Implementation of a Dual on Die 140 V Super-Junction Power Transistors

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Abstract
Increasing the switching frequency for switch mode power supplies is one method to achieve smaller, lighter weight and hopefully cheaper power converters.

Silicon is not only the dominant material used to produce the switches but also it allows more circuitry to be easily integrated on the same die.

This work presents an application customized switches to be used in switch mode power supplies.

The prototype chip was implemented using a 0.18 µm SOI process and includes dual electrically isolated 140 V, 1.2 Ω N-channel MOSFETs.

Project Objectives
Wider Objective:
Develop an Integrated switch-mode power supplies utilize few external components.

Specific Objectives:
To integrate the DTU Elektro proven dc-dc converter topologies in a single module / chip.
To develop state of the art, high power density, high quality power supply prototypes.

Converter
Rectified Universal AC Mains

TinyPower Converter
Output Voltage = 12.5V ± 0.5V
Output Power = 10W

Topological Development
Optimized Power Converter
Control Circuit Development

Semiconductor Technology
Integrated Passives
Integration And Packaging Technologies
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Single Cell Converters developed at DTU

Class E Resonant Converter *

Buck Converter ***

Stacked Cells Converter Developed at DTU

Class DE Resonant Converter **

US Mains Converter****

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Semiconductor Technology

First Generation Switches
• Dual on Die" Electrically 140 V Isolated Super-Junction N-Channel Transistors.
• Using a 0.18 µm SOI process.
• Ron = 1.2 Ω for each switch. (@ 0.1 Vds)
• Designed for homogenous current distribution across the die.
• Die Size is 1.6 mm x 1.6 mm

Measured using Agilent 4294A precision impedance analyzer @ 1MHz

Characterization PCBs

Photomicrograph of the designed chip

Characterization Results