thorough review of the buck converter, we will explore other power-conversion topologies including: inductive boost, switched capacitor, SEPIC and buck/boost.
Stability, Transient Response, and Noise of Portable DC/DC Converters	Poles, Zeros, and Bode Analysis are all terms associated with stability of a power supply's feedback network. How you incorporate / relate these ideas into your design depends on your choice of topology, current or voltage mode control, and integration level. Some easy 'tricks' exist to distinguish good from poor stability performance.
Thermal Considerations for Surface Mount Parts	A fundamental understanding of heat flow from an integrated circuit, through the printed circuit board (PCB) is key for a robust power design. This session discusses the three dissipation methods of conduction, convection and radiation; as well as provides the equations for calculating heat transfer through thermal vias, PCB internal layers (overlapping and adjacent) and provides examples of how to properly de-rate ICs based on packaging.
Li-Ion Battery Characteristics, Trends and Its' Fuel Gauge and Cell Balance in Multi-Cell Battery Packs	With all the different battery chemistries and constructions, it can be difficult to identify the best choice for your particular design. This session provides an overview of current and future technology trends, including tradeoffs based on current technologies (capacity, voltage, discharge rate and safety). Impedance Track™ fuel gauge will be introduced to accurately predict the battery remaining capacity and time to empty, and cell balance technique will be also discussed to improve the safety in multi-cell applications.

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Track 2 – Low-Power Wireless	
Low-Power RF Basics and Modulation Techniques	This session is an overview of common specifications, technologies, functional blocks and networks for low-power RF sensor and networks.
Improving the Range of Your Low-Power Wireless (LPW) Design	The most common question that comes up in any wireless system is “What is my range going to be?” followed by the next most common question “How can I improve my range?”. This session will go through some of the ways that you can answer both of these difficult questions.
Adapting TI LPW Reference Designs	A fast way to implement a low-power wireless design is to duplicate a TI reference design on your own board. This seesion will discuss some of the common pitfalls in the board layout that can be avoided. We'll discuss the do's and don'ts of transferring the reference design to your own PCB.
Wireless Medical Applications – Removing Wires from Patient Sensors	This session will give an overview of medical wireless technologies. Focusing on body area network, ultra-low-power wireless transceivers and power consumption considerations.
Antennae Fundamentals for Low-Power Wireless Designs	Antenna design is often the most complicated section of a wireless design. This session will help designers understand different types of antennas, reference designs, and tradeoffs that can be made when porting the TI reference designs to a new PCB layout.

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Track 3 – System Power Supply Solutions	
Illuminating Facts About High-Power LEDs, Both Visible and Invisible	Multiple topics about LEDs and solid state semiconductor devices will be discussed including the human vision influences and optical treatments of these high-power semiconductors . LEDs have a very steep brightness roadmap which will be highlighted along with the invisible aspects of LEDs. OSRAM is a leader in Illumination Visualization and Sensing and this session will introduce the audience to many application and key LED products attributes that can be applied across a vast array of applications and industries
Designing Power Drivers for Solid State Lighting (LEDs)	Advancements in solid state lighting (SSL) provide many interesting opportunities for engineers to design evolutionally and revolutionary differentiated products. A major part of fully utilizing SSL advantages is designing an appropriate power driver design. This session will cover lessons learned from TI power engineers who have solved various SSL driver issues. We will cover AC/DC and DC/DC topologies and ICs for low, mid and high-power SSL applications. Plus we will give real-world schematic examples of how to tackle SSL challenges.
Introduction to Digital Power	Digitally controlled power conversion is the enabling force of efficiency and performance improvement in today's power-supply and power-conversion designs. TI's 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, etc. 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 be informed of basic and advanced digitalpower conversion concepts and TI's digital power solutions.
Choose Your Weapon – Selecting an Optimal MOSFET	Ever spent hours selecting MOSFETs, calculating losses and comparing multiple possible devices only to be left wondering if you've selected the "best" MOSFET? Ever wish there was a way to quickly evaluate and compare a dozen MOSFETs relative losses in your application? There is. Here, we will discuss MOSFET switching characteristics, loss factors and key parameters, then justify and present a new method developed at TI for rapidly comparing and selecting a loss optimized MOSFET from a list of possible candidates. Generalized equations and specific synchronous buck controller equations will also be presented.
Noise: Spread it Around	A downside to all the many benefits of SMPS power conversion has always been the potential for noise generation from the high dv/dt and di/dt of the power pulses. When 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 topic explores the modulation techniques, models the behavior in SPICE, and examines real-world behavior in two practical examples.

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Track 4 – Signal-Chain Solutions	
Circuit 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.
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 with TINA simulation and bench tests a stable system can be realized.
Sensors and the Analog Interface	In this presentation we will discuss the way 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. Throughout this presentation, the output of every sensor circuit will be suitable for a conversion to a digital signal. You will leave this session fully armed to tackle your on-board or remote-sensor challenges.
Circuit Sensitivity with Emphasis on Analog Filters	In analog applications, much of what is done in the analog domain is amplification and filtering. There are often conflicting requirements for low cost and precision in these circuits forcing the design engineer to make some difficult trade-offs. A good understanding of circuit sensitivity can provide a means to make these trade-offs easier allowing the designer to provide greater performance within an allowable budget.
Approaches to Multichannel, High-Resolution Data Acquisition	Data acquisition systems that require high resolution typically employ delta-sigma analog-to-digital converters. This architecture of converter has traditionally presented some challenges when used in multichannel systems; for example, multiplexer timing must be carefully considered to comprehend latency through the converter digital filter. In some cases, this led designers to using a converter-per-channel approach, which brings with it challenges in synchronization, especially if simultaneous sampling is required. Recent developments in integrated solutions make tradeoffs such as these easier. This presentation will examine these issues and tradeoffs in light of these new solutions, and suggest applications where different approaches may optimize the overall system performance.

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Track 5 – Innovations in Embedded Processing	
FRAM: The Future of Embedded Memory for Microcontrollers	FRAM (Ferroelectric Random Access Memory) 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. TI has over nine years of experience with FRAM and has successfully produced large FRAM memory modules up to 4 MB.
Understanding 32-Bit MCU Peripherals Advanced Capability in Embedded Systems Using the Piccolo™ MCU ControlSTICK	This session will provide an overview of the Piccolo MCU C28x™ core and a deep dive into the functionality and benefits offered in its feature-rich peripheral set optimized for real-time control applications. Attendees will gain insight into the onboard ADC, ePWM, HiResPWM, analog comparator and more. Sample projects include generation of an asymmetric PWM output with period and duty variation, triggered ADC conversion using an onboard filtered PWM output, use of comparators to generate a CPU interrupt on a cycle-by-cycle basis and more. Attendees will leave with a comprehensive understanding of the performance and capability offered in the Piccolo MCU series of devices.
Introduction to Targeted Code Generation for TMS320C2000™ MCUs *by The MathWorks*	In this session, The MathWorks engineers will show how to develop power conversion applications for TI C2000™ microcontrollers using MATLAB, Simulink, and Target Support Package™ TC2. The steps illustrated in this presentation, depicted as incremental model refinements, suggest an example workflow for designing and implementing a DC to DC buck converter application on an embedded platform. This presentation highlights advanced processor-specific capabilities of Target Support Package TC2.
Digital Motion Control System Design – From the Ground Up *by D3 Engineering*	D3 Engineering staff will present a design outline and demonstrate working hardware for a 400-W PMSM controller. Topics covered include processor selection, isolation, interfaces (USB, CAN, RS-232) and driver electronics (power module vs. discrete FETs). The design is controlled through a TI F2806 DSP. D3 will demonstrate how to create a project for a custom board with MATLAB real-time workshop tools. The demos will include both sensored and sensorless control algorithms.
Energy Harvesting for No-Power Embedded Systems	Modern ultra-low-power microcontrollers such as the TI MSP430 consume so little energy that batteries aren't necessary even while sampling various sensors and communicating wirelessly. By properly managing low-power modes and adjusting your activity profile, scavenging energy from the environment enables infinite system uptime without the need for a battery. The various methods of energy harvesting will be discussed including vibration, solar and heat and the tips and tricks to enable an existing application to run from harvested energy.

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Track 6 – Innovations in Application Processors	
Linux Development Tutorial on TI Processors	This presentation 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.
OMAP 3 Graphics Overview	This presentation will provide a detailed overview of the programmable 3D graphics core that is coupled with the ARM Cortex™ A8.
Gaining an Edge in Developing IP Multimedia Devices *by Trinity Convergence*	Whether it's for consumer products, medical devices or industrial equipment, creating a compelling user experience is critical for success in today's electronics market. Embedded software engineers understand that designing a graphical user interface (GUI); supporting multimedia features and functionality; or enabling real-time voice and video communications in next-generation products can require significant resources. This session looks at software development solutions and strategies for streamlining the design and integration of these capabilities in DaVinci and OMAP technologies. The session will include discussion of performance capabilities, key design considerations, and the third party embedded software tools available to ensure fast time-to-market for OEMs.
Using the Zoom™ OMAP34x-II MDP as a Building Block for Your Embedded Design *by Logic*	Join us as we tear down the Zoom OMAP34x-II Mobile Development Platform (MDP) highlighting our integration of the OMAP™ 3 processor, 802.11 wireless, GPS, and full QWERTY keypad. Logic will discuss how these building blocks could be used in your design. In addition, we will show how the product-ready OMAP35x system on module can help you accelerate your time-to-market.
Exploring Windows Embedded CE 6.0 *by BSQUARE*	In this session, attendees 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 attendee will receive an evaluation copy of Platform Builder with Visual Studio 2005.

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