» User Guide «

AM5010

Double Mid-Size AMC Module based on the Intel® Core™2 Duo Processor with the Intel® 3100 Chipset

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Table of Contents

Revision History ..... *ii*
Imprint ..... *ii*
Disclaimer ..... *ii*
Table of Contents ..... *iii*
List of Tables ..... *ix*
List of Figures ..... *xi*
Proprietary Note ..... *xiii*
Trademarks ..... *xiii*
Environmental Protection Statement ..... *xiii*
Explanation of Symbols ..... *xiv*
For Your Safety ..... *xv*
High Voltage Safety Instructions ..... *xv*
Special Handling and Unpacking Instructions ..... *xv*
General Instructions on Usage ..... *xvi*
Two Year Warranty ..... *xvii*

1. Introduction ..... 1 - 3
1.1 Board Overview ..... 1 - 3
1.2 Board-Specific Information ..... 1 - 4
1.3 System Relevant Information ..... 1 - 5
1.4 Board Diagrams ..... 1 - 5
1.4.1 Functional Block Diagram ..... 1 - 5
1.4.2 Front Panel ..... 1 - 7
1.4.3 Board Layouts ..... 1 - 8
1.5 Technical Specification ..... 1 - 10
1.6 Kontron Software Support ..... 1 - 14
1.7 Standards ..... 1 - 15
1.8 Related Publications ..... 1 - 16

2. Functional Description ..... 2 - 3
2.1 CPU, Memory and Chipset ..... 2 - 3
2.1.1 CPU ..... 2 - 3
2.1.2 Memory ..... 2 - 3

2.1.3 Intel® 3100 Chipset ....2 - 4
2.2 Peripherals ....2 - 4
2.2.1 Timer ....2 - 4
2.2.2 Watchdog Timer ....2 - 4
2.2.3 Battery ....2 - 4
2.2.4 Power Monitor and Reset Generation ....2 - 5
2.2.5 FLASH Memory ....2 - 5
2.2.6 Onboard SATA HDD/SSD Interface ....2 - 5
2.3 Board Interfaces ....2 - 6
2.3.1 Front Panel LEDs ....2 - 6
2.3.2 DIP Switches SW2, SW3 and SW5 ....2 - 9
2.3.3 Debug Interface ....2 - 10
2.3.4 Module Handle ....2 - 10
2.3.5 USB Host Interfaces ....2 - 11
2.3.6 Onboard USB 2.0 NAND Flash Connector J9 ....2 - 11
2.3.7 Serial Ports ....2 - 12
2.3.8 Gigabit Ethernet Interfaces ....2 - 12
2.3.9 DVI-I Interface ....2 - 14
2.3.10 Serial ATA Interface ....2 - 15
2.4 AMC Interconnection ....2 - 16
2.4.1 Fabric Interface ....2 - 16
2.4.2 Synchronization Clock Interface ....2 - 18
2.4.3 System Management Interface ....2 - 18
2.4.4 JTAG Interface ....2 - 18
2.4.5 Module Power Interface ....2 - 18
2.4.6 Pinout of AMC Card-edge Connector J1 ....2 - 19
2.5 Module Management ....2 - 23
2.5.1 Module Management Controller ....2 - 23
2.5.2 MMC Signals Implemented on the AM5010 ....2 - 24

3. Installation ....3 - 3

3.1 Safety Requirements ....3 - 3
3.2 Module Handle Positions ....3 - 4

3.3 Hot Swap Procedures ..... 3 - 5
3.3.1 Hot Swap Insertion ..... 3 - 5
3.3.2 Hot Swap Extraction ..... 3 - 7
3.4 Installation of AM5010 Peripheral Devices ..... 3 - 8
3.4.1 USB Device Installation ..... 3 - 8
3.4.2 USB 2.0 NAND Flash Module Installation ..... 3 - 8
3.4.3 Battery Replacement ..... 3 - 9
3.4.4 Onboard HDD/SSD Option Installation ..... 3 - 9
3.5 Software Installation ..... 3 - 9

4. Configuration ..... 4 - 3
4.1 DIP Switch SW2 Configuration ..... 4 - 3
4.1.1 User-Specific LED Configuration (BIOS POST Code) ..... 4 - 4
4.1.2 BIOS Firmware Hub Flash Configuration ..... 4 - 4
4.1.3 Boot Order Configuration ..... 4 - 4
4.1.4 Clear BIOS CMOS Configuration ..... 4 - 4
4.2 DIP Switch SW3 Configuration ..... 4 - 5
4.3 DIP Switch SW5 Configuration ..... 4 - 5
4.4 Interrupts ..... 4 - 6
4.5 Memory Map ..... 4 - 7
4.5.1 I/O Address Map ..... 4 - 7
4.6 AM5010-Specific Registers ..... 4 - 8
4.6.1 BIOS Configuration Register ..... 4 - 8
4.6.2 MMC I/O Status Register ..... 4 - 9
4.6.3 Watchdog Timer Control Register ..... 4 - 10
4.6.4 AMC Geographic Addressing Register ..... 4 - 12
4.6.5 Board and Logic Revision Register ..... 4 - 12
4.6.6 Reset Status Register ..... 4 - 13
4.6.7 Host I/O Status Register ..... 4 - 14
4.6.8 Host I/O Configuration Register ..... 4 - 14
4.6.9 Board ID Register ..... 4 - 14
4.6.10 Board Interrupt Configuration Register ..... 4 - 15
4.6.11 Hot Swap Status Register ..... 4 - 15

4.6.12 User-Specific LED Configuration Register ....4 - 16
4.6.13 User-Specific LED Control Register ....4 - 18
4.6.14 Serial Over LAN Configuration Register ....4 - 19
4.6.15 Delay Timer Control/Status Register ....4 - 20
4.6.16 MMC Configuration Register ....4 - 21
4.6.17 IPMI Keyboard Controller Style Interface ....4 - 21

5. Power Considerations ....5 - 3
5.1 AM5010 Voltage Ranges ....5 - 3
5.2 Carrier Power Requirements ....5 - 3
5.2.1 Payload Power ....5 - 3
5.2.2 Payload and MMC Voltage Ramp ....5 - 4
5.2.3 Module Management Power Consumption ....5 - 4
5.3 Payload Power Consumption of the AM5010 ....5 - 4
5.4 IPMI FRU Payload Power Consumption ....5 - 5
5.5 Payload Start-Up Current of the AM5010 ....5 - 6

6. Thermal Considerations ....6 - 3
6.1 Thermal Monitoring ....6 - 3
6.1.1 Placement of the Temperature Sensors ....6 - 4
6.1.2 Board Thermal Monitoring ....6 - 6
6.1.3 Processor Thermal Monitoring ....6 - 6
6.1.4 Chipset Thermal Monitor Feature ....6 - 8
6.2 System Airflow ....6 - 8
6.2.1 Forced Airflow in MicroTCA Systems ....6 - 8
6.2.2 Airflow Impedance ....6 - 10
6.2.3 Airflow Paths ....6 - 11

A. AM5010M-MK2.5SATA Assembly Kit .... A - 3
A.1 SATA Adapter Overview .... A - 3
A.2 Technical Specifications .... A - 3
A.3 SATA Adapter Functional Block Diagram .... A - 4

A.4 SATA Adapter Layout ..... A - 5
A.5 SATA Adapter Interfaces ..... A - 6
A.5.1 Board-to-Board Connector J1 ..... A - 6
A.5.2 SATA Connector J2 ..... A - 7

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List of Tables

1-1 System Relevant Information ..... 1 - 5
1-2 AM5010 Main Specifications ..... 1 - 10
1-3 Standards ..... 1 - 15
1-4 Related Publications ..... 1 - 16
2-1 Module Management LED Function ..... 2 - 7
2-3 POST Code Sequence ..... 2 - 8
2-2 User-Specific LED Function ..... 2 - 8
2-5 DIP Switch SW2 Functions ..... 2 - 9
2-6 DIP Switch SW3 Functions ..... 2 - 9
2-7 DIP Switch SW5 Functions ..... 2 - 9
2-4 POST Code Example ..... 2 - 9
2-8 Module Handle Positions ..... 2 - 10
2-9 USB Connectors J3/J5 Pinout ..... 2 - 11
2-10 USB NAND Flash Con. J9 Pinout ..... 2 - 11
2-11 Serial Connector J7 (COM1) Pinout ..... 2 - 12
2-12 Gigabit Ethernet Connectors J4/J6 Pinout Based on Implementation .. 2 - 13
2-13 DVI-I Connector J2 Pinout ..... 2 - 14
2-14 SATA Port Routing ..... 2 - 15
2-15 SATA Extension Connector J8 Pinout ..... 2 - 15
2-16 Pinout of AMC Card-edge Connector J1 ..... 2 - 19
2-17 Reserved Pins Description ..... 2 - 22
2-18 Extended Options Region Pins Description ..... 2 - 22
2-19 JTAG Pins Description ..... 2 - 22
2-20 Processor and Chipset Supervision ..... 2 - 24
2-21 AMC-Specific Signals ..... 2 - 24
2-22 Onboard Power Supply Supervision ..... 2 - 24
2-23 Temperature Signals ..... 2 - 25
4-1 SW2 Functions ..... 4 - 3
4-2 User-Specific LED Configuration (BIOS POST Code) ..... 4 - 4
4-3 BIOS Firmware Hub Flash Configuration ..... 4 - 4
4-4 BIOS Boot Order Configuration ..... 4 - 4
4-5 BIOS CMOS Configuration ..... 4 - 4

4-6 Configuration of DIP Switch SW3, Switches 1 and 2 ..... 4 - 5
4-7 Configuration of DIP Switch SW5, Switches 1 and 2 ..... 4 - 5
4-8 Interrupt Setting ..... 4 - 6
4-9 I/O Address Map ..... 4 - 7
4-10 BIOS Configuration Register ..... 4 - 8
4-11 MMC I/O Status Register ..... 4 - 9
4-12 Watchdog Timer Control Register ..... 4 - 11
4-13 AMC Geographic Addressing Register ..... 4 - 12
4-14 Board and Logic Revision Register ..... 4 - 12
4-15 Reset Status Register ..... 4 - 13
4-16 Host I/O Status Register ..... 4 - 14
4-17 Host I/O Configuration Register ..... 4 - 14
4-18 Board ID Register ..... 4 - 14
4-19 Board Interrupt Configuration Register ..... 4 - 15
4-20 Hot Swap Status Register ..... 4 - 15
4-21 User-Specific LED Configuration Register ..... 4 - 16
4-22 User-Specific LED Control Register ..... 4 - 18
4-23 Serial Over LAN Configuration Register ..... 4 - 19
4-24 Delay Timer Control / Status Register ..... 4 - 20
4-25 MMC Configuration Register ..... 4 - 21
5-1 DC Operational Input Voltage Ranges ..... 5 - 3
5-2 Payload Power Consumption: AM5010 with Core™2 Duo, 1.5 GHz ..... 5 - 5
5-3 IPMI FRU Payload Power Consumption of the AM5010 ..... 5 - 5
5-4 Payload Start-Up Current of the AM5010 ..... 5 - 6
6-1 Pressure Drop vs. Airflow Data ..... 6 - 10
6-2 Deviation of the Airflow Rate on the AM5010 ..... 6 - 11
A-1 SATA Adapter Main Specifications ..... A - 3
A-2 Board-to-Board Connector J1 Pinout ..... A - 6
A-3 SATA Connector J2 Pinout ..... A - 7

List of Figures

1-1 AM5010 Functional Block Diagram ..... 1 - 6
1-2 AM5010 Front Panel ..... 1 - 7
1-3 AM5010 Board Layout (Top View) ..... 1 - 8
1-4 AM5010 Board Layout (Bottom View) ..... 1 - 9
2-1 Front Panel LEDs ..... 2 - 6
2-2 Module Handle Positions ..... 2 - 10
2-3 USB Connectors J3/J5 ..... 2 - 11
2-4 USB NAND Flash Connector J9 ..... 2 - 11
2-5 Serial Connector J7 (COM1) ..... 2 - 12
2-6 Gigabit Ethernet Connectors J4/J6 ..... 2 - 13
2-7 DVI-I Connector J2 ..... 2 - 14
2-8 SATA Extension Connector J8 ..... 2 - 15
2-9 AM5010 Port Mapping ..... 2 - 17
3-1 Module Handle Positions ..... 3 - 4
4-1 DIP Switch SW2 ..... 4 - 3
6-1 Board Temperature Sensor Placement (AM5010 Bottom View) ..... 6 - 4
6-2 Processor Temperature Sensor Placement (AM5010 Top View) ..... 6 - 5
6-3 Temperature vs. Airspeed Graph of the AM5010 ..... 6 - 9
6-4 AM5010 Impedance Curve ..... 6 - 10
6-5 Thermal Zones of the AM5010 Module ..... 6 - 11
A-1 SATA Adapter Functional Block Diagram ..... A - 4
A-2 SATA Adapter Layout ..... A - 5
A-3 SATA Connector J2 ..... A - 7

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Please refer also to the section “High Voltage Safety Instructions” on the following page.



Warning, ESD Sensitive Device!

This symbol and title inform that electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

Please read also the section “Special Handling and Unpacking Instructions” on the following page.



Warning!

This symbol and title emphasize points which, if not fully understood and taken into consideration by the reader, may endanger your health and/or result in damage to your material.



Note ...

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Special Handling and Unpacking Instructions



ESD Sensitive Device!

Electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

Warning!



This product has gold conductive fingers which are susceptible to contamination. Take care not to touch the gold conductive fingers of the AMC Card-edge connector when handling the board.

Failure to comply with the instruction above may cause damage to the board or result in improper system operation.

Do not handle this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.

Whenever possible, unpack or pack this product only at EOS/ESD safe work stations. Where a safe work station is not guaranteed, it is important for the user to be electrically discharged before touching the product with his/her hands or tools. This is most easily done by touching a metal part of your system housing.

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In performing all necessary installation and application operations, please follow only the instructions supplied by the present manual.

Keep all the original packaging material for future storage or warranty shipments. If it is necessary to store or ship the board, please re-pack it as nearly as possible in the manner in which it was delivered.

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Chapter 1

Introduction

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1. Introduction

1.1 Board Overview

The AM5010 is a highly integrated CPU board implemented as a Double, Mid-size Advanced Mezzanine Card (AMC) Module. The design is based on the Intel® Core™2 Duo processor combined with the Intel® 3100 server-class chipset.

The board supports the Intel® Core™2 Duo processor, 1.5 GHz version in 65 nm technology with 64 kB L1 and 4 MB L2 cache in a 479 µFCBGA package with a 667 MHz Front Side Bus (FSB) speed. The processor and the memory are soldered on the AM5010, which results in higher Mean Time Between Failures (MTBF) and a significant improvement in cooling.

The Intel® Core™2 Duo is a low-power, dual-core processor supporting Intel's Virtualization Technology (VT), Intel® Extended Memory 64 Technology (Intel® EM64T) support, and enhanced address range for up to 64 GB memory. It delivers optimized power-efficient computing and outstanding dual-core performance with low power consumption.

The board includes up to 4 GB registered Double Data Rate (DDR2) memory with Error Checking and Correcting (ECC) running at 400 MHz. Two Dual Gigabit Ethernet controllers each utilizing a x4 lane PCI Express interconnection to the Intel® 3100 chipset ensure maximum data throughput between processor and memory.

The AM5010 has full hot swap capability, which enables the board to be replaced, monitored and controlled without having to shut down the AMC-supporting carrier board or the MicroTCA system. A dedicated Module Management Controller (MMC) is used to manage the board and support a defined subset of Intelligent Platform Management Interface (IPMI) commands and PICMG (ATCA/AMC) command extensions, which enables operators to detect and eliminate faults faster at module level. This includes monitoring several onboard temperature conditions, board voltages and the power supply status, managing hot swap operations, rebooting the board, etc. All in all, IPMI enhances the board's availability and reliability while reducing the operating costs and the mean-time-to-repair.

The AM5010 supports two USB 2.0 host interfaces, one standard RS-232 COM port, two Gigabit Ethernet ports, and a DVI-I port to the front as well as a variety of high-speed interconnect topologies to the system, such as Dual Gigabit SerDes connection and Dual SATA storage interface in the Common Options Region, 1x4 or 4x1 PCI Express, and a Debug port and Serial port in the Extended Options Region. In addition, the AM5010 provides support for one onboard SATA HDD/SSD and a single USB 2.0 NAND Flash module, both of which are optionally available.

The AM5010 fits into applications situated in industrial environments, including I/O intensive applications. The careful design and the selection of high temperature resistant components ensure a high product availability. This, together with a high level of scalability, reliability, and stability, make this state-of-the-art product a perfect core technology for long-life embedded applications. In addition, it is targeted towards telecom market applications such as radio network controllers, media streaming, traffic processing, database management and routing.

1.2 Board-Specific Information

Due to the outstanding features of the AM5010, such as superior processing power and flexible interconnect topologies, this AMC board provides a highly scalable solution not only for a wide range of telecom and data network applications, but also for several highly integrated industrial environment applications with solid mechanical interfacing.

Some of the AM5010's outstanding features are:

- Intel® Core™2 Duo processor L7400 (LV), 1.5 GHz, 667 MHz FSB, 4 MB L2 cache
- Intel® 3100 chipset
- Up to 4 GB DDR2 SDRAM memory with ECC running at 400 MHz (PC3200)
- AMC interconnection
  - Dual Gigabit SerDes connection in the Common Options Region
  - Dual SATA storage interface in the Common Options Region
  - 1x4 or 4x1 PCI Express in the Fat Pipes Region (operates as a root complex controller only)
  - Serial port in the Extended Options Region
  - Debug port in the Extended Options Region
  - PCI Express clock reference input, FCLKA
- Full hot swap support
- Two Intel® 82571EB Dual Gigabit Ethernet controllers:
  - One controller connected to the Common Options Region
  - One controller connected to Front I/O
- Onboard USB 2.0 port for up to 8 GB USB 2.0 NAND Flash memory
- Two USB 2.0 host ports on Front I/O
- One Serial port on Front I/O (RS232)
- Two Gigabit Ethernet ports on Front I/O
- One DVI-I interface on front panel, digital and analog
- One SATA interface for onboard 2.5” SATA HDD/SSD (HDD/SSD optional)
- Two redundant FWH Flash chips for BIOS (2 x 1 MB)
- Battery backed-up real-time clock (RTC)
- Dedicated IPMI Module Management Controller with redundant Firmware Flash (2 x 512 kB)
- Watchdog Timer
- JTAG interface for debugging and manufacturing
- Four bicolor User-Specific LEDs (providing debugging and POST code information, etc.)
- Two onboard DIP switches (for selecting the BIOS bank, overwriting E-Keying, etc.)
- Standard temperature range: -5°C to + 55°C
- Thermal management
- Passive heat sink solution
- Double, Mid-size AMC module
- Designed to be compliant with the following specifications:
  - PICMG AMC.0, Advanced Mezzanine Card Specification R2.0 (with mechanical restrictions)
  - PICMG AMC.1, PCI Express and Advanced Switching R1.0
  - PICMG AMC.2, Gigabit Ethernet R1.0
  - PICMG AMC.3, Storage Interface R1.0
  - PICMG MTCA.0 Micro Telecommunications Computing Architecture R1.0
  - IPMI - Intelligent Platform Management Interface Specification, v2.0, R1.0
- AMI BIOS

1.3 System Relevant Information

The following system-relevant information is general in nature but should still be considered when developing applications using the AM5010.

Table 1-1: System Relevant Information

SUBJECT	INFORMATION

Hardware Requirements	The AM5010 can be installed on any AMC-supporting carrier board (with mechanical restrictions) or MicroTCA backplane with the following AMC Card-edge connector port mapping:
	• Common Options Region ports 0-1
	  • Two Gigabit Ethernet SerDes ports
	• Common Options Region ports 2-3
	  • Two Serial ATA ports
	• Fat Pipes Region ports 4-7
	  • PCI Express interface: configurable as either 1x4 or 4x1
	• Extended Options Region port 14
	  • One Debug port
	• Extended Options Region port 15
	  • One Serial port
	• Clock
	  • PCI Express clock reference input, FCLKA
	For further information on the AMC interconnection, refer to Chapter 2.4, “AMC Interconnection”.

PCI Express Configuration	The AM5010 only supports the PCI Express root complex configuration; non-transparent bridge functionality is not supported.
Operating Systems	The AM5010 is offered with various Board Support Packages. Please contact Kontron for information concerning the availability of operating systems for the AM5010.

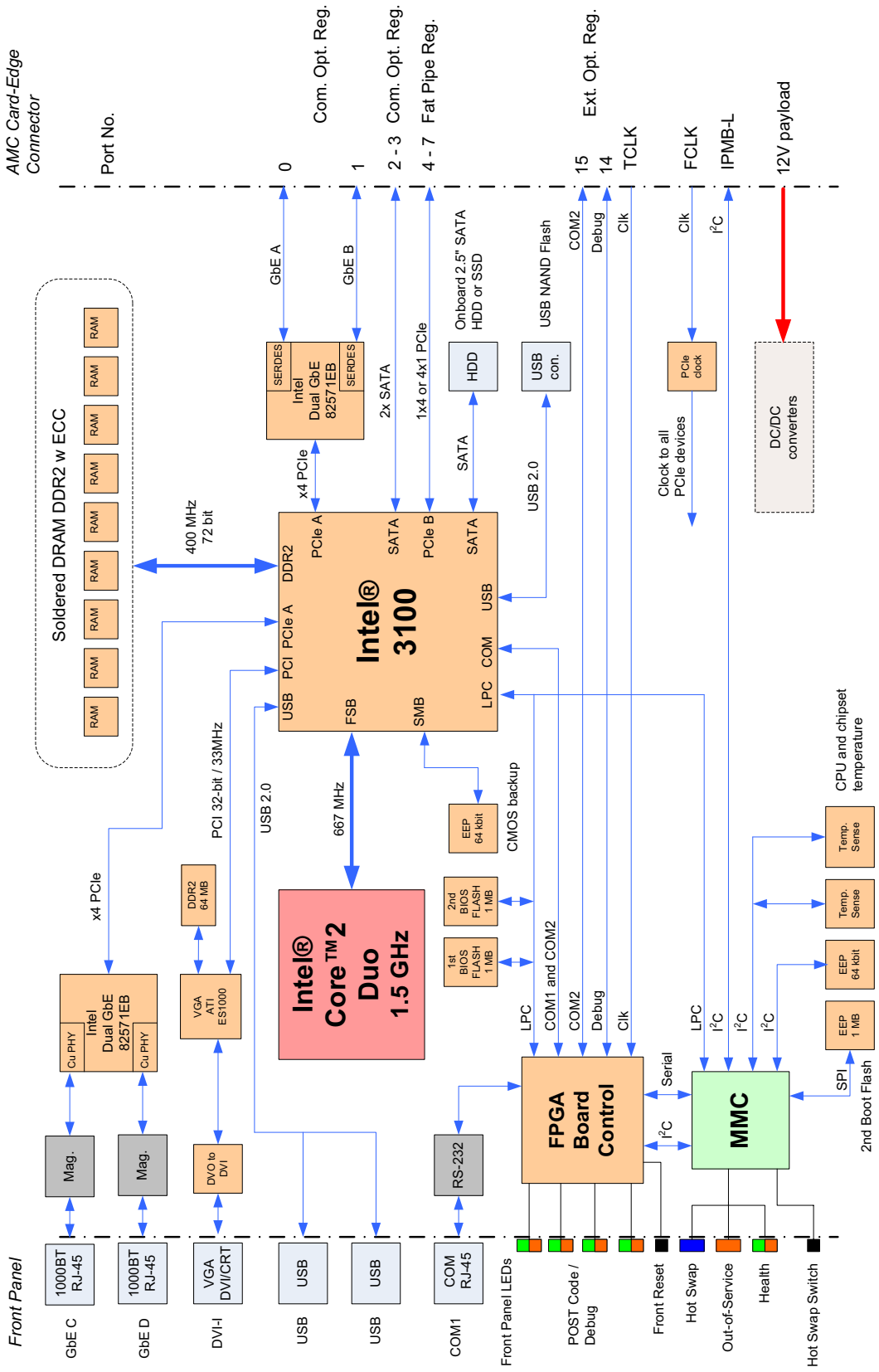
1.4 Board Diagrams

The following diagrams provide additional information concerning board functionality and component layout.

1.4.1 Functional Block Diagram

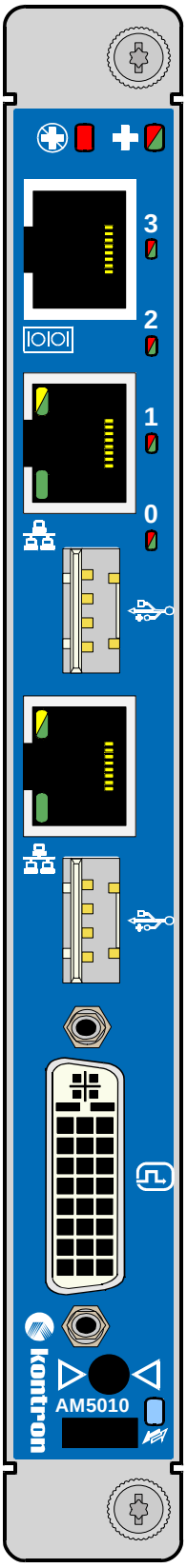
The following figure shows the block diagram of the AM5010.

Figure 1-1: AM5010 Functional Block Diagram



1.4.2 Front Panel

Figure 1-2: AM5010 Front Panel



Module LEDs

	LED1 (red):	Out-of-Service LED
	LED2 (red/green/amber):	Health LED
	HS LED (blue):	The hot swap indicator provides basic feedback to the user on the hot swap state of the module. The HS LED states are *off*, *short blink*, *long blink*, and *on*.

User-Specific LEDs

3	ULED3 (red/green):	AMC Eth. port A link signal status or BIOS POST code LED
2	ULED2 (red/green):	AMC Eth. port B link signal status or BIOS POST code LED
1	ULED1 (red/green):	Freely configurable or BIOS POST code LED
0	ULED0 (red/green):	Freely configurable or BIOS POST code LED

Connectors

- Serial Connector
- Gigabit Ethernet Connector
- USB Connector
- DVI-I Connector

For further information on the LEDs used on the AM5010, refer to Chapter 2.3.1, “Front Panel LEDs”.

1.4.3 Board Layouts

Figure 1-3: AM5010 Board Layout (Top View)

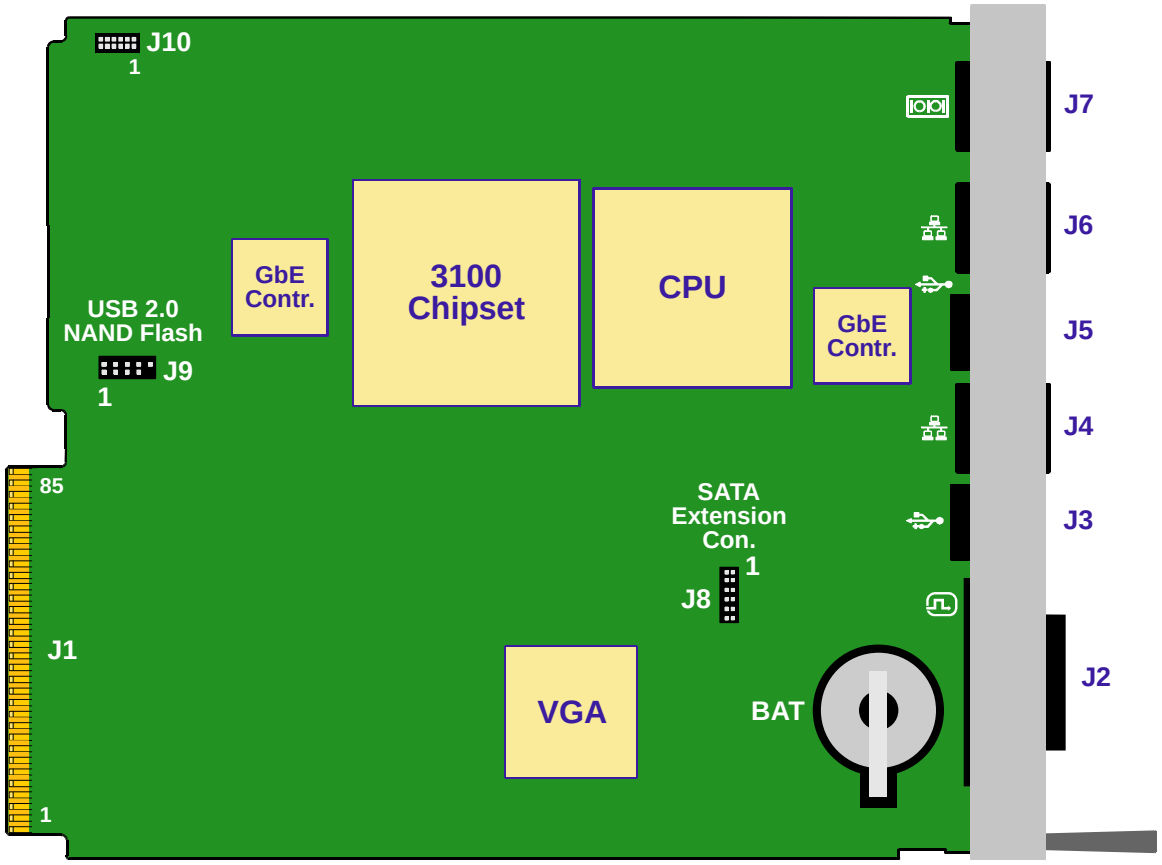
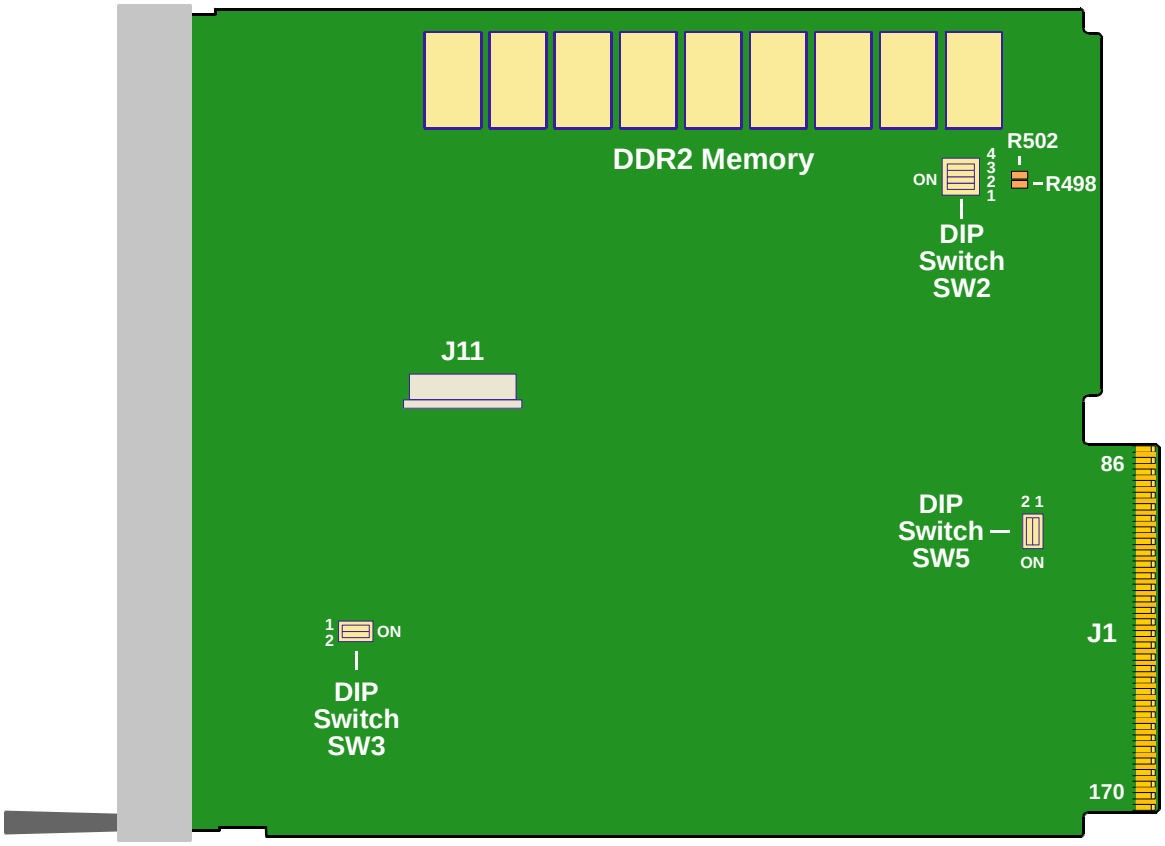


Figure 1-4: AM5010 Board Layout (Bottom View)



1.5 Technical Specification

Table 1-2: AM5010 Main Specifications

	FEATURES	SPECIFICATIONS
Processor and Memory	CPU	The AM5010 supports the following microprocessor: • Intel® Core™2 Duo processor L7400 (LV), 1.5 GHz, 667 MHz FSB, 4 MB L2 cache, 479 µFCBGA packaging Please contact Kontron for further information concerning the suitability of other Intel processors for use with the AM5010.

	Memory	Main Memory:
		• Up to 4 GB registered DDR2 SDRAM memory with ECC running at 400 MHz (PC3200)
		Cache structure:
		• 64 kB L1 on-die full speed processor cache
		  • 32 kB for instruction cache
		  • 32 kB for data cache
		• 4 MB L2 on-die full speed processor cache
		FLASH Memory:
		• Two redundant Firmware Hub (FWH) Flash chips (2 x 1 MB) controlled by the MMC
		Mass Storage Device:
		• Up to 8 GB USB 2.0 NAND Flash memory optionally available
		Serial EEPROM with 64 kbit

Chipset	Intel® 3100	Intel® 3100 chipset:
		• Support for a Core™2 Duo processor
		• 64-bit AGTL/AGTL+ based System Bus interface at up to 667 MHz
		• System Memory interface with optimized support for DDR2 SDRAM memory at 400 MHz with ECC
		• Three x4 PCI Express ports
		• RASUM (Reliability, Availability, Serviceability, Usability, and Manageability) features:
		  • Memory error detection and reporting of 1- and 2-bit errors including correction of 1-bit failures
		  • Integrated Memory Scrub Engine, which logs any uncorrectable memory errors
		  • Support for automatic read retry on uncorrectable errors
		  • Memory sparing allows for one memory bank per channel to be held in reserve and brought on-line if another memory bank in the channel becomes defective (only supported with 2 GB main memory configuration)
		• Six-Channel SATA 150 interface (only three channels are used)
		• USB 2.0 host interface with up to four USB ports available (only three USB 2.0 ports are used on the AM5010)
		• Firmware Hub (FWH) interface support
		• Low Pin Count (LPC) interface
		• PCI Rev. 2.2 compliant with support for 32-bit/33 MHz PCI operations (not used on the AM5010)
		• Power management logic support
		• Enhanced DMA controller, interrupt controller, and timer functions
		• System Management Bus (SMBus) compatible with most I²C™ devices
		• Two 16550-compatible Serial ports (COM)
		• Battery backed-up real-time clock (RTC)

Table 1-2: AM5010 Main Specifications (Continued)

FEATURES		SPECIFICATIONS
Onboard Controllers	Gigabit Ethernet	Two Intel® 82571EB Dual Gigabit Ethernet PCI Express bus controllers: • One controller connected to the Common Options Region • One controller connected to Front I/O
	VGA/DVI	ATI ES1000 2D graphics controller for enhanced graphics performance: • Supports resolutions of up to 1600 x 1200 pixels at a 75 Hz refresh rate • Digital and analog output • Dedicated 64 MB DDR2 memory
AMC Interconnection	Gigabit Ethernet	Common Options Region ports 0-1 • Two Gigabit Ethernet SerDes ports
	Serial ATA	Common Options Region ports 2-3 • Two Serial ATA 150 ports
	PCI Express	Fat Pipes Region ports 4-7 • PCI Express interface, configured either as 1x4 or 4x1, operating as a root complex controller only
	Debug Interface	Extended Options Region port 14 • One Debug port
	Serial Interface	Extended Options Region port 15 • One Serial port
	Clock Input	Clocks • PCI express clock reference input (FCLKA)
Connectors	Front Panel Connectors	• Two USB 2.0 ports on 4-pin connectors • One Serial port (COM1) with RS232-signal level on RJ45 connector • Two Gigabit Ethernet ports on RJ45 connectors • One DVI-I interface, digital and analog signals
	Onboard Connectors	• One SATA connector for optional 2.5” HDD/SSD • One USB 2.0 connector for optional USB 2.0 NAND Flash
	AMC Card-edge Connector	• One 170-pin AMC Card-edge connector
Switches	DIP Switches	Three DIP switches for board configuration: one four-position switch, and two two-position switches
	Reset Switch	One front panel hardware reset switch

Table 1-2: AM5010 Main Specifications (Continued)

	FEATURES	SPECIFICATIONS
LEDs	Module Management LEDs	• LED1 (red): Out-of-Service LED • LED2 (red/green/amber): Health LED • HS LED (blue): The hot swap indicator provides basic feedback to the user on the hot swap state of the module. The HS LED states are *off*, *short blink*, *long blink*, and *on*.
	User-Specific LEDs	• ULED3 (red/green): AMC Ethernet port A link signal status or BIOS POST code LED • ULED2 (red/green): AMC Ethernet port B link signal status or BIOS POST code LED • ULED1 (red/green): Freely configurable or BIOS POST code LED • ULED0 (red/green): Freely configurable or BIOS POST code LED
Timer	Watchdog Timer	• Software-configurable, two-stage Watchdog with programmable timeout ranging from 125 ms to 256 s in 12 steps • Serves for generating IRQ or hardware reset
	System Timer	• The Intel® 3100 chipset contains three 8254-style counters which have fixed uses • Real-time clock with battery backup • Hardware delay timer for short reliable delay times
IPMI	Module Management Controller	• Renesas H8 microcontroller with 40 kB RAM and redundant 512 kB Firmware Flash with automatic roll-back strategy • The MMC carries out IPMI commands such as monitoring several onboard temperature conditions, board voltages and the power supply status, and managing hot swap operations • The MMC is accessible via a local IPMB (IPMB-L) and two host Keyboard Controller Style (KCS) Interfaces
	Hot Swap	The AM5010 has full hot swap capability.
	Thermal Management	CPU and board overtemperature protection is provided by: • Four temperature sensors for monitoring the board temperature • Six processor sensors • One chipset sensor • Specially designed heat sink
Options	SATA HDD/SSD	The AM5010 provides interfacing for adding a single SATA hard disk drive or solid-state disk drive via the assembly kit: AM5010M-MK2.5SATA. This kit comes with a special SATA adapter which provides direct board-to-drive interfacing for 2.5” SATA HDD/SSDs.
	USB 2.0 NAND Flash	Up to 8 GB USB 2.0 NAND Flash can be added to the AM5010 using an optionally available mezzanine module connected to J9.

Table 1-2: AM5010 Main Specifications (Continued)

	FEATURES	SPECIFICATIONS
General	Power Consumption	See Chapter 5, “Power Considerations” for details.
	Temperature Range	Operational: -5°C to +55°C Storage: -40°C to +70°C Without battery or any additional components  *Note ...* When a battery is installed, refer to the operational specifications of the battery as this will most likely have an influence on the storage temperature of the AM5010 (See "Battery" below).  *Note ...* When additional components are installed, refer to their operational specifications as this will influence the operational and storage temperature of the AM5010.
	Mechanical	Double, Mid-size module
	Dimensions	180.6 mm x 148.5 mm x 18.96 mm
	Board Weight	Mid-size: 338 grams (without HDD/SSD)
	JTAG	Two JTAG interfaces: • One processor JTAG interface routed to the onboard debug connector for debugging purposes • One onboard JTAG interface connected to the AMC Card-edge connector for debugging and manufacturing purposes
	Battery	The AM5010 is provided with a battery socket for a 3.0V lithium battery for the RTC. Recommended type: CR2025 Temperature ranges: Operational: -20°C to +70°C typical (refer to the battery manufacturer’s specifications for exact range) Storage: -55°C to +70°C typical (no discharge)

Table 1-2: AM5010 Main Specifications (Continued)

	FEATURES	SPECIFICATIONS
Software	BIOS	AMI BIOS with 1 MB of Flash memory and having the following features: • Serial console redirection via the Serial port or LAN • QuickBoot • QuietBoot • BootBlock • LAN boot capability for diskless systems (standard PXE boot) • Boot from USB device (floppy, CD-ROM, hard disk, memory stick) • BIOS support for USB keyboards • Plug and Play capability • BIOS parameters are saved in the EEPROM • Board serial number is saved within the EEPROM • ACPI
	IPMI	Module Management Controller Firmware providing the following features: • The MMC is accessible via IPMB-L and two KCS interfaces with interrupt support • The MMC Firmware can be updated in field through all supported interfaces using the function “fwum...” of the free tool “ipmitool”. For further information on the ipmitool refer to the sourceforge.net website. • Two MMC Flash banks with automatic roll-back capability in case of an upgrade Firmware failure • Board supervision and control extensions such as board reset, power and Firmware Hub Flash control, and boot order configuration
	Operating Systems	The AM5010 is offered with various Board Support Packages. Please contact Kontron for information concerning the availability of operating systems for the AM5010.

1.6 Kontron Software Support

Kontron is one of the few AdvancedTCA, µTCA and CompactPCI vendors providing inhouse support for most of the industry-proven real-time operating systems that are currently available. Due to its close relationship with the software manufacturers, *Kontron* is able to produce and support BSPs and drivers for the latest operating system revisions thereby taking advantage of the changes in technology.

Finally, customers possessing a maintenance agreement with *Kontron* can be guaranteed hotline software support and are supplied with regular software updates. A dedicated web site is also provided for online updates and release downloads.

1.7 Standards

The *Kontron* AMC boards comply with the requirements of the following standards.

Table 1-3: Standards

COMPLIANCE	TYPE	STANDARD	TEST LEVEL
CE	Emission	EN55022 EN61000-6-3 EN300386	--
	Immission	EN55024 EN61000-6-2 EN300386	--
	Electrical Safety	EN60950-1	--
Mechanical	Mechanical Dimensions	IEEE 1101.10	--
Environmental and Health Aspects	Vibration (sinusoidal)	IEC60068-2-6	tbd
	Vibration (sinusoidal, transportation)	IEC60068-2-6	tbd
	Shock (operating)	IEC60068-2-27	tbd
	Climatic Humidity	IEC60068-2-78	93% RH at 40°C, non-condensing (see note below)
	WEEE	Directive 2002/96/EC	Waste electrical and electronic equipment
	RoHS	Directive 2002/95/EC	Restriction of the use of certain hazardous substances in electrical and electronic equipment



Note ...

Kontron performs comprehensive environmental testing of its products in accordance with applicable standards.

Customers desiring to perform further environmental testing of Kontron products must contact Kontron for assistance prior to performing any such testing. This is necessary, as it is possible that environmental testing can be destructive when not performed in accordance with the applicable specifications.

In particular, for example, boards **without conformal coating** must not be exposed to a change of temperature exceeding 1K/minute, averaged over a period of not more than five minutes. Otherwise, condensation may cause irreversible damage, especially when the board is powered up again.

Kontron does not accept any responsibility for damage to products resulting from destructive environmental testing.

1.8 Related Publications

The following publications contain information relating to this product.

Table 1-4: Related Publications

PRODUCT	PUBLICATION
ATCA	PICMG® 3.0 AdvancedTCA Base Specification R2.0, March 18, 2005
MicroTCA	PICMG® MTCA.0 Micro Telecommunications Computing Architecture R1.0, July 6, 2006
AMC	PICMG® AMC.0, Advanced Mezzanine Card Specification R2.0 PICMG® AMC.1, PCI Express and Advanced Switching R1.0 PICMG® AMC.2, Gigabit Ethernet R1.0 PICMG® AMC.3, Storage Interfaces R1.0
IPMI	IPMI - Intelligent Platform Management Interface Specification, v2.0 Document Revision 1.0, February 12, 2004 IPMI - Platform Management FRU Information Storage Definition, V1.0 Document Revision 1.1, September 27, 1999
PCI Express	PCI Express Base Specification Revision 1.0a
Serial ATA	Serial ATA 2.5 Specification