Cool RoadRunner 4
PCI-104 CPU-Board

Technical Manual

TME-P104-CRR4-R2V1.DOC
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Contents

1 Functional Specification

1.1 General

The Cool RoadRunner 4 is a CPU module conforming to the PCI-104 standard definition.

At the core of the Cool RoadRunner 4 works the Intel® Pentium® M processor together with the Intel® i82855GME (855GME) chipset. Running at up to 2000 MHz and more, this processor consumes very little power while delivering outstanding performance at the same time. The processor's clock frequencies will even be increased when faster CPU chips will become available. At the other side of the performance spectrum, at lower clock frequencies, it is even possible to operate the Cool RoadRunner 4 with a heatsink only.

The i82855GME chipset features a high performance 2D/3D graphics controller as well as an integrated display controller with improved unified memory architecture. Displays with resolutions up to 2048 x 1536 pixels at 75 Hz can be handled. Dual channel LVDS allows interference-free connection of LCD modules.

The Cool RoadRunner 4 comes with PS/2 keyboard and mouse support. Two Ultra ATA 100 devices can be connected to the EIDE port. An AC´97 2.3 compatible sound I/O system is also integrated, allowing easy construction of embedded multimedia computers.

The communication possibilities match the processor's performance: a Gigabit-Ethernet (1000BaseT) port is integrated on the board. Further connection possibilities are provided by 6 independent USB 2.0 ports in USB host mode, which allow connection of all kinds of different USB peripheral devices.

There is a PCI slot available for system expansion. It is a conventional 5V PCI-104 slot, which can be used for all kinds of PCI-104 or PC/104Plus standard modules.

The system’s main memory is expandable up to 1024 MB DDR-333 (PC2700) SDRAM in the on-board SO-DIMM socket.

The board's basic functionality is supervised with the integrated status indicators. These indicators show the state of the supply voltages, Ethernet activity as well as EIDE accesses. Also watchdog and live will be indicated.

The Cool RoadRunner 4 is intended for embedded high performance PC applications.

1.2 Features

CPU:

- **Intel® Pentium® M Processor**

Cache Memory:

- On-die 32 KB Level 1 instruction and data caches
- And the 1 or 2 MB Level 2 cache with Advanced Transfer Cache Architecture

Main Memory:

- One memory slot for 64-bit memory, with up to 1 GB DDR-SODIMM (PC2700/333MHz).

Extension slots:

- 1x 32-bit PCI-104 slot (5V)

Interfaces:

- Power supply
- PS/2 Keyboard
- PS/2 Mouse
- 6x USB 2.0
- Ethernet 10/100/1000 BaseT
- EIDE (1x IDC44)
- LVDS 18/24-bit dual channel LVDS
- PCI-104 bus

Other configurations are possible at higher volumes.

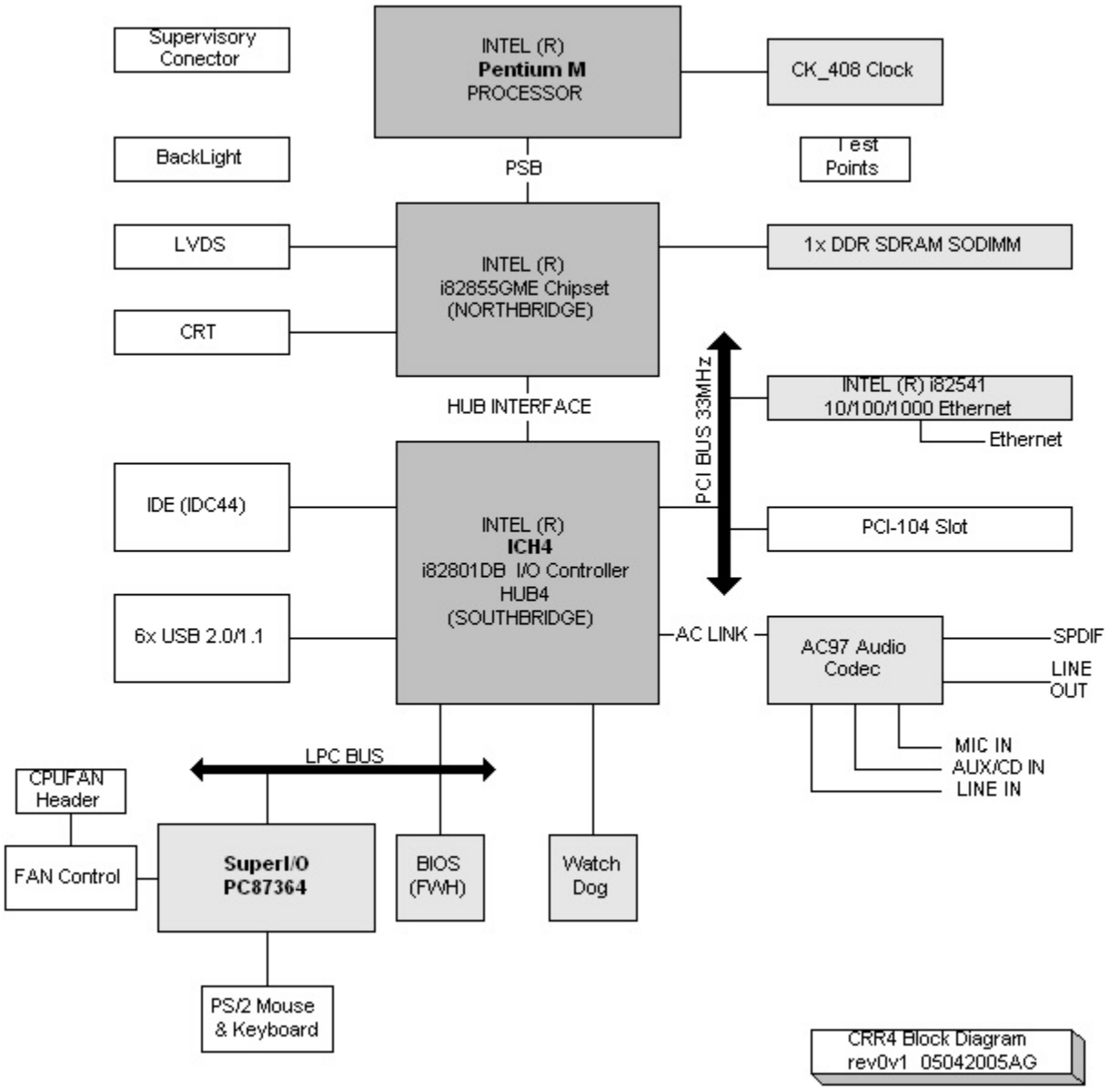
Dimensions:

- 95.9mm x 115.6mm x 15mm

Mounting:

- 4 mounting holes

1.3 Functional Block Diagram



1.4 Processor

Intel® Pentium® M Processor, 600 MHz…2.0GHz

The Intel® Pentium® M processor is a high performance, low power mobile processor with several micro-architectural enhancements over existing Intel mobile processors.

Some of the key features of this processor are:

- Supports Intel® Architecture with Dynamic Execution
- High performance, low-power core
- On-die, primary 32-kbyte instruction cache and 32-kbyte write-back data cache
- On-die, 1-MByte second level cache with Advanced Transfer Cache Architecture
- Advanced Branch Prediction and Data Prefetch Logic
- Streaming SIMD Extensions 2 (SSE2)
- 400-MHz, Source-Synchronous processor system bus
- Advanced Power Management features including Enhanced Intel® SpeedStep® technology
- Micro-FCPGA and Micro-FCBGA packaging technologies

The Intel Pentium M processor is manufactured on Intel’s advanced 0.13-micron and in 90 nm process technology with copper interconnect. The processor maintains support for MMX™ technology and Internet Streaming SIMD instructions and full compatibility with IA-32 software. The high performance core features architectural innovations like Micro-op Fusion and Advanced Stack Management that reduce the number of micro-ops handled by the processor. This results in more efficient scheduling and better performance at lower power. The on-die 32-kB Level 1 instruction and data caches and the 1-MB or 2MB Level 2 cache with Advanced Transfer Cache Architecture enable significant performance improvement over existing mobile processors. The processor also features a very advanced branch prediction architecture that significantly reduces the number of mispredicted branches. The processor’s Data Prefetch Logic speculatively fetches data to the L2 cache before an L1 cache requests occurs, resulting in reduced bus cycle penalties and improved performance.
The Streaming SIMD Extensions 2 (SSE2) enables break-through levels of performance in multimedia applications including 3-D graphics, video decoding/encoding, and speech recognition.
The new packed double-precision floating-point instructions enhance performance for applications that require greater range and precision, including scientific and engineering applications and advanced 3-D geometry techniques, such as ray tracing.

1.5 Northbridge

Intel® i82855GME, Chipset Graphics and Memory Controller Hub (GMCH)

- Processor/Host Bus at 400 MHz
- Memory System PC1600/PC2100/PC2700 DDR SDRAM (200/266/333MHz)
- System Interrupts Intel 8259
- Video Stream Decoder improved hardware motion compensation for MPEG2 and Software DVD at 60 Fields/second and 30 frames/second full screen, encoding at low CPU utilization
- Analog display support, 350-MHz integrated 24-bit RAMDAC that can drive a standard progressive scan analog monitor with pixel resolution up to 1600x1200 at 85 Hz and up to 2048x1536 at 75 Hz
- Dual independent pipe support

  - Concurrent: Different images and native display timings on each display device
  - Simultaneous: Same images and native display timings on each display device

- Dedicated LFP (local flat panel) LVDS interface, Single- or dual-channel LVDS panel support up to UXGA panel resolution with frequency range from 25 MHz to 112 MHz (single channel/dual channel), Supports data format up to 24 bpp

- Internal Graphics Features, 2D/3D graphics engine

For detailed information, please use the Intel® i82855GME datasheet.

1.6 Southbridge

Intel® i82801DB I/O Controller Hub 4 (ICH4)

The ICH4 provides extensive I/O support. Functions and capabilities include i.e.:

- *PCI Local Bus Specificatio*n, Revision 2.2-compliant with support for 33 MHz PCI operations.
- ACPI Power Management Logic Support
- Enhanced DMA controller, Interrupt controller, and timer functions
- Integrated IDE controller supports Ultra ATA100/66/33
- USB host interface with support for 6 USB ports; 3 UHCI host controllers; 1 EHCI high-speed USB 2.0 Host controller
- *System Management Bus (SMBus) Specificatio*n, Version 2.0 with additional support for I2C devices
- Supports *Audio Codec ’97*, Revision 2.3 specification (a.k.a., *AC ’97 Component Specificatio*n, Revision 2.3) Link for Audio and Telephony codecs (up to seven channels)

1.7 PCI Bus Interface

The main features are:

- Rev. 2.2 compliant implementation
- Integrated PCI arbitration interface (32 bit wide, 5V-IO).
- Translation of PCI cycles to ISA bus
- Translation of ISA master initiated cycle to PCI
- Support for burst read/write from PCI master
- 33 MHz PCI clock

The Cool RoadRunner 4 supports only 5 Volt signal levels on the PCI bus. Adapter boards on the PCI-slot must tolerate this voltage.

1.8 Super I/O

The onboard Super I/O (National Semiconductor, PC87364) provides:

- PS2 keyboard interface
- PS/2 mouse interface
- FAN speed control and monitor

1.9 PS/2 Keyboard Interface

The keyboard interface is located on the PS2 “Keyboard/Mouse Connector”. A standard PS2 keyboard can be used.

1.10 PS/2 Mouse Interface

The PS/2 mouse function is always active. PS/2 Mouse function can be disabled.

1.11 Reset-In Signal

The RESET-IN signal is accessible on the IDC12 Header “System Panel Connector”. To reset the board, this signal must be pulled to GND.

1.12 USB Ports

The Cool RoadRunner 4 supports six USB ports.
Two USB ports are located on each of the three 2.0 mm IDC10 headers on the CPU-board. To use legacy USB functions like USB boot or USB keyboard, they have to be enabled in the BIOS setup. To enter the BIOS press <**F2**> key at boot time.

Integrated Peripherals – Onboard Devices

USB Controller : Enabled/Disable
USB 2.0 Controller : Enabled/Disable

1.13 EIDE Port

An EIDE (**E**xtended **I**ntelligent **D**rive **E**lectronics) port is provided by the chipset to connect intelligent drives that integrate the controller (hard disk, CD-ROM etc.). This port supports LBA (Logic Block Addressing) that allows the use of hard disks larger than 512 Mbytes. To enhance the performance, this port supports DMA F type transfer. The EIDE port is located on a standard 44-pin header (2.0 mm) for hard disks. For optimal performance, an ATA100 cable should be used.

1.14 CRT/LCD Graphic-Controller

The GMCH IGD provides a highly integrated graphics accelerator delivering high performance 2D, 3D, and video capabilities. With its interfaces to an analog display and an LVDS port (e.g. flat panel), the GMCH can provide a complete graphics solution.

The GMCH also supports 2D hardware acceleration for block transfers of data (BLTs). The BLT engine provides the ability to copy a source block of data to a destination and perform raster operations (e.g., ROP1, ROP2, and ROP3) on the data using a pattern, and/or another destination. Performing these common tasks in hardware reduces CPU load, and thus improves performance. High bandwidth access to data is provided through the System Memory interface. The GMCH uses tiling architecture to increase System Memory efficiency and thus maximize effective rendering bandwidth. The Intel 855GME GMCH also improves 3D performance and quality with 3D Zone Rendering technology.

The GMCH supports two display ports, one analog and one digital. These provide support for a progressive scan analog monitor and a dedicated dual channel LVDS LCD panel.
The Graphics Controller has an integrated 350-MHz, 24-bit RAMDAC with maximum pixel resolution support up to 1600x1200 at 85 Hz and up to 2048x1536 at 72 Hz.

1.15 LVDS

The Intel 855GME GMCH has an integrated dual channel LFP Transmitter interface to support LVDS LCD panel resolutions up to UXGA with center and down spread SSC support of 0.5%, 1%, and 2.5% utilizing an external SSC clock. The display pipe provides panel up-scaling to fit a smaller source image onto a specific native panel size, as well as provides panning and centering support. The LVDS port can only be driven by Pipe B, either independent or simultaneous with the Analog Display port, respectively.

The Dedicated Dual Channel LFP LVDS interface with a frequency range of 25 MHz to 112 MHz (single channel/dual channel) supports up to UXGA (1600x1200 at 60 Hz) LCD panel resolution with a maximum pixel format of 24-bpp.

There is a connector on-board to supply the LC-Display's inverter.

1.16 Gigabit Ethernet (1000BaseT)

The Intel® 82541PI integrates fourth generation Gigabit MAC design with fully integrated, physical layer circuitry to provide a standard IEEE 802.3 Ethernet interface for 1000BASE-T, 100BASE_TX, and 10BASE-T applications (802.3, 802.3u, and 802.3ab). The controller is capable of transmitting and receiving data at rates of 1000 Mbps, 100 Mbps or 10 Mbps.

1.17 Audio

The Cool RoadRunner 4 features a six channel audio system with an ALC203 CODEC (Realtek).
The ALC203 is an 18-bit, full duplex AC'97 2.3 compatible stereo audio CODEC designed for PC multimedia systems.
This CODEC also supports an AC’97 2.3 compliant S/PDIF out function which allows easy connection of the PC to consumer electronic products, such as AC3 decoder/speaker and mini disk.

1.18 Watchdog

A watchdog is implemented by a Maxim 691 Reset/Watchdog circuit. It is accessible through some general-purpose ports of the Southbridge controller: setting bit 7 of port 48Eh to 1 enables the watchdog function. Thereafter the watchdog must be triggered within 600ms; otherwise, the watchdog generates a hardware reset. Toggling bit 4 of port 48Eh triggers the watchdog.

The status of the watchdog can either be read through port 48Eh (bit 7) or be determined from pin 3 of the supervisory connector (WD-ACTIVE). In each case a high level indicates, that a watchdog time-out has occurred. Additionally a LED indicates the occurrence of a watchdog time-out.

2 Hardware Installation

The Cool RoadRunner 4 is delivered with the correct jumper settings for proper operation. The customer must not change the default jumper settings. Improper jumper settings will cause system instability or system hang-ups.

Attention:	The board must not be connected or disconnected to peripherals (e.g. HDD, CDROM etc.) with the power supply switched ON!

2.1 Adapter Cable Set

With the optionally available cable set, standard PC peripherals can be easily connected to the board.

2.2 Getting Started

The easiest way to get the Cool RoadRunner 4 running is to use LiPPERT's CRR4 Starter Kit.

1.) Plug in SO-DIMM module into SO-DIMM-socket.
2.) Make all necessary connections by using the cables out of the starter kit. At least use CRT monitor (VGA) and keyboard.
3.) Connect power supply (5VDC / min. 7A).
4.) Make sure that all connections have been made correctly.
5.) Switch on power supply.
6.) Enter the BIOS Setup Utility by pressing <**F2**> key at boot-time.
7.) Choose “**Load Optimized Defaults**”, save setting and reboot

3 Software

3.1 BIOS

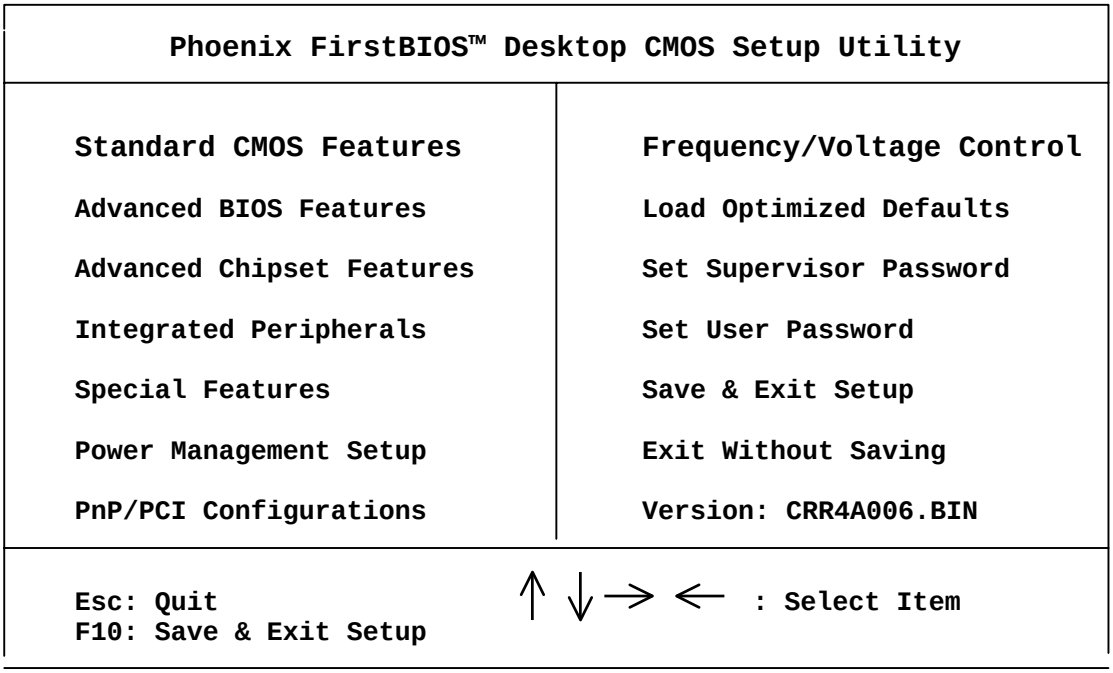
BIOS stands for *Basic Input and Output System*. The BIOS is the first program to run when you turn on your computer.

The Cool RoadRunner 4 is delivered with a standard PC BIOS. By default, all setup settings are done to have a “ready to run” system, even without a BIOS setup backup battery. The BIOS is located in a Flash PROM and can be easily updated on-board.

More BIOS information is available at: http://www.phoenix.com/en/customer+services/bios/awardbios/

3.1.1 Setup

Pressing the <F2> or <DEL> key at boot-time starts the setup utility.



For detailed BIOS information, ask for the “BIOS-GUIDE for Thunderbird and Cool Roadrunner 4”.

3.1.2 Special Features

For the Cool RoadRunner 4 is an **extension module** called "Bridge to ISA" (B2I**)** available. This module includes many new hardware features for the Cool RoadRunner 4. To configure the attached hardware, several parameters can be changed with the BIOS setup utility. For more details, please refer to the B2I user manual.

```
        Phoenix FirstBIOS™ Desktop CMOS Setup Utility
                    Special Features

BIOS PLUGIN                 20050530        Item Help

DiskOnChip Base Address     [Disabled]

FDD Controller              [Disabled]      Menu Level >

Serial Port 1               [Disabled]
Serial Port 1 Mode          [RS-232]

Serial Port 2               [Disabled]
Serial Port 2 Mode          [RS-232]

Parallel Port               [Disabled]
Parallel Port Mode          [SSP]

Program FPGA by BIOS        [Disabled]
```

3.1.3 Booting from alternative device

Pressing the <**ESC**> key at power-up starts the Boot Menu. Choose one of the listed bootable devices for booting.

3.1.4 Reload default BIOS values

The default values of the BIOS can be automatically reloaded at boot time. Therefore the key <**0** / **INSERT**> on the NUM pad has to be pressed before the system is turned on. While pressing this key and turning the system on, the default values will be loaded.
After reloading the default BIOS values and rebooting you should start the BIOS Setup Utility.

Choose “**Load Optimized Defaults**” to get the best setup for CRR4.

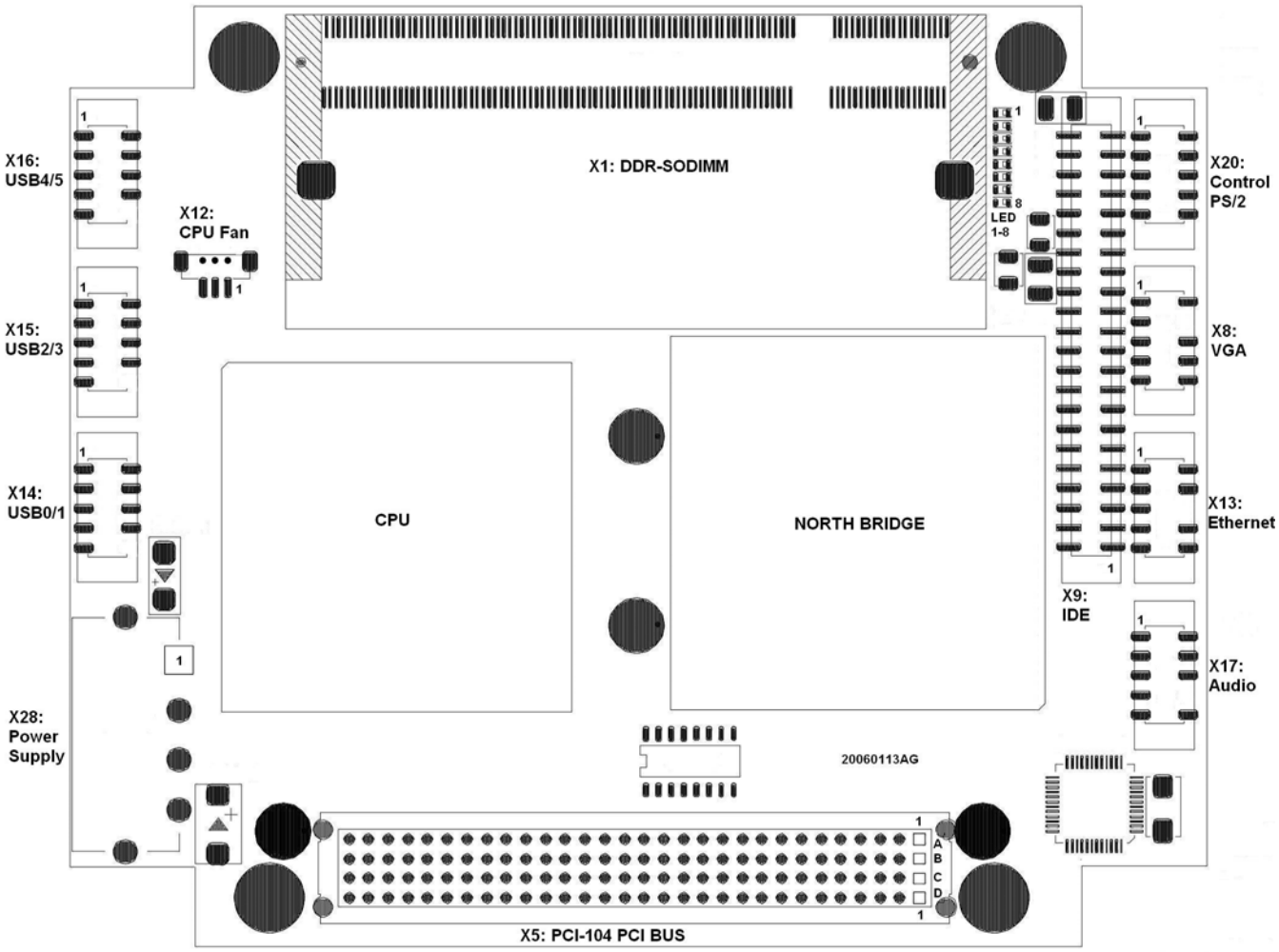
3.2 Software Installation

The drivers for the Cool Roadrunner 4 are available either on the product CD-ROM or at LiPPERT's Website (www.lippert-at.com). To install them correctly, please read the instructions on the driver disks before installing.

The latest drivers are always available from Intel's website:
http://downloadfinder.intel.com/scripts-df/Support_Intel.asp

4 Connector Definitions

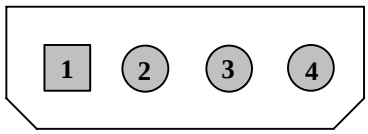
4.1 Overview Connectors (top)



4.1.5 Power Supply Connector

Connector type: AMP type 350211-1 connector (X28)

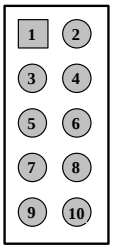
PIN	Signal
1	+12V (only for PCI slot and Inverter power supply)
2	GND
3	GND
4	+5V



4.1.6 Control – PS/2 connector

Connector type: IDC10 pin header 2.0 mm (X20)

PIN	Signal	PIN	Signal
1	PC Speaker Out	2	MouseCLK
3	Reset IN	4	MouseDAT
5	KeybDAT	6	KeybCLK
7	GND	8	+5V out
9	Vext. Bat Input	10	PowerButton IN

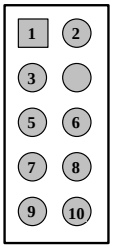


Vext.Bat Input: typ. 3VDC (2.5…3,6VDC), max. current 10uA

4.1.7 VGA connector

Connector type: IDC10 pin header 2.0 mm (X8)

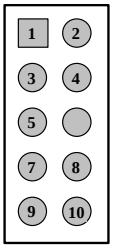
PIN	Signal	PIN	Signal
1	Red	2	Video-GND
3	Green	4	**key**
5	Blue	6	DDCCLK
7	H-Sync	8	DDCDAT
9	V-Sync	10	GND



4.1.8 Ethernet connector

Connector type: IDC10 pin header 2.0 mm (X13)

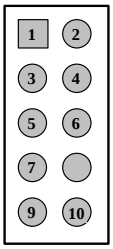
PIN	Signal	PIN	Signal
1	MX1-	2	MX1+
3	MX2-	4	MX2+
5	n.c.	6	**key**
7	MX3-	8	MX3+
9	MX4-	10	MX4+



4.1.9 Audio connector

Connector type: IDC10 pin header 2.0 mm (X17)

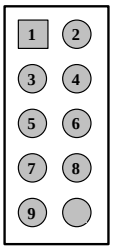
PIN	Signal	PIN	Signal
1	Line In Right	2	Line In Left
3	Line Out Right	4	Line Out Left
5	CD In Right	6	CD In Left
7	Mic In	8	**key**
9	SPDIF Out	10	Audio GND



4.1.10 USB 0/1 connector

Connector type: IDC10 pin header 2.0 mm (X14)

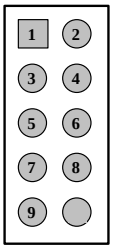
PIN	Signal	PIN	Signal
1	VCC USB0	2	VCC USB1
3	USB0-	4	USB1-
5	USB0+	6	USB1+
7	GND	8	GND
9	n.c.	10	**key**



4.1.11 USB 2/3 connector

Connector type: IDC10 pin header 2.0 mm (X15)

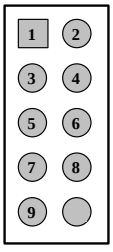
PIN	Signal	PIN	Signal
1	VCC USB2	2	VCC USB3
3	USB2-	4	USB3-
5	USB2+	6	USB3+
7	GND	8	GND
9	n.c.	10	**key**



4.1.12 USB 4/5 connector

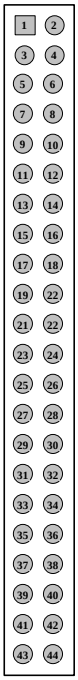
Connector type: IDC10 pin header 2.0 mm (X16)

PIN	Signal	PIN	Signal
1	VCC USB4	2	VCC USB5
3	USB4-	4	USB5-
5	USB4+	6	USB5+
7	GND	8	GND
9	n.c.	10	**key**



4.1.13 IDE connector

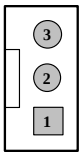
Connector type: IDC44pin header 2.0 mm (X9)



PIN	Signal	PIN	Signal
1	RST#	2	GND
3	Data7	4	Data8
5	Data6	6	Data9
7	Data5	8	Data10
9	Data4	10	Data11
11	Data3	12	Data12
13	Data2	14	Data13
15	Data1	16	Data14
17	Data0	18	Data15
19	GND	20	n.c.
21	DRQ	22	GND
23	IOW#	24	GND
25	IOR#	26	GND
27	RDY	28	CSEL
29	DACK#	30	GND
31	IRQ	32	n.c.
33	Adr1	34	PDIAG#
35	Adr0	36	Adr2
37	CS1#	38	CS3#
39	LED	40	GND
41	+5V	42	+5V
43	GND	44	GND

4.1.14 CPU Fan Supply

Connector type: DF13-3P-1.25V, Hirose (X12)

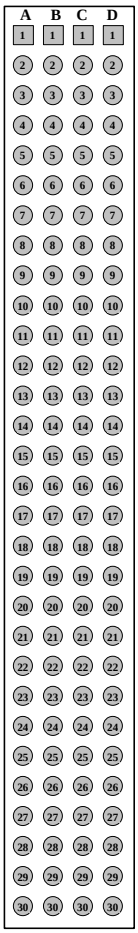


PIN	Signal
1	Speed Signal from fan (yellow)
2	+5VDC (red)
3	GND (black)

Current at +5VDC output: max.500mA

4.1.15 PCI Bus

Connector type: PCI-104 PCI connector (X5)



Pin	A	B	C	D
1	GND	Reserved	+5V	AD00
2	VI/O	AD02	AD01	+5V
3	AD05	GND	AD04	AD03
4	C/BE0#	AD07	GND	AD06
5	GND	AD09	AD08	GND
6	AD11	VI/O	AD10	M66EN
7	AD14	AD13	GND	AD12
8	NC (+3.3V)	C/BE1#	AD15	NC (+3.3V)
9	SERR#	GND	Reserved	PAR
10	GND	PERR#	NC (+3.3V)	Reserved
11	STOP#	NC (+3.3V)	LOCK#	GND
12	NC (+3.3V)	TRDY#	GND	DEVSEL#
13	FRAME	GND	IRDY#	NC (+3.3V)
14	GND	AD16	NC (+3.3V)	C/BE2#
15	AD18	NC (+3.3V)	AD17	GND
16	AD21	AD20	GND	AD19
17	NC (+3.3V)	AD23	AD22	NC (+3.3V)
18	IDSEL0	GND	IDSEL1	IDSEL2
19	AD24	C/BE3#	VI/O	IDSEL3
20	GND	AD26	AD25	GND
21	AD29	+5V	AD28	AD27
22	+5V	AD30	GND	AD31
23	REQ0#	GND	REQ1#	VI/O
24	GND	REQ2#	+5V	GNT0#
25	GNT1#	VI/O	GNT2#	GND
26	+5V	CLK0	GND	CKL1
27	CLK2	+5V	CLK3	GND
28	GND	INTD#	+5V	RST#
29	+12 Volts	INTA#	INTB#	INTC#
30	NC(-12V)	REQ3#	GNT3#	GND

Note: All “**VI/O**” pins are connected to **+5 Volts.**
This board does not support -12 Volts.

Note: All signals named "NC (+3.3V)" are in fact not connected. It is possible to jumper 3.3V to all pins. However, this is a configuration option and is only available for larger orders.

4.1.16 LED's

4.1.16.1 LED1: IDE active

Color: yellow
Function: IDE device active (ON)

4.1.16.2 LED2: Activity

Color: red
Function: Ethernet activity (ON)

4.1.16.3 LED3: Speed1000

Color: yellow
Function: Ethernet speed is 1Gbit (ON)

4.1.16.4 LED4: Link

Color: green
Function: Ethernet Link (ON)

4.1.16.5 LED5: Watchdog

Color: red
Function: Watchdog activated (ON)

4.1.16.6 LED6: Power

Color: green
Function: 5VDC Power connected (ON)

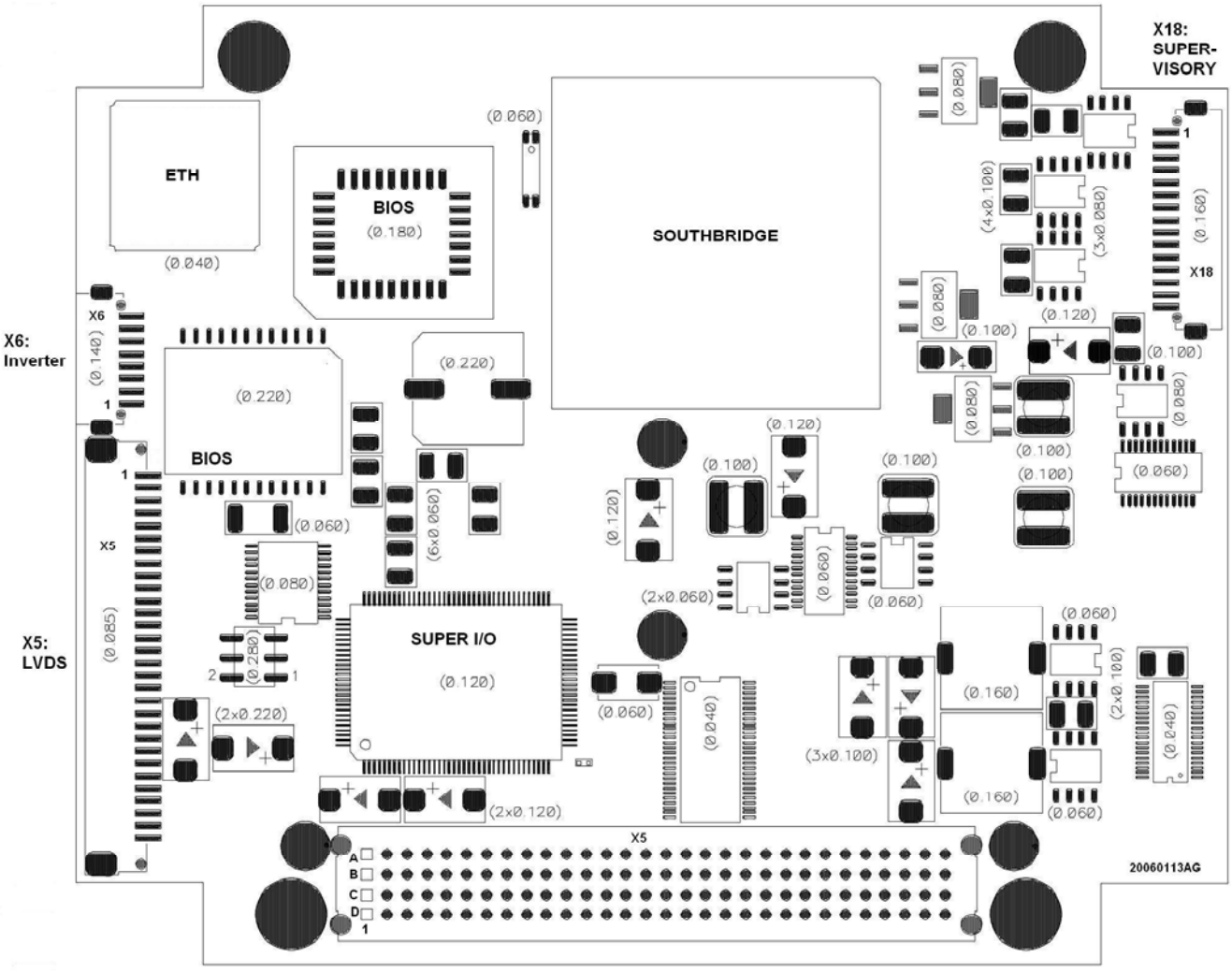
4.1.16.7 LED7: Power Good

Color: green
Function: Power Good (ON)

4.1.16.8 LED8: Live

Color: green
Function: Live Signal (ON)

4.2 Overview Connectors (bottom)

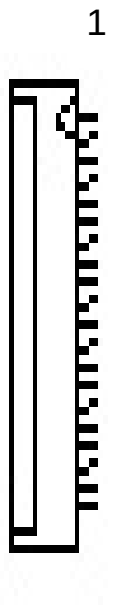


X5: PCI-104 PCI BUS

4.2.17 LVDS Dual Channel connector

Connector type: DF14-30P-1.25H, Hirose (X5)

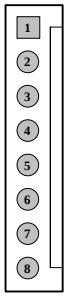
PIN	Signal
1	VDD (3.3V, opt.5V)
2	VDD (3.3V, opt.5V)
3	GND
4	GND
5	TXA3 -
6	TXA3 +
7	TXACLK -
8	TXACLK +
9	GND
10	TXA2 -
11	TXA2 +
12	TXA1 -
13	TXA1 +
14	TXA0 -
15	TXA0 +
16	GND
17	TXB3 -
18	TXB3 +
19	TXBCLK -
20	TXBCLK +
21	GND
22	TXB2 -
23	TXB2 +
24	TXB1 -
25	TXB1 +
26	TXB0 -
27	TXB0 +
28	GND
29	LVDS DDCCLK
30	LVDS DDCDAT



4.2.18 Inverter Supply

Connector type: Hirose DF13 8 pin (X6)

PIN	Signal
1	+12V DC
2	+12V DC
3	+5V DC
4	+5V DC
5	Backlight enable (level: 3,3V)
6	Backlight enable (level: 5V/12V)
7	GND
8	GND

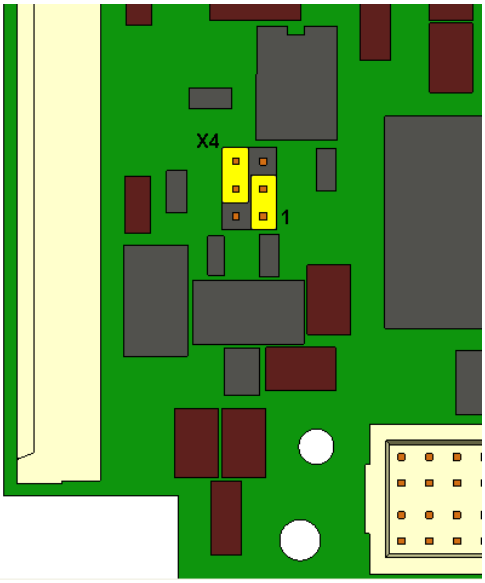


4.2.19 Display Voltage Selector

Jumper X4, Location is behind X5 (LVDS connector).

Use a 2 mm jumper between 1-3 or 3-5 to select the backlight voltage.
Use a 2 mm jumper between 2-4 or 4-6 to select the display voltage.

Connector type: IDC6 jumper 2.00 mm.



Pin	Signal name	Pin	Signal name
1	+3,3V DC	2	+12V DC
3	Display voltage	4	Backlight voltage
5	+5V DC	6	+5V DC

Default setup:
Display Voltage is +3,3V DC
Backlight Voltage is +5V DC

Example 1:
5V for the inverter at 3,3V display

Pin	Signal name	Pin	Signal name
1	+3,3V DC	2	+12V DC
3	Display voltage	4	Backlight voltage
5	+5V DC	6	+5V DC

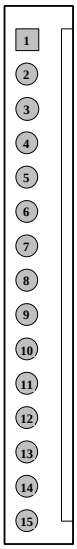
Example 2:
12V for the inverter at 3,3V display

Pin	Signal name	Pin	Signal name
1	+3,3V DC	2	+12V DC
3	Display voltage	4	Backlight voltage
5	+5V DC	6	+5V DC

Note: Setup depends on your display and inverter type. Check first the datasheets.

4.2.20 Supervisory connector

Connector type: Hirose DF13 8 pin (X18)



Pin	Signal	Type	Description
1	5VSBY Power		5.0 Volt Stand-by power.
2	3.3VSBY Power		3.3 Volt Stand-by power.
3	Watchdog active	OD PD5V 1k8	Shows the status of the watchdog (see also Section 1.18).
4	Live signal#	O 3.3V	Indicates board status. After board initialization this signal goes active (Low)
5	IDE active	O 5V	This pin indicates accesses to the IDE port. This output is Active High.
6	5V Power		5.0 Volt power
7	FAN revolution	I/OD PU3.3V 10k	This signal is directly connected to X12-Pin 1. If no onboard fan is used, you can apply a fan speed signal to this pin.
8	SMB clock	OD PU3.3V 10k	ACCESS.bus Clock Signal from Super I/O Controller PC87364.
9	SMB data	I/OD PU3.3V 10k	ACCESS.bus Data Signal from Super I/O Controller PC87364.
10	Ext. SMI#	OD PU3.3V 10k	System Management Interrupt from Super I/O Controller PC87364.
11	GPIO43	I/O	GPIO43 of ICH4
12	Ethernet SPEED1000 LED#	OD PU3.3V 1k5	The Speed LED pin will be Low at 1000 Mbps connection.
13	Ethernet ACTIVITY LED#	OD PU3.3V 1k5	The Activity LED pin will be Low if either transmit or receive activity is present.
14	Ethernet LINK LED#	OD PU3.3V 1k5	The Link LED pin will be Low when a valid link is detected.
15	GND		Common ground

5 Software Specifications

5.1 System Address Map

This section describes the mapping of the CPU memory and I/O address spaces. Also covered in this section are the PCI configuration space mapping.

> **Note:** Depending on enabled or disabled functions in the BIOS, other or more resources may be used!

Memory address map

Address Range (Dec)	Address Range (Hex)	Size	Description
1024K – XXXXXK	100000 – XXXXXX	xxxx	Extended Memory
961K – 1024K	0F0000 – 0FFFFF	64K	System Bios
865K – 960K	0D8000 – 0EFFFF	96K	Free
832K – 864K	0D0000 – 0D7FFF	32K	Mapped RAM
818K – 831K	0CC800 – 0CFFFF	~142K	Free
768K – 817K	0C0000 – 0CC7FF	~50K	Adapter ROM
704K – 768K	0B0000 – 0BFFFF	64K	VGA Adapter
640K – 704K	0A0000 – 0AFFFF	64K	VGA Adapter
0K – 640K	0 – 9FFFF	640K	Conventional Memory

I/O address map

The system chipset implements a number of registers in I/O address space. These registers occupy the following map in the I/O space (depending on enabled or disabled functions in the BIOS other or more resources may be used).

Address Range (Hex)	Size (Hex)	Description
0000-000F	16 Bytes	DMA Controller 1 (8237)
0020-0021	2 Bytes	Interrupt Controller 1 (8259)
0040-0043	4 Bytes	Timer Controller (8254)
0060	1 Bytes	Keyboard Controller Data Byte
0061	1 Byte	Speaker Control
0064	1 Byte	Kbd Ctlr, CMD,STAT Byte
0070-0071	2 Bytes	Real Time Clock
0078	1 Byte	internal
0079	1 Byte	Watchdog
0080-0091	18 Bytes	DMA Page Registers
00A0-00A1	2 Bytes	Interrupt Controller 2 (8259)
00C0-00DF	32 Bytes	DMA Controller 1 (8237)
00F0-00FF	16 Byte	Math Coprozessor
0170-0177	8 Bytes	(Secondary IDE Channel)
01F0-01F7	8 Bytes	(Primary IDE Channel)
02F8-02FF	8 Bytes	(Serial Port 2)
0376	1 Byte	IDE Controller
0378-037F	8 Bytes	(Parallel Port 1)
03B0- 03BB	12 Bytes	VGA Registers
03C0-03DF	32 Bytes	VGA Registers
03F0-03F5	6 Bytes	(Floppy Controller Registers)
03F6	1 Byte	IDE Command Port
03F7	1 Byte	(Floppy Command Port)
03F8-03FF	8 Bytes	(Serial Port 1)
0400-04BF	192 Bytes	PCI Bus
04D0-04D1	2 Bytes	PCI Bus
0CF8-0CFF	8 Bytes	PCI Bus
9000-9FFF	4096 Bytes	PCI-PCI Bridge
A000 – A01E	31 Bytes	USB Controller
A400 – A41E	31 Bytes	USB Controller
A800 – A81E	31 Bytes	USB Controller
AC00 – AC06	7 Bytes	VGA Adapter
F000 – F00E	15 Bytes	IDE Controller

5.2 Interrupts and DMA Channels

Interrupts

IRQ	System Resource
NMI	Parity Error
0	Timer
1	Keyboard
2	Interrupt Controller 2
3	Serial Port 2 (extension board)
4	Serial Port 1 (extension board)
5	Not used
6	Floppy (extension board)
7	Not used
8	Real Time Clock
9	USB Controller
10	VGA Adapter
11	USB Controller
12	Not used
13	Math coprocessor
14	IDE Controller
15	IDE Controller (not used)

DMA channels

DMA	Data width	System Resource
0	8 bits	User available
1	8 bits	User available
2	8 bits	Floppy (extension board)
3	8 bits	(Parallel Port, extension board)
4		Reserved, Cascade Channel
5	16 bits	User Available
6	16 bits	User Available
7	16 bits	User Available

6 Technical Characteristics

6.1 Electrical Specifications

Supply voltage: +5 VDC
(+12VDC only for PCI slot and inverter-power supply)

Supply voltage ripple: ± 5%

Supply current

1.0 GHz: approx. 4A at +5V

1.4 GHz: approx. 5A at +5V

1.8 GHz: approx. 7A at +5V

6.2 Environmental Specifications

Operating:

Temperature range: -20…60 °C

Temperature change: max. 10K / 30 minutes

Humidity (relative): 10…95 % (non-condensing)

Pressure: 450…1100 hPa

Non-Operating/Storage/Transport:

Temperature range: -40…+85°C

Temperature change: max. 10K / 30 minutes

Humidity (relative): 5%...95% (non-condensing)

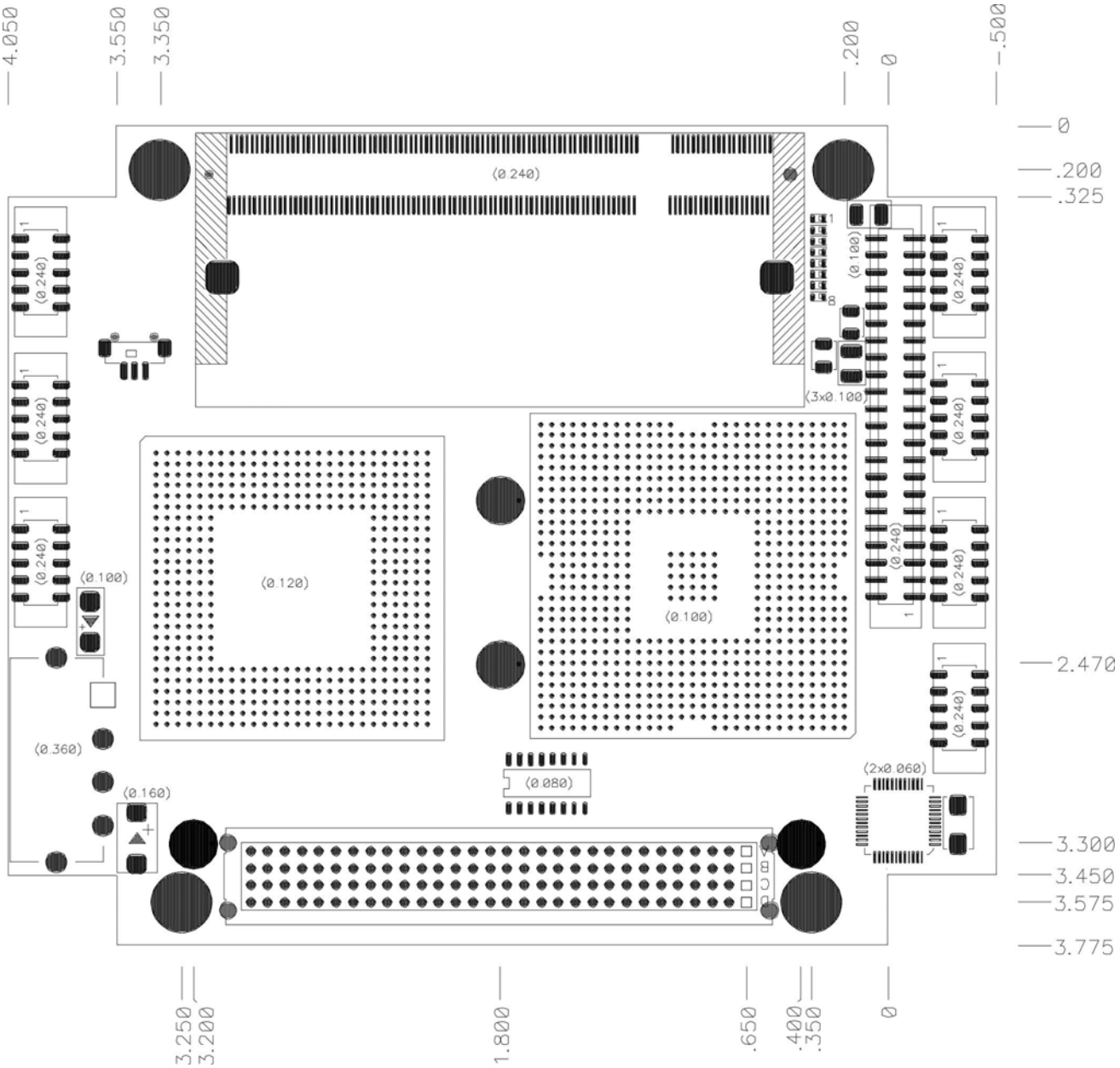
Pressure: 450...1100 hPA

6.3 Mechanical Specification

Dimensions (LxW) : 95.9mm x 115.6mm
(including I/O extension)
Height : 15 mm
Weight : approx. 140g

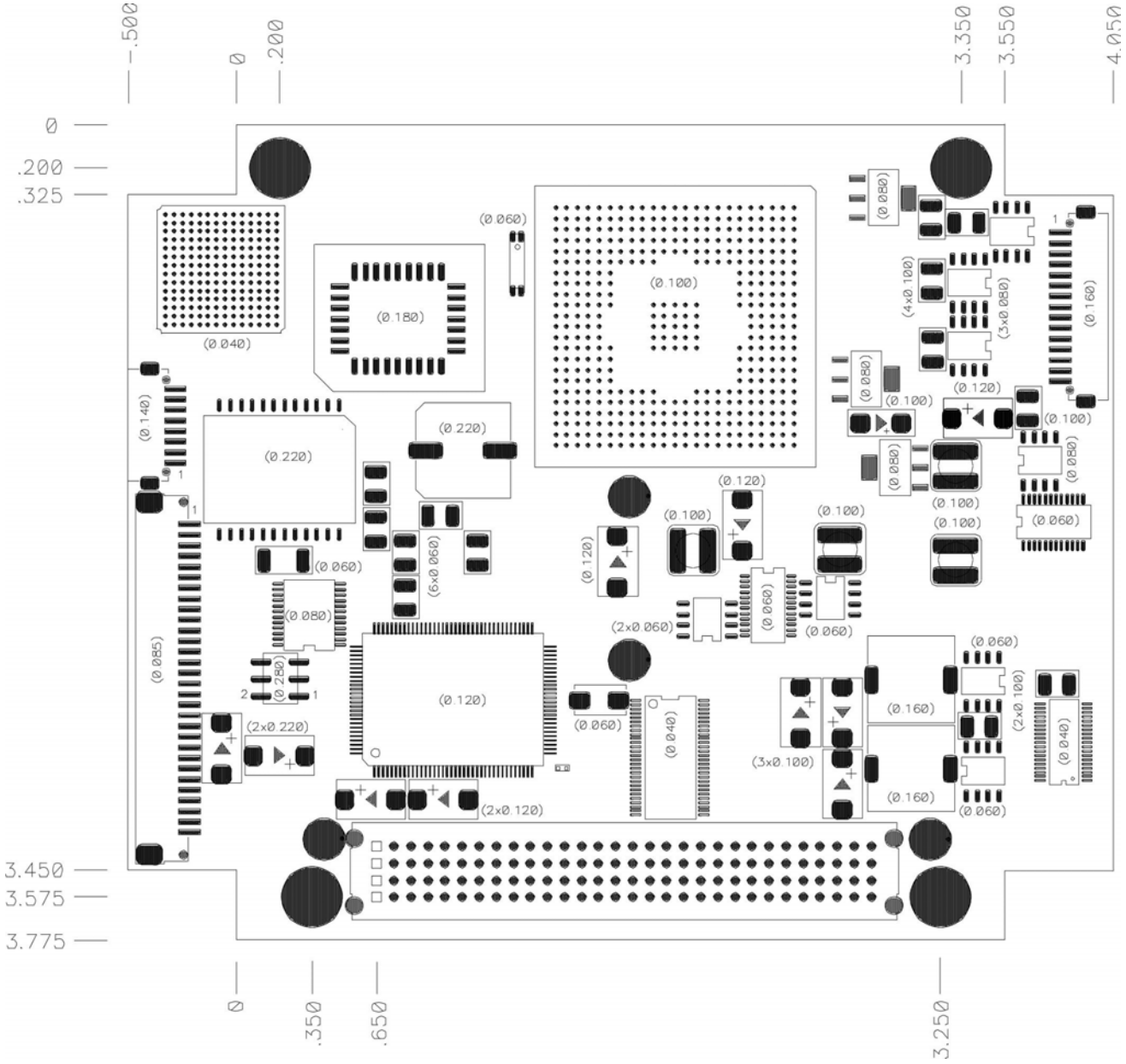
6.3.21 Top View

Notes:
- Values in () indicate the height of the component
- All dimensions are in inch



6.3.22 Bottom View

Notes:
- Values in () indicate the height of the component
- All dimensions are in inch



7 Options

There are various options available for the Cool RoadRunner 4.
Please check their availability before ordering.

- Heatsink
- Cable set
- CompactFlash Adapter
- Board extension modules (serial, DOC, FireWire, WLAN...)
- B2I Adapter

8 Troubleshooting

PROBLEM: The system will not come up at all, the display is blank and the computer does not make any beep sounds from the speaker.

First steps if the Board does not boot:

- Check the power connectors to the board, monitor and additional devices.
- Are all cables plugged on the correct connector and in the correct orientation? The board may not boot if some of the cables are not plugged in correctly!
- Is a RAM module inserted?
- Check the power supply. Is the supply voltage correct for the board? If you are not sure, read the manual. Try plugging in a different power supply or multi-meter to check the power a wrong supply voltage can easily FRY a computer and other electrical devices.
- Is your display ok? Is the monitor powered on? Is the monitor's video cable plugged into the video connector? Double-check the brightness and contrast settings. Plug the monitor into another computer if possible to verify the monitor isn't the problem.
- Apply power to the board while holding down the ”Insert” key at the numeric block of the keyboard. This will load the manufacturer BIOS defaults.
- Remove all additional devices from the system. Only the processor board, power supply, monitor and the keyboard should remain in the system.
- Replace the system RAM
- If all else has failed, replace the CPU Board itself.
- If system comes up then load at first the OPTIMIZED DEFAULTS in the BIOS setup and reboot.

9 Document History

Filename	Date	Edited by	Change
TME-P104-CRR4-R0V0	04-05-18	Alfred Glass	Draft
TME-P104-CRR4-R0V1	04-09-09	Alfred Glass	Some corrections
TME-P104-CRR4-R0V2	04-09-09	Alfred Glass	Power supply connector corrected
TME-P104-CRR4-R0V3	05-04-05	Alfred Glass	New block diagram
TME-P104-CRR4-R0V4	05-04-11	Jürgen Stauffer	Supervisory connector description
TME-P104-CRR4-R0V5	05-04-11	Alfred Glass	Electric. Spec. for 1.0 and 2.0GHz
TME-P104-CRR4-R1V0	05-07-13	Alfred Glass	New PCB rev. 1v0
TME-P104-CRR4-R2V0	06-01-14	Alfred Glass	PCB rev. 2v0, troubleshooting, getting started
TME-P104-CRR4-R2V0	07-05-15	Alfred Glass	Description for X4