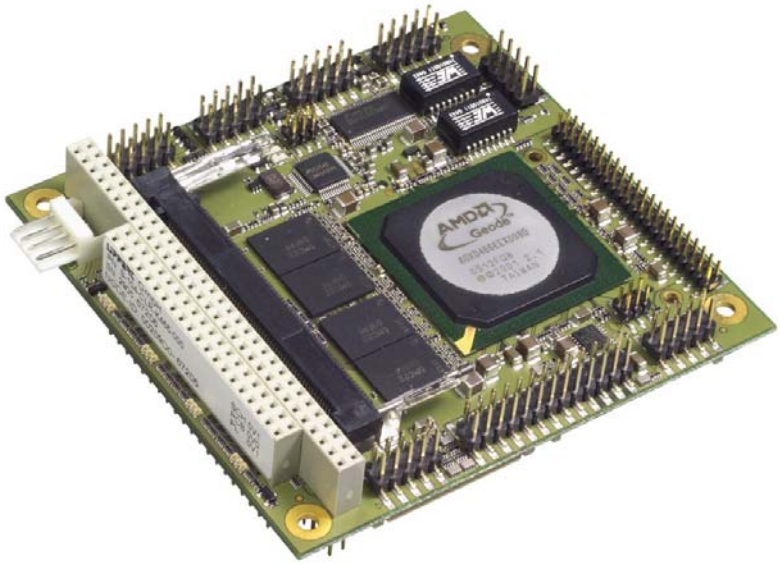
# Cool LiteRunner
## PC/104 CPU Board

Technical Manual



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Hans-Thoma-Str. 11
D-68163 Mannheim
http://www.lippert-at.com/

# Contents

# 1 Overview

## 1.1 General

The Cool LiteRunner is an all-in-one CPU module conforming to the PC/104 specification. It comes up with two 10/100BaseT Ethernet and an ATA-5 (Ultra DMA-66) compliant EIDE interface where an additional Compact Flash adapter can be mounted. The system’s main memory is soldered down on the board, providing 128 or 256MB DDR SDRAM. Other features are a Mini PCI Slot, CompactFlash Socket, PS/2 Mouse and Keyboard, four USB 1.1 compliant ports, three serial and one parallel port.

The AMD Geode GX466@0.9W (333MHz) processor is the core of the board, featuring a high performance 2D graphics controller as well as an integrated display controller with improved unified memory architecture. CRT Displays with resolutions up to 1600 x 1200 x 16bpp at 85 Hz can be handled. TFT-Panels can be handled via 24 Bit LVDS or 18 Bit parallel TFT interfaces with a maximum resolution of 1280 x 1024 pixels. The 64 Bit wide memory controller is integrated in the CPU providing low latency and an operating frequency of 111 MHz, 222 MT/S for DDR (Double Data Rate).

The AMD CS5535 companion device provides the infrastructure of the board. The CS5535 incorporates many I/O functions, including those found in typical Super-I/O chips. The device contains state-of-the-art power management that enables systems, especially battery powered systems, to significantly reduce power consumption.

An IrDA interface, hardware monitoring features and eight freely usable GPIO round up the widely spread application fields for the Cool LiteRunner.

## 1.2 The Cool LiteRunner at a glance

**CPU:**

- **AMD Geode™ GX 466@0.9W (333MHz)**

**Cache Memory:**

Split I/D cache/TLB (Translation Look-aside Buffer):

- 16 KB/16 KB caches
- Efficient Prefetch

**Main Memory:**

- Standard version: 128MB of soldered down DDR SDRAM
- On request: 256MB of soldered down DDR SDRAM

**Chipset:**

- AMD CS5535 companion device

**Extension slots:**

- 1 x Mini PCI – Slot Type IIIa
- 1 x 8/16-bit PC/104

**Interfaces:**

- 2 x Ethernet 10/100BaseT
- ATA-5 EIDE (Ultra DMA-66)
- CF Socket
- PS/2 Keyboard
- PS/2 Mouse
- 4 x USB 1.1 ports
- 3 x serial ports:
  - 2 x RS232/RS485 software selectable,
  - 1 x RS485
- 1 x IrDA (SIR)
- 1 x parallel port
- SVGA monitor
- 18 Bit Flat Panel
- 24 Bit LVDS for displays
- Supervisory port: external power button, live signal, watchdog, hardware monitoring and some general purpose signals
- Power supply

Other configurations are possible at high volumes.

**Dimensions:**

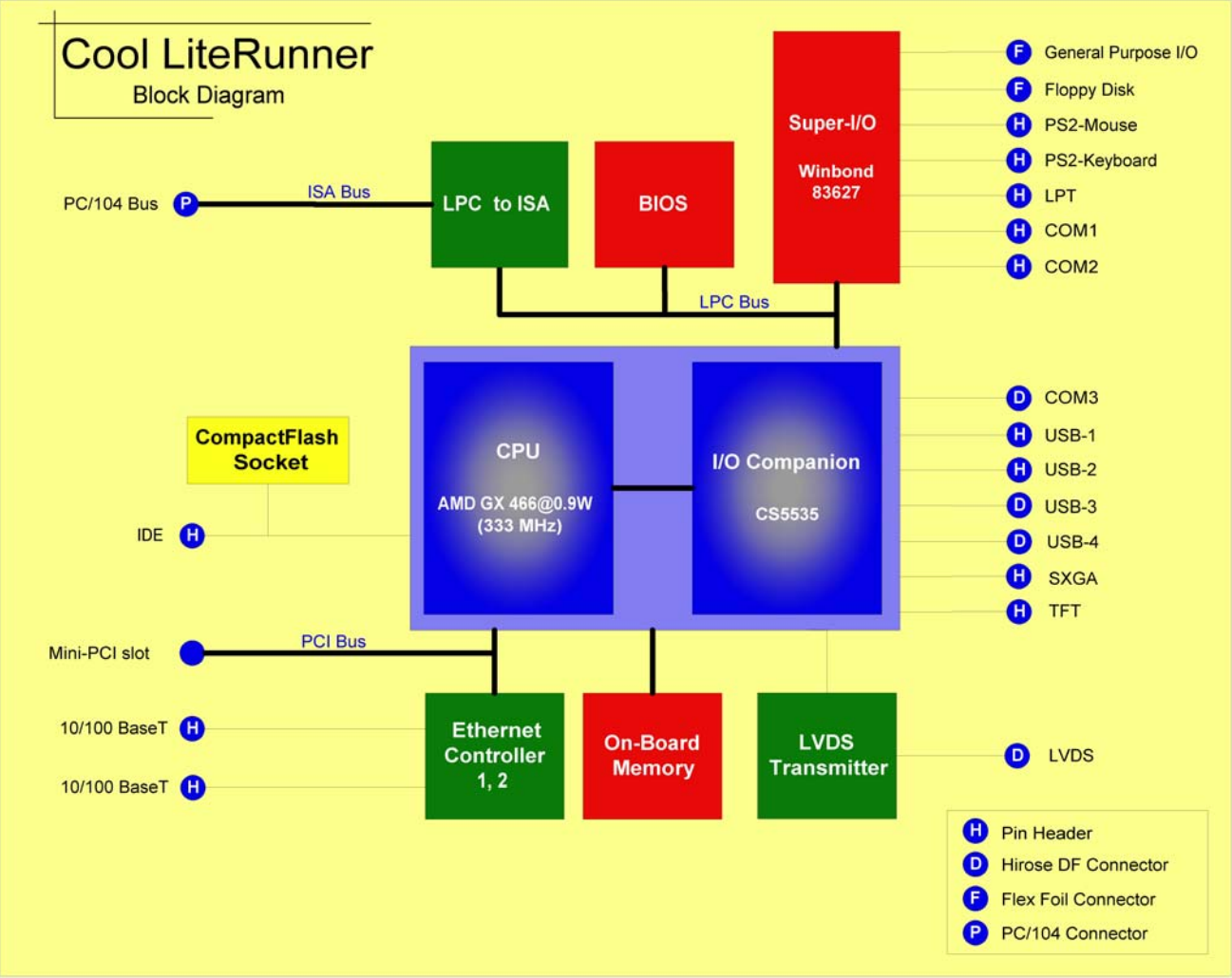
90 mm x 96 mm

**Mounting:**

- 4 mounting holes for PCB
- 2 mounting holes for Compact Flash adapter

| |
|---|
| **Note**: It is strongly recommend using plastic spacers instead of metal spacers to mount the board. With metal spacers, there is a possible danger to create a short circuit with the components located around the mounting holes.<br>This can damage the board! |

## 1.3 Functional Block Diagram



# 2 Hardware Description

## 2.1 Processor

AMD Geode™ GX 466@0.9W

The AMD Geode™ GX 466@0.9W processor is a x86 compatible integrated processor running at 333 MHz specifically designed to power embedded devices for entertainment, education, and business. Serving the needs of consumers and business professionals alike, the Geode GX processors are an excellent solution for embedded applications, such as thin clients, interactive set-top boxes, personal access devices (PAD's), and industrial appliances. Available with a core voltage of 1.5V, the Geode GX processors offer an extremely low typical power consumption of 2.0W, leading to longer battery life and enabling small form-factor, fanless designs.

While the CPU core provides maximum compatibility with the vast amount of Internet content available, the intelligent integration of several other functions, including graphics, offers a true system-level multimedia solution.

The AMD Geode™ GX 466@0.9W processor is manufactured in 0.15 micron process featuring following functional blocks:

- CPU Core
  - Integrated FPU that supports the Intel MMX® and AMD 3DNow!™ instruction sets
  - 16 KB Instruction cache, 16 KB Data cache
- GeodeLink™ Control Processor
  - Debugging features
  - Power management
- GeodeLink Interface Units
  - High bandwidth packetized unidirectional bus for internal peripherals
- GeodeLink Memory Controller
  - 64-Bit wide SDRAM bus operating frequency: 111 MHz, 222 MT/S for DDR
- Graphics Processor
  - High performance 2D graphics controller
- Display Controller
  - Hardware frame buffer compression improves UMA (Unified Memory Architecture) memory efficiency
  - Supports up to 1600x1200x16 bpp and 1280x1024x24 bpp running at 85 Hz (CRT)
  - 24 Bit DAC (CRT only)
- Video Processor
  - TFT Controller: 1280x1024 max resolution
- GeodeLink PCI Bridge
  - Industry standard PCI 2.2 specification compliant
  - 32-Bit, 66 MHz PCI interface
- Geode I/O Companion Device Interface
  - Designed to work in conjunction with the AMD Geode™ CS5535 companion device

For further information, please refer to the data book of the AMD Geode™ GX 466@0.9W

## 2.2 Companion

AMD Geode™ CS5535 companion device

The AMD Geode™ CS5535 companion device is designed to work with an integrated processor North Bridge component such as an AMD Geode™ GX processor. Together, the Geode GX processor and Geode CS5535 companion device provide a system-level solution well suited for the high-performance and low-power needs of a host of information appliances that include digital set-top boxes, personal access devices, and thin client applications.

The internal architecture uses a single, high-performance modular structure based on GeodeLink™ architecture. This architecture yields high internal speed (over 4 GB/s) data movement and extremely versatile internal power management. The GeodeLink architecture is transparent to application software. Communication with the Geode GX processor is over a 33/66 MHz PCI bus.

The CS5535 incorporates many I/O functions, including those found in typical Super-I/O chips, simplifying many system designs. Since the graphics subsystem is entirely contained in the Geode GX processor, system interconnect is simplified. The device contains state-of-the-art power management that enables systems, especially battery powered systems, to significantly reduce power consumption.

An internal controller, designed to connect to multiple AC97 compatible codecs, supports audio (Audio is optional on request). An IR (infrared) port supports all popular IR communication protocols. The IR port is shared with one of two industry-standard serial ports that can reach speeds of 115.2 kbps. An LPC (low pin count) port is provided to facilitate connections to a Super-I/O should additional expansion, such as a floppy drive, be necessary, and/or to an LPC ROM for the system BIOS.

The hard disk controller is an ATA-5 compatible bus mastering IDE controller; includes support for two ATA-compliant devices on one channel. Two dual-port USB (universal serial buses, USB specification v1.1 compliant) provide four ports with both low and full-speed capabilities for Plug & Play expansion for a variety of consumer peripheral devices such as a keyboard, mouse, printer, and digital camera. A GoldCap-backed RTC (real-time clock) keeps track of time and provides calendar functions.

A suite of 82xx devices provide the legacy PC functionality required by most designs, including two PIC (programmable interrupt controllers), one PIT (programmable interval timer) with three channels, and DMA (direct memory access) functions. The Geode CS5535 companion device contains eight MFGPT (multi-function general purpose timers) that can be used for a variety of functions. A number of GPIO (general purpose input/outputs) are provided, and are assigned to system functions on power-up (i.e., LPC port); each of these may be reassigned and given different I/O characteristics such as debounce, edge triggering, etc.

State-of-the-art power management features are attained with the division of the device into two internal power domains. The GPIO and multi-function timers are distributed into each of the two domains to allow these to act as wakeup sources for the device. In addition to full ACPI (Advanced Configuration Power Interface) compliance and support of industry-standard Wakeup and Sleep modes, the device automatically disables clocks from internal blocks when they are not being used.

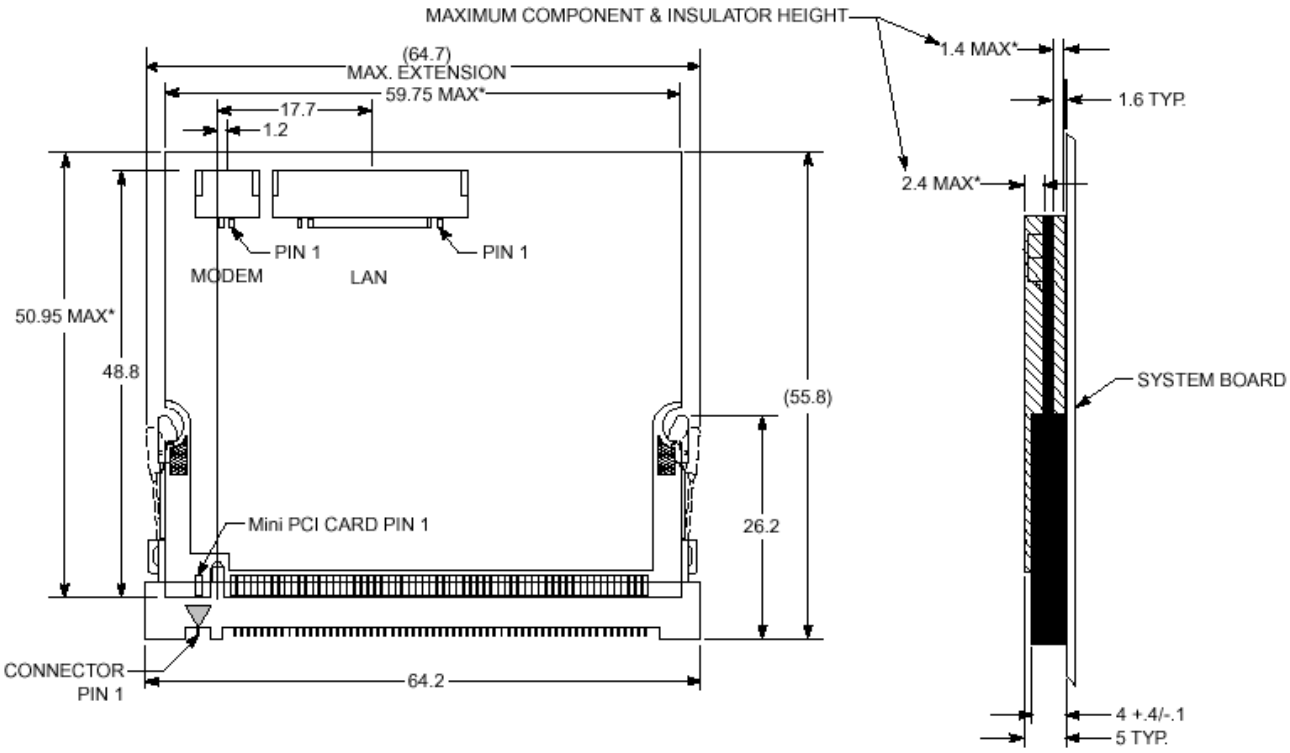
## 2.3 Mini-PCI Bus Interface

The Mini-PCI specification defines a small form factor daughter card for the 32bit PCI bus that can be used on CPU-boards in which standard PCI cards cannot be used due to mechanical constraints. A CPU board with such a card can easily be enhanced with new functionality. The onboard Type IIIA Mini PCI Slot can be used to extend the system easily with peripheral functionality, like:

- WLAN modules
- Fire Wire ports
- USB 2.0 ports
- Ultra 160 SCSI interface

Several Mini PCI extension boards are available on request.

Mini-PCI Type IIIA:




## 2.4 PC/104 Bus Interface

The PC/104 bus is a modification of the industry standard (ISA) PC bus specified in IEEE P996. The PC/104 bus has different mechanics than P966 to allow the stacking of modules. The main features are:

- Supports programmable extra wait state for ISA cycles
- Supports I/O recovery time for back-to-back I/O cycles

The specifications for the PC/104 bus and the PC/104-Plus bus are available from the PC/104 Consortium at http://www.pc104.org.

### 2.4.1 PC/104 bus Limitations

In the Cool LiteRunner, the PC/104 (ISA) bus is connected through a LPC to ISA bridge to this chipset. Due to the chipset's limitation of 8-bit-only data transfers on the LPC bus, all 16-bit accesses to I/O and memory on the PC/104 bus are translated into two consecutive 8-bit accesses. This happens even if the peripheral board supports a complete 16-bit wide bus.

**16-Bit read accesses:**

The first access is done as a normal 8-bit access to the lower byte on the PC/104 data lines SD0…SD7. The second 8-bit access reads the higher byte on the upper data lines SD8…SD15, if the peripheral board indicates 16-bit support by pulling either IOCS16 or MEMCS16 low. The chipset signals a data transfer on the upper data lines SD8…SD15 by pulling SBHE low.

**16-Bit write accesses:**

The first access is as a normal 8-bit access with the lower byte on the PC/104 data lines SD0…SD7. The second 8-bit access writes the higher byte on both, the lower data lines SD0…SD7, and the upper data lines SD8…SD15, if the peripheral board indicates 16-bit support by pulling either IOCS16 or MEMCS16 low. The chipset signals a data transfer on the upper data lines SD8…SD15 by pulling SBHE low.

This behavior results in erroneous data accesses under the following circumstances:

- The software is using 16bit I/O and memory accesses

**and**

- The peripheral board does support 16 bit access to I/O or memory and indicates this by pulling either IOCS16 or MEMCS16 to low

**and**

- The peripheral board does not decode the SBHE signal properly to know about the data on the upper data lines SD8…SD15

**Solution**

The problem can be overcome with the following measures:

- Use only 8 bit accesses in software

**or**

- Set the peripheral board to 8-bit access only

**or**

- Use a peripheral board that decodes the SBHE signal correctly on 16-bit accesses.

## 2.5 National MacPhyter Ethernet Controller I/II

The National Semiconductor MacPhyter is a fully integrated 10/100 Base-TX LAN solution and consists of both the Media Access Controller and the physical layer interface combined into a single component solution.

The 32-bit PCI v2.2 controller provides enhanced scatter-gather bus mastering capabilities and enables the MacPhyter to perform high-speed data transfers over the PCI bus. Its bus master capabilities enable the component to process high level commands and perform multiple operations, which lowers CPU utilization by off-loading communication tasks from the CPU: two large transmit and receive FIFOs of 2 KB each help to prevent data underrun and overrun while waiting for bus accesses. This enables the MacPhyter to transmit data with minimum interframe gap.

The CSMA/CD unit of the MacPhyter allows it to be connected to either a 10 or 100 Mbps Ethernet network. The CSMA/CD unit performs all of the functions of the 802.3 protocol such as frame

formatting, frame stripping, collision handling, deferral to link traffic, etc. The CSMA/CD unit can also be placed in a full duplex mode, which allows simultaneous transmission and reception of frames. In full duplex mode, it adheres to the IEEE 802.3x Flow Control specification.

The PHY unit of the MacPhyter supports Auto-Negotiation for 10BaseT-/100BaseTX Half Duplex and 10BaseT-/100BaseTX Full Duplex modes.

The signals of the Ethernet interfaces are located on the IDC10 header “Ethernet” and “Ethernet/USB”. Adapter cables from IDC10 to RJ45 connector are available.

LED’s on the topside of the board are showing the status of link, 10/100 Mbit and activity of each port.

## 2.6 Watchdog

A watchdog is implemented by a Maxim 691 Reset/Watchdog circuit. It is accessible through some general-purpose ports of the Super I/O. controller. Additionally a red LED lights up, which is located on the topside of the board.

Please refer to chapter 5. for programming watchdog functions.

## 2.7 CPU Temperature and Hardware Monitoring

AMD Geode™ GX 466@0.9W processor contains a temperature sensor to monitor the CPU temperature. The current temperature is shown in the **PC Health Status** screen of BIOS setup. Additionally the environment temperature is measured and shown in the **PC Health Status** screen. It also can be used to control the rotation of a 5 Volt environment fan, which must be connected to the supervisory connector.

The Cool LiteRunner does not need any cooling measures at the standard environment temperatures from –20 °C … +60 °C.

## 2.8 On Board Power Supply

The on board power supply generates all necessary voltages from the single supply voltage of 5 volts. The voltages are observed by the Super I/O and are shown in the **PC Health Status** screen of BIOS setup.
The generated voltage of 3.3 Volts is available on the connectors “Flat Panel“ and “LVDS“.

> **Note**: This 3.3 V must not be used to supply external electronic devices with high power consumption like other PC/104 boards or displays.

## 2.9 EIDE Port

An EIDE (**E**nhanced **I**ntegrated **D**rive **E**lectronics) port is provided by the chipset to connect up to two drives that integrate the controller (hard disk, CD-ROM etc.). To enhance the performance, this port supports Ultra DMA-66 type of transfer. The EIDE port is available on a standard 44-pin header (2 mm) for 2,5” hard disks. An adapter cable is available to connect standard EIDE devices with a 40 pin IDC header.

Additionally a Compact Flash adapter can be provided. It can be mounted on the 44-pin header.

## 2.10 Compact Flash Connector

On the bottom side of the board a compact flash connector is located that allows the use of compact flash cards instead of a mechanical hard disk. This socket is also connected to the primary EIDE port of the chipset. Care must be taken when using a compact flash card and another EIDE device (hard disk, CDROM) on the EIDE port at the same time. The compact flash card is always the master device; the device on the EIDE port must be set up as slave. Compact flash cards are available as solid-state disks from 4 to 1 GByte and as IBM Microdrive up to 1 GByte.

## 2.11 Floppy Disk Interface

The floppy interface connector is built for slim-line floppy disk drives. For connection of a conventional floppy disk drive, an optional adapter connector is available.

## 2.12 PS/2 Keyboard Interface

The keyboard interface is located on the IDC10 Header “KEYB/MOUSE”. An adapter cable is available to use a standard PS/2 keyboard with this connector.

## 2.13 PS/2 Mouse Interface

The PS/2 mouse signals MCLK and MDAT are located on the IDC10 header “KEYB/MOUSE”. The PS/2 mouse function is programmable in BIOS setup by pressing DEL at boot time. **PS/2 mouse function control** can be enabled or disabled in the **Advanced BIOS features** menu.

## 2.14 USB 1.1 Ports

One USB 1.1 ports are located on the IDC10 header “USB”, one on the IDC10 header “ETHERNET”, and the two others on the supervisory connector. When using USB it has to be enabled in BIOS setup by entering **Advanced Chipset Features** and then choosing **USB Controller: Enabled**.
It is possible to use an USB keyboard under MSDOS without special driver software*. To do so, USB legacy support has to be enabled in the BIOS. Entering **Advanced Chipset Features** and then selecting **USB Keyboard support**: **Enabled** does this setting**.**
An adapter cable with two standard USB connectors is available.

*Note: not all keyboard manufacturers are supported.

***Note:*** *The system BIOS and the USB controller do not support all USB2.0 mass storage devices on the market, which might result in problems when using these. Typical problems are hanging in boot process if a USB2.0 mass storage device is connected, or slow data transfer rates for USB2.0 mass storage devices. We recommend using USB1.1 mass storage devices instead, if such a problem occurs.*

## 2.15 Serial Ports

Two of the serial ports are located on two IDC headers “COM1” and “COM2”. Adapter cables with standard DB9 male connectors are available. They can either work in RS232 or RS485 mode, selectable in the BIOS. When entering **Special Features**, **COM Port 1 Mode** and **COM Port 2 Mode** can be selected. The third serial Port is located at the supervisory connector and is RS485 only. Termination resistors for RS485 Mode can be set with Jumper X9 as described in chapter 4.18.

COM Port 3 is RS485 only and can be used in 2-wire and in 4-wire systems. In 2-wire systems only Half Duplex is possible in 4-wire systems both, Half- and Full-Duplex. In 2-wire systems or 4-wire systems with more than 1 transmitters the transmitter must be disabled in receive mode, and enabled in transmit mode. Therefore, program GP34 of the Winbond SuperIO (Logical Device 9, Bit 4). ‘0’ → disable transmitter, ‘1’ → enable transmitter.

Example in debug mode:

Set the SuperIO into configuration mode by writing 87h to index register 4Eh:
- 4E 87
- 4E 87

Enable Logical Device 9 for programming by writing 09h to register 07h of the SuperIO:
- 4E 07
- 4F 09

Writing to configuration register F1h, Bit 4 sets the GPIO’s value. Be sure not to change the values of the other Bits.
- 4E F1
- i 4F → Now change only Bit 4!
- 4F xx

To enable the transmitters of COM1 and COM2 in RS485 mode set the RTS# signal to ‘1’. Depending on your operating system driver’s logic, this may mean setting a (non-inverted) RTS bit to ‘0’ in your application software.

The serial ports are programmable in BIOS setup by pressing DEL at boot time. When entering **Integrated Peripherals** and then choosing **COM Port 1, COM Port 2,** or **COM Port 3**, configuration of the serial ports is accessible.

The following settings are possible for COM1 and COM2:

- Auto
- Disabled
- 3F8 / IRQ4 (base address / interrupt channel)
- 2F8 / IRQ3 (base address / interrupt channel)
- 3E8 / IRQ4 (base address / interrupt channel)
- 2E8 / IRQ3 (base address / interrupt channel)

The following settings are possible for COM3:

- Disabled
- 3F8 / IRQ4 (base address / interrupt channel)
- 2F8 / IRQ3 (base address / interrupt channel)
- 3E8 / IRQ6 (base address / interrupt channel)

2E8 / IRQ5 (base address / interrupt channel)

## 2.16 IrDA Interface

The IrDA interface signals IRRX and IRTX are located on the supervisory connector. The IrDA interface shares its UART with COM3, so the normal serial port 3 cannot be used at the same time as the IrDA interface.
To use the IrDA interface an external transmitter must be connected to the IrDA signals.

## 2.17 Parallel Port LPT1

The parallel port is located on an IDC26 header. An adapter cable with a standard DB25 female connector is available.
The parallel port is programmable in BIOS setup by pressing DEL at boot time. Entering **Integrated Peripherals** and then choosing **Onboard Parallel Port**, configuration of LPT1 is accessible.

Configuring LPT1, the following settings are possible:

- Disabled
- 3BC/IRQ7 (base address / interrupt channel)
- 378/IRQ7 (base address / interrupt channel)
- 278/IRQ5 (base address / interrupt channel)

While not disabled, **Parallel Port Mode** can be selected by choosing:

- Normal
- SPP
- EPP
- ECP
- ECP+EPP
- Normal

If **Parallel Port Mode** is switched to **ECP** or **ECP+EPP**, **ECP Mode Use DMA** is accessible. DMA channel 1 or 3 can be selected.

## 2.18 Speaker

The speaker signal is located on the IDC10 Header “KEYBOARD”. A standard PC Speaker can be connected between the signal SPEAKER and VIO_5V.

## 2.19 External Power-Button

The Power-Button signal is located on the IDC10 Header “KEYBOARD”. To turn-on/off the board the signal, "Power-Button" must be connected to GND. This function is depending on the used operating system. Driver software may be necessary.

## 2.20 Reset-In Signal

The RESET-IN signal is located on the IDC10 Header “KEYBOARD”. To reset the board the signal RESET-IN must be connected to GND.

## 2.21 CRT / LCD Graphics-Controller

A high performance 2D-graphics controller is integrated within the GX2. CRT monitors can be used as well as TFT- and LVDS-Displays. Therefore, different connectors are on the board.

The SVGA connector is located on a 10-pin IDC header. An adapter cable to Sub-D HD15 female for CRT Monitors is available. The following display modes are supported:

| Resolution | Color (bpp) | Max. Refresh rate (Hz) |
|---|---|---|
| 640x480 | 8/16/24 | 85 |
| 800x600 | 8/16/24 | 85 |
| 1024x768 | 8/16/24 | 85 |
| 1280x1024 | 8/16/24 | 85 |
| 1600x1200 | 8/16 | 75 |

The Board supports 3,3V and 5V TFT displays up to 18bit and LVDS displays with 24bit interfaces.

The display type and resolution can be selected in BIOS **Integrated Peripherals → Flat Panel Configuration.**

### 2.21.1 Flat Panel Configuration

The following options can be selected:

Flat Panel Type
- TFT
- LVDS

Resolution
- 640 by 480
- 800 by 600
- 1024 by 768

Data Type
- Normal → 1 Bit per Clock
- 2 X → 2 Bits per Clock

Refresh Rate
- 60 Hz
- 70 Hz
- 72 Hz
- 75 Hz
- 85 Hz
- 90 Hz

HSYNC Polarity
- High
- Low

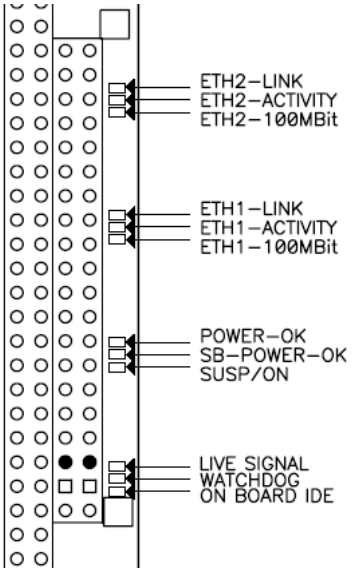
VSYNC Polarity
- High
- Low

SHFCLK Active Period
- Active Only → only active during SYNC
- Free Running → always active

For an easy connection of these displays it’s possible to choose the display and backlight supply voltages on the on board Voltage Selector jumpers (Chapter 4.15).

## 2.22 On Board LED indicators

The onboard LED indicators provide a very comfortable way to check out the board’s status. The customer is able to check the boot success the power status of the board the IDE accesses and the Ethernet accesses.
The LED indicators are located on the topside of the Board. For a easy implementation of external LED indicators in a customer specific system the most important LED signals are additional accessible on the Supervisory Connector




**POWER-OK**
Indicates that the on board supply voltages are ok.

**SB-POWER-OK**
Indicates that the on board standby supply voltages are ok.

**WATCHDOG**
Indicates that the on-board Watchdog has triggered a system reset.

**ETH1-ACTIVITY; ETH1-100-ACTIVITY; ETH1-LINK**
Shows Ethernet 1 Port activity, 100MBit transfer rate, and the Ethernet Link status.

**ETH2-ACTIVITY; ETH2-100-ACTIVITY; ETH2-LINK**
Shows Ethernet 2 Port activity, 100MBit transfer rate, and the Ethernet Link status.

**ON BOARD IDE**
Indicates IDE activity

**LIVE SIGNAL**
Indicates that the Board’s boot process was successful.

**Suspend/ON**
Indicates that the Board is in the suspend Mode.

## 2.23 Supervisory Connector

The Cool LiteRunner provides a 25-pin Supervisory Connector on its bottom side. The table below shows the assignment of the different signals. Secondary signals are available by setting a 0 Ohm-Jumper on the board:

| Pin | Primary | Secondary | 5V Tolerant |
|---|---|---|---|
| 1 | 5V | | |
| 2 | 3.3V (1) | | |
| 3 | GPIO0 (2) | I2C-CLK | yes/yes |
| 4 | GPIO1 (2) | I2C-Data | yes/yes |
| 5 | GPIO2 (2) | IDE-LED (3) | yes/yes |
| 6 | GPIO3 (2) | IrDA-Send | yes/yes |
| 7 | GPIO4 (2) | IrDA-Rec. | yes/yes |
| 8 | GPIO5 (2) | ACT-LED (3) | yes/yes |
| 9 | GPIO6 (2) | 100Mbit-LED (3) | yes/yes |
| 10 | GPIO7 (2) | LINK-LED (3) | yes/yes |
| 11 | Suspend-LED (3) | | yes/- |
| 12 | Live-Signal-LED (3) | | yes/- |
| 13 | PME#(4) | SMI#(5) | **no/no** |
| 14 | USB2-VCC | | |
| 15 | USB2+ | | |
| 16 | USB2- | | |
| 17 | USB-GND | | |
| 18 | USB3+ | | |
| 19 | USB3- | | |
| 20 | USB3-VCC | | |
| 21 | RS485-TX+ | Sleep-Button (6) | yes/**no** |
| 22 | RS485-TX- | Sys-Fan Voltage (7) | yes/yes |
| 23 | RS485-RX+ | Tacho Signal (8) | yes/yes |
| 24 | RS485-RX- | Disable Fan (9) | |
| 25 | GND | | |

(1) External devices must not exceed a over all power consumption of 500mA
(2) For GPIO programming, see chapter 4.3 for hints.
(3) Connect cathode of LED to this pin. An external resistor is required.
(4) Power Management Signal
(5) System Management Interrupt
(6) Pulling this pin to GND causes system to go into sleep mode.
(7) Connect to VCC of 5V system fan.
(8) Connect to tacho sensor signal of system fan
(9) Setting this pin to 1 will disable the system fan.

# 3 Connector Definitions

Refer to chapter 5.2 Mechanical specifications for an overview of the connector positions.

## 3.1 PC/104 Bus

| Pin | D | C |
|---|---|---|
| 0 | GND | GND |
| 1 | MEMCS16 | SBHE |
| 2 | IOCS16 | LA23 |
| 3 | IRQ10 | LA22 |
| 4 | IRQ11 | LA21 |
| 5 | IRQ12 | LA20 |
| 6 | IRQ15 | LA19 |
| 7 | IRQ14 | LA18 |
| 8 | DACK0 | LA17 |
| 9 | DRQ0 | MEMR |
| 10 | DACK5 | MEMW |
| 11 | DRQ5 | SD8 |
| 12 | DACK6 | SD9 |
| 13 | DRQ6 | SD10 |
| 14 | DACK7 | SD11 |
| 15 | DRQ7 | SD12 |
| 16 | +5 Volts | SD13 |
| 17 | MASTER | SD14 |
| 18 | GND | SD15 |
| 19 | GND | GND |

| Pin | A | B |
|---|---|---|
| 1 | IOCHCK | GND |
| 2 | D7 | RSTDRV |
| 3 | D6 | +5 Volts |
| 4 | D5 | IRQ9 |
| 5 | D4 | -5 Volts |
| 6 | D3 | DRQ2 |
| 7 | D2 | -12 Volts |
| 8 | D1 | ENDXFR |
| 9 | D0 | +12 Volts |
| 10 | IOCHRDY | KEY |
| 11 | AEN | SMEMW |
| 12 | A19 | SMEMR |
| 13 | A18 | IOW |
| 14 | A17 | IOR |
| 15 | A16 | DACK3 |
| 16 | A15 | DRQ3 |
| 17 | A14 | DACK1 |
| 18 | A13 | DRQ1 |
| 19 | A12 | REFRESH |
| 20 | A11 | SYSCLK |
| 21 | A10 | IRQ7 |
| 22 | A9 | IRQ6 |
| 23 | A8 | IRQ5 |
| 24 | A7 | IRQ4 |
| 25 | A6 | IRQ3 |
| 26 | A5 | DACK2 |
| 27 | A4 | TC |
| 28 | A3 | BALE |
| 29 | A2 | +5 Volts |
| 30 | A1 | OSC |
| 31 | A0 | GND |
| 32 | GND | GND |

-5 Volts and –12 Volts are not supported on this board.

## 3.2 EIDE Connector

Connector type: IDC14 pin header 2.00 mm

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| /Reset | 1 | GND | 2 |
| Data7 | 3 | Data8 | 4 |
| Data6 | 5 | Data9 | 6 |
| Data5 | 7 | Data10 | 8 |
| Data4 | 9 | Data11 | 10 |
| Data3 | 11 | Data12 | 12 |
| Data2 | 13 | Data13 | 14 |
| Data1 | 15 | Data14 | 16 |
| Data0 | 17 | Data15 | 18 |
| GND | 19 | NC | 20 |
| DRQ0 | 21 | GND | 22 |
| Write | 23 | GND | 24 |
| Read | 25 | GND | 26 |
| Ready | 27 | CSEL | 28 |
| DACK0 | 29 | GND | 30 |
| IRQ | 31 | IOCS16- | 32 |
| Address1 | 33 | PD66 | 34 |
| Address0 | 35 | Address2 | 36 |
| CS1 | 37 | CS3 | 38 |
| NC | 39 | GND | 40 |
| +5 Volts | 41 | +5 Volts | 42 |
| GND | 43 | GND | 44 |

## 3.3 Floppy connector pin definition

Connector type: FFC 26 pin 1.00 mm

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| +5 Volt | 1 | Index | 2 |
| +5 Volt | 3 | Drive Select 0 | 4 |
| +5 Volt | 5 | Disk change | 6 |
| n.c. | 7 | n.c. | 8 |
| n.c. | 9 | Motor On 0 | 10 |
| n.c. | 11 | Direction | 12 |
| n.c. | 13 | Step | 14 |
| GND | 15 | Write Data | 16 |
| GND | 17 | Write Gate | 18 |
| GND | 19 | Track 0 | 20 |
| GND | 21 | Write Protect | 22 |
| GND | 23 | Read Data | 24 |
| GND | 25 | Head Select | 26 |

## 3.4 Ethernet Interface 1 / USB1.1 Connector

Connector type: IDC10 pin header 2.54 mm

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| TX+ | 1 | TX- | 2 |
| RX+ | 3 | PE | 4 |
| PE | 5 | RX- | 6 |
| USB1+ | 7 | USB1- | 8 |
| USB_VCC | 9 | USB_GND | 10 |

## 3.5 Ethernet Interface 2

Connector type: IDC10 pin header 2.54 mm

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| ETH_TX+ | 1 | ETH_TX- | 2 |
| ETH_RX+ | 3 | ETH_PE | 4 |
| ETH_PE | 5 | ETH_RX- | 6 |
| ETH_PE | 7 | ETH_PE | 8 |
| N.C. | 9 | N.C. | 10 |

## 3.6 Power Connector

Connector type: 3.5” FDD Power connector

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| +5 Volts | 1 | GND | 2 |
| GND | 3 | + 12 Volts | 4 |

## 3.7 Keyboard / Mouse Connector

Connector type: IDC10 pin header 2.54 mm

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| Speaker | 1 | Mouse Clock | 2 |
| #Reset-In | 3 | Mouse Data | 4 |
| KB Data | 5 | KB Clock | 6 |
| GND | 7 | +5 Volts | 8 |
| Ext. battery | 9 | #Reset in<br>( optional<br>#Ext. power button ) | 10 |

## 3.8 USB 1.1 Connector

Connector type: IDC10 pin header 2.54 mm

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| USB0+ | 1 | USB0- | 2 |
| USB_VCC | 3 | USB_GND | 4 |
| LINEIN_L (optional) | 5 | LINEIN_R (optional) | 6 |
| LINEOUT_L (optional) | 7 | LINEOUT_R (optional) | 8 |
| MIC | 9 | GND | 10 |

## 3.9 COM1 Connector

Connector type: IDC10 pin header 2.54 mm
RS232 function, (names in brackets for RS485/RS422 function)

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| DCD (unused) | 1 | DSR (RXD+) | 2 |
| RXD (RXD-) | 3 | RTS (TXD+) | 4 |
| TXD (TXD-) | 5 | CTS (unused) | 6 |
| DTR (unused) | 7 | Unused | 8 |
| GND | 9 | +5 Volts | 10 |

## 3.10 COM2 Connector

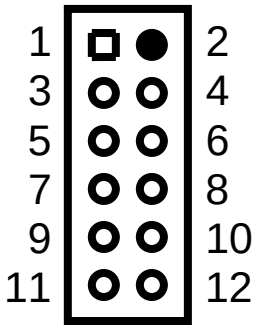
Connector type: IDC10 pin header 2.54 mm
RS232 function, (names in brackets for RS485/RS422 function)

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| DCD (unused) | 1 | DSR (RXD+) | 2 |
| RXD (RXD-) | 3 | RTS (TXD+) | 4 |
| TXD (TXD-) | 5 | CTS (unused) | 6 |
| DTR (unused) | 7 | Unused | 8 |
| GND | 9 | +5 Volts | 10 |

## 3.11 RS485-Termination Jumper

Connector type: IDC12 pin header 2.00 mm. Use 2 mm jumpers to terminate lines correctly.

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| COM1TX- | 1 | COM1TX+ | 2 |
| COM1RX- | 3 | COM1RX+ | 4 |
| COM2TX- | 5 | COM2TX+ | 6 |
| COM2RX- | 7 | COM2RX+ | 8 |
| COM3TX- | 9 | COM3TX+ | 10 |
| COM3RX- | 11 | COM3RX+ | 12 |

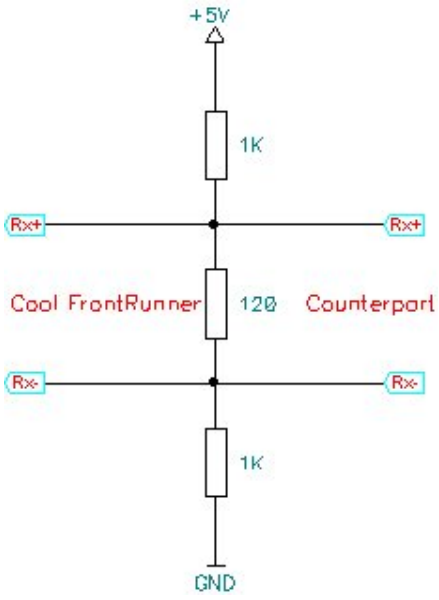



Default setting: no termination

When the jumper is set, differential pairs (e.g. RX+ and RX-) are terminated with 120Ω between them.

Additionally positive/negative receive lines are pulled up/down with 1kΩ to 5V/GND in order to protect the transceivers of the Cool FrontRunner from over voltages.

It is recommended to protect the receive lines of the communication partner device in the same way!




**<u>Caution</u>:** Termination Resistors **must not** be set in RS232 Mode. Otherwise the Serial Ports will not work.

## 3.12 Supervisory Connector

Connector type: Hirose DF14 25-pin
Primary (Secondary, function available only on request)

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| +5 Volts | 1 | +3.3 Volts | 2 |
| GPIO0 (I2C-CLK) | 3 | GPIO1 (I2C-Data) | 4 |
| GPIO2 (IDE) | 5 | GPIO3 (IrDA-Send) | 6 |
| GPIO4 (IrDA-Rec) | 7 | GPIO5 (ACT) | 8 |
| GPIO6 (100Mbit) | 9 | GPIO7 (LINK) | 10 |
| SUSPEND | 11 | LIVE | 12 |
| PME# (SMI#) | 13 | USB2VCC | 14 |
| USB2+ | 15 | USB2- | 16 |
| USBGND | 17 | USB3+ | 18 |
| USB3- | 19 | USB3VCC | 20 |
| COM3-TX+ (SLP-BTN) | 21 | COM3-TX- (SYS-FAN) | 22 |
| COM3-RX+ (TACHO) | 23 | COM3-RX- (DIS-FAN) | 24 |
| GND | 25 | | |

**Note:** The 3,3 Volts are generated by an on-board DC-DC converter. It must be not used to supply power to any peripherals with high power consumption.

## 3.13 LPT1 Connector

Connector type: IDC26 pin header 2.54 mm

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| Strobe | 1 | Auto LF | 2 |
| Data0 | 3 | Error | 4 |
| Data1 | 5 | Init | 6 |
| Data2 | 7 | Select In | 8 |
| Data3 | 9 | GND | 10 |
| Data4 | 11 | GND | 12 |
| Data5 | 13 | GND | 14 |
| Data6 | 15 | GND | 16 |
| Data7 | 17 | GND | 18 |
| ACK | 19 | GND | 20 |
| Busy | 21 | GND | 22 |
| Paper End | 23 | GND | 24 |
| Select | 25 | NC | 26 |

## 3.14 VGA Connector

Connector type: IDC10 pin header 2.54 mm

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| Red | 1 | RGB-GND | 2 |
| Green | 3 | RGB-GND | 4 |
| Blue | 5 | RGB-GND | 6 |
| HSYNC | 7 | GND | 8 |
| VSYNC | 9 | Not connected | 10 |

## 3.15 Flat Panel Connector

Connector type: IDC30 pin header 2.00 mm

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| GND | 1 | FPCLK | 2 |
| HSYNC | 3 | VSYNC | 4 |
| GND | 5 | R0 | 6 |
| R1 | 7 | R2 | 8 |
| R3 | 9 | R4 | 10 |
| R5 | 11 | GND | 12 |
| G0 | 13 | G1 | 14 |
| G2 | 15 | G3 | 16 |
| G4 | 17 | G5 | 18 |
| GND | 19 | B0 | 20 |
| B1 | 21 | B2 | 22 |
| B3 | 23 | B4 | 24 |
| B5 | 25 | GND | 26 |
| EN | 27 | VLCD-SW | 28 |
| VLCD-SW | 29 | GND | 30 |

## 3.16 Flat Panel Backlight

Connector type: Hirose DF13 8 pin

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| +12 Volts | 1 | +12 Volts | 2 |
| +5 Volts | 3 | +5 Volts | 4 |
| EN | 5 | NC | 6 |
| GND | 7 | GND | 8 |

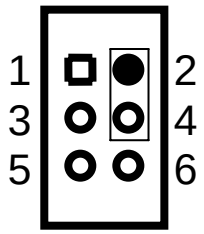
## 3.17 LVDS Connector

Connector type: Hirose DF14 20-pin header

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| SW-VDD | 1 | SW-VDD | 2 |
| GND | 3 | GND | 4 |
| TX3- | 5 | TX3+ | 6 |
| GND | 7 | TXCLK- | 8 |
| TXCLK+ | 9 | GND | 10 |
| TX2- | 11 | TX2+ | 12 |
| GND | 13 | TX1- | 14 |
| TX1+ | 15 | GND | 16 |
| TX0- | 17 | TX0+ | 18 |
| DDC Data | 19 | DDC Data | 20 |

## 3.18 Display Type Selector

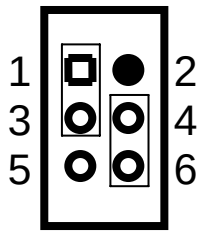
Connector type: IDC6 pin header 2.00 mm. Use 2 mm jumpers to choose the display type.
TFT: Jumpers between Pins 4&6 and Pins 1&3
CRT: Jumpers between Pins 4&6 and Pins 3&5
BIOS: Jumper between Pins 2&4




Default setting: BIOS select

## 3.19 Display Voltage Selector

Connector type: IDC6 pin header 2.00 mm.
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.




Default setting: Display voltage +3.3V Backlight voltage +12V

| Signal name | Pin | Signal name | Pin |
|---|---|---|---|
| +12 volts | 1 | +5 volts | 2 |
| Backlight voltage | 3 | Display voltage | 4 |
| + 5 volts | 5 | +3.3 volts | 6 |

# 4 Software

## 4.1 BIOS

The Cool LiteRunner is delivered with a standard PC BIOS. The default setting guarantees a “ready to run” system, even without a BIOS setup backup battery.

If the user wants to change settings, pressing the <DEL> key on power up accesses the setup utility.

The BIOS is located in a flash prom and can be easily updated on board with software under DOS.

All changes in the setup of the BIOS are stored in the CMOS RAM of the real time clock. A copy of the CMOS RAM excluding date and time data is stored in the flash ROM. This means that even if the backup battery runs out of power, the CMOS settings are not lost. Only date and time will be set to their default value. Without an external battery the on board, the GoldCap is able to buffer the date and time information for about 2 days.

The default values of the BIOS can be automatically loaded at boot time. To achieve this, the key “0 / INSERT” on the numerical keypad or “INSERT” on the cursor block should be pressed before the system is turned on. Holding this key and turning the system on loads the default values.

## 4.2 Drivers

Software drivers for sound (option), Ethernet and graphics adapter are available for the Cool LiteRunner.

These drivers can be downloaded from LiPPERT's website http://www.lippert-at.com.

For installation, follow the instructions on the driver disks.

## 4.3 Programming GPIOs

The Cool LiteRunner's GPIOs are part of the Winbond W83627HF SuperIO (GPIO10-GPIO17 on SuperIO = GPIO0-GPIO7 on CFR). They are located in Logical Device 7 of the SuperIO and can be programmed with the MSDOS **debug** program using simple IN/OUT commands on Index/Data registers 4Eh/4Fh. The following lines show an example how to do this.

Set the SuperIO into configuration mode by writing 87h to index register 4Eh twice:

- o 4E 87
- o 4E 87

Now set the pins to GPIO function:

- o 4E 2A
- o 4F FD

Select Logical Device 7 for programming by writing 07h to register 07h of the SuperIO and enable it by setting bit 0 of register 30h:

- o 4E 07
- o 4F 07
- o 4E 30
- o 4F 01

Define GPIOs as input or output. GPIO0…GPIO7 → bit0 … bit7 of the configuration register F0h. Set bits to ‘1’ for input, ‘0’ for output:

- o 4E F0
- o 4F 00

Now all GPIOs are set as outputs. Writing to configuration register F1h sets the GPIO’s value, when it is set as an output:

- o 4E F1
- o 4F FF

All GPIO’s are set as outputs with the value ‘1’.

When the GPIOs are set as inputs (please look two steps above) or if the output values shall be verified, it is possible to read from configuration register F1h in the following manner:

- o 4E F1
- i 4F

For further information, please refer to chapter 4.8 of the Winbond W83627HF datasheet.

## 4.4 Programming the Watchdog

Since the Watchdog is disabled in delivery status, it must be programmed for proper use. Setting GP33 of the Winbond SuperIO (logical device 9, bit 4) to high enables Watchdog, after that it has to be triggered by GP23 (logical device 8, bit 4). That means it has to be set to low and to high again within 600ms. If the Watchdog is not triggered within this time, the board will perform a hardware reset.

The following program in C is an example how to test Watchdog function under DOS. Programming the Watchdog is quite similar programming GPIO’s.

```
#include <stdio.h>
#include <conio.h>

typedef unsigned char BYTE;

void main()
{
  BYTE trigger, temp;                          //define variables

  printf("Watchdog is now activated and triggered.\n");
  printf("Press any key to generate reset...");

  outp(0x4E, 0x87);                            //enter SuperIO configuration mode
  outp(0x4E, 0x87);
  outp(0x4E, 0x07);                            //enable logical device 9
  outp(0x4F, 0x09);

  outp(0x4E, 0xF0);                            //set GP33 as output in configuration register F0h → Bit4 = ‘0’
  outp(0x4F, 0xC7);

  outp(0x4E, 0xF1);                            //set GP33 (Bit4) value in cofiguration register F1h to ‘1’ enables
  temp = inp(0x4F);                            //watchdog function. Make sure to let the other Bits unchanged!
  temp = temp | 0x08;
  outp(0x4F, temp);
                                              //trigger Watchdog by toggling Bit4 of logical Device 8
  outp(0x4E, 0x07);                            //enable logical device 8
  outp(0x4F, 0x08);
  outp(0x4E, 0xF1);                            //toggle Bit4 in configuration register F1h.

  do
  {                                            //create a loop
      trigger = inp(0x4F);                     //read data register
      trigger = trigger ^ 0x08;                //exor with 08h, to toggle Bit4
      outp(0x4F, trigger);                     //write value to data register
  } while (!kbhit());                          //stop then any key is hit and reset will be created
                                               //as indication that watchdog is acivated, a red LED is switched on.
  printf("\nWatchdog timeout in 600ms...");
  return;
}
```

Setting GP33 to low can disable the watchdog. The status of the Watchdog can be read from GP32. A high signal indicates that a watchdog timeout has occurred, which is also indicated by a red LED.

The following program in C is an example how to read out the watchdog status.

```
#include <stdio.h>
#include <conio.h>

typedef unsigned char BYTE;

void main()
{
  BYTE crf1, temp;                          //define variables
  BYTE mask = 4;

  outp(0x4E, 0x87);                         //enter SuperIO configuration mode
  outp(0x4E, 0x87);
  outp(0x4E, 0x07);                         //enable logical device 9
  outp(0x4F, 0x09);

  outp(0x4E, 0xF1);                         //read out configuration register F1h
  cfr1 = inp(0x4F);

  temp = crf1 & mask;                       //delete non relevant bits

  if (temp == 4)
    printf(“Watchdog timeout occurred!”);   //return message
  else
    printf(“No Watchdog timeout!”);

  return;
}
```

# 4.5 CPU, Board Temperature, and Fan Speed

Temperatures and Fan Speed can be read from the Winbond SuperIO by using the LPC interface's Index/Data Ports 295h/296h.

## 4.5.1 Board Temperature

An 8-bit value can be read from register 27h, which can be accessed by using the LPC interface's Index/Data Ports 295h/296h.

Debug example: -o 295 27
-i 296

Please refer to the table in the following chapter for calculating the board temperature. The register value in decimal system equals the board temperature in °C.

E.g. value from register 27h → 37h = 55°C

## 4.5.2 CPU Temperature

The value of the CPU temperature sensor is 9 bits wide. Hence, to read it, the LPC interface's Index/Data ports 295h/296h must be used to form a two-part access. Select bank 01 writing ‘01’ to the bank select register at 4Eh. Then read the bits 1…8 from register 50h and take the most significant bit of register 51h as bit 0 to form the complete 9-bit value. Please refer to the following table for calculating temperature.

Debug example:
-o 295 4E
-o 296 01
-o 295 50
-i 296 → These are Bits 8..1 of the 9 Bit value. E.g. 22h → 0010,0010
-o 295 51
-i 296 → Take the MSB of this byte as Bit 0
(e.g. value is 00h → MSB = 0)

Now the complete 9-bit value would be 0 0100 0100 → 044h. As it can be seen from the table below, the temperature value is the decimal register value, divided by 2. Hence:

044h = 68

Temp = $\frac{68}{2}$ [°C] = 34°C

| Temperature | Board Temperature | | CPU Temperature | |
|---|---|---|---|---|
| | *8-Bit Binary* | *8-Bit Hex* | *9-Bit Binary* | *9-Bit Hex* |
| +125°C | 0111 1101 | 7Dh | 0 1111 1010 | 0Fah |
| +25°C | 0001 1001 | 19h | 0 0011 0010 | 032h |
| +1°C | 0000 0001 | 01h | 0 0000 0010 | 002h |
| +0.5°C | - | - | 0 0000 0001 | 001h |
| 0°C | 0000 0000 | 00h | 0 0000 0000 | 000h |
| -0.5°C | - | - | 1 1111 1111 | 1FFh |
| -1°C | 1111 1111 | FFh | 1 1111 1110 | 1Feh |
| -25°C | 1110 0111 | E7h | 1 1100 1110 | 1Ceh |
| -55°C | 1100 1001 | C9h | 1 1001 0010 | 192h |

### 4.5.3 Fan Speed and PWM regulation

If the Cool FrontRunner is configured to use a 5V system fan (available as an option), it is possible to read out the fan's speed by reading register 28h of the LPC Interface Index/Data Ports 295h/296h.

Debug example: -o 295 28
-i 296

You can calculate the RPM value with the following equation: $$RPM = \frac{1.35 \bullet 10^6}{Count \bullet Divisor}$$

While the count is the value from above, the divisor consists of Bit 5 in register 5Dh in Bank 0 (Bit 2 of divisor) and register 47h, Bits 5 and 4 (Bit 1 and 0 of divisor). Reading out the Bits values is done as shown in the example above. The default divisor is 2. Changes might be made to get the correct speed, depending on the fan used.

| Bit 2 | Bit 1 | Bit 0 | Divisor |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 2 |
| 0 | 1 | 0 | 4 |
| 0 | 1 | 1 | 8 |
| 1 | 0 | 0 | 16 |
| 1 | 0 | 1 | 32 |
| 1 | 1 | 0 | 64 |
| 1 | 1 | 1 | 128 |

The default duty cycle of the fan is 100% (FFh). It is possible to reduce the fans speed by setting the duty cycle to lower values. Therefore, you have to write the value to register 5Ah in Bank 0 (remember: Bank Select register → 4Eh). 00h → 0% = Off, FFh → 100% = Full Speed.

Debug example: -o 295 4E
-o 296 00
-o 295 5A
-o 296 80 sets duty cycle to 50%.

# 5 Address Map

This section describes the layout of the CPU memory and I/O address spaces.

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

## 5.1 Memory Address Map

| Address Range (Dec) | Address Range (Hex) | Size | Description |
|---|---|---|---|
| 1024K - 16384K | 100000 - FFFFFF | 15360K | Extended Memory |
| 896K - 1024K | E8000 - FFFFF | 128K | System BIOS |
| 800K - 895K | C8000 - E7FFF | 96K | Unused |
| 768K - 799K | C0000 - C7FFF | 32K | Graphics BIOS |
| 736K - 768K | B8000 - BFFFF | 32K | Monochrome Text Memory |
| 704K - 736K | B0000 - B7FFF | 32K | Color Text Memory |
| 640K - 704K | A0000 - AFFFF | 64K | Graphic Memory |
| 0K - 640K | 0 - 9FFFF | 640K | Conventional Memory |

## 5.2 I/O Address Map

The system chip set implements a number of registers in I/O address space. These registers occupy the following map in the I/O space.

| Address Range (Hex) | Size | Description |
|---|---|---|
| 0000 – 000F | 16 bytes | DMA Controller 1 (8237) |
| 0020 – 0021 | 2 bytes | Interrupt Controller 1 (8259) |
| 002E – 002F | 2 bytes | LPC to ISA Bridge Configuration Registers |
| 0040 – 0043 | 4 bytes | Timer Controller (8254) |
| 004E – 004F | 2 bytes | Super-I/O Configuration Registers |
| 0060 | 1 byte | Keyboard Controller Data Byte |
| 0061 | 1 byte | Misc. Functions & Speaker Control |
| 0064 | 1 byte | Keyboard Controller Command, Status |
| 0070, bit 7 | 1 bit | NMI Enable |
| 0070, bit6:0 | 7 bits | Real Time Clock Address |
| 0071 | 1 byte | Real Time Clock Data |
| 0072 – 0075 | 2 byte | Reserved |
| 0080 | 1 byte | Reserved |
| 0081 – 008F | 15 bytes | DMA Page Registers |
| 0092 | 1 byte | System Control |
| 00A0 – 00A1 | 2 bytes | Interrupt Controller 2 (8259) |
| 00C0 – 00DE | 31 bytes | DMA Controller 1 (8237) |
| 00F0 – 00FF | 16 bytes | Coprocessor |
| 01F0 – 01F7 | 8 bytes | IDE Controller |
| 02F8 – 02FF | 8 bytes | Serial Port 2 |
| 0378 – 037F | 8 bytes | Parallel Port 1 (Standard & EPP) |
| 03B0 – 03BB | 11 bytes | VGA Adapter |
| 03C0 – 03DF | 32 bytes | VGA Adapter |
| 03E8 – 03EF | 8 bytes | Serial Port 3 |
| 03F6 | 1 byte | IDE Controller |
| 03F8 – 03FF | 8 bytes | Serial Port 1 |
| 0480 – 048F | 16 bytes | Plug&Play PCI BUS |
| 04D0 – 04D1 | 1 byte | Plug&Play PCI BUS |
| 0778 – 077A | 3 bytes | Parallel Port 1 (ECP Extensions) |
| 0CF8 – 0CFB | 4 bytes | PCI Configuration Address Register |
| 0CFC – 0CFF | 4 bytes | PCI Configuration Data Registers |
| 6000 – 6006 | 7 bytes | PCI – ISA Bridge |
| 6080 – 609E | 63 bytes | PCI – ISA Bridge |
| 6100 – 61FE | 255 bytes | PCI – ISA Bridge |
| 6200 – 623E | 63 bytes | PCI – ISA Bridge |
| 9C00 – 9CE3 | 228 bytes | PCI – ISA Bridge |
| 9D00 – 9D7E | 127 bytes | PCI – ISA Bridge |
| AC1C – AC1E | 3 bytes | Host Bridge |
| FA00 – FAFE | 255 bytes | Ethernet Controller 1 |
| FC00 - FCFE | 255 bytes | Ethernet Controller 2 |

## 5.3 Interrupts

| IRQ | System Resource |
|---|---|
| NMI | Parity Error |
| 0 | Timer |
| 1 | Keyboard |
| 2 | Interrupt Controller 2 |
| 3 | Serial Port 2 |
| 4 | Serial Port 1 |
| 5 | Serial Port 3 |
| 6 | FDD Controller |
| 7 | Parallel Port 1 |
| 8 | Real Time Clock |
| 9 | ACPI Controller |
| 10 | Available (PC/104 or Mini PCI) |
| 11 | Network Controller 1 / USB Controller 1 (shared) |
| 12 | PS/2 Mouse |
| 13 | Math coprocessor |
| 14 | EIDE |
| 15 | Network Controller 2 / USB Controller 2 (shared) |

**Note:** depending on the BIOS settings, it’s possible to reserve several IRQ’s for the PC/104 or Mini PCI bus

## 5.4 DMA Channels

| DMA | Data width | System Resource |
|---|---|---|
| 0 | 8 bits | Available |
| 1 | 8 bits | Available |
| 2 | 8 bits | Floppy |
| 3 | 8 bits | Parallel Port |
| 4 | | Reserved, Cascade Channel |
| 5 | 16 bits | IDE Controller |
| 6 | 16 bits | Available |
| 7 | 16 bits | Available |

# 6 Technical Characteristics

## 6.1 Electrical Specifications

**Supply voltage:** +5 V DC

**Supply voltage ripple:** ± 3%

**Supply current:** max. 1.3 A depending on operating system

typ. 0.9 A (Windows XP idle mode)
typ. 1.2 A (MS-DOS)

## 6.2 Environmental Specifications

**Operating:**

**Temperature range**: -20 … 60 °C (standard version)

-40 … 85 °C (extended version)

**Temperature change**: max. 10K / 30 minutes

**Humidity (relative):** 10 … 90 % (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 MTBF

MTBF at 25°C: 222.066 hours

In order to perform a failure rate assessment, several assumptions have to be made to minimize the complexity of the analysis.

1. Basis for the calculation was „Parts-Stress“ method according to MIL-HDBK-217 F Notice 2. Although this method requires stress values for all components, mean stress values have been used.
2. Environmental factor „Ground Benign“ according to MIL-HDBK-217 has been used as well as an environmental temperature of 25 °C.
3. Failure rate of mechanical components (screws, chassis, etc) is negligible.

The detailed analysis report is available on request.

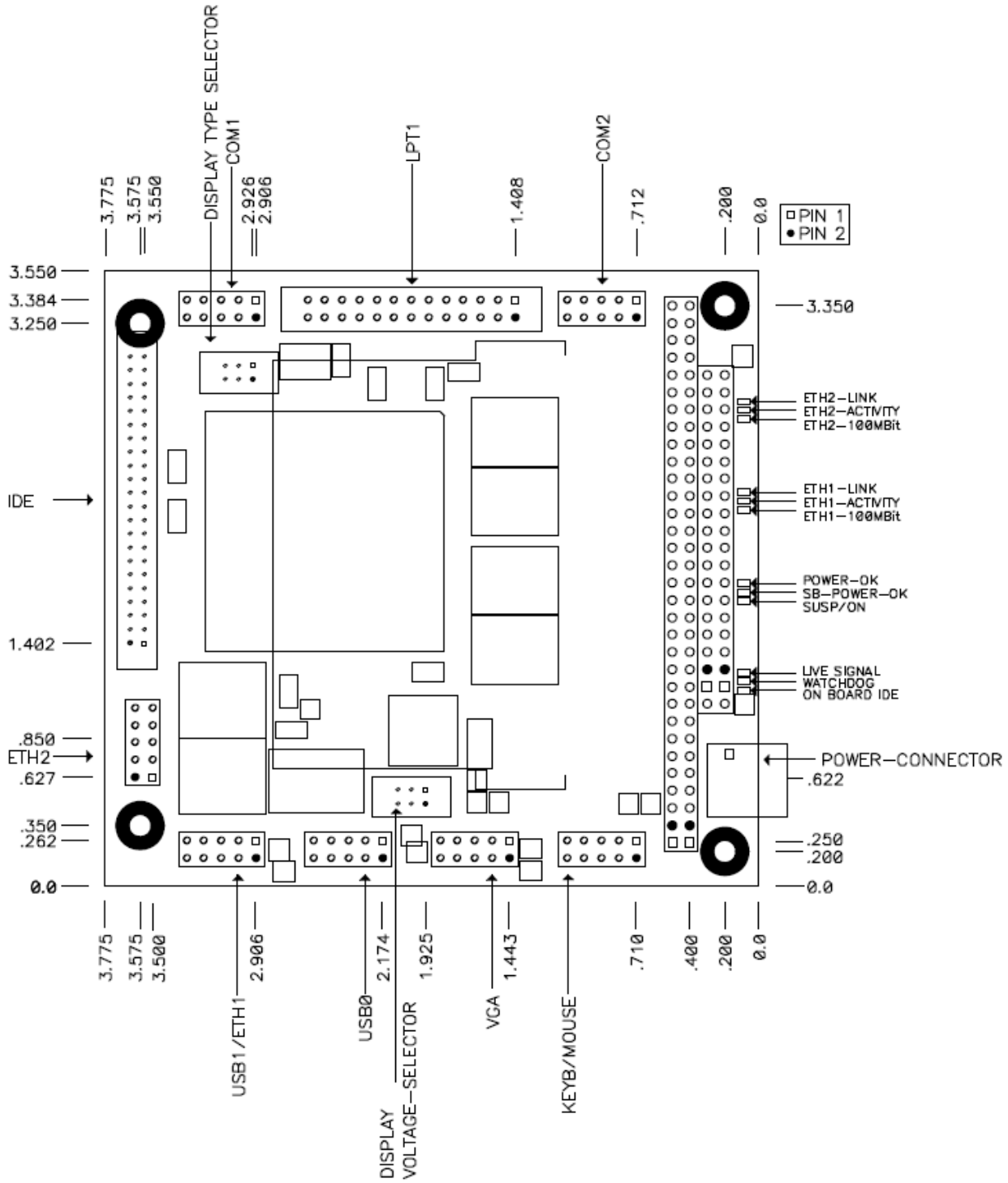
## 6.4 Mechanical

**Dimensions (LxW):** 90.2 mm x 95.9 mm

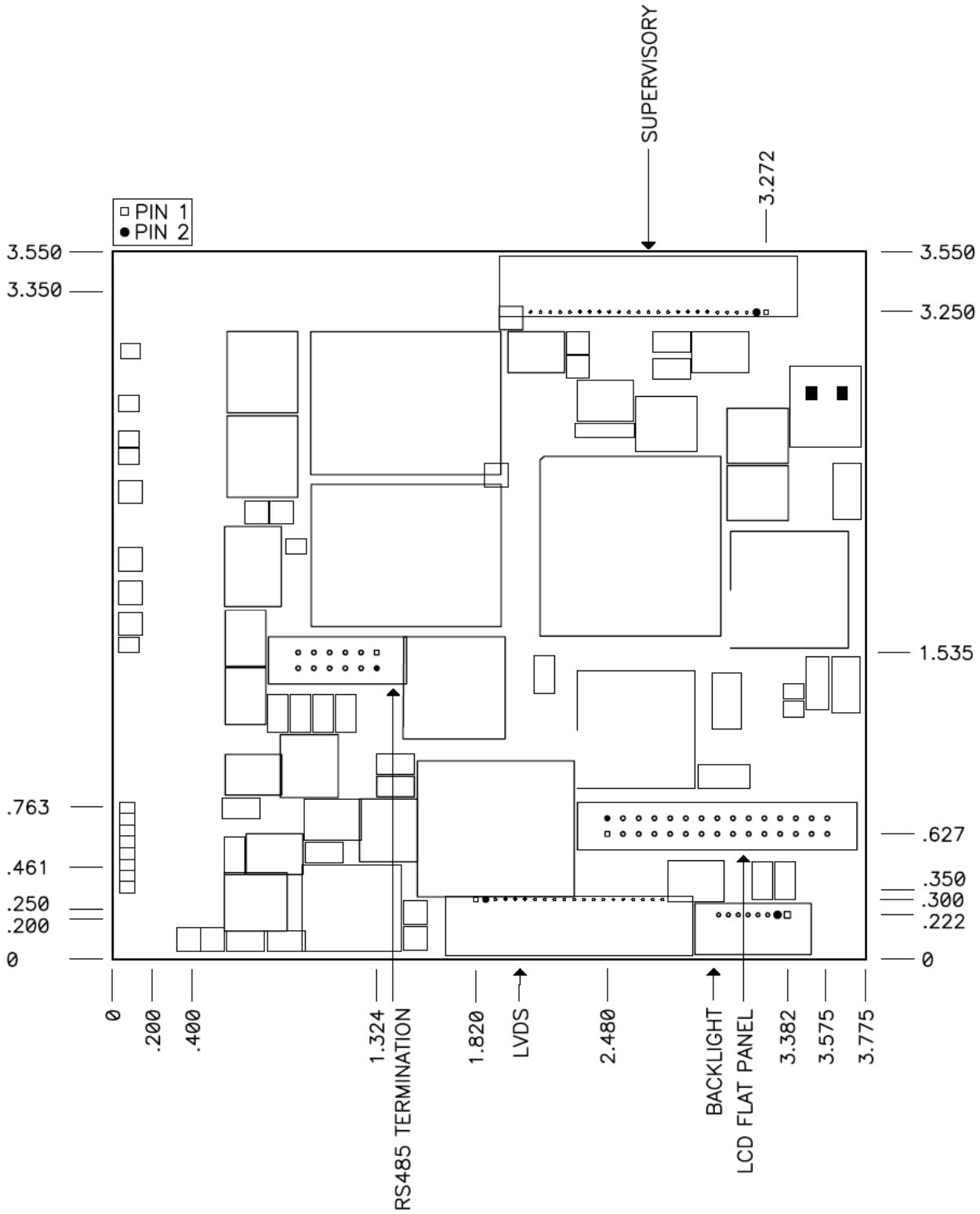
**Height:** max. 8.5 mm on topside above PCB (with passive heatsink)

**Weight:** 120 g

## 6.4.1 Top View


DISPLAY TYPE SELECTOR
COM1
LPT1
COM2
3.775
3.575
3.550
2.926
2.906
1.408
.712
.200
0.0
PIN 1
PIN 2
3.550
3.384
3.250
3.350
ETH2–LINK
ETH2–ACTIVITY
ETH2–100MBit
IDE
ETH1–LINK
ETH1–ACTIVITY
ETH1–100MBit
POWER–OK
SB–POWER–OK
SUSP/ON
1.402
LIVE SIGNAL
WATCHDOG
ON BOARD IDE
.850
ETH2
.627
POWER–CONNECTOR
.622
.350
.262
.250
.200
0.0
0.0
3.775
3.575
3.500
2.906
2.174
1.925
1.443
.710
.400
.200
0.0
USB1/ETH1
USB0
VGA
KEYB/MOUSE
DISPLAY VOLTAGE–SELECTOR

## 6.4.2 Bottom View



# 7 Installation

The Cool LiteRunner 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, etc.) with the power supply switched ON! |

# 8 Options

There are some options available for the Cool LiteRunner. Please check their availability before ordering.

- Extended temperature range –40° … +85°C
- AC97 Audio Interface ( Line In, Line Out, Mic. In)
- Cable set
- CompactFlash Adapter
- Adapter Cable Set
  With the optionally available cable set, standard PC peripherals can be easily connected to the board. The adapter cable set comprises the following items:
  - Adapter cable 3.5’’ power supply connector female to 5.25’’ power supply connector male for supplying the board with a standard PC power supply
  - Two adapter cables IDC10 female to DB9 male for serial port 1 and 2
  - Adapter cable IDC26 female to DB25 female for parallel port
  - Adapter cable IDC10 female to DB9 female plus adapter to SUB-D 15p female for standard VGA monitors
  - Adapter cable IDC44 / 2mm female to IDC44 / 2mm female to connect 2.5’’ EIDE hard disks
  - Adapter cable IDC10 female to PS/2 keyboard and PS/2 mouse connector
  - Adapter cable IDC10 female to USB header
  - Adapter cable IDC10 female to USB connector and RJ45 Ethernet connector
  - Adapter cable IDC10 female to RJ45 Ethernet connector

# 9 Revision History

| Filename | Date | Edited by | Change |
|---|---|---|---|
| TME-PC104-CLR-R0V0 | 2005-09-13 | Jürgen Kern | Draft |
| TME-PC104-CLR-R1V0 | 2005-09-23 | Jürgen Kern | Released |
| TME-PC104-CLR-R1V1 | 2005-09-26 | Jürgen Kern | Alignment of status LED’s corrected |
| TME-PC104-CLR-R1V2 | 2005-10-04 | Jürgen Kern | Added information:<br>PC/104 bus Limitations<br>RS485-Termination Jumper setting<br>RS232/485 setting<br>Flat Panel Configuration<br><br>Added programming description<br>how to read CPU/Board Temperature and Fan Speed<br>Watchdog programming<br>GPIO’s programming |
| TME-PC104-CLR-R1V3 | 2006-04-11 | Jürgen Kern | Top View drawing changed |
| TME-PC104-CLR-R1V4 | 2006-10-30 | Jürgen Kern | Keyboard connector Pin10 description corrected |
| TME-PC104-CLR-R1V5 | 2007-09-18 | Jürgen Kern | Gold cap storage time changed to 2 days instead of 2 weeks,<br>CPU, board temp sensor corrected |
| TME-PC104-CLR-R1V6 | 2007-09-19<br>2008-05-19 | Jens Rottmann<br>Matthias Fellhauer | Enable device to use GPIOs.<br>Ch. 2.14 Note on USB2.0 mass storage devices |
| TME-PC104-CLR-R1V7 | 2008-06-05 | Jens Rottmann | RS485: RTS# usage |