Overview of Specifications

- Proven in space – TRL-9
- Wide range of operating capability:
  - 200 – 1800 MIPS
  - 7 – 30 watts typical
- Speed and power settings can be managed via software in real time; no reboot required.
- Outstanding SBC radiation hardness
  - TID greater than 100 krad (Si)
  - SEU hard
  - SEL immune
- Standard development platform – VxWorks®

The SCS750® Single Board Computer is DDC’s answer to the space industry’s need for both mid- and high-performance computing, and on-board data processing requiring the upmost 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. DDC has developed a comprehensive strategy to provide total dose, latch-up, and upset hardness for the SCS750® SBC.

DDC’s SCS750® Single Board Computer has become the benchmark against which all space processor boards are measured.
Single Event Upset Mitigation

<table>
<thead>
<tr>
<th>Commercial Technology</th>
<th>Mitigation Technique</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latest SOI PowerPC at 800MHz</td>
<td>TMR/Resynch and Scrubbing</td>
<td>SCS750 1 Uncorrected Error &gt; 80 Years</td>
</tr>
<tr>
<td>High Performance SDRAM</td>
<td>Double Device Correct and HW Scrub (Reed-Solomon)</td>
<td></td>
</tr>
<tr>
<td>On-Board Control Logic</td>
<td>Actel RT-AX Built-in TMR</td>
<td>Better Upset Immunity Than Other Space SBC's!</td>
</tr>
</tbody>
</table>

1 Upset Per Day Unacceptable
**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

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**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

SCS750 Power vs MIPS, 800 MHz Max

Estimated MIPS vs. Code/Data Size

SCS750 at 800MHz with 512KByte L2 Cache

RH PowerPC at 133MHz without L2 Cache

9X

1000X
### 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)

### Processors
- (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

### 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
#### SC5750F - Flight Configuration
- Rad-Tolerant, Class “S” or equivalent components
- Conduction cooled
- Flight cPCI connectors

#### SC5750E - Engineering Configuration (EM)
- Parts identical to flight (but not screened to flight level)
- Conduction cooled
- Flight cPCI connectors

#### SC5750D - Engineering Design Configuration (EDM)
- Commercial components
- Full hardware & software compatibility w/ E & F models
- Conduction or convection cooled

#### SC5750P - 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

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### Worldwide Headquarters
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All specifications are subject to change.