

SESSION 6 – TAPA I  
**Analog Circuits**

Wednesday, June 16, 3:25 p.m.

Chairperson: G. van der Plas, IMEC

M. Ito, Renesas Technology Corporation

**6.1 - 3:25 p.m.**

**A Fully-Integrated Switched-Capacitor 2:1 Voltage Converter with Regulation Capability and 90% Efficiency at 2.3A/mm<sup>2</sup>**, L. Chang, R. Montoye, B. Ji, A. Weger, K. Stawiasz, R. Dennard, IBM T.J. Watson Research Center, USA

A switched-capacitor DC-DC voltage converter in 45nm SOI CMOS leverages on-chip trench capacitors to achieve 90% efficiency at an output of 2.3A/mm<sup>2</sup> for 2V-to-0.95V conversion at 100MHz. Operation in step-up and step-down modes is demonstrated. Combined with stacked voltage domains, self-regulation capability enables further efficiency improvement.

**6.2 - 3:50 p.m.**

**An Interleaving Energy-Conservation Mode (IECM) Control in Single-Inductor Dual-Output (SIDO) Step-Down Converters with 91% Peak Efficiency**, Y.-H. Lee, K.-H. Chen, Y.-H. Lin\*, Y.-Y. Yang, S.-J. Wang, Y.-K. Chen\*, C.-C. Huang\*, National Chiao Tung University, Taiwan, \*Realtek Semiconductor Corp., Taiwan

This interleaving energy-conservation mode control for single-inductor dual-output converter uses the superposition technique to yield the optimal average inductor current and 91% peak efficiency. Neither a freewheel stage nor a post-regulator is needed at nominal conditions. The output voltage ripple appears notably minimized over 50% by means of current interleaving at full load. The chip occupies 1.44 mm<sup>2</sup> in 65 nm CMOS and integrates with a 3D architecture for ultra-wide band system.

**6.3 - 4:15 p.m.**

**High Efficiency Single-Inductor Boost/Buck Inverting Flyback Converter with Hybrid Energy Transfer Media and Multi Level Gate Driving for AM OLED Panel**, S.-W. Wang, Y.-J. Woo, S.-S. Yuk, G.-H. Cho, G.-H. Cho\*, KAIST, Korea, \*JDA Technology, Korea

A hybrid-type Single Inductor Boost/Buck Inverting Flyback(SIBBIF) DC-DC Converter is presented. To increase the converter efficiency, a flying capacitor as well as an inductor is adopted as another energy transfer medium together with multi-level gate driver (MLGD). Besides, to enhance load transient response, hybrid fast transient control (HFTC) is adopted. The proposed chip is implemented in a 0.5um BCD process and operates at 1.25 MHz with a max efficiency of 87.1% at an output power of 600 mW.

**6.4 - 4:40 p.m.**

**A High-Efficiency 4x45W Car Audio Power Amplifier using Load Current Sharing**, C. Mensink, E. van Tuijij\*\*, S. Gierkink, F. Mostert\*, R. van der Zee\*\*, Axiom IC, \*NXP, \*\*University of Twente, The Netherlands

A 4x45W (EIAJ) monolithic car audio power amplifier is presented that achieves a power dissipation decrease of nearly 2x over standard class AB operation by sharing load currents between loudspeakers. Output signals are conditioned using a common-mode control loop to allow switch placement between loads with minimal THD increase. A prototype is realized in a SOI bipolar-CMOS-DMOS process with 0.5µm feature size. Die area is 7.5x4.6mm<sup>2</sup>. THD+N @(1kHz,5W) is 0.05%.

**6.5 - 5:05 p.m.**

**An Energy Management IC for Bio-Implants Using Ultracapacitors for Energy Storage**, W. Sanchez, C. Sodini, J. Dawson, Massachusetts Institute of Technology, USA

We present the first known energy-management IC to allow low-power systems (e.g., bio-implants), to optimally use ultracapacitors instead of batteries. The chip consists of a switched-capacitor regulator, 4nW bandgap reference, high-efficiency rectifier for wireless recharging, and a switch matrix and digital control circuitry to govern the stacking and unstacking of the ultracapacitors. The stacking procedure allows for more than 98% of the initial energy stored to be removed before the output voltage drops unsuitably low.