CP6001-V

6U CompactPCI Processor Board based on the Intel® Celeron® M 440 Processor with the Intel® 945GM Express Chipset

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User Guide

kontron

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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!

All operations on this device must be carried out by sufficiently skilled personnel only.

Caution, Electric Shock!

Before installing a not hot-swappable Kontron product into a system always ensure that your mains power is switched off. This applies also to the installation of piggybacks.

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.

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.

Two Year Warranty

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.

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Chapter 1

Introduction

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1. Introduction

1.1 Board Overview

The CP6001-V is a highly integrated 6U CompactPCI CPU board based on the Intel® Celeron® M 440 processor combined with the high-performance Mobile Intel® 945GM Express Chipset.

The board supports the Intel® Celeron® M processor 440 with 1.86 GHz clock speed, 533 MHz front-side bus speed as well as 64 kB L1 and 1 MB L2 cache provided in a 479 µFCBGA package, and utilizes the Mobile Intel® 945GM Express Chipset as Graphics Memory Controller Hub and the ICH7R as I/O Controller Hub.

Two SO-DIMM sockets are available on the board to provide up to 4 GB dual-channel, Double Data Rate (DDR2) memory running at 533 MHz (PC2-4200). The board also includes four Intel® 82574L Gigabit Ethernet controllers, each utilizing a x1 lane PCI Express interconnection to the ICH7R I/O Controller Hub. In addition, the board can accommodate a CompactFlash memory card and a USB 2.0 NAND Flash module for flexible, non-volatile, non-rotating memory extension. Onboard SATA HDD/SSD support is also provided via an optional CP6001-EXT-SATA module.

The CP6001-V offers a complete set of data and communication interfaces, such as four Gigabit Ethernet ports (two on front I/O and two on rear I/O), one Parallel ATA interface connected to the CompactFlash socket, two onboard Serial ATA interfaces (one for connecting a SATA cable and one for connecting a 2.5" HDD/SSD to the board), one high-resolution VGA interface (CRT), and one 32-bit/33 MHz PMC interface. In addition, three USB 2.0 ports are available on the board, two on the front panel, and one onboard port for the USB 2.0 NAND Flash module. One RS-232 COM port is also available on the front panel.

The board supports a configurable 32-bit, 33/66 MHz, hot swap CompactPCI interface. If installed in the system slot, the interface is enabled, and if installed in a peripheral slot, the CP6001-V is isolated from the CompactPCI bus.

Designed for stability and packaged in a rugged format, the board fits into all applications situated in industrial environments, including I/O intensive applications where only one slot is available for the CPU, making it a perfect core technology for long-life applications. Components with high temperature tolerance have been selected from embedded technology programs, and therefore offer long-term availability.

The board is offered with Microsoft® Windows® XP, Windows® XP Embedded, and Linux operating systems. Please contact Kontron for further information concerning the operation of the CP6001-V with other operating systems.

1.2 Board-Specific Information

The CP6001-V is a CompactPCI single-board computer based on the Intel® Celeron® M processor 440 processor and specifically designed for use in highly integrated platforms with solid mechanical interfacing for a wide range of industrial environment applications.

Some of the CP6001-V's outstanding features are:

- Intel® Celeron® M processor 440, 1.86 GHz, 533 MHz FSB, 1 MB L2 cache
- 479-pin µFCBGA package
- 64 kB L1 and up to 1 MB L2 cache on-die, running at CPU speed
- Mobile Intel® 945GM Express Chipset with Intel® 82801GR (ICH7R) I/O Controller Hub
- Up to 4 GB DDR2-SDRAM memory running at 533 MHz
- Integrated 3D high-performance VGA controller
- Analog display support for up to 2048 x 1536 pixels at 75 Hz
- 32-bit, 33/66 MHz CompactPCI interface (PICMG 2.0)
- PMC interface with bezel cutout on front panel and PCI functionality, 32-bit/33 MHz PCI
- Four Gigabit Ethernet interfaces utilizing a x1 lane PCI Express per GbE controller
  - Two Gigabit Ethernet interfaces on the front panel
  - Two optional Gigabit Ethernet interfaces on the rear I/O (PICMG 2.16)
- EIDE Ultra ATA interface for onboard CompactFlash socket (type I and type II CF cards)
- Two onboard Serial ATA interfaces
  - One standard Serial ATA interface for connecting a SATA cable
  - One Serial ATA interface for connecting a Serial ATA 2.5" HDD/SSD via the CP6001-EXT-SATA module
- Three USB 2.0 ports:
  - Two ports on the front panel
  - One onboard port for the USB 2.0 NAND Flash module
- One RS-232 COM port on the front panel
- One 1 MB soldered FWH for BIOS
- Hardware Monitor (Super I/O SCH3112)
- Watchdog Timer
- Real-time clock
- 4HP, 6U CompactPCI
- Passive heat sink solution for forced convection cooling
- Hot swap capability: as system controller or as peripheral device
- Supports PICMG Packet Switching Backplane Specification 2.16
- AMI BIOS

1.3 System Expansion Capabilities

1.3.1 PMC Module

The CP6001-V has one PCI, 32-bit/33 MHz PMC mezzanine interface. This interface supports a wide range of available PMC modules with PCI interface including all of Kontron's PMC modules and provides an easy and flexible way to configure the CP6001-V for various application requirements.

For further information concerning the PMC interface, refer to Chapter 2.3.8, PMC Interface.

1.3.2 CP6001-V-MK2.5SATA Assembly Kit

The CP6001-V comes with an optional CP6001-V-MK2.5SATA assembly kit comprised of one CP6001-EXT-SATA module and the neccessary components needed for mounting the module on the CP6001-V. The CP6001-EXT-SATA module is required for connecting an onboard 2.5" Serial ATA HDD/SSD to the CP6001-V.

For further information concerning the CP6001-EXT-SATA module, refer to Appendix A.

1.3.3 USB 2.0 NAND Flash Module

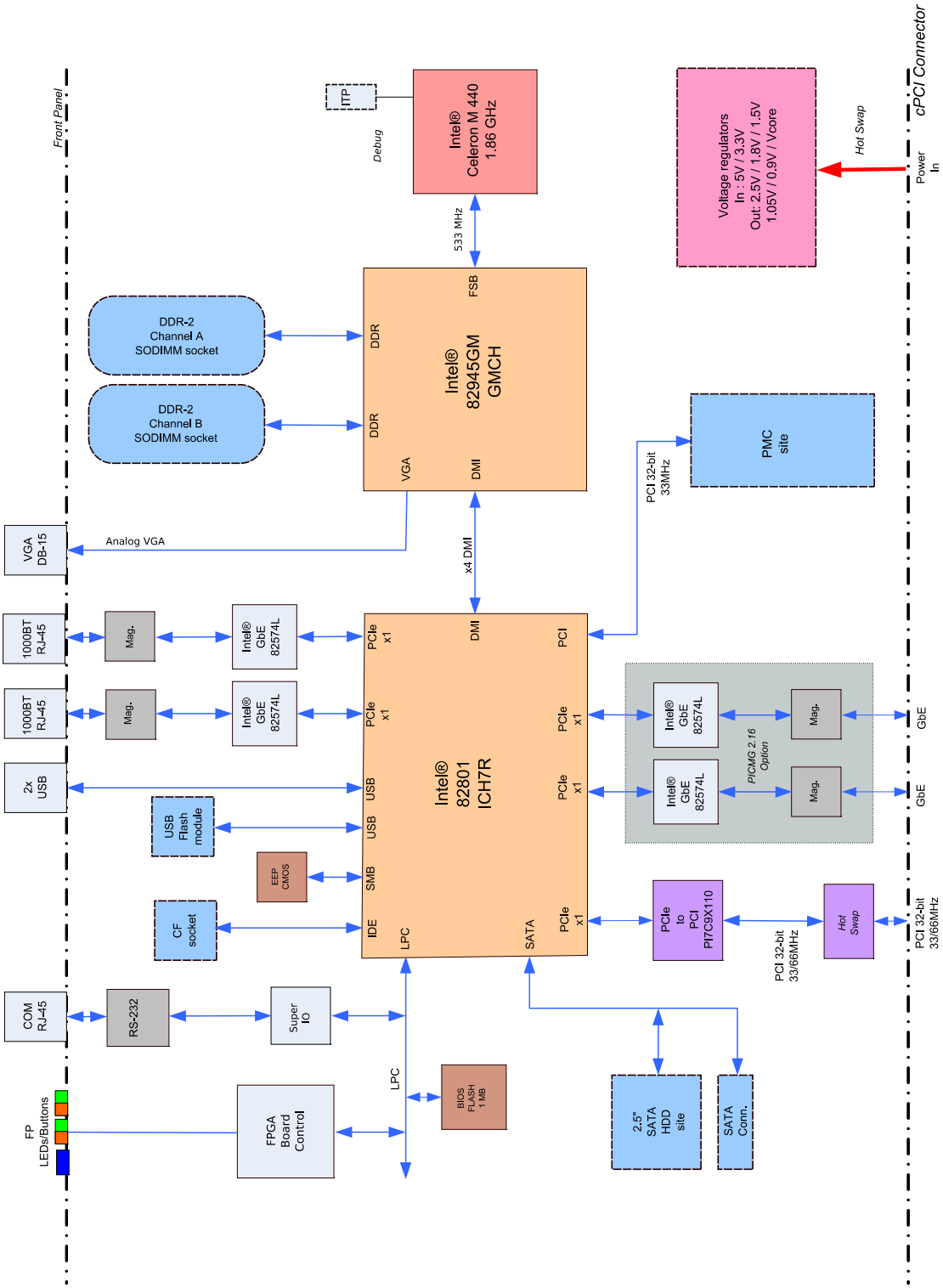
The CP6001-V provides support for one optional USB 2.0 NAND Flash module. For information on the USB 2.0 NAND Flash interface, refer to chapter 2.2.7.2, "USB 2.0 NAND Flash Module".

1.4 Board Diagrams

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

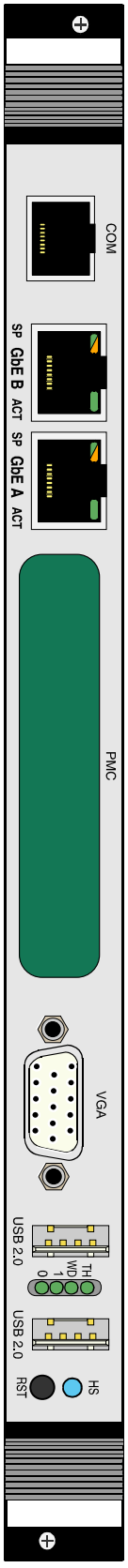
1.4.1 Functional Block Diagram

Figure 1-1: CP6001-V Functional Block Diagram



1.4.2 Front Panels

Figure 1-2: CP6001-V Front Panels



Legend:

Status LEDs

WD (red/green): Watchdog Status

TH (red/green/amber): Temperature Status

HS (blue): Hot Swap Control

General Purpose LEDs

LED 0..1 (red/green/amber):General Purpose/POST code

Integral Ethernet LEDs

ACT (green): Ethernet Link/Activity

SPEED (green/orange): Ethernet Speed

SPEED ON (orange): 1000 Mbit

SPEED ON (green): 100 Mbit

SPEED OFF: 10 Mbit

Note ...

If the General Purpose LEDs are lit red during boot-up, a failure is indicated before the BIOS has started.

For further information, please contact Kontron.

1.4.3 Board Layout

Figure 1-3: CP6001-V Board Layout (Front View)

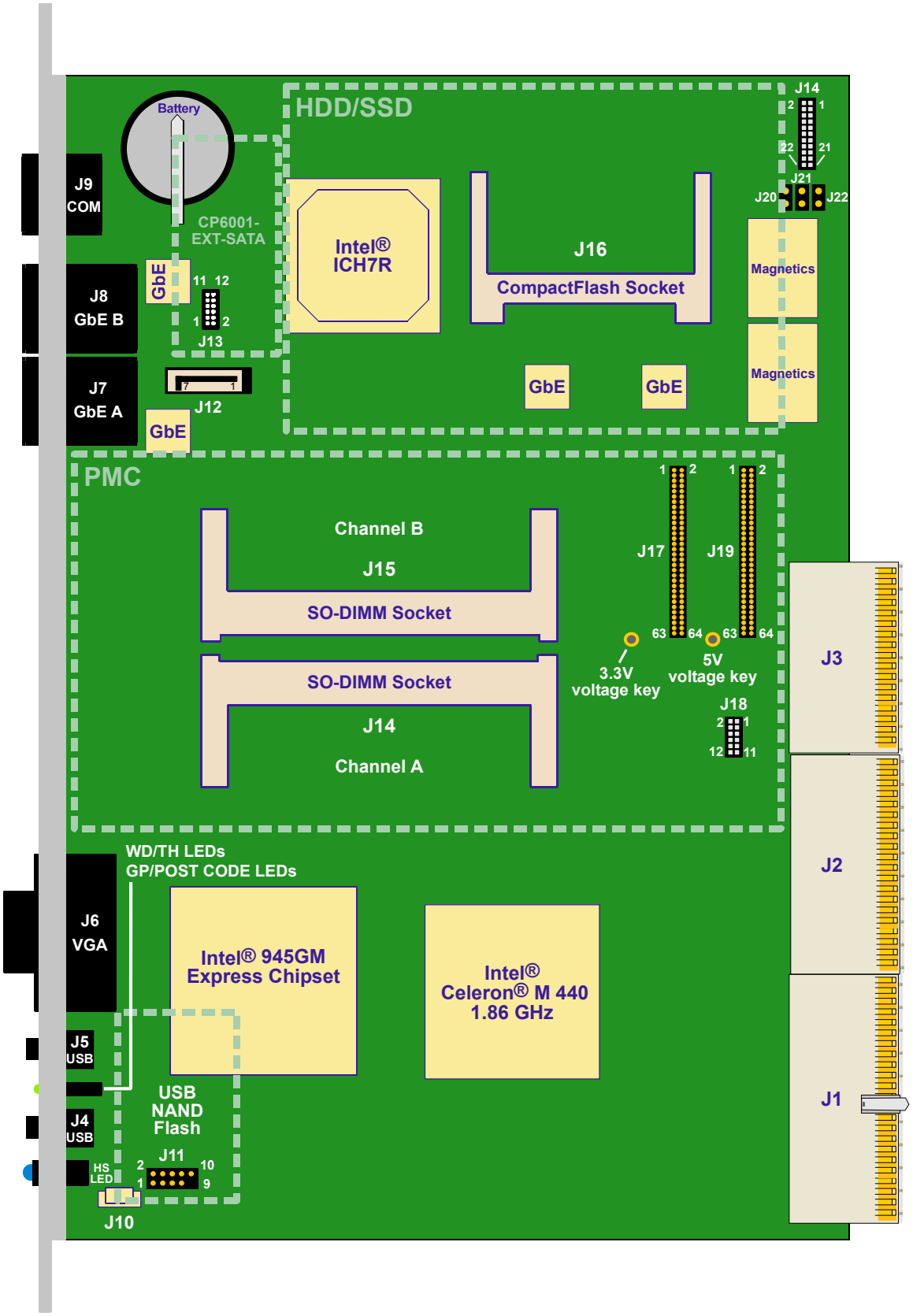
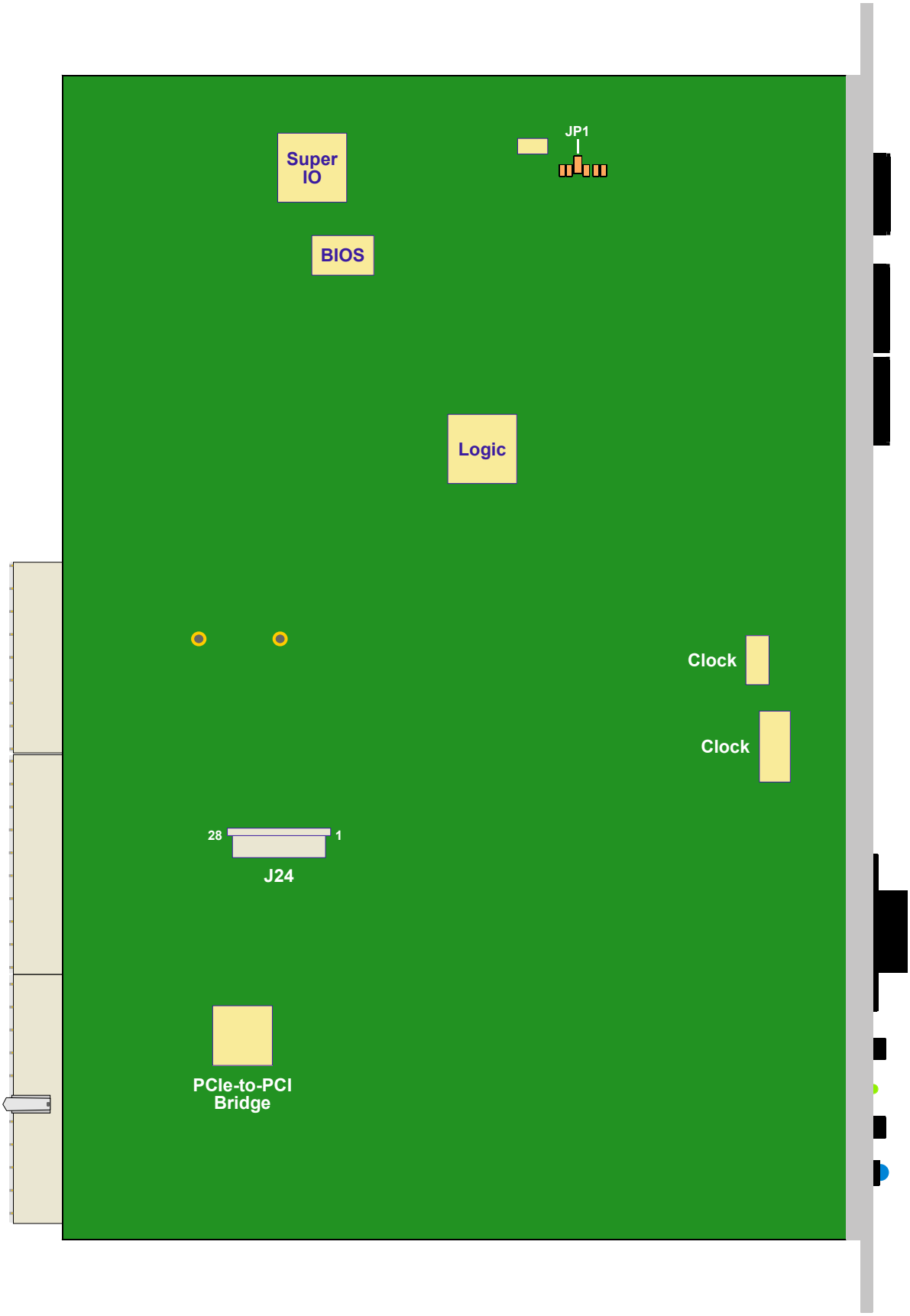


Figure 1-4: CP6001-V Board Layout (Reverse View)



1.5 Technical Specification

Table 1-1: CP6001-V Main Specifications

CP6001-V		SPECIFICATIONS
Processor and Memory	CPU	The CP6001-V supports the Intel® Celeron® M processor 440, 1.86 GHz, 533 MHz FSB, 1 MB L2 cache in a 479 µFCBGA packaging.

	Memory	Main Memory:
		• Up to 4 GB dual-channel, DDR2 memory running at 533 MHz
		Cache structure:
		• 64 kB L1 on-die full speed processor cache
		  • 32 kB for instruction cache
		  • 32 kB for data cache
		• 1 MB L2 on-die full speed processor cache
		FLASH Memory:
		• One 1 MB onboard FWH for BIOS
		• CompactFlash memory optionally available
		• USB 2.0 NAND Flash memory optionally available (e.g. 8 GB)
		• Serial ATA SSD Flash memory optionally available
		Serial EEPROM:
		• 24LC64 (64 kbit)

Chipset	Intel® 945GM Express GMCH	Mobile Intel® 945GM Express Graphics Memory Controller Hub: • Support for a single Intel® Celeron® M processor 440 • 64-bit AGTL/AGTL+ based System Bus interface up to 533 MHz • System Memory interface with optimized support for dual-channel DDR2 SDRAM memory at 533 MHz without ECC • Integrated 2D and 3D Graphics Engines • Integrated 400 MHz RAMDAC

	Intel® ICH7R	Intel® 82801GR I/O Controller Hub (ICH7R):
		• Power management logic support
		• Enhanced DMA controller, interrupt controller, and timer functions
		• Integrated IDE controller Ultra ATA/100/66/33 and PIO mode
		• USB 2.0 host interface with seven USB ports (only three ports are used on the CP6001-V)
		• SATA Host Controller with two ports, 3 Gbit/s transfer rate
		• Five of the six x1 PCI Express ports are used on the CP6001-V:
		  • Four x1 PCI Express ports are used for Gigabit Ethernet
		  • One x1 PCI Express port is used for the PCIe-to-CPCI bridge
		• System Management Bus (SMBus) compatible with most I²C™ devices
		• Low Pin Count (LPC) interface
		• Firmware Hub (FWH) interface support

Table 1-1: CP6001-V Main Specifications (Continued)

CP6001-V		SPECIFICATIONS
Interfaces	CompactPCI	Compliant with the CompactPCI Specification PICMG 2.0 R3.0: • System controller operation • 32-bit, 33/66 MHz PCI master interface • 3.3V or 5V signaling levels (universal signaling support) Compliant with Packet Switching Specification PICMG 2.16 R1.0 When installed in a peripheral slot, the CP6001-V is electrically isolated from the CompactPCI bus. It receives power from the backplane and supports rear I/O in compliance with the PICMG 2.16 specification.
	Rear I/O	The following interfaces are routed to the rear I/O connector J3: • 2 x Gigabit Ethernet (compliant with PICMG 2.16)
	Hot Swap Compatible	The CP6001-V supports System Master hot swap functionality and application dependent hot swap functionality when used in a peripheral slot. When used as a System Master, the CP6001-V supports individual clocks for each slot and the ENUM signal handling is in compliance with the PICMG 2.1 Hot Swap Specification.
	VGA	Built-in Intel 3D Graphics accelerator for enhanced graphics performance. • Supports resolutions of up to 2048 x 1536 at a 75 Hz refresh rate • Hardware motion compensation for software MPEG2 decoding • Dynamic Video Memory Technology (DVMT3.0)
	Gigabit Ethernet	Up to four 10 Base-T/100 Base-TX/1000 Base-T Gigabit Ethernet interfaces based on the Intel® 82574L Ethernet PCI Express bus controllers: • Two RJ-45 connectors on front panel • Two optional Gigabit Ethernet interfaces on the rear I/O connector J3 (PICMG 2.16) • Automatic mode recognition (Auto-Negotiation) • Automatic cabling configuration recognition (Auto MDI-X) Cabling requirement: Category 5, UTP, four-pair cabling
	USB	Three USB 2.0 ports supporting UHCI and EHCI: • Two type A connectors on the front panel • One onboard connector for the USB 2.0 NAND Flash module

Table 1-1: CP6001-V Main Specifications (Continued)

CP6001-V		SPECIFICATIONS
Interfaces	Serial	One 16C550-compatible UART on the front panel (RS-232 signaling)
	PMC	PMC interface: • Jn1 and Jn2 PCI mezzanine connectors for standard PMC modules • 32-bit/33 MHz PCI interface • Supported voltages: 3.3 V, 5 V, +12 V, and -12 V • Supports 3.3 V / 5V signaling voltage (VI/O)
	Keyboard and Mouse	USB Support for keyboard and mouse

	Mass Storage	EIDE ATA:
		• One onboard ATA interface for the CompactFlash socket supporting type I and type II CompactFlash cards (true IDE mode and Multiword DMA support)
		SATA: Integrated Serial ATA Host Controllers
		• Provide independent DMA operation on 2 channels:
		  • One onboard SATA interface for connection to a SATA cable
		  • One onboard SATA interface for connection to the CP6001-EXT-SATA module
		Onboard 2.5" HDD/SSD:
		• Onboard 2.5" Hard Disk Drive (HDD) or Solid State Drive (SSD) is supported via the 12-pin Serial ATA connector, J13, and the CP6001-EXT-SATA module

Sockets	Front Panel Connectors	• VGA: 15-pin, D-Sub connector • USB: two type A connectors • Ethernet: two RJ-45 connectors • COM: 8-pin, RJ-45 connector • PMC front panel

	Onboard Connectors	Onboard connectors:
		• USB 2.0 NAND Flash connector, J11
		• I/O extension connector, J14
		• PMC connectors J17 and J19 (Jn1 and Jn2)
		• Two SATA connectors:
		  • One 7-pin, standard SATA connector with locking mechanism, J12
		  • One 12-pin, SATA extension connector, J13
		• CompactPCI Connector J1 to J3
		• One CompactFlash socket for type I and type II CF cards, J16
		• One JTAG connector, J18
		• One ITP700 JTAG connector, J24
		• Two 200-pin SO-DIMM sockets, J14 and J15

Table 1-1: CP6001-V Main Specifications (Continued)

CP6001-V		SPECIFICATIONS
HW Monitoring	LEDs	System Status LEDs: • WD (red/green): Watchdog Status • TH (red/green/amber): Temperature Status • HS (blue): Hot Swap Control General Purpose LEDs: • LED 0..1 (red/green/amber): General Purpose / POST code Gigabit Ethernet Status: • ACT (green): Ethernet Link/Activity • SPEED (green / orange): Ethernet Speed • SPEED ON (orange): 1000 Mbit • SPEED ON (green): 100 Mbit • SPEED OFF: 10 Mbit
	Watchdog	Software configurable Watchdog generates IRQ or hardware reset.
	Thermal-Related Functions	CPU overtemperature protection is provided by: • Internal processor temperature control unit • CPU shut down via the hardware monitor
	System Monitoring	In SCH3112 integrated hardware monitor for supervision of: • Several system power voltages • Board temperature

Software	Software BIOS	AMI BIOS with 1 MB Flash memory and the following features:
		• User BIOS defaults (Setup Default Override - SDO)
		• ACPI support
		• FWH write protection (BIOS Flash)
		• Fail-safe mechanism
		  • Boot block recovery
		• CMOS parameters are saved in the EEPROM
		• PC Health Monitoring
		• Manufacturing data:
		  • Serial number
		  • Material number
		  • Chipset revision
		  • CPU microcode

	Operating Systems	Operating systems supported: • Microsoft® Windows® XP • Microsoft® Windows® XP Embedded • Linux

Table 1-1: CP6001-V Main Specifications (Continued)

CP6001-V		SPECIFICATIONS
General	Mechanical	6U, 4HP, CompactPCI-compliant form factor
	Power Consumption	Typical 24 W Refer to Chapter 5 for further information.
	Temperature Ranges	Operational: 0°C to +60°C Standard Storage: -55°C to +85°C Without battery or any additional components ***Note ...*** When a battery is installed, refer to the operational specifications of the battery as this determines the storage temperature of the CP6001-V (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 CP6001-V.
	Climatic Humidity	93% RH at 40°C, non-condensing (acc. to IEC 60068-2-78)
	Dimensions	233.35 mm x 160 mm
	Board Weight	550 g 4HP with heat sink and SO-DIMM modules but without mezzanine boards such as PMC module, HDD/SSD, and CP6001-EXT-SATA module
	Battery	The CP6001-V provides a 3.0V lithium battery for RTC with battery socket. 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)

1.6 Kontron Software Support

Kontron is one of the few CompactPCI and VME manufacturers 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 CP6001-V complies with the requirements of the following standards:

Table 1-2: Standards

TYPE	ASPECT	STANDARD
CE	Emission	EN55022 EN61000-6-3
	Immission	EN55024 EN61000-6-2
	Electrical Safety	EN60950-1
Mechanical	Mechanical Dimensions	IEEE 1101.10
Environmental	Climatic Humidity	IEC60068-2-78
	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 1-3: Related Publications

PRODUCT	PUBLICATION
CompactPCI Systems and Boards	CompactPCI Specification PICMG 2.0, Rev. 3.0 CompactPCI Packet Switching Backplane Specification PICMG 2.16 Rev. 1.0 CompactPCI System Management Specification PICMG 2.9 Rev. 1.0 CompactPCI Hot Swap Specification PICMG 2.1 Rev. 2.0
	Kontron CompactPCI Backplane Manual, ID 24229
CompactFlash Cards	CF+ and CompactFlash Specification Revision 2.1
PMC Modules	IEEE 1386-2001, IEEE Standard for a Common Mezzanine Card (CMC) Family IEEE 1386.1-2001, IEEE Standard Physical and Environmental Layers for PCI Mezzanine Cards (PMC)
All Kontron products	Product Safety and Implementation Guide, ID 1021-9142

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