» User Guide «

AM4011

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

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Disclaimer

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Caution, Electric Shock!

This symbol and title warn of hazards due to electrical shocks (> 60V) when touching products or parts of them. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material.

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 ...

This symbol and title emphasize aspects the reader should read through carefully for his or her own advantage.

For Your Safety

Your new Kontron product was developed and tested carefully to provide all features necessary to ensure its compliance with electrical safety requirements. It was also designed for a long fault-free life. However, the life expectancy of your product can be drastically reduced by improper treatment during unpacking and installation. Therefore, in the interest of your own safety and of the correct operation of your new Kontron product, you are requested to conform with the following guidelines.

High Voltage Safety Instructions

Warning!

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Before installing any piggybacks or carrying out maintenance operations always ensure that your mains power is switched off.

Serious electrical shock hazards can exist during all installation, repair and maintenance operations with this product. Therefore, always unplug the power cable and any other cables which provide external voltages before performing work.

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.

It is particularly important to observe standard anti-static precautions when changing piggybacks, ROM devices, jumper settings etc. If the product contains batteries for RTC or memory backup, ensure that the board is not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or conductive circuits on the board.

General Instructions on Usage

In order to maintain Kontron's product warranty, this product must not be altered or modified in any way. Changes or modifications to the device, which are not explicitly approved by Kontron and described in this manual or received from Kontron's Technical Support as a special handling instruction, will void your warranty.

This device should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This applies also to the operational temperature range of the specific board version, which must not be exceeded. If batteries are present, their temperature restrictions must be taken into account.

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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Kontron grants the original purchaser of Kontron's products a ***TWO YEAR LIMITED HARDWARE WARRANTY*** as described in the following. However, no other warranties that may be granted or implied by anyone on behalf of Kontron are valid unless the consumer has the express written consent of Kontron.

Kontron warrants their own products, excluding software, to be free from manufacturing and material defects for a period of 24 consecutive months from the date of purchase. This warranty is not transferable nor extendible to cover any other users or long-term storage of the product. It does not cover products which have been modified, altered or repaired by any other party than Kontron or their authorized agents. Furthermore, any product which has been, or is suspected of being damaged as a result of negligence, improper use, incorrect handling, servicing or maintenance, or which has been damaged as a result of excessive current/voltage or temperature, or which has had its serial number(s), any other markings or parts thereof altered, defaced or removed will also be excluded from this warranty.

If the customer's eligibility for warranty has not been voided, in the event of any claim, he may return the product at the earliest possible convenience to the original place of purchase, together with a copy of the original document of purchase, a full description of the application the product is used on and a description of the defect. Pack the product in such a way as to ensure safe transportation (see our safety instructions).

Kontron provides for repair or replacement of any part, assembly or sub-assembly at their own discretion, or to refund the original cost of purchase, if appropriate. In the event of repair, refunding or replacement of any part, the ownership of the removed or replaced parts reverts to Kontron, and the remaining part of the original guarantee, or any new guarantee to cover the repaired or replaced items, will be transferred to cover the new or repaired items. Any extensions to the original guarantee are considered gestures of goodwill, and will be defined in the "Repair Report" issued by Kontron with the repaired or replaced item.

Kontron will not accept liability for any further claims resulting directly or indirectly from any warranty claim, other than the above specified repair, replacement or refunding. In particular, all claims for damage to any system or process in which the product was employed, or any loss incurred as a result of the product not functioning at any given time, are excluded. The extent of Kontron liability to the customer shall not exceed the original purchase price of the item for which the claim exists.

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Chapter 1

Introduction

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1. Introduction

1.1 Board Overview

The AM4011 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 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 built on 65-nm process technology in a 479 µFCBGA package providing 64 kB L1 and 4 MB L2 cache as well as 667 MHz front side bus (FSB) speed. The processor and the memory are soldered on the AM4011, which results in higher Mean Time Between Failures (MTBF) and a significant improvement in cooling.

The Intel® Core™2 Duo processor is a low-power, dual-core processor supporting Intel's Virtualization Technology (VT), Intel® Extended Memory 64 Technology (Intel® EM64T), 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 AM4011 further provides up to 8 GB Flash memory via an optional USB 2.0 NAND Flash module.

The AM4011 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 AM4011 supports one USB 2.0 host interface, one standard RS-232 COM port, and two Gigabit Ethernet ports to the front as well as a variety of high-speed interconnect topologies to the system, such as Dual Gigabit SerDes connection and Dual Serial ATA storage interface in the Common Options Region, x4 PCI Express, and a Debug port and a Serial port in the Extended Options Region.

Optimized for high-performance, packet-based telecom systems, the AM4011 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 AM4011 also 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.

The board is offered with the generic Linux Board Support Package which supports various Linux distributions including the Carrier Grade Linux (CGL) operating system. Please contact Kontron for further information concerning the operation of the AM4011 with other operating systems.

1.2 Board-Specific Information

Due to the outstanding features of the AM4011, 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 AM4011'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
  - x4 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 NAND Flash memory
- One USB 2.0 host port on Front I/O
- One Serial port on Front I/O (RS-232)
- Two Gigabit Ethernet ports on Front I/O
- Two redundant FWH Flash chips for BIOS (2 x 1 MB)
- Dedicated IPMI Module Management Controller with redundant Firmware Flash (2 x 512 kB)
- Watchdog Timer
- JTAG interface for debugging and manufacturing
- Four bicolor Debug LEDs
- Standard temperature range: -5 °C to + 55 °C
- Thermal management
- Passive heat sink solution
- 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.3, Storage Interfaces 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 AM4011.

Table 1-1: System Relevant Information

SUBJECT	INFORMATION

Hardware Requirements	The AM4011 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
	• Common Options Region ports 2-3
	  • Two Serial ATA 150 ports
	• Fat Pipes Region ports 4-7
	  • One x4 PCI Express interface
	• 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 section 2.4, “AMC Interconnection”.

PCI Express Configuration	The AM4011 supports only the PCI Express root complex configuration. Non-transparent bridge functionality is not supported.
Operating Systems	The AM4011 is offered with the generic Linux Board Support Package which supports various Linux distributions including the Carrier Grade Linux (CGL) operating system. Please contact Kontron for further information concerning the operation of the AM4011 with other operating systems.

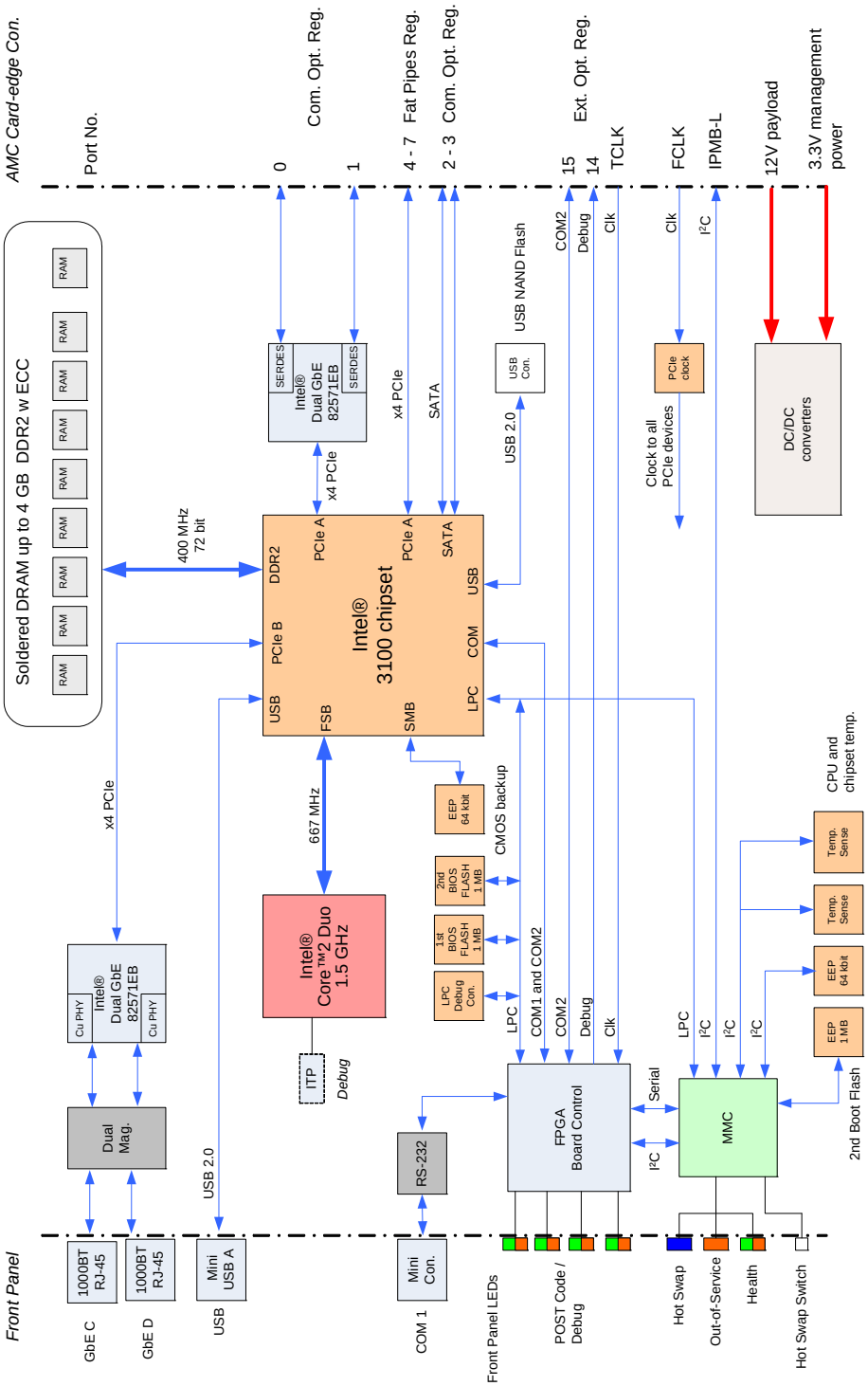
1.4 Board Diagrams

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

1.4.1 Functional Block Diagram

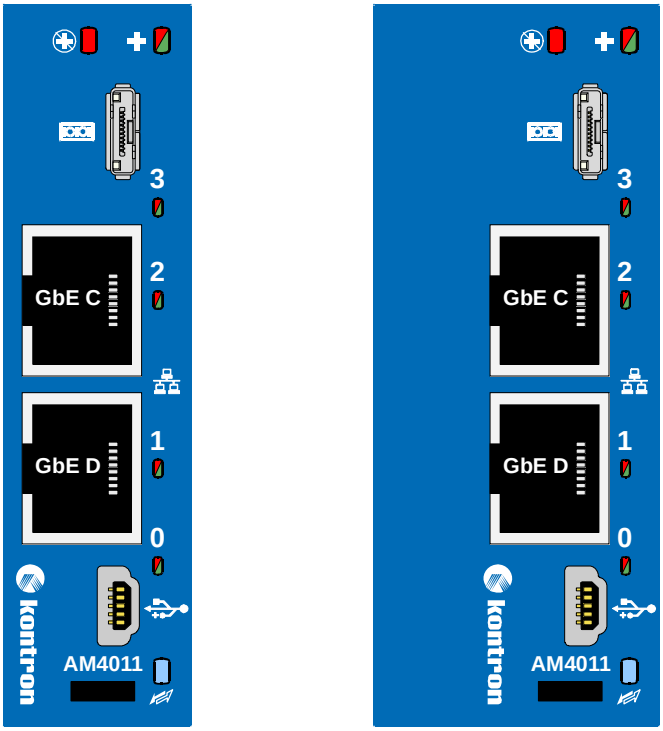
The following figure shows the block diagram of the AM4011.

Figure 1-1: AM4011 Functional Block Diagram



1.4.2 Front Panel

Figure 1-2: AM4011 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): AMC Eth. port A link signal status or BIOS POST code LED
- 2 • ULED2 (red/green): Front Eth. port C link signal status or BIOS POST code LED
- 1 • ULED1 (red/green): Front Eth. port D link signal status or BIOS POST code LED
- 0 • ULED0 (red/green): AMC Eth. port B link signal status or BIOS POST code LED

Connectors

- Serial Connector
- Gigabit Ethernet Connector
- USB Connector

For further information on the LEDs used on the AM4011, refer to section 2.3.1, “Front Panel LEDs”.

1.4.3 Board Layouts

Figure 1-3: AM4011 Board Layout (Top View)

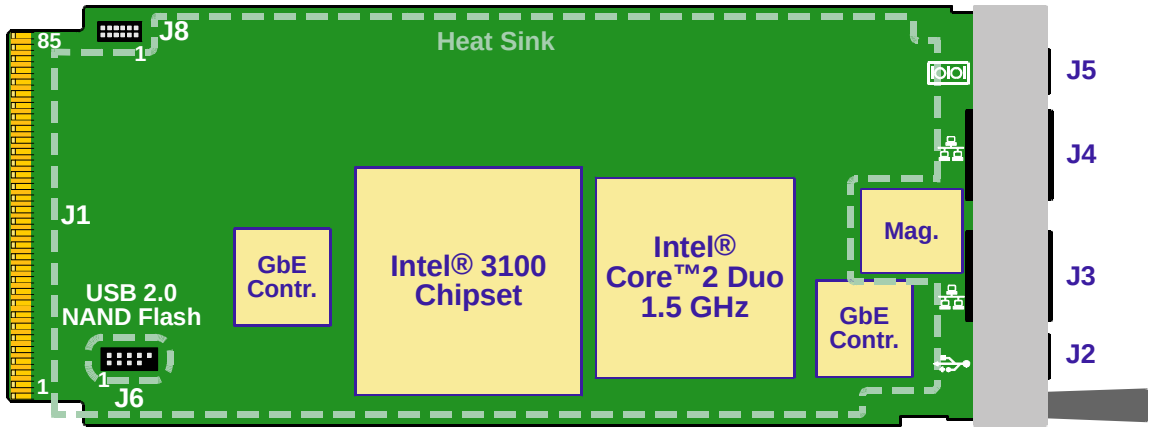
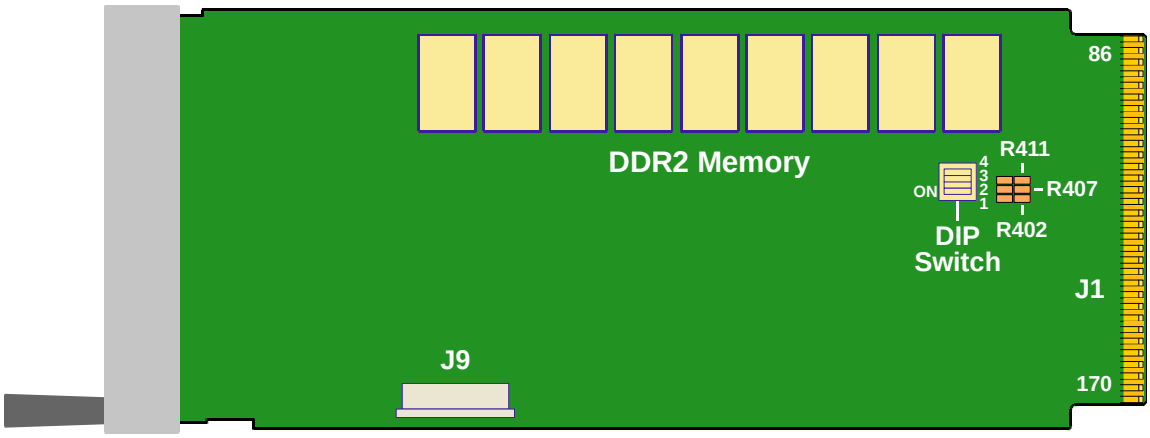


Figure 1-4: AM4011 Board Layout (Bottom View)



1.5 Technical Specification

Table 1-2: AM4011 Main Specifications

	FEATURES	SPECIFICATIONS
Processor and Memory	CPU	The AM4011 supports the Intel® Core™2 Duo processor L7400 (LV), 1.5 GHz clock speed, 667 MHz FSB, and 4 MB L2 cache in a 479 µFCBGA packaging. Please contact Kontron for further information concerning the suitability of other Intel processors for use with the AM4011.

	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 NAND Flash memory optionally available
		Serial EEPROM with 64 kbit

Chipset	Intel® 3100	Intel® 3100 chipset:
		• Support for a single Intel® 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-bit 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 and 4 GB main memory configuration)
		• Six-Channel SATA 150 interface (only two channels are used)
		• USB 2.0 host interface with up to four USB ports available (only two USB 2.0 ports are used on the AM4011)
		• 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 AM4011)
		• 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)

Table 1-2: AM4011 Main Specifications (Continued)

FEATURES		SPECIFICATIONS
Onboard Controller	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
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 • One x4 PCI Express interface 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	• One USB 2.0 port on a 5-pin, mini USB type A connector • One Serial port (COM1) with RS-232 signal level on a mini 10-pin connector • Two Gigabit Ethernet ports on two RJ-45 connectors
	Onboard Connector	• One USB 2.0 connector for optional NAND Flash
	AMC Card-edge Connector	• One 170-pin AMC Card-edge connector
Switch	DIP Switch	One DIP switch consisting of four switches for board configuration
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 Eth. port A link signal status or BIOS POST code LED • ULED2 (red/green): Front Eth. port C link signal status or BIOS POST code LED • ULED1 (red/green): Front Eth. port D link signal status or BIOS POST code LED • ULED0 (red/green): AMC Eth. port B link signal status or BIOS POST code LED

Table 1-2: AM4011 Main Specifications (Continued)

FEATURES		SPECIFICATIONS
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 • In addition to the three 8254-style counters, the Intel® 3100 chipset includes three individual high-precision event timers that may be used by the operating system. They are implemented as a single counter each with its own comparator and value register. • 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 AM4011 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
Option	USB 2.0 NAND Flash	Up to 8 GB USB 2.0 NAND Flash memory can be added to the AM4011 using an optionally available USB 2.0 NAND Flash module.
General	Power Consumption	See Chapter 5, “Power Considerations” for details.
	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: 259 grams (with heat sink and USB NAND Flash module) Full-size: 315 grams (with heat sink and USB NAND Flash module)
	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: AM4011 Main Specifications (Continued)

	FEATURES	SPECIFICATIONS
Software	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
	Software 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 AM4011 is offered with the generic Linux Board Support Package which supports various Linux distributions including the Carrier Grade Linux (CGL) operating system. Please contact Kontron for further information concerning the operation of the AM4011 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.

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	5-150 [Hz] / 1 [g] / 1 [oct/min] 10 [cycles/axis] 3 [directions: x,y,z]
	Vibration (sinusoidal, transportation)	IEC60068-2-6	2-50 [Hz] / 1 [g] / 0.1 [oct/min] 50-500 [Hz] / 3 [g] / 0.25 [oct/min] 10 [cycles/axis] 3 [directions: x,y,z]
	Shock (operating)	IEC60068-2-27	4 [g] 22 [ms] 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
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