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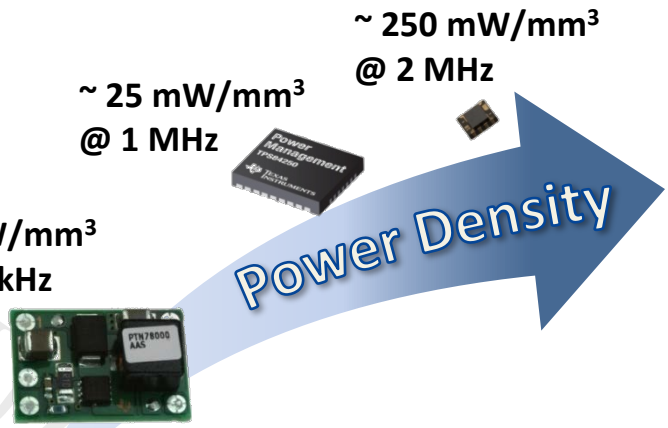
TEXAS INSTRUMENTS



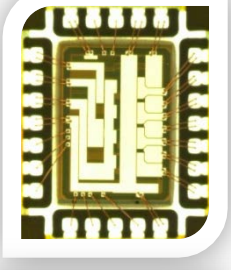
Study and design of topologies and components for high power density DC/DC converters

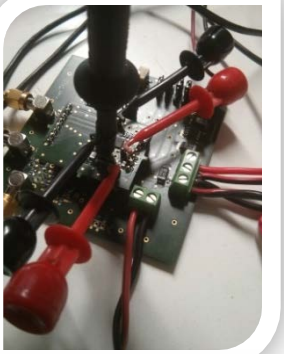
PhD research activity overview and results

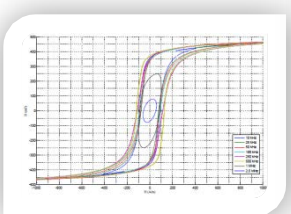
Ing. Giacomo Calabrese

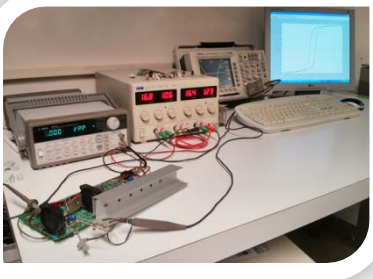
Firenze, 11 Novembre 2014
Sala riunioni DINFO (Stanza 516)

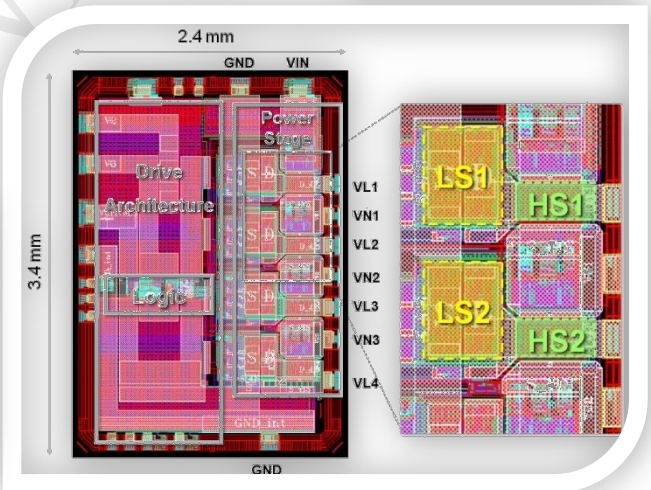
Ore 14:30











Abstract:

Size reduction of electronic DC–DC converters is a topic of major interest for power electronics. The design goal is usually the achievement of size shrinking without scarifying the quantity of managed power. This means an increase in power density, expressed as managed power over converter volume. Increasing the switching frequency of the converter, aiming at the size reduction of the passive components, has often a key role in this direction. This requires the study and design of circuits and components working under redefined requirements.
New converters' circuital topologies can provide advantages in terms of power density increment, especially in applications where a single chip integration is possible. Single chip integration can dramatically reduce the impact of parasitics, allowing at the same time more complex and specifically fitted circuital designs. This concept has been applied to implement an integrated high step-down multiphase buck converter.
With respect to passive components, particular attention has been dedicated to magnetic cores of power inductors and to the study of magnetic materials' core hysteresis losses. In fact, these losses are increasing with switching frequency increment and a more detailed knowledge of their mechanisms could allow a better selection of the magnetic materials depending on converter's requirements. This concept has been investigated focusing on the development of an hysteresis model and a measurement setup which can be used to characterize magnetic cores' materials hysteresis behaviour under different current waveforms.

Biography:

Giacomo Calabrese was born in Poggibonsi, Italy in 1986. He obtained the Bachelor's and Master's degree in Electronic Engineering from the University of Florence, Italy respectively in 2009 and 2011. In 2011, he carried out a visiting student internship program at the TU Delft – MTSR group. In 2013, he worked as an intern at Texas Instruments - R&D Labs. In 2014, he has been a visiting graduate student at University of Toronto - Laboratory for Power Management.
He is currently a research fellow at the University of Florence - USCND lab and a PhD student of the doctorate course in "Science and Information Engineering". His research activity, done in cooperation with Texas Instruments and the University of Florence, is focused on the study and design of topologies and components for high power density DC-DC converters.