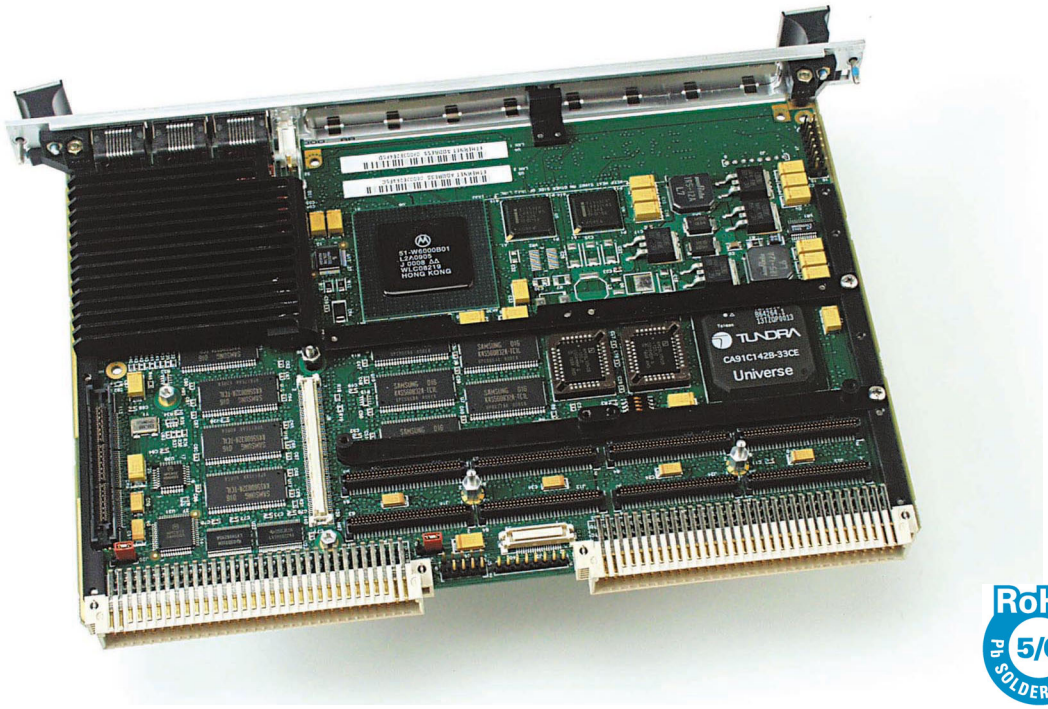
C5110

High Performance Ruggedized PowerPC® SBC



RoHS 5/6 Pb SOLDER EXEMPT

- *Single Slot Rugged VME SBC*
- *Conduction-Cooled (IEEE 1101.2) or Air-Cooled (ANSI/VITA 1-1994) Formats*
- *Dual PMC Slots for I/O Expansion (IEEE 1386-2001 compliant)*
- *ANSI VME64 Compliant*
- *Accommodates Standard or Custom Transition Modules*
- *Rugged & Military Operating Temperature Ranges*
- *Vibration Resistant: up to 7.62 G RMS*
- *Shock Resistant: 30 G during 11 msec*
- *Conformally Coated*
- *MPC7410 (G4) PowerPC® Processor at up to 500 MHz*
- *Based on PowerPlus II Architecture*
- *2 MB of L2 Cache*
- *Up to 1GB of ECC SDRAM*
- *16 MB of User Flash Memory*
- *PCI Interface 2.2 Compliant*
- *Two Ethernet Interfaces (10/100 Mbps)*
- *Two ASYNC Serial Interfaces*
- *Four Timers and Watchdog*
- *Comprehensive Software Support*
- *5/6 RoHS Compliant (Pb Solder Exempt)*

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Functional Features

Central Processing Unit

- Motorola MPC7410 PowerPC® (G4) @ 400 or 500 MHz
- 2 MB Backside L2 cache

Board Architecture

- MCG PowerPlusII® architecture
- 100 MHz front-side bus

Memory

- Up to 1GB of SDRAM with ECC on-board
- 16 MB user Flash memory
- 32 kB NVRAM (4 kB available to users)

Ports and Interfaces

- 2 asynchronous serial ports
- EIA-574 DTE configuration
- RS-232 interface
- Baud rate: 38.4 Kbps (RS-232), 115.2 Kbps (raw)

VMEbus Interface

- High performance A32/D32/BLT64 master-slave, VME64 compliant, VMEbus interface
- Includes DMA support for VMEbus D64 and 64-bit PCI local bus memory burst cycles
- Programmable Interrupter and Interrupt Handler
- Full System Controller Functions

PCI Bus

- 32/64-bit Data, 33 MHz bus clock
- PCI Rev. 2.2 compliant

Timers

- Four user programmable 32-bit timers
- Watchdog timer
- TOD timer with battery backup

Ethernet Interface

- Two on-board Ethernet controllers
- Built-in PCI interface with DMA capability
- 10/100 Mbps, auto negotiate speed select

PMC Interface

- Two 32/64-bit PMC Slots with P2 rear I/O and front panel I/O, IEEE 1386.1 compliant
- Accepts 2 single-width or 1 double-width PMC

Test and Diagnostic Features

- Power-up and self-test diagnostics
- On-board monitor/debugger

Software Support

- Firmware monitor/debugger
- Power-up diagnostics
- Extensive diagnostics suite
- Operating Systems support: VxWorks, Linux, AIX

Environmental Features

Please refer to Aitech ruggedization datasheet.

A Unique Product

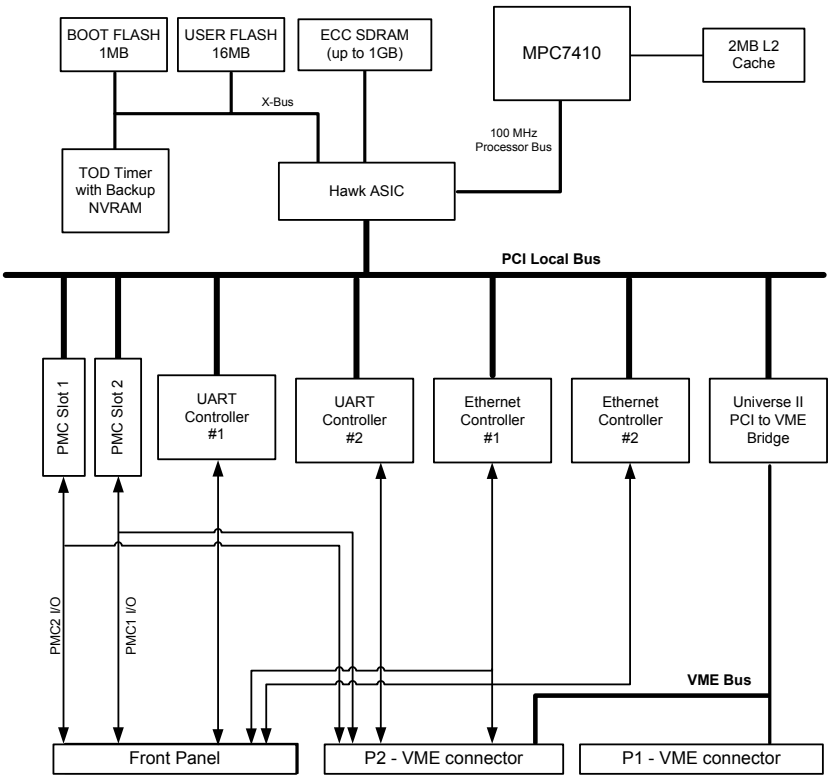
The Aitech C5110 is a ruggedized, single-slot PowerPC® processor module based on the new Motorola® MVME5110 family of VME processor modules. Available in two models, the C5110 features Motorola's 400 or 500MHz MPC7410 PowerPC® microprocessor with the highly anticipated AltiVec technology for algorithmic-intensive computations.

This implementation of the Motorola PowerPlusII VME Architecture® provides the highest performance and I/O versatility available on a rugged VME board.

The C5110 utilizes leading edge technologies such as Motorola's low power, high-performance PowerPC® processors, the 33 MHz PCIbus for high throughput on-board peripherals, a new integrated PCI bridge and memory controller designed by MCG, and a sophisticated VME interface to achieve levels of performance and functionality not possible on any other rugged VME board.

Ideal for a variety of military, aerospace, and industrial applications that require supercomputing levels of performance, the C5110 offers support for dual PMCs, providing an open standard for convenient and flexible I/O expansion, and up to 1GB of ECC protected SDRAM.

With its standard mechanical format, this module can be installed into any IEEE 1101.2 conduction cooled VME chassis or ANSI/VITA 1-1994 standard air-cooled, providing a truly COTS (commercial off-the-shelf) solution suitable for embedded systems applications in any kind of harsh operating environment.



C5110 Block Diagram

Overview

The Aitech C5110 PowerPC® Processor Module is a rugged VME module designed to deliver high levels of computing power and multiple I/O functionality to severe environment applications. The C5110 is a ruggedized version of the Motorola MVME5110® board, offering the user the best of two worlds. It combines a well-engineered state-of-the-art commercial Motorola product with the most advanced ruggedization technology based on Aitech's vast experience in the field of rugged and military computer systems.

The C5110 is a single-slot, PowerPC® based VME computer available with the MPC7410 operating at 400 or 500MHz. With optional memory expansion mezzanines, the board features a total of up to 1GB of SDRAM protected by ECC and 16 MB of on-board programmable user Flash. Dual Ethernet interfaces, two asynchronous serial ports, real-time clock, four general purpose timers and a watchdog timer are also implemented on the board. The C5110 supports two single-width or one double-width PMC mezzanines, and provides PMC I/O lines routed to both the front panel and the P2 connector.

The C5110-A air-cooled version of this board requires a single VME slot and can be installed in any standard ANSI/VITA 1-1994 VME enclosure. I/O signals are routed to both the front panel of the board and the P2 connector. In order to access all the I/O signals on P2, a 5 row VME64 compatible backplane is required.

Packaged as a single-slot VME module, the conduction-cooled ruggedized C5110-R conforms to the IEEE 1101.2 standard for conduction cooled VME systems. It can be installed in any standard conduction cooled VME chassis. All external interfaces are accessed through the P2 connector of the VME backplane.

A rich set of firmware and software tools and options, including on board monitor and diagnostic firmware complement the C5110 hardware and support for the most used real-time operating systems.

Central Processing Unit

Available with the Motorola's the MPC7410 fourth generation PowerPC® processor, the C5110 delivers unmatched computing power while minimizing power dissipation. The MPC7410 has a typical power dissipation of 5 Watts.
In addition to the enhanced reliability and wider temperature range achieved by this low power microprocessor, the MPC7410 includes several features which boost performance. A separate 64-bit Level 2 cache bus, which can transfer data at almost double the previous cache clock rate, improves the processor performance while off-loading cache traffic from the main CPU/memory bus. The board is populated with 2 MB of L2 cache SRAM. Dual integer ALUs, double precision floating-point unit, vector unit, 32 kB on-chip instruction and data caches along with dynamic branch prediction significantly increase processing power.

Architecture

The C5110 is an implementation of Motorola's PowerPlus II Architecture®. This architecture eliminates bottlenecks on the PowerPC® bus, the PCI bus and the VMEbus, optimally decoupling each bus from the others. This allows the processor to utilize its full bandwidth when accessing main memory over the 100MHz front-side bus and minimize performance reduction due to data transfers to the slower PCI bus. Using the new Hawk system memory controller, the PowerPlusII architecture achieves 528 MB/s memory read bandwidth and 640 MB/s burst write bandwidth. Using the same approach, the PCI bus can transfer data at its full 264 MB/s bandwidth with only minimal degradation caused by transfers to/from the VMEbus.

Memory

ECC Protected SDRAM Memory

The C5110 can be configured with 512 MB expandable to 1 GB SDRAM with ECC. The ECC mechanism detects double bit errors and corrects single bit errors, greatly enhancing the system reliability. Coupled to the high bandwidth processor/memory bus (100 MHz), the 64 bit, single interleave DRAM structure provides fast memory access on all operation modes.

Flash Memory
The C5110 includes 16 MB of on-board programmable flash memory available to the user

Boot Flash Memory
The C5110 includes two 32-pin PLCC sockets populated with 1 MB of Boot Flash memory for firmware and system software.

NVRAM
The C5110 also includes 32 kB of NVRAM with battery backup. 4 kB of the NVRAM space is available for users to save system information, configuration parameters, etc.

VMEbus Interface

A complete high performance VMEbus interface is implemented with the Tundra Universe II bus controller. The master-slave interface includes the system controller function and high speed DMA transfer capability to support the more advanced VME modes. All VMEbus options are software-programmable.

The VMEbus interface operates in A32/A24/A16 addressing modes performs D64/D32/D16/D08 as well as BLT64 data transfers. The DMA feature fully supports the VMEbus D64 extension and also 64-bit PCI local bus memory burst cycles. It can be programmed to both Round Robin and Prioritized arbitration schemes. The controller also includes a 4-level requester, a 7-level VME interrupt generator and a 7-level VME interrupt handler. Additional VMEbus features include two LMA32 location monitors.

PCI Bus

The main connecting path between functional blocks in Motorola's PowerPlusII Architecture® is a 64-bit wide PCI bus clocked at 33 MHz. This high bandwidth path can achieve data transfer rates of 264 MB/s taking advantage of the 64-bit data width as required. It also supports 32-bit 33 MHz PCI controllers. The PCI local bus interfaces with the CPU/memory subsystem through a sophisticated PCI Bridge that maximizes decoupling between the processor bus and the PCI bus to increase system performance.

The local PCI bus on the C5110 is also used to provide an I/O expansion feature. This interface allows the user to enhance and customize the I/O capabilities of the module by installing PMC modules (See I/O interface)

Ethernet Interface

The C5110 contains two Intel 82559ER controller chips and can work either as a standard 10 Mbps Ethernet link or as a 100 Mbps Fast Ethernet link. The Ethernet controller has a built-in PCI interface which supports DMA transfers through the PCI bus, including PCI burst mode. One Ethernet interface can be directly connected to 10BaseT or 100BaseTX (twisted pair) network through the P2 connector or the front panel. The other Ethernet interface is available on the front panel only, but can be routed to the P2 connector using a custom transition module from Aitech.

Serial Interfaces

Two asynchronous serial ports are provided on the board. The asynchronous serial ports are implemented using a 16C550C UART located on the board and have a maximum Baud rate of 38.4 kbps (115.2 kbps raw). The electrical interface is a standard EIA-232-D interface, and the ports are routed to the front panel or P2 connector.

Timers

General Purpose Timers The C5110 includes four 32-bit programmable timers for system timing or to generate interrupts.

Time-of-Day Timer A Time-of-Day clock with battery backup is available on the C5110 module.

Watchdog Timer This timer forces a reset if the watchdog is not serviced within the required interval.

I/O Interface
Two IEEE 1386 PMC slots are provided for flexible I/O expansion. The PMC slots include four connectors (PN1, PN2, PN3, PN4) and support A32/D32/D64 operation at 33 MHz bus clock per PCI standard Rev 3.0. The board provides all the standard power voltages (+3.3V, +5V, ±12V) to the PMC slot and accepts two single-width or one double-width PMC mezzanines.

Front Panel
The air-cooled C5110-A is equipped with a front panel including the following connectors:

- Dual RJ45 for the Ethernet interfaces
- A connector for the async serial port and combined reset
- Abort switch
- Status LEDs

Power Requirements
The C5110 power requirements (excluding power consumed by the PMC mezzanines) are:

+5 V (±5%)	3.0 A (typ)	4.7 A (max)
+12 V (±10%)	8.0 mA	N/A
-12 V (±10%)	2.0 mA	N/A

Mechanical Features
The C5110 is available in two mechanical formats:

- Air-cooled per ANSI/VITA 1-1994
- Conduction cooled per IEEE 1101.2

Both mechanical formats are single slot 6U modules.

Custom metal frame provides excellent rigidity and shock resistance. In addition custom metal frame provides an array of stiffeners to support rugged PMC boards.

Dimensions
- Air-cooled: per ANSI/VITA 1-1994
- Conduction cooled: per IEEE 1101.2

Thermal Management
A careful mechanical design including custom Heatsink modules combined with a metal frame allow for optimal heat dissipation and relief of the board.

Software Support

Firmware
The C5110 module comes with a full package of firmware, which contains all the standard tools: hardware initialization and power-up tests, a powerful monitor/debugger tool that allows monitoring and debugging in the field when no other debugging tools are available, Flash memory programming tools, and an extensive suite of diagnostic tests. The C5110 firmware also supports booting from different operating systems.

Operating Systems
Board support packages for the most popular operating systems are available, including

WindRiver:	VxWorks™
Motorola Computer Group:	AIX™
Integrated Systems, Inc.:	pSOSystem™
Lynx Real-Time Systems, Inc.:	LynxOS™
Multiple Partners:	Linux™