



## Technology Day Chicago – April 5, 2011

Time	Session	Track 1 Power	Track 2 Signal Chain	Track 3 Wireless Connectivity	Track 4 Motor Control	Track 5 Embedded Processors
8:30 - 9:00	<b>Registration</b>					
9:00 - 10:00	1	Wireless Power: Total Solution for Charging Using the Wireless Power Consortium Standard	Clocking to Maximize High-Speed Signal-Chain Performance	RF Basics, Tools and Getting Started	From Model to Motion <i>by D3</i>	Making USB Design Simple with MSP430™ MCUs
10:00 - 10:15	<b>Break</b>					
10:15 - 11:15	2	Designing Wide-Input-Voltage (Up to 60 V), High-Current, Non-Isolated DC/DC Converters	Using Fully Differential Op Amps to Signal-Condition High-Voltage Signals to Drive ADCs	Texas Instruments Wireless Products and What Works Best for Your Design	MCU Rapid Application Development with Model-Based Programming <i>by VisSim</i>	The Art of Adding Wired Network Support to Your Embedded System
11:15 - 12:30	<b>Lunch</b>					
12:30 - 1:30	3	High-Switching Frequency Barriers to Wide-Input-Voltage (Up to 60 V) DC/DC Converters	FilterPro™ Software 3: Designing Active Filters	Range Considerations for RF Networks	Science and Art of Your Bipolar Microstepper Driver	Linux Application Debugging with Code Composer Studio™ Software
1:30 - 1:45	<b>Break</b>					
1:45 - 2:45	4	Utilizing DC/DC Converters with High-Speed Data Converters	Digital Isolation Techniques and Implementations	Fundamentals of Antennae Design <i>by LSR</i>	Analog Motor Drivers: Steppers, Microsteppers and DC Motors	Adding <i>Bluetooth®</i> to MCU-Based Systems
2:45 - 3:00	<b>Break</b>					
3:00 - 4:00	5	Power Supply Layout Considerations	Op Amp Stability Analysis	Energy Harvesting, Wireless Charging and Zero-Power Devices <i>by Cymbet</i>	Designing Motor Controls <i>by D3</i>	Jumpstart Your Digital Media Development with New TI Software Development Kits

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# Texas Instruments

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### Session Titles and Abstracts

Track and Course	Abstracts
<b>Track 1 – Power</b>	
Wireless Power: Total Solution for Charging Using the Wireless Power Consortium Standard	TI has launched its first wireless power solution for the mass market, the bqTESLA100LP solution. This Qi-compatible kit includes both the transmit and receive ICs plus design to take a Wireless Power Consortium-based solution to market today. We will discuss the basics of wireless power, the Wireless Power Consortium and the TI devices that make up our first-generation solution in this session.
Designing Wide-Input-Voltage (Up to 60 V), High-Current, Non-Isolated DC/DC Converters	Designing wide-input (up to 60 V) non-isolated DC/DC converters for high amperage applications (up to 20 A) creates some unique design challenges. This session will present these challenges and circuit solutions to overcome them. This application has been traditionally solved using expensive isolated bricks. Examples of circuit layout considerations and component selection will be provided. The solution for this discussion will be based around the TPS40170, a 4.5-V- to 60-V-input synchronous PWM buck controller.
High-Switching Frequency Barriers to Wide-Input-Voltage (Up to 60 V) DC/DC Converters	A DC/DC converter switching at 1 or 2 MHz sounds like a great idea, but there is more to understand about the impact to the power supply system than size and efficiency. Several design examples will be shown revealing benefits and obstacles when switching at faster frequencies. This session will revolve around the TPS54160, which is a switching converter with integrated FETs at up to a 60-V input voltage range.
Utilizing DC/DC Converters with High-Speed Data Converters	Customers continually demand lower power consumption from our high-speed ADCs. The power efficiency in their system is usually not so good because the standard, proven method is to power an ADC with an LDO. In the past, this was necessary to ensure best performance; however this configuration comes at the cost of a lot of wasted power. Advances in ADC design and process technology, along with improved DC/DC converter design, allow designers to eliminate the LDO and power the high-speed ADC directly from a switching regulator without sacrificing performance. This lecture will compare traditional LDO power supplies against new DC/DC versions for our ADS548x, ADS61xx and ADS41xx converters.
Power Supply Layout Considerations	This topic will address methods for keeping circuit parasitic components from degrading the operation of your designs. Techniques to minimize the impact of parasitic inductance and capacitance of filter components and PWB traces will be discussed, together with a description of the impact that PWB trace resistance can have on power supply regulation and current capacity. A general overview of thermal design is also included as well as sample temperature rise calculations in a natural and forced-air environment. Finally, some practical examples of power stage and control IC layouts are reviewed.
<b>Track 2 – Signal Chain</b>	
Clocking to Maximize High-Speed Signal-Chain Performance	Selecting a clock driver for a high performance sampling system involving high-speed data converters is a hard task and often underestimated. The designer must first understand the fundamentals of the analog to digital converter to design a clock solution that does not degrade performance of the entire signal chain. Clocking solutions range from simple fan-out buffers to sophisticated clock generators with the ability to control output frequencies, shape noise, and control skew. As the input bandwidth of the ADC increases, the keystone of overall system performance can rely heavily on the jitter performance of the clock. This is particularly true for SNR and SRDR. This presentation will address sampling clock dependencies on the ADC performance metrics (namely SNR and SFDR), explain methods to calculate required sampling clock jitter, introduce TI high performance synthesizers/jitter cleaners and show demonstrations of achieving best possible SNR (and SFDR) with such cost effective yet high performance clocking devices.
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. Performing circuit analysis will aid understanding of the key design points, and a design methodology will be 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 an 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.
FilterPro™ Software 3: Designing Active Filters	Active filters are commonly applied in ADC anti-aliasing and DAC anti-imaging applications and directly in the analog signal path to condition signals. FilterPro™ software has been in use for two decades and is a favorite, easy-to-use tool for synthesizing these filters. As time has passed, FilterPro software has been updated to include additional responses; however, these changes were add-ons to the original program that limited their usefulness. Now, FilterPro software has been completely rebuilt from the ground up, featuring a new math engine and software that provides for additional filter features/responses and a modern GUI look. This session will look at FilterPro software 3's new features and capabilities using practical filter examples. Some filter basics will be included for those who are less familiar with filter characteristics.



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Digital Isolation Techniques and Implementations	Multiple options are now available to electronics designers to implement galvanic isolation. Apart from choosing between capacitive, optical and inductive/magnetic isolation technologies, 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	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-TI™ software simulation and bench tests, a stable system can be realized.
<b>Track 3 – Wireless Connectivity</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 designers 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.
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 <i>Bluetooth</i> ® and ZigBee to proprietary radio hardware. How the standards fit into 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 6LoWPan, <i>Bluetooth</i> ®, Bluetooth low energy, ZigBee, ANT, WiLAN, RF4CE, Simplicii™ software, RFID and proprietary solutions. Also talked about will be what modules are available for evaluation and design support.
Range Considerations for RF Networks	This course will cover the theories behind antennas and RF range and discuss what occurs when line of sight is not an option. Antenna types and sizes will be compared, as well as when elements in near field (plastic enclosures) and far field (a wall) are introduced into a system. Finally, these considerations will be applied to a link budget example.
Fundamentals of Antennae Design by LSR	Antenna design is one of the most intimidating and important parts of any RF design. It is critical to understand the key factors involved when choosing an antenna topology, as well as what tools are needed for design, simulation and characterization. Designs must account for the effects of the enclosure material, the available space, the required radiation patterns, EMC compliance rules and regulations. This presentation discusses the fundamentals of antenna design for short-range devices, as well as the trade-offs between size, cost and performance. An antenna that is properly designed and optimized will enhance the overall performance of any radio.
Energy Harvesting, Wireless Charging and Zero-Power Devices <i>by Cymbet</i>	New techniques and technologies are now available to create self-powered devices by harvesting ambient energy. Actual energy harvesting (EH)-based designs will be reviewed that use photovoltaic, piezoelectric, thermoelectric and electromagnetic EH transducers. New technologies in the areas of ultra-low-power MSP430™ MCUs, CC430 combined MCU/integrated radios, wireless charging and communications using the TI passive low frequency interface (PaLFI) device, energy processors, solid-state batteries, and solar energy harvesting for the TI MSP430 LaunchPad kit will be detailed. The last portion of this session will include hands-on lab demos of various EH implementations.
<b>Track 4 – Motor Control</b>	
From Model to Motion <i>by D3</i>	As you move to more advanced controls and larger power stages, the need for modeling and simulating the system becomes more important. This session explores not only the concept of system modeling, but the capability to test that model in the hardware loop and deploy the tested model with automatic code generation.
MCU Rapid Application Development with Model-Based Programming <i>by VisSim</i>	Attendees will learn how to develop efficient digital control applications using the VisSim/Embedded Controls Developer. Topics covered include intro to VisSim programming, clock and timer configurations, peripherals access (PWM, GPIO, ADC, SCI, I <sup>2</sup> C, SPI), interrupt handling, thread priority, and timing. High-level blocks for motor control, digital power and PID will be reviewed.
Science and Art of Your Bipolar Microstepper Driver	This session takes a careful view of all the "steps" needed to take a single stepper motor step into multiple microsteps and how you can take advantage of full integration into a single device. We will explore what makes a stepper tick and how we can improve motion profiles in order to minimize dreadful resonance and vibration, followed by techniques on how to connect different stepper topologies and how to route the PCB layout.
Analog Motor Drivers: Steppers, Microsteppers and DC Motors	This session will walk through TI's solutions for motor drivers, which are all-inclusive to the DRV8xxx product family. Solutions will be provided for several stepper motor examples such as microstepping, driving two stepper motors from a single driver, dual H-bridge driver with microstepping indexer, and motor driver control through a serial interface. Many other features will be discussed, such as PWM current control, programmable decay modes and all the protection features that a motor driver should have. Coming out of this session, you will fully understand what TI products fit your application best.



# Texas Instruments Technology Day Chicago – April 5 Session Titles and Abstracts

Track and Course	Abstracts
Designing Motor Controls by D3	This session will explore the process of designing a low-voltage motor and motion control system, including analog motor drivers, microcontrollers, hardware reference designs, modular software libraries, debugging tips, and creating GUIs for interface and instrumentation.
<b>Track 5 – Embedded Processors</b>	
Making USB Design Simple with MSP430™ MCUs	Modern MSP430™ MCUs have integrated USB peripherals allowing easy connection to a PC or mobile host. This course begins with an overview of the MSP430 microcontroller's USB module, followed by a discussion of the tools TI provides to make USB design simple. This includes a robust API for the most common device classes, a utility that instantly configures the API according to your needs, and a turnkey Visual Studio application for the creation of customer-ready firmware update packages. Minimize the USB learning curve by basing your design on MSP430 microcontrollers.
The Art of Adding Wired Network Support to Your Embedded System	This session will provide an overview of major areas within an embedded system that must be considered when attempting to support a wired or wireless network. The presentation will include both hardware and software aspects of the design challenge and will be primarily focused on Ethernet and CAN networks. Each aspect will include discussions regarding design goals, challenges and proposed solutions, along with explanations about how TI's Stellaris® offerings can help address these successfully within an embedded system.
Linux Application Debugging with Code Composer Studio™ Software	Learn how to develop and debug Linux applications using the Code Composer Studio™ IDE v5. Many customers of Sitara™, Integra™ and DaVinci™ devices spend much of their time developing Linux applications. In this session, you will learn how Code Composer Studio software can be used for both kernel-level debugging as well as application debugging.
Adding Bluetooth® to MCU-Based Systems	Quickly and easily add Bluetooth® technology to systems using MCUs like Stellaris® or MSP430™ processors. In this session, we will start with a detailed overview of the CC2560-PAN1325 Bluetooth® v2.1+EDR transceiver and then go into the details of the platform. The platform provides complete system integration of all components including Bluetooth® hardware (CC2560-PAN1325), host hardware (Stellaris or MSP430 processor), firmware, low-level drivers, Bluetooth® stack, profiles, RTOS and sample source applications using APIs. We will demonstrate how to establish a Bluetooth® connection by showing a sample application running on a Stellaris LM3S9B96 kit. We will also cover the MSP430-based Bluetooth® platform.
Jumpstart Your Digital Media Development with New TI Software Development Kits	This 60-minute session will provide an overview of TI's latest SDKs featuring the Matrix user interface for intuitive setup and navigation among applications. A networked video application will be created on the DM3730 evaluation module using the included Linux board support package, codecs and industry-standard frameworks such as GStreamer and Qt. The application will take full advantage of the DM3730's ARM® Cortex™-A8, high-definition video accelerator and the PowerVR 3-D graphics accelerator. Procedures for integrating your own codec as well as adding Wi-Fi and Bluetooth® support will also be highlighted. From this session, attendees should leave with a good understanding of TI's latest SDKs and how they can be used to quickly develop advanced networked video applications with sophisticated user interfaces.

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