

**TECHNOLOGY 2004
Paper Abstract**

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Paper Title: CCSDS Spacecraft Uplink Protocol in a Space-Qualified ASIC

Category: Electronics

Description: This paper describes the functionality of the Hardware Command Decode (HCD) application specific integrated circuit (ASIC) developed for the Cassini spacecraft. The ASIC is used on the spacecraft in the Command and Data Subsystem computer to receive uplink data. The ASIC receives a serial, digital data stream of uplink data from the antennae receiver electronics. Implemented in the ASIC is the "receiving end coding layer" of the Consultative Committee for Space Data Systems (CCSDS) Telecommand standard. The CCSDS Telecommand standard is a widely used, international standard. The ASIC, produced in Honeywell's RIMOS technology, is radiation hard, single event upset hard, and highly reliable (Class S). The implementation of the "receiving end coding layer" of the CCSDS Telecommand standard into a space-qualified ASIC is expected to have applications in commercial spacecraft, the fact that the ASIC also contains a variety of additional features unrelated to uplink that are often needed in spacecraft data systems makes this ASIC particularly useful.

The ASIC supports the Codeblock and Command Link 1 transmission Unit data format specified in the CCSDS standard. The ASIC will perform one of two types of error detection/correction on the uplink data: single bit error correction and double bit error detection; or triple bit error detection (no correction). The ASIC

also supports direct ground control of up to 32 relays and 24 discrete outputs via Virtual Channel O commands. These relays and discrete outputs allow ground control of critical functions independent of the flight software.

The ASIC's uplink data interface consists of a serial, NRZ data input, a clock input, and a Lock input which indicates if the receiver is in lock. The ASIC will support data rates up to 200,000 bits per second.

The ASIC interfaces to the host computer via a 16-bit, parallel, fully-interlocked asynchronous interface. A space-qualified field programmable gate array is currently under development which will allow the ASIC to interface to a VME bus. A double buffering scheme is used within the ASIC to provide software with a simple method for fetching the uplink data.

The ASIC also provides a variety of other features independent of uplink that are often needed in spacecraft data systems, such as:

- A "(sophisticated" watchdog timer
- Interrupt control support
- Reset control
- Eight discrete outputs which support the exchange of system "(health" and other information between redundant systems