

A HARDENED ONE CHIP SOLUTION FOR HIGH SPEED SPACEWIRE SYSTEM IMPLEMENTATIONS

Session: SpaceWire Components

Long Paper

Joseph R. Marshall and Richard W. Berger

BAE Systems, 9300 Wellington Road, Manassas, Virginia 20110 USA

E-mail: Joe.Marshall@baesystems.com, Richard.W.Berger@baesystems.com

Glenn P. Rakow

NASA-GSFC, Code 561, Greenbelt, Maryland 20771 USA

E-mail: Glenn.P.Rakow@nasa.gov

ABSTRACT

An Application Specific Integrated Circuit (ASIC) that implements the SpaceWire protocol has been developed in a radiation hardened 0.25 micron CMOS technology. This effort began in March 2003 as a joint development between the NASA Goddard Space Flight Center (GSFC) and BAE Systems. The BAE Systems SpaceWire ASIC is comprised entirely of reusable core elements, many of which are already flight-proven. It incorporates a router with 4 SpaceWire ports and two local ports, dual PCI bus interfaces, a microcontroller, 32KB of internal memory, and a memory controller for additional external memory use. The SpaceWire cores are also reused in other ASICs under development. The SpaceWire ASIC is planned for use on the Geostationary Operational Environmental Satellites (GOES)-R, the Lunar Reconnaissance Orbiter (LRO) and other missions. Engineering and flight parts have been delivered to programs and users.

This paper reviews the SpaceWire protocol and those elements of it that have been built into the current and next SpaceWire reusable cores and features within the core that go beyond the current standard and can be enabled or disabled by the user. The adaptation of SpaceWire to BAE Systems' On Chip Bus (OCB) for compatibility with the other reusable cores will be reviewed and highlighted. Optional configurations within user systems and test boards will be shown. The physical implementation of the design will be described and test results from the hardware will be discussed. Application of this ASIC and other ASICs containing the SpaceWire cores and embedded microcontroller to Plug and Play and reconfigurable implementations will be described. Finally, the BAE Systems roadmap for SpaceWire developments will be updated, including some products already in design as well as longer term plans.