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Single chip DC-DC controller with high voltage input for space applications

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Thales Alenia Space has partnered with MinDCet (IC design house) in an ESA program for the development of a single chip dc-dc controller. The IC design was done on SOI and high voltage process.

The component includes all classical features required for the control of a dc-dc converter, allowing it to control a multitude of topologies.

- Current sensing amplifier with edge blanking, error amplifier and voltage reference
- PWM controller with 3 modes of operation: peak current control, average current control and finally also the innovative Peak & Valley current control (PVCC) proposed by ESA
- Various protections: over-current, over-temperature, over-voltage and under-voltage
- Reference oscillator with external synchro input.

One of the most innovative features is an on-chip high voltage (up to 100V) input. This input delivers power during the transitory startup phase of the dc-dc converter. Super-junction 200V transistors are being used which have shown satisfactory robustness to radiation effects: total dose up to 60krad & 62 MeV.cm^2/mg heavy ions.

Opposed to most commercial dc-dc controller ICs, the complete low-level control subsystem is designed with 5V transistors. Within the constraint of a low bias current (DC-DC efficiency), this architecture allows reaching high bandwidths and high speeds. The target is to be able to control high frequency GaN based dc-dc converters.

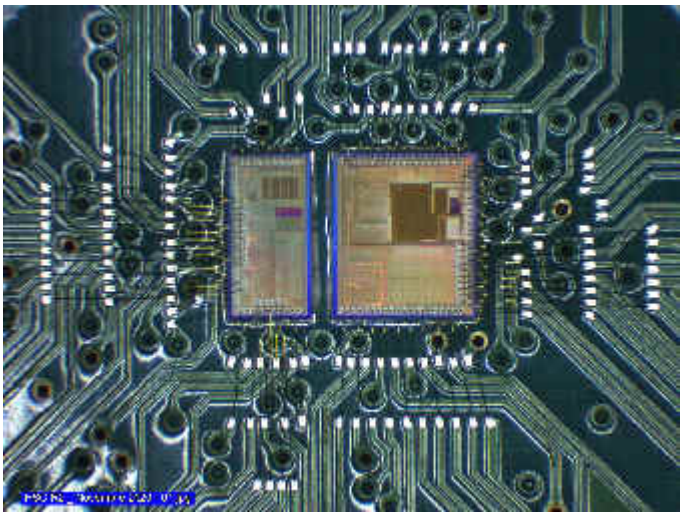

Figure 1: Run2 of DC-DC controller for Space applications

Controller run1 was developed and tested in the frame of a VLAIO (Flemish regional) project. The aim was to achieve integration of high voltage super-junction transistors into space radiation hardened ICs.

Controller run2, was developed & tapped-out in development under an ESA GSTP program. It has already successfully passed functional electrical tests. TRR is also passed & the development of test infrastructure to perform detailed electrical characterization and volume production in ongoing.

The 2 controller dies and associated passive components are assembled into a single non-hermetic plastic 11x11 BGA package.

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