Ensemble 7100 Platform HCD7500 Module

Enables Full Signal and Image Processing Close to the Sensor in Mobile Platforms

- Optimized for high performance at 80 GFLOPS per slot, up to 1.920 TFLOPS peak per system
- Lower latency and increased processing throughput compared to previous generations
- 5 GB/s RapidIO® bandwidth to the backplane
- Patented air-cooling system with ManagedAir™ technology

The HCD7500 Module (High Compute Density) from Mercury Computer Systems is an integral part of the Ensemble 7100 Platform. The HCD7500 is designed around the Freescale™ MPC8640D dual-core microprocessor, which includes on-chip interfaces to RapidIO® communications fabric. The module offers extreme performance density, exceeding 80 GFLOPS per slot and up to 1.920 TFLOPS per system. This density enables full signal and image processing close to the sensor in mobile platforms and other severely space-constrained environments.

Each of the five compute nodes (CN) includes a Freescale MPC8640D dual-core microprocessor, 2-GB DDR2 SDRAM, and 128-MB flash EEPROM, all connected to the serial RapidIO switch fabric. Each MPC8640D core includes an e600 core (with per core Altivec™ 128-bit vector processing engine), 32-KB instruction, 32-KB data L1 cache, and an on-chip 1-MB L2 cache. The double data-rate SDRAM enables overlapping memory access requests from the local processor and remote accesses over the RapidIO switch fabric. A 128-MB flash EEPROM on each node is used for built-in self-test, operating system booting, and user applications.

The true power of the Ensemble 7100 Platform is realized when many processors, working as a finely coordinated team, are applied to a single algorithm step. The processors, enhanced DMA controllers, and RapidIO switch fabric combine to drastically lower the latency, while increasing the processing throughput compared to previous generations.

System Management

The HCD7500 Module implements system management functions based on the PICMG®, MicroTCA®, and AMC® standards.

Warnings and failures are indicated locally via front-panel lights. The system automatically monitors temperature, power supplies, voltages, and currents. Normally, faults cause the system to power-down immediately or after a warning, or prevent system power-up. The system can be configured to override certain of these faults, or allow the user to override them using the Environmental Bypass switch.
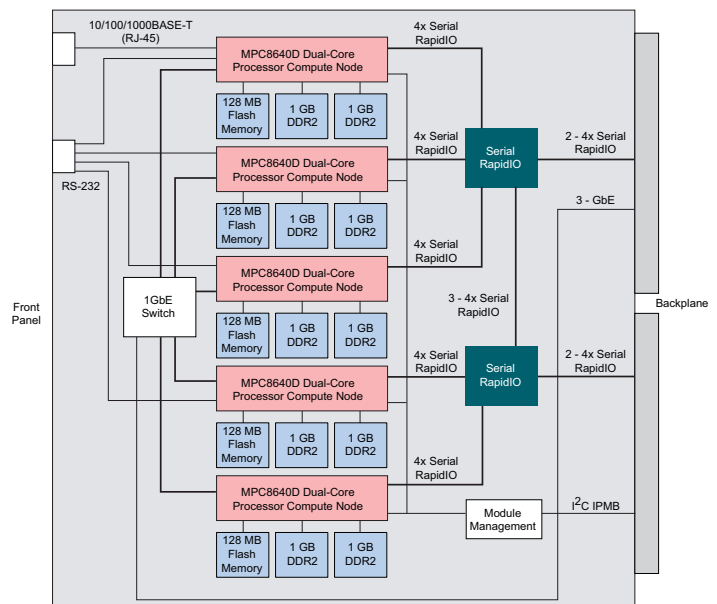

Figure 1. HCD7500 Module functional block diagram

Patented Air-Cooling System with ManagedAir Technology

The Ensemble 7100 Platform utilizes patented ManagedAir™ cooling technologies to provide sufficient cooling to satisfy extreme performance density requirements. ManagedAir technology is a system-level approach to meeting the challenges posed by the escalating power consumption of today's processors and infrastructure chips, especially in industrial and military environments.

Implemented at all levels from the component through the chassis, ManagedAir cooling maximizes the effectiveness of unconditioned moving air, allowing the system to support higher-performance processors and their associated circuitry without conduction cooling, liquid cooling, or other exotic cooling techniques. The result is a simpler, lighter system that is easier to deploy and maintain. For example, ManagedAir technology encloses each printed circuit board assembly with a cover that is tailored to the profile, placement, and airflow requirements of the board's components. The cover's topography manages the airflow for that board by directing air through the heat sinks, increasing their cooling capacity.

At the slot level, ManagedAir technology manages the airflow to get an even distribution from front to back and across all slots. The covers for each board regulate the airflow and stay with the board as it is moved or replaced.

Serviceability

During power-on self-test (POST), diagnostics run out of the flash memory on each module. The results of these diagnostics are available before the modules are used in a multicomputer application. This testing from the inside out provides excellent fault isolation. Slot keying ensures proper replacement of boards during service.

Specifications

5 compute nodes, each with:

Processor	1.0-GHz Freescale MPC8640D
Processor bus	MPX bus at 500 MHz
Memory	2-GB DDR2 SDRAM
Memory speed	500 MT/s (267 MHz DDR)
DRAM bandwidth	8.0 GB/s
Flash memory	128-MB EEPROM
Switch fabric	Dedicated 4x serial RapidIO interface at 3.125 Gbaud

Switch fabric

Protocol   4x serial RapidIO at 3.125 GBaud (ISO/IEC DIS 18372)
Bandwidth   1.25 GB/s in each direction, 5.0 GB/s to the backplane

Gigabit Ethernet secondary fabric

Protocol	1000BASE-X (IEEE-802.3)
Connections	To SFM7180 Modules 1, 2, and 4

Front-panel connections

1 Gigabit Ethernet port to CN1 (Compute Node 1)
5 RS-232 serial ports to each CN (for debug use)

Electrical/Mechanical

Input voltage	48.0 VDC +/-5%, main power
	5.0 VDC +/-5%, management power

Input voltages measured at the backplane pins inclusive of all ripple. Mercury strongly recommends that system-level power designs use a ±2% margin to avoid any potential issues with respect to the system-level operating characteristics and operating environment.

Power	180W typical max
Dimensions	M155 format
Slot spacing	1.015 in

Environmental*

Commercial
Minimum airflow/slot
     28 CFM, stacked configuration at sea level
Temperature*

Operating	0°C to 35°C

Altitude*

Operating	Sea level to 10,000 ft

MTBF
     Calculated using MIL standard 217F
     (Consult factory for Mil 217F reliability data)

*As altitude increases, air density decreases and, therefore, the cooling effect of a particular number of CFM decreases. Different limits can be achieved by trading among altitude, temperature, performance, and airflow. Contact Mercury for more information.

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