Design Article Archive

Abstracts of articles published in the September through December 2009 issues

September 2009:

Switching-Regulator Insights: Achieving Longer Battery Life in DSP Systems

by Sridhar Gurram, Oliver Brennan, and Tim Wilkerson, Analog Devices, San Jose, Calif.

Abstract: Battery-powered systems such as MP3 players typically employ an embedded digital signal processor (DSP) to achieve maximum processing power when handling multimedia applications. Battery life is of prime importance in these products, so the efficiency of the power system is critical. But so are good voltage regulation and fast transient response. In this feature, the authors discuss a switching regulator architecture designed to meet all three objectives.

Notes: 9 figures. Read the full story...

A Simpler Way to Dim Fluorescent Lamps

by Tom Ribarich, International Rectifier, El Segundo, Calif.

Abstract: Electronic ballasts require a control interface for the user to set the desired brightness level of fluorescent lamps. Existing interface circuits require additional wiring to each ballast during installation, a special lamp socket or wall dimmer, or an additional signal processing unit. In this feature, the author describes the operation and application of a new dimming ballast control chip that eliminates the need for any additional components by sensing the on/off switching of the ac mains voltage and cycling through the dimming range in four steps, allowing a lamp to be dimmed with any standard on/off switch.

Notes: 7 figures. Read the full story...

Frequency Dithering: A Tool For Overcoming Last-Minute EMC Hurdles

by Bob Bell and Ajay Hari, National Semiconductor, Phoenix, Ariz.

Abstract: When designing a power converter to meet electromagnetic compatibility (EMC) requirements there is no substitute for good layout, design and filtering practices. But, often the emissions of the power converter are not measured until late in the development process when the power converter is integrated into the final assembly. Usually, at that time there is limited space to add filtering components and no time for re-design. As the authors discuss in this feature, one relatively simple but controversial way to reduce a converter's peak emissions and possibly pass the EMC requirements is to enable a clock-dithering circuit, which dithers the converter's switching frequency.

Notes: 5 figures Read the full story...

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October 2009:

Debunking Transformer Performance Myths

by Steven M. Sandler and Danny Chow, AEi Systems, Los Angeles, Calif.

Abstract: There are three common myths regarding transformers, and more generally, magnetic coupling. Surprisingly, these myths concern fundamental concepts in transformer design, and perhaps they're a source of unexpected results in your design work. One myth concerns how you measure the turns ratio. Another relates to the meaning of leakage inductance. The third myth deals with the role of inductance factor (AL) in calculating transformer inductance. To dispel these myths, the authors conducted a series of experiments on transformers with different winding configurations.

Notes: 9 figures, 1 table. Read the full story...

Ultracapacitors Give Lift To Material Handling

by Chad Hall, Ioxus, Oneonta, NY

Abstract: Many battery-powered electric forklifts are used in large refrigerated warehouses. In these sub-freezing environments, traditional batteries have a lower than normal terminal voltage. This loss of voltage reduces a battery's power output and requires that the users stop to change the batteries at least once during a normal eight-hour shift. Ultracapacitors can help by provide energy storage to support the batteries in lifting loads of 3000 lbs. Ultracaps even enable forklifts to deliver full power output at temperatures as low as 40 degrees below zero. In this article, the author discusses the benefits of deploying ultracapacitors in forklifts and application issues that arise when doing so.

Notes: 1 figure. Read the full story...

November 2009:

Give Your Battery A Rest With A Supercapacitor-based Power Subsystem

by Greg Lubarsky, National Semiconductor, Santa Clara, Calif.

Abstract: Mobile handsets are becoming more feature rich and power hungry as high-current LED flashes, high-power stereo drivers, and even multiple RF power amps make their way into the handset. Unfortunately, each of these functions can draw large pulses of battery current (1 A or more) when in use. If allowed to operate at the same time, these features can often cause a battery current fault or prematurely shut down the device. These problems can be avoided through careful pulse timing management and performance compromises such as limiting the flash current or audio volume. But such approaches limit the phone's capabilities. An alternative described in this feature creates a power subsystem based on a supercapacitor and a supercapacitor management IC.

Notes: 6 pages, 4 figures. Read the full story...

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Integrated Driver Shrinks Class D Audio Amplifiers

by Jun Honda, International Rectifier, El Segundo, Calif.

Abstract: From automotive entertainment to home theater systems, consumers are demanding more channels of high-amplitude, high-quality audio. But driving each channel individually translates into higher power consumption and the accompanying thermal challenges, as well as more components and board space. To address these issues, designers have been turning to class D audio amplifiers, which achieve efficiencies over 90%, while seeking integrated solutions to reduce parts count and board space. This feature discusses the operation and application of the IRS2093M, an audio driver chip that packs four channels of high-voltage power MOSFET drivers on the same die.

Notes: 5 pages, 5 figures. Read the full story...

Drive Multiple LED Strings with SEPIC Converters

by L.K. Wong and T.K. Man, National Semiconductor, Santa Clara, Calif.

Abstract: A common method to drive multiple LED strings is to make use of a power converter together with linear current regulators. Based on the input voltage and the output voltage, which is related to the number of LEDs in a string, a buck or boost topology will normally be used in the power converter. However, if the input voltage is closed to the output voltage, buck and boost topologies are not suitable. This article explains why a SEPIC topology offers the best solution to this problem and presents a design example to illustrate implementation of a SEPIC-based LED driver circuit.

Notes: 8 pages, 7 figures, 1 table. Read the full story...

December 2009:

Loop Control: Hand Calculations or Automation?

by Christophe Basso, ON Semiconductor, Toulouse, France

Abstract: Loop control is an important element of switching power supply design, but it is often neglected until the very end of the project when the main components have already been selected and the prototype has been built. It is possible to get the impression that a prototype, which delivers acceptable transient response on the oscilloscope, is ready for production. But such a conclusion is unwise and potentially costly. Stray and parasitic elements often remain hidden during prototype tests. In the factory, the dispersions of these parameters, combined with silicon lot-to-lot variations, can make converters fail in quantity at final test. To avoid such situations, designers should spend time analyzing the loop in detail. Automated design tools can help.

Notes: 6 pages, 5 figures. Read the full story...

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*Designing the Sine Wave Quiet Converter**

by Colonel W. T. McLyman, Kg Magnetics, Idyllwild, Calif.

Abstract: Although this resonant converter has been around for years, many designers are unaware of it and its benefits. The Quiet Converter produces a sinusoidal voltage across a parallel resonant tank and as the name implies, it features inherently low noise. This converter was originally developed at the Jet Propulsion Laboratory (JPL), Division 38, to power very sensitive instruments and has been used in various JPL programs. It has been applied at power levels ranging all the way from 1 watt to 2 kilowatts. In this article, operation of the Quiet Converter is explained and instructions are given for implementing this design.

**This paper was originally presented at the 2009 Electrical Manufacturing & Coil Winding Expo in Nashville, Tenn.*

Notes: 11 pages, 11 figures. Read the full story...

A Practical Look At Current Ratings

by Sanjay Havanur, Alpha & Omega Semiconductor, Sunnyvale, Calif.

Abstract: System designers are often faced with the task of selecting the most suitable power device from a wide array of products from different manufacturers with very similar ratings. While a detailed parameter-by-parameter comparison is technically the most correct way of selection, it is not the most practical and designers resort to making their first cut based on three or four simple parameters such as package type, voltage and current ratings, and $R_{DS(ON)}$. This article examines current ratings and explains why they are not generally helpful, and can even be misleading, when selecting power devices. The focus here is on MOSFETs in low- and medium-power packages, but this discussion applies to other technologies as well.

Notes: 5 pages, 2 figures. Read the full story...