Analysis and design of high power monolithically integrated switching DC/DC converters

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I. INTRODUCTION

Thanks to integration and technology scaling, the power and function density of most analog and digital circuits has drastically increased throughout the years. In many systems, the power supply has been unable to keep up with this rapid evolution, and is therefore becoming a crucial factor to further reduce the physical dimensions of the system.

So-called Smart Power technologies allow the monolithic integration of precision analog circuits, logic gates and power devices on a single silicon die[1]. A number of monolithically integrated power supplies are already commercially available. However, these are typically limited to a few Watt of output power. For higher power levels, the current state of the art converters still use discrete power devices, which limit the further reduction in size of the converter. Therefore, the goal of this research is the development of high power monolithically integrated switching DC/DC converters.

II. METHODS

A typical Telecom back-office power supply, with a 36-72 Volt input range and a 12 Volt/7 Ampere output, was selected as a test-case. In a first phase, we performed a theoretical analysis to select the optimal technology and circuit topology for the converter. In a second phase, the circuits are designed using simulations, and concepts are verified using discrete prototypes. In the final phase, the monolithic converter will be manufactured through an MPW service to verify the performance.

Based on the availability of Smart Power technologies through the Europractice MPW service[2], a cost function was derived for the implementation of a number of topologies in the offered technologies. The optimal topology for the aforementioned test-case can be shown to be a full bridge converter, using the ON Semiconductor I3T80 technology for the primary circuits, and the ON Semiconductor I3T50 technology for the secondary circuits.

The implementation in a Smart Power technology allows the use of circuit design techniques that would be infeasible or costly with a discrete converter, such as the use of additional converters for providing auxiliary voltages, or for the recovery of energy.

III. CONCLUSIONS

A theoretical optimization of high power monolithically integrated DC/DC converters was performed. Current work is focusing on the circuit implementation of a full bridge Telecom back-office power supply.

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REFERENCES

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