Contribution ID: **58** Type: **Oral**

High Radiation Resistant DC-DC Converter Regulators for use in Magnetic fields for LHC High Luminosity Silicon Tracker

Thursday, 6 September 2007 14:40 (25 minutes)

We have found at least one commercial Buck regulator with integrated inductor fabricated with 0.25µm CMOS technology. This device was exposed to a Cobalt 60 source at BNL; there was negligible effect to 100 mega rad dosage (when the exposure was terminated). System implementation issues are being evaluated.

Summary

At the "12th Workshop on Electronics for LHC and Future Experiments"held in Valencia, Spain 25-29 September, 2006, we presented some results showing operations using air core coils.

Our focus is to investigate the possibility of using DC-DC converters for the powering of the silicon Tracker for the high luminosity ATLAS upgrade. Our objective is to locate these regulators on the same PCB as the silicon readout chips.

CMOS at small feature size (0.25um or less) shows promise for radiation environments. We recently found out that at a company had designed a Buck regulator using 0.25um CMOS technology. A device mounted on an evaluation board with an output of 4 amps @ 1.8 Volts was exposed to Cobalt 60 source. There was no noticeable effect even with an accumulated dosage of 100 mega rads when the exposure was stopped (after 3 weeks of exposure). This chip is a multichip module with a silicon die and a ferrite rod inductor. For our application (high radiation, high magnetic field), this inductor will be replaced by an air core coil.

We are investigating
1. Switching noise of the Buck into the silicon strip detector and its readout chip.
2. Antenna affect, the charge from the input capacitors is transferred to the output capacitors at a frequency of 5 MHz with a duty cycle given by output voltage = Output voltage /Input voltage. Traces on the PC board become part of the antenna. One solution is to bury these traces in the inner layers of the PCB.
3. Are other vendors working on 0.25um CMOS technology Buck regulators operating at higher frequencies?
4. More radiation testing

Figure: Power conversion Efficiency vs Output current before and after 100 Mrad Gamma exposures.

At the conference, we shall report on the results of our research.

Primary author: Dr DHAWAN, Satish (Yale University)

Co-authors: Dr LYNN, David (Brookhaven National Laboratory); Mr KIERSTEAD, James (Brookhaven National Laboratory); Prof. BAKER, Oliver Keith (Yale University); Prof. TIPTON, Paul (Yale University)

Presenter: Dr DHAWAN, Satish (Yale University)

Session Classification: Topical 3: Detector Power Supply and Distribution 3