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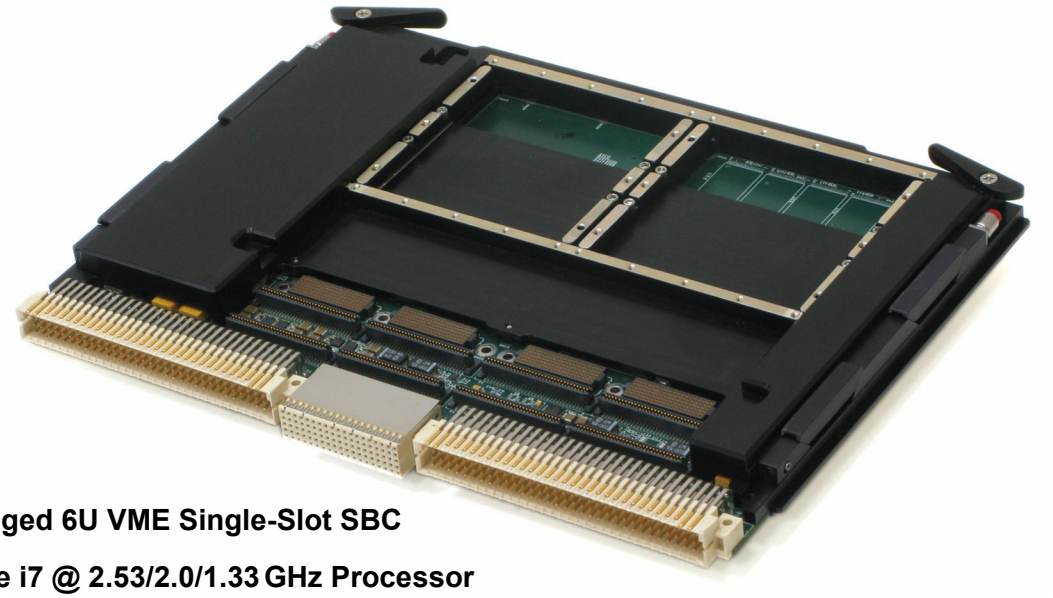
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Find the *Aitech Defense Systems C162* at our website: ***Click HERE***

C162
Core™ i7 6U VME SBC



- Rugged 6U VME Single-Slot SBC
- Core i7 @ 2.53/2.0/1.33 GHz Processor
  - Two Cores/Four Threads (Intel Hyperthreading Technology)
  - Intel® Virtualization Technology for Directed I/O (Intel® VT-d)
  - Streaming SIMD Extensions 4.2 (Intel® SSE4.2) SSE 4.2
  - On-chip 32 kB Data/32 kB Instruction L1 Cache per core
  - 256 k L2 Cache per core
  - 4 MB L3 Cache shared between cores
  - High Performance Graphics Controller
- Memory Resources
  - Up to 8 GB Dual-channel DDR3, @ 1066 MT/s with ECC
  - Up to 128 GB SATA Flash Disk
  - Dual Redundant BIOS Flash
- I/O Interfaces
  - Four Gigabit Ethernet Ports
  - Seven USB 2.0 Ports
  - Two SATA II Ports
  - Four RS-232/422/485 Serial Ports
  - 12 Discrete I/O Lines
  - Two CANbus Ports
  - One CRT Display Output
  - Two HDMI/DVI Display Outputs
  - High Definition Audio I/O
- VME 2eSST with Legacy VME Support
- Two PMC/XMC Slots
  - PMC Slots supporting 64-bit PCI/PCI-X buses @ up to 133 MHz
  - XMC Slots supporting PCIe x8 Gen 2.0
- System Resources
  - Two Temperature Sensors
  - Real Time Clock
  - Avionics Windowed Watchdog Timer
  - Elapsed Time Recorder (ETR)
- Software Support
  - Windows™
  - VxWorks®
  - Linux®
- Conduction and Air-Cooled Versions
- Vibration and Shock Resistant

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C162 – Core™ i7 6U VME SBC

Aitech's C162 is a high-performance 6U VME SBC (Single Board Computer) for embedded and harsh environment applications. The C162 is based on Intel's Calpella (Arrandale + ECC) platform comprising an i7 dual-core/four thread (Intel Hyper-Threading® Technology) processor with large integrated on-chip L1, L2, and shared L3 caches, and a companion QM57 PCH I/O controller hub.

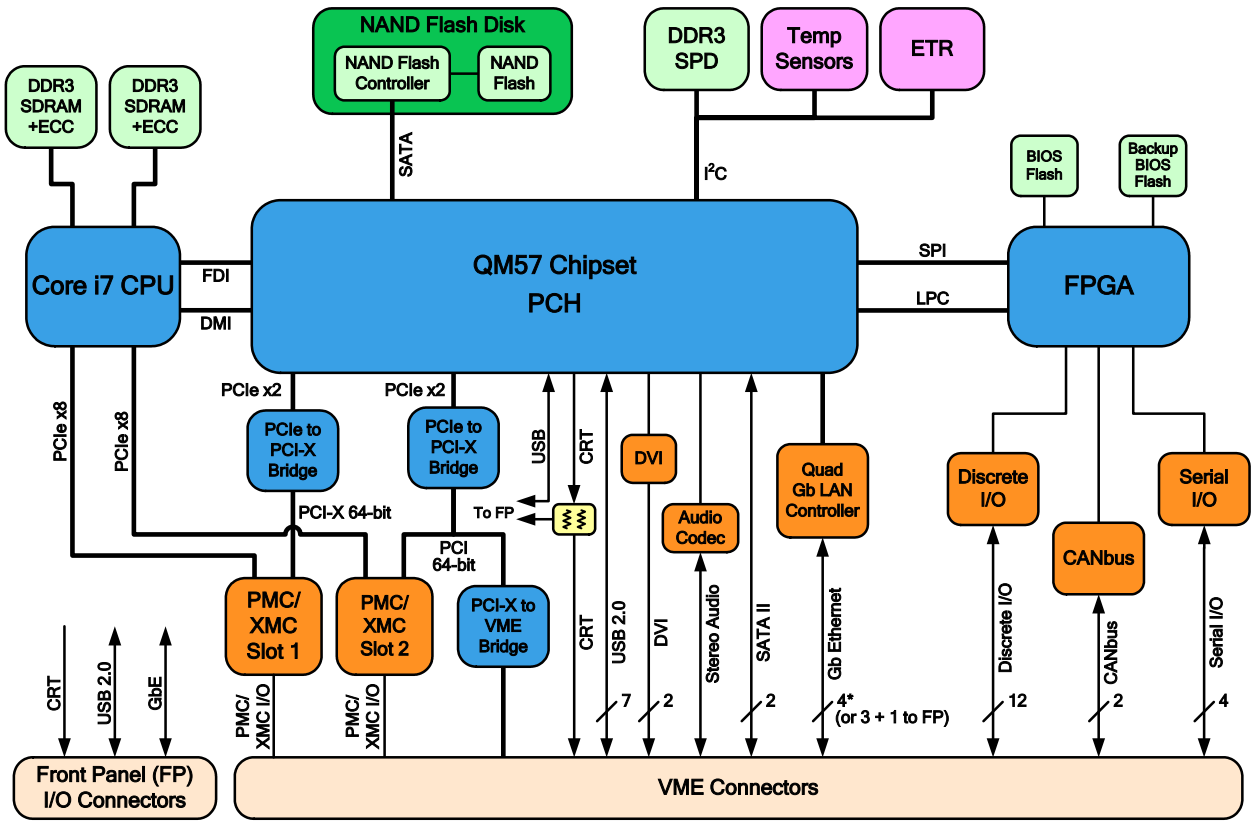
The processor's integrated 2D/3D graphics controller supports graphics and video processing and provides CRT and DVI output channels.

The C162 integrates large on-board memory arrays to support processor and user application needs. Memory resources include up to 8 GB fast DDR3 Dual Channel SDRAM with ECC protection and a SATA Flash SSD of up to 128 GB for user/application-specific parameter storage.

In addition to its high-performance processor architecture, the C162 provides a wide variety of I/O, including four Gigabit Ethernet ports, seven USB 2.0 ports, two SATA II ports, four UART ports, up to 12 general-purpose discrete I/O channels, two CANbus ports, and high-definition stereo audio I/O. To further expand its capabilities, the C162 is equipped with two industry-standard PMC/XMC slots.

The C162 is VME64x compliant, and supports VME advanced protocols such as 2eSST and 2eVME while maintaining full compliance with legacy VME operation.

C162 mechanical and electrical design guarantee operation over the full range of rugged application environments. It is available in industry standard conduction- and air-cooled form factors.



C162 Block Diagram

Functional Description

Processor and Bus Architecture

The C162 is a high-performance 6U VME SBC based on Intel's Calpella platform, and supported by extensive memory arrays. In addition the board's architecture is designed to utilize all bus interfaces to the maximum.

System Architecture

The Calpella platform is based on the Intel® Core™ i7 Processor (Intel's high-performance, low-power mobile processor) and Platform Controller Hub (PCH). This two-chip solution implements the dual core processor, memory controller, and graphics core in a single device, with the PCH providing the platform I/O and display interfaces in a second device.

Core i7 Processor

The Core i7 Processor device provides the host interface controller, system memory interface (DDR3), direct media interface, and integrated graphics engine, and also supports external graphics interfaces (over a PCI Express port). The Core i7 includes two PCIe x8 ports for connectivity to platform devices.

Core i7 is Intel's high performance, low power processor based on the Intel Core micro-architecture with Two Cores/Four Threads (Intel Hyper-Threading® Technology), 32 kB (per core) on-die instruction and data L1 caches, a 256 kB (per core) on-chip L2 cache, and a 4 MB shared L3 cache.

Processor operation speed can be factory configured to 2.53 GHz for high performance, 2.0 GHz for low power, and 1.33 GHz for ultra low power.

Platform Controller Hub (PCH)

The PCH integrates a number of I/O device controllers and interfaces supporting legacy and high-speed resources to allow system design flexibility. The PCH also includes HDMI and CRT controllers which receive their display data from the Core i7 integrated graphics controller over the Intel Flexible Display Interface (Intel FDI) interconnecting the Core i7 device with the PCH.

VME

The C162 implements Tundra's Tsi148 PCI-X to VME 2eSST Bridge for interconnection to the VME bus. The VME Bridge is located on the PCI bus allowing for high-speed operation and throughput.

The VME interface provides full master and slave capabilities and supports the following:

- 2eSST and 2eVME protocol support
- Legacy traditional VME protocol support
- A64/A32/A24/A16 addressing modes
- MBLT/BLT/D64/D32/D16/D8 data transfer modes
- Interrupter and handler capability on all seven VME interrupt lines
- Four mailbox and four location monitors for in-system board communication
- Full system controller functionality – arbitration, VME clock generation, VME global timeout timer (BERR)
- Flexible register set allowing manipulation of all VME options

The Tsi148 Bridge incorporates large FIFOs for optimal usage of the two buses on which it operates (PCI and VME). In addition, it includes two DMA engines supporting high data rate transfers.

Memory

SDRAM

Up to 8 GB of DDR3 SDRAM with error correction (ECC) operating at 1066 MT/s, configured in dual channels, provides maximum performance.

Dual Redundant Flash BIOS

The C162 is equipped with two 4 MB Flash BIOS devices. If the board fails to boot from the primary device, the boot process redirects to the backup Flash BIOS.

Flash Disk

A SATA II Flash Disk of up to 128 GB provides on-board mass storage, eliminating the need for externally attached mass-storage media. The Flash Disk is controlled by the SATA controller integrated in the PCH I/O hub.

The SATA Flash Disk is soldered on the board for maximum reliability under harsh environmental conditions.

Integrated Graphics Controller

The C162 includes an on-board graphics controller implemented in the Core i7. The graphics core is the Intel Gen 5.75 with 12 execution units, capable of 2D/3D graphics processing, supporting Microsoft DirectX 10 and SGI OpenGL 2.1.

The graphics core implements Intel's Floating Point technology enhancing the visual quality of the generated image.

The C162 provides a CRT (RGBHV) video output, routed to the backplane connectors for conduction-cooled boards, and to a front panel connector for air-cooled boards. In addition, two single link HDMI/DVI outputs with integrated audio are routed to the backplane connectors. The CRT output supports resolutions up to 2048x1536 @ 75 Hz, and the HDMI/DVI outputs support resolutions up to 1920x 1200 @ 60 Hz.

I/O Interfaces

In addition to its extremely high processing power, the C162 provides a wide variety of I/O capabilities.

Ethernet

Four 10BaseT/100BaseTX/1000BaseT interfaces are implemented in a Quad Gigabit LAN Controller (with integrated PHY) using four of the PCH PCIe lanes.

For air-cooled boards, one of these ports is routed to a front panel connector.

USB 2.0 Ports

USB Rev. 2.0 host controllers (backward compliant with Rev. 1.0 and Rev. 1.1) integrated in the PCH provide eight USB 2.0 ports (seven routed to backplane connectors and one to a front panel connector on air-cooled boards). The controllers integrate the USB transceivers supporting high-speed, full-speed, and low-speed signaling. The C162 is capable of providing power to downstream devices.

SATA II

Two SATA II interfaces enable connection of external mass storage devices to the C162. The SATA II interface is fully compliant with the Serial ATA 1.0 specification with SATA II extensions, supporting data transfer rates of up to 300 MB/s.

Serial I/O

The C162 provides four UART serial ports supporting full RS-232/422/485 physical interfaces. Serial ports are fully compliant with the 16550 programming model.

Discrete I/O

Up to 12 single-ended or six differential general-purpose discrete I/O channels are provided. Each channel may be independently configured as input or output. Configured as input each of these channels may be programmed to generate an interrupt on any level shift event.

The 12 discrete I/O channels are divided into six groups, each controlling two signals. Each group may be configured as two single-ended TTL channels or one differential RS-422 channel.

Opto-Isolated CANbus 2.0B Interface

The C162 includes two independent opto-isolated CANbus 2.0B ports supporting speeds up to 1 Mbps.

HD Audio

The ICH8 Controller Hub supports Intel's High Definition (HD) Audio, which is compliant with Microsoft's Universal Audio Architecture (UAA). Using an HD Audio codec, the C162 provides stereo input and output interfaces though its VME connectors.

PMC/XMC Expansion

The C162 provides two industry standard expansion slots for extended flexibility and integration of additional elements to the SBC. The expansion slots are capable of operating as PMC or XMC.

PMC Slot 1

C162 PMC slot 1 resides on a 64-bit PCI-X bus, provided by a PCIe to PCI-X Bridge, and is capable of up to 133 MHz bus operation.

PMC slot 1 is universal, supporting both 3.3 V and 5 V PCI I/O signaling levels. This slot therefore does not include a voltage key.

PMC Slot 2

C162 PMC slot 2 resides on a 64-bit PCI bus, provided by a PCIe to PCI-X Bridge, and is capable of up to 66 MHz bus operation.

PMC slot 2 supports only 3.3 V PCI I/O signaling levels and thus includes the voltage key that only allows installation of 3.3 V PMCs.

XMC Slots

The XMC slots connect to the CPU subsystem through a PCIe x8 port. The PCIe interface supports x8, x4, x2 and x1 bus widths and is compliant with PCIe Revision 2.0 at 2.5 GHz.

The XMC slots are fully complaint with VITA 42.

I/O Routing

C162 on-board I/O resources and PMC/XMC I/O are routed to the VME P2 and P0 backplane connectors.

Due to the limited number of I/O pins available on the P2 and P0 connectors, it is not possible to simultaneously route all C162 on-board I/O plus all PMC/XMC I/O to the backplane. For this reason, various I/O configurations of the C162 are available (for more information, see *I/O Variants* below).

On air-cooled versions, some of the I/O interfaces are available at the front panel. Refer to the front panel section for more information.

Timers

The C162 includes one 32/64-bit and seven 32-bit timers/counters providing high-precision timing functionality. These timers can be chained together (cascaded) to support long timing interval counting applications.

A real-time clock (RTC) provides time and date keeping. The RTC is backed up by a large capacitor as well as a battery for long term parameter storage.

Both standard and windowed (avionics-style) watchdog timers are available on the C162. Implemented in the system FPGA, the watchdog is an avionics-style programmable windowed watchdog timer, which must be serviced within a software programmable window defined by minimum and

maximum times. If serviced too early, too late, or not at all, this watchdog timer will generate a timeout event. It may be independently set to generate a non-maskable interrupt or reset the SBC.

Elapsed Time Recorder

An on-board electronic Elapsed Time Recorder (ETR) records cumulative operation time and power on-off cycles in a dedicated NVRAM whenever the C162 is powered. ETR data is software accessible by the user.

Front Panel Connectors and Switches

The air-cooled version of the board is provided with a front panel. The front panel includes the following:

- One GbE port (RJ-45 connector)
- One USB port (standard USB connector)
- One CRT output (standard VGA connector)
- Reset Pushbutton

The front panel GbE port is at the expense of one backplane GbE port. Other front panel I/O is in addition to backplane I/O.

Drop-in Compatibility

As a true drop-in replacement for Aitech's C160 SBC, the C162 provides a convenient upgrade path for systems currently using the C160. The C162 delivers increased processing power while retaining the same form factor and identical pinout.

Software

Test and Diagnostic Features

The C162 is supplied with a customized BIOS tailored to its architecture, capabilities, and features.

The BIOS includes POST capabilities as well as system configuration options for boot device, boot sequence, etc.

A JTAG/COP interface to the processor is provided for debugging and development purposes.

Operating Systems

The C162 with its custom BIOS fully supports installation and operation of the following operating systems:

- Microsoft Windows™
- Linux®
- WindRiver VxWorks®

Operating system specific device drivers are provided for all on-board resources, allowing the user to take full advantage of the C162's powerful features.

Support for other operating systems may be available upon request.

Mechanical Features

The C162 is available in both air-cooled and conduction-cooled mechanical formats. Both are single slot 6U modules.

A custom metal frame integral to the conduction-cooled version of the C162 provides excellent rigidity and shock resistance. The frame also provides an array of stiffeners to support rugged PMCs/XMCs.

Dimensions

Air-cooled: per ANSI/VITA 1-1994

Conduction-cooled: per IEEE 1101.2

Weight

Cooling	CPU *	Weight
Air	U, L	< 800 g (1.77 lbs)
	S	< 800 g (1.77 lbs) [Commercial] * < 1000 g (2.21 lbs) [Rugged, Military] *
Conduction	U	< 900 g (1.99 lbs)
	L, S	< 1100 g (2.43 lbs)

* See Processor and Ruggedization options in Ordering Information

Thermal Management

Careful mechanical design, including custom heatsinks combined with a metal frame, allow for optimal heat dissipation and relief of the board. The C162 is also equipped with two temperature sensors, located at temperature-critical locations, to monitor board temperature and provide temperature data to user application software.

Power Requirements

The C162 takes all its power from the VME backplane. It should be provided with +5.0 V and ±12 V as defined by the VME64x specification (±12 V is required for PMC/XMC compliance only; the C162 does not require ±12 V for its own operation).

All other power sources required by C162 resources are generated on board.

In its fully featured configuration (no PMCs/XMCs installed), C162 power consumption with the different processors options, in Windows XP idle condition and when running the PassMark® BurnInTest (CPU, memory, graphics), is as follows:

Input Voltage	Processor		
	1.33 GHz	2.0 GHz	2.53 GHz
+5.0 V	5.2/6.8 A	5.4/8.6 A	5.6/11 A
+12 V	0 A (no PMC/XMC mounted)		
–12 V	0 A (no PMC/XMC mounted)		
Power	26/34 W	27/43 W	28/55 W

* Values are Idle/PassMark

Environmental Features

Please refer to the Aitech Ruggedization datasheet.

C162
Core™ i7 6U VME SBC

Accessories

For system integration and other development purposes, the TM162 Rear Transition Module (RTM) provides convenient access via standard connectors to all C162 I/O interfaces and all PMC/XMC I/O. The RTM supports both the air-cooled and conduction-cooled versions of the C162 when mounted in a commercial air-cooled chassis.

I/O Variants

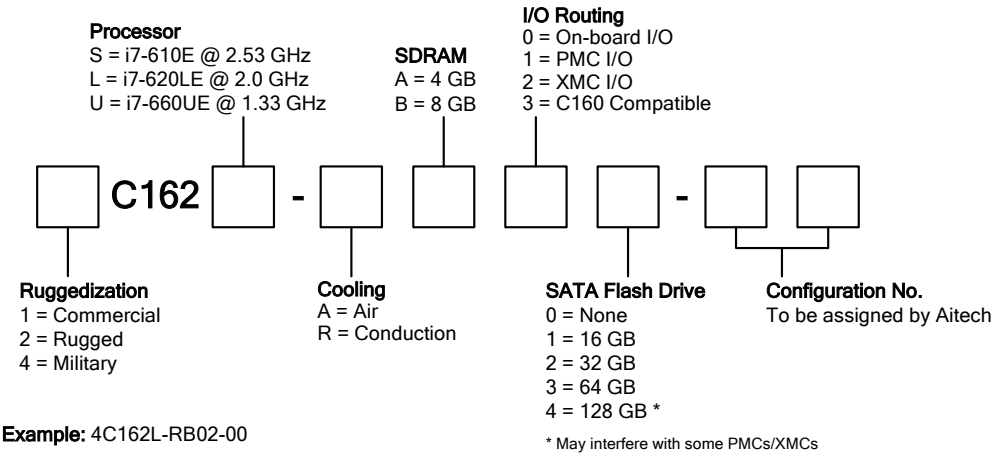
The C162 is available in four basic I/O variants. These configurations are hard-wired at the factory and are not configurable by the user. Customized versions can also be produced to meet specific customer requirements. Contact an Aitech sales representative for more information.

The following table lists available I/O for each of the standard C162 variants.

	Variant #0 On-board I/O	Variant #1 PMC I/O	Variant #2 XMC I/O	Variant #3 C160 Compatible
GbE	4	2	1	2
DVI	2	N/A	N/A	N/A
RGBHV	1	1	1	1
Discrete	4	8	8	8
Serial	4	4	1	2
CANbus	2	N/A	N/A	N/A
USB	7 *	2 *	2 *	4 *
SATA	2	2	2	2
AUDIO	In and Out	In and Out	N/A	In and Out
PMC #1 I/O	55	64	N/A	64
PMC #2 I/O	22	64	N/A	58
XMC #1 I/O	N/A	N/A	Diff 20, SE 38	N/A
XMC #2 I/O	N/A	N/A	Diff 20, SE 38	N/A

* Air-cooled versions of the C162 include one additional USB 2.0 port, available only at the front panel

Ordering Information



Example: 4C162L-RB02-00

* May interfere with some PMCs/XMCs

For more information about the C162 or any Aitech product, please contact Aitech Defense Systems sales department at (888) Aitech-8 (248-3248).

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