TI Tech Day–Chicago

Analog Design Seminars and Technology Abstracts

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Technical Design courses in the following areas:
- **Track 1 – Power Supply Design Seminar – SEM1700**
- **Track 2 – Embedded Processing Solutions**
- **Track 3 – High Performance Analog**
- **Track 4 – Low Power RF and ZigBee™ Design Techniques**
- **Track 5 – Audio Solutions**

Descriptions of each track's session are on the following pages or click the track you wish to review.

- **Register for FREE**
- **Reception to follow**
- **Time with TI experts**
- **Presentation materials**
- **Demos available**
- **Build your own agenda**

TI Tech Day Analog Design Seminar

Track 1 – Power Supply Design – SEM1700

Improving Power Supply Efficiency and Green-Mode Power by the Milli-Watt

- This topic addresses the heightened importance of power-supply energy efficiency by describing the drivers coming from both voluntary market incentives as well as the increasing enactment of governmental regulation. A review of power losses and design techniques for minimizing them will also be presented.
- A multiple-mode flyback converter is described as the solution for high efficiency over a wide load range plus having low-idle state power. The converter is controlled in quasi-resonant, discontinuous conduction, frequency foldback, and green modes in order to enhance efficiency from full-load to no-load. This topic includes text techniques and performance verification.

An Interleaved PFC Preregulator for High-Power Converters AND New Power Supply Components from Texas Instruments.

- To fully utilize the line power in higher power applications, power factor correction (PFC) is typically required. At first, this was done with bulky passive solutions. Next, active solutions were used to increase power densities. Further increases in power density can be gained through interleaving PFC boost stages. This topic will quantitatively illustrate how interleaving can further reduce EMI filter and boost inductor volume.
- A brief introduction of recently released TI products that will further enhance the possibilities in power supply design will be discussed.

Designing Planar Magnetics

- Planar magnetic structures offer many advantages for transformers and inductors. AC current flow patterns and leakage inductance values are determined by the magnetic field. To achieve an optimized design, understanding magnetic field behavior is essential.

Digital Power: Software Design AND Designing a Digital Telecom Rectifier

- CPU based Digital Power supply controllers can perform multiple tasks with a single processor or "executable" resource, which can be shared amongst several independent and often unrelated tasks, e.g. software control loops, diagnostics, fault monitoring, etc. Resource sharing is possible in time-sampled systems via Time Division Multiplexing (TDM). Designing software to take advantage of TDM for a fully digital controlled power supply can be a challenge, but by understanding some key principles and following appropriate guidelines this job can be greatly simplified, resulting in well structured and efficient software.
- The design of a 1000-W universal AC input to 48-VDC output power supply consisting of an interleaved Power Factor Correction (PFC) stage and a phase shifted full bridge (PSFB) DC/DC converter is described. The design steps leading to the development of the control effort for the DSP are outlined and compared to the equivalent steps for an analog design.

Feedback in the Fast Lane – Modeling Current-Mode Control in High-Frequency Converters

- Small-signal analysis of current-mode control has guided power supply designers for nearly thirty years. As switching frequencies increase to the megahertz range, circuit component characteristics begin to affect feedback loop response creating discrepancies between measured and predicted results. This paper re-examines a small-signal control model, and discusses circuit parameter effects on feedback loop performance.

Track 2 – Embedded Processing Solutions

The Evolution of the Microcontroller. "What is the Ideal MCU for Innovation in Today's Systems?"

- For years, microcontrollers and DSPs have served completely separate application requirements. The differences between the two types of products have historically been rather obvious. Today, control system developers face numerous challenges as they pursue the development of products that demand increasing levels of innovation. The challenges facing today's control system developer and the solution for addressing those challenges are explored in the presentation.

Differentiating the TI ARM7® Microcontroller Family.

- ARM7 is an industry standard now for embedded applications. This session will discuss what sets TI's ARM7 architecture apart from our competitors. This session is tutorial in nature, so participants can learn the unique ways TI's ARM7 peripheral set can be used in industrial applications.

Low-Power MCU Design Considerations.

- In low-power designs, it's not just about picking a low-power MCU in order to extend the battery life and run time of your system. This presentation discusses some often overlooked aspects of your design such as power component selection, power architecture, and code optimization, which all affect the total power consumption of the processor. Examples using the MSP430 low-power microcontroller will be provided.

High-Speed Interface Challenges.

- The next generation of system architectures will likely fuse multiple technologies: high-speed analog/signal chain, FPGA, memory. This session will review trade offs and pitfalls of high-speed interconnectivity schemes through reusable standardized inter-processor communications schemes.

Research Presentation in Practical Applications of Adaptive Filtering.

- Local universities such as Northern Illinois University are developing students with skills in digital signal processing. Areas such as Adaptive Filtering have long been used in the industrial, telecom and wireless industry. This session features new areas of research work being done in NIU's CEET graduate studies program relating to Adaptive Filtering.

Track 3 – High Performance Analog

Battery Technology for Portable Applications

- Understanding battery characteristics and performance is a fundamental aspect of portable product design. This session will illustrate the performance tradeoffs and selection criteria for common battery technologies used in hand-held applications (Li-Ion, NiMH, NiCd and single-use Alkaline). The electronic design aspects associated with battery charging, safety, and capacity monitoring will be explored, and practical solutions to common design problems will be addressed.

Practical Techniques for Thermal Management in Portable Products

- The design of any power conversion circuit requires that some attention be given to the thermal aspects of the design. Traditional methods of thermal management (such as heat sinks, ventilation, cooling fans, etc.) are not generally applicable to the design of handheld products. The primary method used to transfer heat away and keep the silicon cool is the design of the PC board itself. This topic explains some of the basic methods of analyzing power dissipation capability of a given PCB design, and offers suggestions for optimizing layouts to improve thermal relief capability.

Small Signal Amps and Power Op Amp Crossover Distortion

- This section will explain what crossover distortion is and what causes it in signal and power amplifiers. Will also discuss how to recognize it, how to reduce it, and how to live with it. Will then see what consequence it has to output signal wave shape, total harmonic distortion, and harmonic spurs. Also see the consequence it has in specific applications such as dc power supplies, ac power signal sources, audio amplifiers, and servo loops. Crossover distortion does not always occur at zero voltage crossing, for reactive loads it is when current equals zero.

EMI and RFI – Board and System Level

- This session discusses typical specifications and tests that companies must comply with for EMI/RFI testing and will also talk about EMI/RFI definitions. Practical tips and rules-of-thumb for good EMI/RFI design.

CDAC SAR Op Amp + Filter Selection

- Detailed analysis behind an analytical approach to choosing op amp and RC filter for driving a CDAC-SAR data converter

Track 4 – Low Power RF and ZigBee™ Design Techniques

Introduction to RF Basics

- What is low-power wireless?; RF basics; frequency spectrum allocation and government regulations; frequency hopping strategies such as FHSS, DSSS; bandwidth considerations.

RF Circuit Design

- Design best practices; transmission lines and power planes; impedance matching; design trade-offs; noise and power considerations; designing with external power amplifiers; design for manufacturing.

Low-Power RF Design Consideration

- Frequency band trade-offs; power consumption minimization; design techniques and trade-offs; power design pitfalls; system level implications; application examples.

ZigBee™ Overview and Design Considerations

- ZigBee™ basics; ZigBee™ vs proprietary considerations; h/w design requirements; s/w considerations; location engine; network topologies; stack and application profiles; application design process.

Application Demos

- Live demos will be presented and shown of various LPW applications, including a ZigBee™ Mesh Network.

Track 5 – Audio Solutions

Class-D PCB Layout and Filtering for EMC

- EMC reduction can be achieved with Class-D amplifiers using appropriate PCB layout and filtering techniques and components. These techniques and components are not generally well understood, so the subject is often considered "black magic". It is helpful to understand how EMI is produced, through propagation of RF currents in PCB traces and cables that function as radiating antennas. It is also helpful to understand limitations of potential filter components and of PCB traces, including parasitic elements and inherent inductances. With knowledge of these factors it is possible to design PCBs and EMI filters with sufficient accuracy to avoid lengthy tests of designs that cannot succeed. The necessary basic knowledge, provided in this presentation, makes EMC with Class-D amplifiers comprehensible.

Minimizing Output Noise of a Class-D amp with a DAC Source

- The high efficiency of Class-D amplifiers makes them ideal for applications in which power must be conserved. Their switching action, though, makes them susceptible to increased audio-band noise when their input is an audio source with wide-band noise like a DAC. The noise increase that results from Class-D modulation of out-of-band noise components into the audio range can be very audible. Fortunately the solution is as simple as an RC low-pass filter. This presentation describes the way the noise increase is generated and the easy elimination of it with a simple passive filter.

Design Using Codec with Integrated PLL and Digital Microphone

- With portable devices integrating many features into a single form factor, sometimes more than one audio serial data bus is present in a system. An example is a portable system that would contain both a multimedia processor and telephony processor. This requires that two DACs be used to decode the data since the buses cannot multiplex onto the same lines. The TLV320AIC33 CODEC provides that capability for an additional audio serial data bus for applications that would normally require a second DAC. The usage of microphones for voice and noise canceling in cellphones can require careful planning of board layout and circuits to prevent noise problems. Digital microphones help to reduce the susceptibility of the microphone output to noise and allow for more flexible designs. However, the digital microphones require digital circuitry to operate properly that is not cost effective. The integration of digital microphone function into the TLV320AIC33 CODEC will be discussed.

SMPS Design for Digital/Class-D Amplifiers

- Power ratings, Voltage ratings, PSRR and kSVR, current ratings, EMI

MPEG-4-HE-AAC, Spatial Audio, Ultra-Low Delay Audio: Latest Fraunhofer Audio Coding Technology for TI DSPs

- State-of-the-art audio CODECs such as MPEG-4 Advanced Audio Coding (AAC) and MPEG Layer-3 (MP3) have become key technologies for high-quality transmission and storage of music and speech in recent years. This track will give an introduction into the technical background of modern audio coding and explain the features and capabilities of the widely used MPEG audio CODEDCs: AAC,MP3 and ,the new MPEG-4 High efficiency AAC.

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