The SCS750® Single Board Computer is Maxwell’s answer to the space industry’s need for both mid- and high-performance computing, and on-board data processing requiring the utmost in reliability and upset immunity. There is a trend to perform data management and manipulation on the spacecraft, which requires a large amount of processing power. The SCS750® SBC enables satellite designs to dramatically increase error-free, on-board data processing, mission planning, and critical decision-making.

The SCS750® SBC has been designed to operate in a cPCI system targeting high performance computing for the most demanding space applications. Its design decisions have been driven by a guarantee of the highest reliability and performance. Maxwell has developed a comprehensive strategy to provide total dose, latch-up, and upset hardness for the SCS750® SBC.

Maxwell’s SCS750® Single Board Computer has become the benchmark against which all space processor boards are measured.
Rad Hard Architecture

Block Diagram

- Auto Controller/Peripheral Configuration
- Processor & SDRAM Error Logging
- Front Panel Test Connector
- Front Panel Flight Connector

Upset Mitigation by Architectural Design
- Rad-Hard/Rad Tolerant SEU Tolerant Component

Commercial Technology
- Latest SOI PowerPC at 800MHz
- High Performance SDRAM
- On-Board Control Logic

Mitigation Technique
- TMR/Resynch and Scrubbing
- Double Device Correct and HW Scrub (Reed-Solomon)
- Actel RT-AX Built-in TMR

Result
- SCS750 1 Uncorrected Error > 80 Years
- Better Upset Immunity Than Other Space SBC’s!

Single Event Upset Mitigation
**Triple Redundant Processing**

**Resynchronization & Scrubbing**
Software will reset, reload, and resynchronize all three processors to clear errors in 1 ms.

**TMR Voting**
Output of each clock cycle is voted and majority is output without delay

**Error Detection**
Hardware isolates a disagreeing processor and holds it in reset

**Triple Modular Redundancy Protection**

**TMR Processor SEU Flush**
- Detects upset
- Flushes μProcessors memory into main memory
- Tri-states upset μProcessor

**TMR Processor Restore**
- Restores memory back into μProcessors
- Resynchronizes all three μProcessors into lockstep

-Flushes and Restores in 1ms!
Software Selectable Power Consumption

Estimated MIPS vs. Code/Data Size
RADIATION TOLERANCE

- One board upset every 80 years in GEO orbit and 115 years in LEO orbit
- TID: > 100 krad (Si) - orbit dependent
- SEL (th): 84 MeV-cm²/mg (room temperature)

(3) FULLY TMR PROTECTED PROCESSORS

- PowerPC 750FX™ on silicon on insulator (SOI), 0.13um
- 2.32 Dhrystone MIPS/MHz
- > 1800 Dhrystone MIPS @ 800MHz
- 400 to 800MHz - Software selectable core clock rate

PROCESSORS

L1 CACHE
- 32 KByte Instruction with parity
- 32 KByte Data with parity

L2 CACHE
- 512 KByte on-chip with ECC @ CPU core clock rate

MEMORY

VOLATILE
- 256 MByte SDRAM - Reed-Solomon protected - Double Device Data Correction

NON-VOLATILE
- 8 MByte EEPROM - ECC protected
- 7.0 MByte EEPROM available to user
- 0.5 MByte Primary SuROM
- 0.5 MByte Secondary SuROM (autoswap on primary failure)

INTERFACES

cPCI BUS
- 6U
- 3.3V
- 32 bit, 33MHz
- Master/Target & Syscon/Peripheral

1553
- BC/RT/MT
- SEU Immune

SERIAL
- UART (Asynchronous), LVDS
- (2) USRTs (Synchronous), LVDS

PROGRAMMABLE I/O
- 32 Programmable General Purpose I/O (GPIO)

POWER

- 7 - 30 watts (typical) dependent on clock rate/MIPS requirements
- 5V for 1553 interface, 3.3V for rest of board

OPERATING SYSTEM

- VxWorks, Tornado

TEMPERATURE

- -30°C to +65°C (Acceptable levels)
- -40°C to +70°C (Qualification levels)

MECHANICAL

- 6U x 160mm
- 1.5 Kg (3.3 Lbs.) Max

MODELS

SCS750F - FLIGHT CONFIGURATION
- Rad-Tolerant, Class “S” or equivalent components
- Conduction cooled
- Flight cPCI connectors

SCS750E - ENGINEERING CONFIGURATION (EM)
- Parts identical to flight (but not screened to flight level)
- Conduction cooled
- Flight cPCI connectors

SCS750D - ENGINEERING DESIGN CONFIGURATION (EDM)
- Commercial components
- Full hardware & software compatibility w/ E & F models
- Conduction or convection cooled

SCS750P - PROTOTYPE CONFIGURATION (PEM)
- Commercial components
- Similar functionality to D, E & F models
- Convection cooled

All models are available with an optional 1553 interface

Deliverables

- Board support package
- Management documents
- Product assurance documents
- Engineering and verification documents
- Manufacturing and test documents