Portable Power Design Seminar
- Abstracts -

TEXAS INSTRUMENTS

Agenda

08:15 – 09:00   Registration
09:00 – 09:15   Opening/Introduction
09:15 – 10:15   Topic 1: Battery Characteristics, Safety, Cell Balancing and Cell-based Thermal Sensing
10:15 – 10:55   Topic 2: Design Challenges & Solutions of a System-side Fuel Gauge for Handheld Devices
10:55 – 11:20   Coffee break / demos
11:20 – 12:00   Topic 3: 3MHz Synchronous Switching Charger with USB On-The-Go (OTG) Capability
12:00 – 13:20   Lunch
13:20 – 13:55   Topic 4: Optimizing High Frequency Synchronous Switching Buck Converter Performance
13:55 – 14:40   Topic 5: Optimizing Power-Save Mode Performance in Low-Power Synchronous Buck Converters
14:40 – 15:20   Topic 6: Designing LED Backlight Drivers for Media Form Factor Displays
15:20 – 15:50   Coffee break / demos
15:50 – 16:25   Topic 7: Minimizing High-Frequency Noise from Switch-Mode Power Supplies
16:25 – 17:10   Topic 8: New Portable Power Management Products and Development Trends
17:10 – 17:30   Q&A/Closing

Topic 1
09:15 – 10:15

Battery Characteristics, Safety, Cell Balancing and Cell-based Thermal Sensing
Authors: Simon (Sihua) Wen and Doug Williams

The Lithium Ion (Li-Ion) battery has gained great popularity in recent years as the market for battery powered portable devices grows rapidly. It has 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 paper aims to discuss the characteristics and safety of rechargeable batteries, and emerging battery chemistries such as $LiFePO_4$ and $LiMn_2O_4$ batteries. It will also present design considerations on connecting the battery cells in parallel or in series in applications. New trends toward designing safer battery solutions and longer battery life, such as advanced cell balancing technologies and cell-based thermal monitoring, will be discussed.

Topic 2
10:15 – 10:55

Design Challenges and Solutions of a System-side Fuel Gauge for Handheld Devices
Authors: Yevgen Barsukov and Michael Vega

The system-side fuel gauge can reduce the end users total cost for buying a replacement battery pack when the original battery life has expired. This article discusses how to extend the range of systems with imbedded gauging while satisfying increased accuracy requirements of modern hand-held devices and improving battery run-time. System-side battery management system advantages and design challenges including detection of the battery's initial capacity upon insertion, co-operation with battery charging system, and minimizing power consumption are analyzed in detail. Applicability of different capacity gauging methods to system-side gauging is reviewed. Use of battery state of health (SOH) information based on actual impedance and capacity measurements for improving the indication of the battery degradation is discussed.

Topic 3
11:20 – 12:00

3MHz Synchronous Switching Charger with USB On-The-Go (OTG) Capability
Authors: Mao Ye and Jinrong Qian

Charging a single cell Lithium-Ion (Li-Ion) battery through a Universal Serial Bus (USB) interface has become very popular in portable devices. With high-power demand, small size requirements and better thermal management, battery powered portable devices have to efficiently and fully use the power available from the power source like USB or adapter to safely charge the battery fast and improve the system thermal performance. How to charge a battery fast with a limited power available from a USB port has challenged the system designers. This paper will present a 3MHz synchronous switching battery charger with integrated MOSFET for minimizing the inductor size and discuss the design challenges. It can reduce the battery charging time by over 10 percent compared with a linear charger. In addition, how to communicate between the mobile devices becomes another challenge for supporting USB On-The-Go (OTG), which requires a boost converter for generating a 5V from a Li-Ion battery. This article addresses how to achieve and optimize the bidirectional DC-DC converter as a battery charger and a boost converter. A design example and test results are provided as well.

Topic 4
13:20 – 13:55

Optimizing High Frequency Synchronous Switching Buck Converter Performance
Authors: Michael Day and Bill Johns

With all converters, the performance of the IC is only as good as the external components around it. The external components, including the inductors and capacitors, have a large influence on the performance. If the recommended components from the data sheet are used, 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 paper covers the key design points for external component selection and helps the designer understand the tradeoffs associated with changing the external components in their high frequency, integrated power supply. This understanding is especially critical when working with high frequency power supplies. This paper provides measured data to show the affects of changing external components in the power supply.

Topic 5
13:55 – 14:40

Optimizing Power-Save Mode Performance in Low-Power Synchronous Buck Converters
Authors: Markus Matzberger and Christophe Vaucourt

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.

Topic 6
14:40 – 15:20

Designing LED Backlight Drivers for Media Form Factor Displays
Authors: Xianghao Meng and Jeff Falin

White Light Emitted Diodes (WLEDs) have long been the choice for backlighting small LCD displays, such as those used in mobile phones. With continuing performance improvements and cost reductions, LEDs have quickly moved into larger media form factor (MFF) displays, replacing Cold Cathode Florescent Lamps (CCFL) for LCD back (edge or side)-lighting. MFF displays up to 19" may require up to 100 LEDs for proper backlighting. Determining whether these LEDs should be configured in series or parallel requires collaboration between both the panel maker and the LED backlight driver manufacturer. In addition, how to implement dimming is critical design decision where power efficiency, display quality, and cost all need to be analyzed and compromised. This article provides guidance on how to choose the best WLED backlight solution, from LED configurations to dimming methods.

Topic 7
15:50 – 16:25

Minimizing High-Frequency Noise from Switch-Mode Power Supplies
Author: Scot Lester

With high efficiency, small size, and ease of use, switching 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 switching power supply may produce conducted or radiated noise that interferes with surrounding circuits. This topic discusses sources of high frequency noise, common system-level noise problems, and methods to reduce high-frequency noise in switching power supplies.

Topic 8
16:25 – 17:10

New Portable Power Management Products and Development Trends
No abstract available for this session.