AM4101

Single Mid and Full-size AMC Module
based on the Freescale™ MPC8641D
Dual-Core PowerPC® Processor

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User Guide

kontron

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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!

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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.

Special care is necessary when handling or unpacking the product. Please consult the special handling and unpacking instruction on the previous page of this manual.

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Chapter 1

Introduction

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1. Introduction

1.1 AdvancedTCA System Overview

The Advanced Mezzanine Card (AMC) described in this manual operates with the Advanced Telecommunications Computing Architecture (AdvancedTCA® or ATCA) and the Micro Telecommunications Computing Architecture (MicroTCA or µTCA) defined by the *PCI Industrial Computer Manufacturers Group (PICMG).* The main advantages of AdvancedTCA include high throughput, multi-protocol support, high-power capability, hot swappability, high scalability, and integrated system management. For further information regarding the AdvancedTCA/MicroTCA standards and their use, please consult the complete AdvancedTCA specification or visit the *PICMG* web site.

The Kontron AMC cards can be integrated not only on Kontron ATCA carrier boards or MicroTCA backplanes, but also on a variety of AMC-supporting ATCA and proprietary carrier boards and backplanes providing them with superior processing power and maximum design options. To learn more about the outstanding features and advantages of Kontron ATCA carrier boards, please contact Kontron or visit the Kontron web site.

1.2 Board Overview

1.2.1 Board Introduction

The AM4101 is a highly integrated CPU board implemented as a Single, Mid-size or Full-size Advanced Mezzanine Card (AMC) Module. The design is based on the Freescale™ MPC8641D dual-core PowerPC® processor, which uses two e600 cores and high-speed interconnect technology to balance processor performance with I/O system throughput for networking, storage, wireless infrastructure and general-purpose embedded applications.

The MPC8641D is a highly integrated system-on-chip (SOC) platform that consists of two e600 cores, each having 32 kB L1 instruction cache, 32 kB L1 data cache and 1 MB L2 cache, a high-speed DDR2 memory interface, four triple speed Ethernet controllers (TSECs), a x4 Serial RapidIO™ fabric interface, a x4 PCI Express I/O interface and a high-performance MPX bus that scales to 600 MHz.

The board is capable of supporting core frequencies ranging from 1.0 GHz to 1.5 GHz providing up to 600 MHz platform speed. The processor and the memory are soldered on the AM4101 which results in higher Mean Time Between Failures (MTBF) and a significant improvement in cooling.

The AM4101 includes up to 2 GB unbuffered Double Data Rate (DDR2) memory with Error Checking and Correcting (ECC) running at frequencies up to 600 MHz. The four integrated TSECs ensure maximum data throughput between the processor and the Ethernet infrastructure. The board further provides up to 4 GB Flash memory via an onboard NAND Flash Controller.

The AM4101 has full hot swap capability, which enables the board to be replaced, monitored and controlled without having to shut down the ATCA 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.

As a "headless" AMC design (no onboard graphics controller), the AM4101 supports one standard RS-232 serial port (SER0) and up to two Gigabit Ethernet ports on the front panel as well as a variety of high-speed interconnect topologies to the system, such as two Gigabit Ethernet SerDes connections in the Common Options Region, x4 PCI Express connection and x4 Serial RapidIO connection in the Fat Pipes Region, as well as a debug port and a serial port in the Extended Options Region.

Optimized for high-performance, packet-based telecom systems, the AM4101 is targeted towards, but not limited to the telecom market application such as radio network controllers, media streaming, traffic processing, database management and routing. The AM4101 also fits into all 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.

The AM4101 is offered with various Board Support Packages. Please contact Kontron for further information concerning the operation of the AM4101 with other operating systems.

1.2.2 Board-Specific Information

Due to the outstanding features of the AM4101, 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 AM4101's outstanding features are:

- Freescale™ MPC8641D processor, 1.0 GHz, 400 MHz platform frequency
- Freescale™ MPC8641D processor, 1.32 GHz, 528 MHz platform frequency
- Freescale™ MPC8641D processor, 1.5 GHz, 600 MHz platform frequency
- Up to 2 GB DDR2 SDRAM memory with ECC running at 400/500/528/600 MHz
- AMC interconnection
  - Two Gigabit SerDes connections in the Common Options Region
  - x4 PCI Express interface in the Fat Pipes Region (operates as a root complex or end-point controller)
  - x4 Serial RapidIO interface in the Fat Pipes Region (operates as host or agent)
  - Serial port in the Extended Options Region
  - Debug port in the Extended Options Region
  - PCI Express clock reference input, FCLKA
- Full hot swap support
- NAND Flash Controller
- One serial port on Front I/O (RS-232)
- Two Gigabit Ethernet ports on Front I/O
- Two redundant NetBootLoader (NBL) Firmware Flash chips (2 x 4 MB)
- Dedicated IPMI Module Management Controller (MMC) with redundant MMC Firmware Flash
- Watchdog Timer
- JTAG interface for debugging and manufacturing purposes
- Four bicolor debug LEDs
- Standard temperature range: -5°C to + 55°C
- Passive heat sink solution (system air flow required)
- Single Mid-size and Full-size AMC module
- Designed to be compliant with the following specifications:
  - 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.4, Serial RapidIO (Rev. 0.96)
  - PICMG® MTCA.0 Micro Telecommunications Computing Architecture R1.0
  - IPMI - Intelligent Platform Management Interface Specification, v2.0, R1.0
  - SCOPE - MicroTCA Hardware Profile, Version 1.0
- Kontron NetBootLoader

1.3 System Relevant Information

The following system relevant information is general in nature but should still be considered when developing applications using the AM4101.

Table 1-1: System Relevant Information

SUBJECT	INFORMATION

Hardware Requirements	The AM4101 can be installed on any AMC-supporting carrier board or MicroTCA backplane with the following AMC Card-edge connector port mapping:
	• Common Options Region ports 0-1
	  • Two Gigabit Ethernet SerDes ports
	• Fat Pipes Region ports 4-7
	  • One x4 PCI Express interface
	• Fat Pipes Region ports 8-11
	  • x4 Serial RapidIO interface
	• Extended Options Region port 14
	  • Reserved for 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 section 2.4, “AMC Interconnection”.

PCI Express Configuration	The AM4101 supports PCI Express root complex and endpoint configuration.
Operating Systems	The AM4101 is offered with various Board Support Packages. Please contact Kontron for further information concerning the operation of the AM4101 with other operating systems.

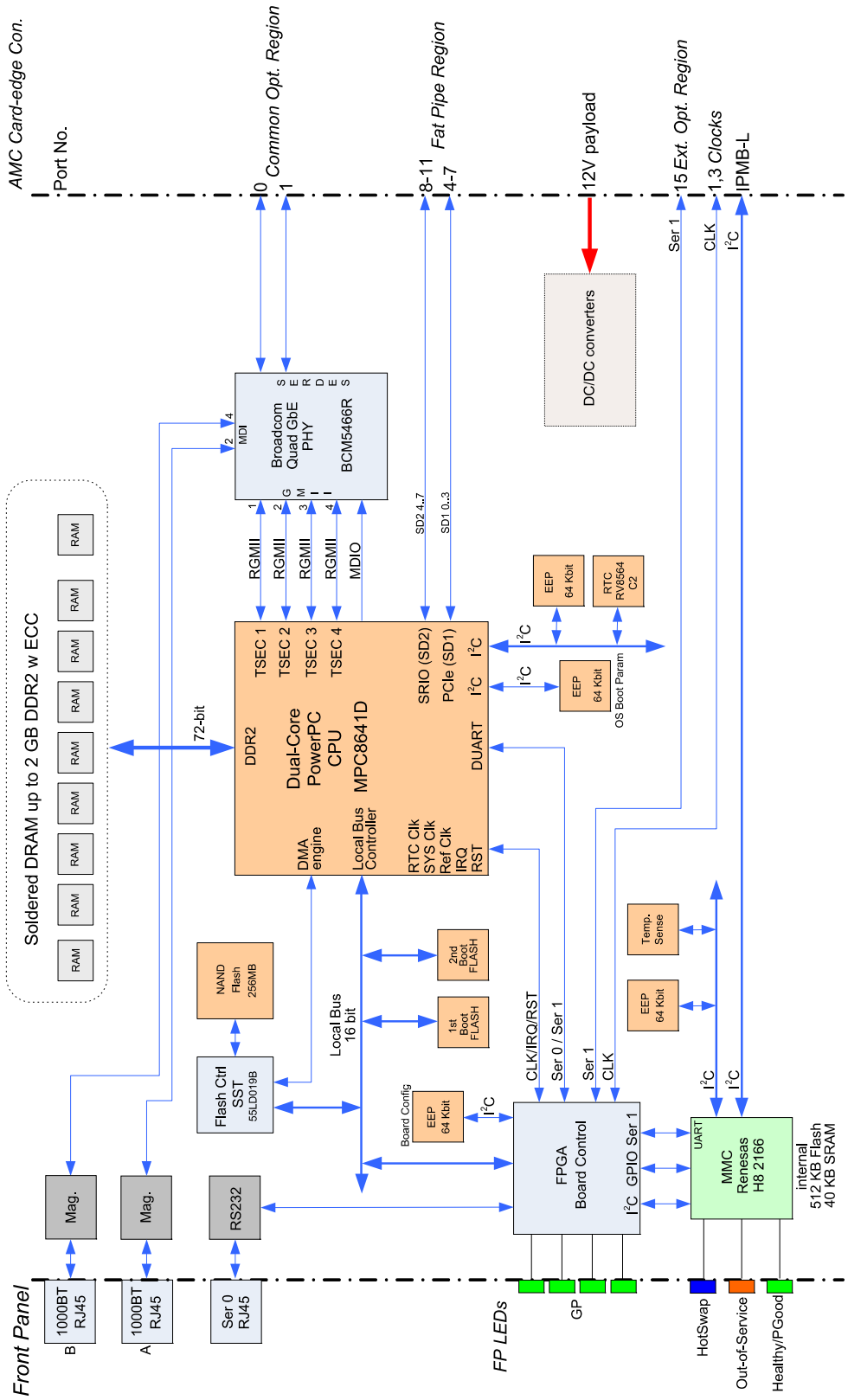
1.4 Board Diagrams

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

1.4.1 Functional Block Diagram

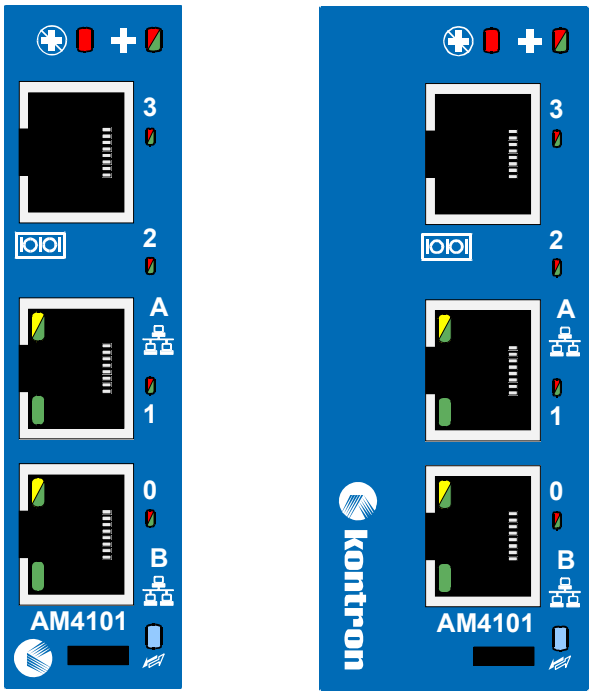
The following figure shows the block diagram of the AM4101.

Figure 1-1: AM4101 Functional Block Diagram



1.4.2 Front Panel

Figure 1-2: AM4101 Front Panel Versions



Mid-size Full-size

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

- 3 • ULED3 (red/green/amber): AMC Ethernet port A link signal status or POST code LED
- 2 • ULED2 (red/green/amber): AMC Ethernet port B link signal status or POST code LED
- 1 • ULED1 (red/green/amber): Freely configurable or POST code LED
- 0 • ULED0 (red/green/amber): Freely configurable or POST code LED

Connectors

- Serial Connector
- Gigabit Ethernet Connector

For further information on the LEDs used on the AM4101, refer to section 2.3.1, “Front Panel LEDs”.

1.4.3 Board Layouts

Figure 1-3: AM4101 Board Layout (Top View)

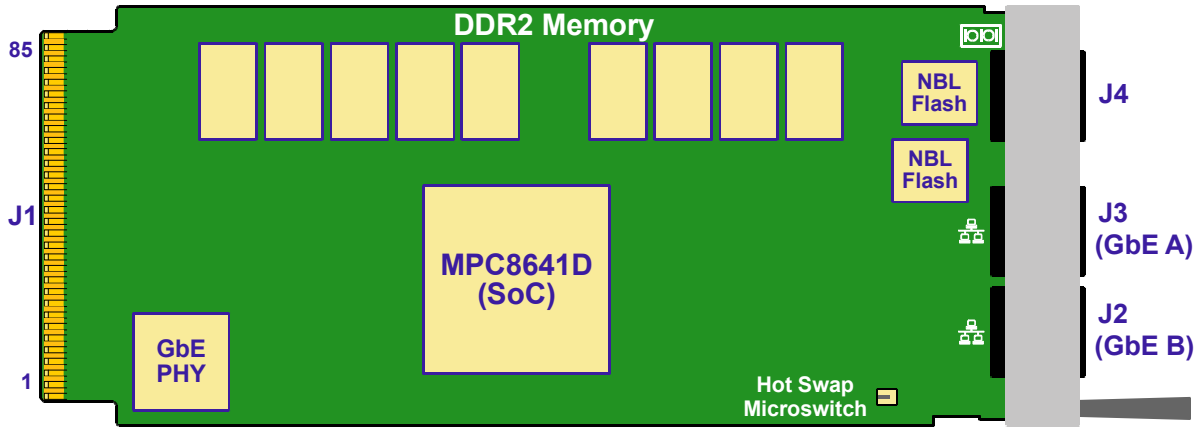
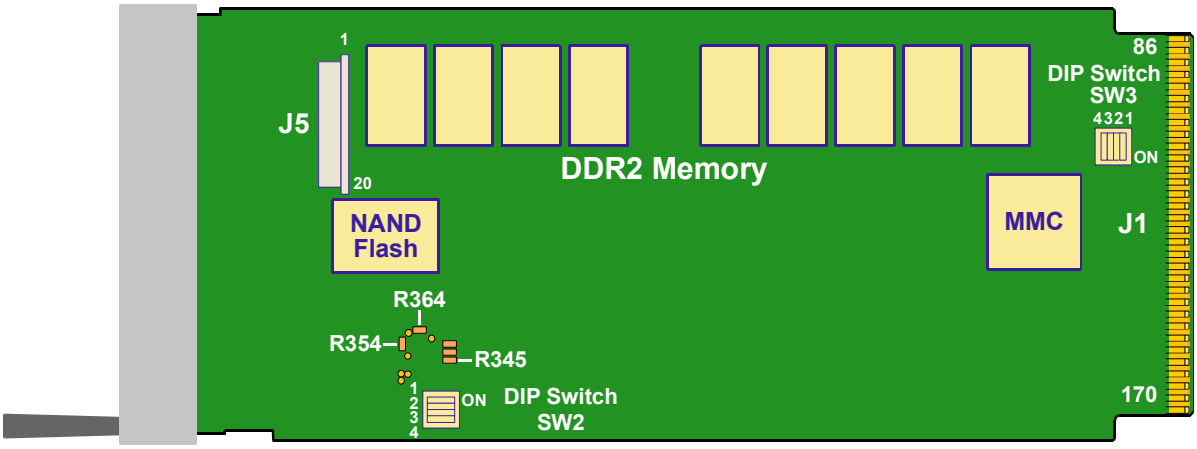


Figure 1-4: AM4101 Board Layout (Bottom View)



1.5 Technical Specification

Table 1-2: AM4101 Main Specifications

AM4101		SPECIFICATIONS
Processor and Memory	CPU	The AM4101 supports the following microprocessors: • Freescale™ MPC8641D processor, 1.0 GHz, 400 MHz platform frequency • Freescale™ MPC8641D processor, 1.32 GHz, 528 MHz platform frequency • Freescale™ MPC8641D processor, 1.5 GHz, 600 MHz platform frequency All microprocessors are provided in a 1023 FC-CBGA packaging. Please contact Kontron for further information concerning the suitability of other Freescale processors for use with the AM4101.

	Memory	Main Memory:
		• Up to 2 GB unbuffered DDR2 SDRAM memory with ECC running at 600 MHz
		Cache structure:
		• 64 kB L1 on-die full speed processor cache
		  • 32 kB for instruction cache for each core
		  • 32 kB for data cache for each core
		• 1 MB L2 cache for each core
		NetBootLoader (NBL) Flash Memory:
		• Two redundant Firmware NOR Flash chips (2 x 4 MB)
		Mass Storage Device:
		• Up to 4 GB NAND Flash via an onboard IDE Flash Controller
		Serial EEPROM with 64 kbit

AMC Interconnection	Gigabit Ethernet	Common Options Region ports 0-1 • Two Gigabit Ethernet SerDes ports Front Panel • Two Gigabit Ethernet copper ports
	PCI Express	Fat Pipes Region ports 4-7 • One x4 PCI Express interface operating in root complex or endpoint
	Serial RapidIO	Fat Pipes Region ports 8-11 • One x4 Serial RapidIO interface operating in host or agent configuration
	Debug Interface	Extended Options Region port 14 • Reserved for 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	• One serial port (SER0) with RS-232-signal level on RJ-45 connector • Two Gigabit Ethernet ports on RJ-45 connectors
	AMC Card-edge Connector	• One 170-pin AMC Card-edge connector
Switches	DIP Switches	• One DIP switch SW2 consisting of four switches for board configuration • One DIP switch SW3 consisting of four switches for Fat Pipes Region configuration and IPMI FRU data selection

Table 1-2: AM4101 Main Specifications (Continued)

AM4101		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 POST code LED • ULED2 (red/green): AMC Ethernet port B link signal status or POST code LED • ULED1 (red/green): Freely configurable or POST code LED • ULED0 (red/green): Freely configurable or 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, hardware reset or both in cascaded mode
	System Timer	• Two groups of four global 32-bit timers clocked with MPX clock or RTC clock input • Timers within each group can be joined to time longer durations • Hardware delay timer for short reliable delay times
IPMI	Module Management Controller	• Renesas H8 microcontroller with 40 kB RAM and redundant 512 kB MMC 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 Keyboard Style Interfaces (KCS).
	Hot Swap	The AM4101 has full hot swap capability.
	Thermal Management	CPU and board overtemperature protection is provided by: • Four temperature sensors for monitoring the board temperature • CPU internal sensors • Specially designed heat sinks
General	Power Consumption	For further information, refer to Chapter 5, “Power Considerations”.
	Temperature Range	Operational: -5°C to +55°C Storage: -40°C to +70°C
	Mechanical	Single Module: • Mid-size version • Full-size version
	Dimensions	Mid-size: 181.5 mm x 73.5 mm x 18.96 mm Full-size: 181.5 mm x 73.5 mm x 28.95 mm
	Board Weight	Mid-size: 261 grams (with heat sink) Full-size: 304 grams (with heat sink)
	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

Table 1-2: AM4101 Main Specifications (Continued)

AM4101		SPECIFICATIONS
Software	Firmware	Kontron NetBootLoader having the following features: • Terminal communication via the serial port on the front panel or via the AMC Card-edge connector • LAN boot capability for diskless systems (DHCP/BOOTP) • Plug and Play capability (PCI Express device enumeration) • NetBootLoader (NBL) Firmware parameters are saved in the EEPROM • Board serial number is saved within the EEPROM
	Software IPMI	Module Management Controller Firmware providing the following features: • The MMC is accessible via IPMB-L and KCS interfaces with interrupt support • The MMC Firmware can be updated in field through all supported interfaces using the free Linux Tool “IPMItool” • 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 NBL Firmware Flash control, and boot order configuration
	Operating Systems	The AM4101 is offered with various Board Support Packages. Please contact Kontron for further information concerning the operation of the AM4101 with other operating systems.

1.6 Kontron Software Support

Kontron is one of the few AdvancedTCA 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.

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, operating)	GR-63-CORE EN300019-2-3 IEC61131-2 IEC60068-2-6	5-150 [Hz] frequency range 1 [g] acceleration 1 [oct/min] sweep rate 10 sweeps/axis 3 directions: x, y, z
	Shock (operating)	EN300019-2-3 IEC61131-2 IEC60068-2-27	15 [g] acceleration 11 [ms] pulse duration 3 shocks per direction 5 [s] recovery time 6 directions, ±x, ±y, ±z
	Climatic Humidity	IEC60068-2-78	93% RH at 40°C, non-condensing
	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

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 SCOPE - MicroTCA Hardware Profile, Version 1.0
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.4, Serial RapidIO Rev. 0.96
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 RapidIO	RapidIO Interconnect Specification Revision 1.2