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Thunderbird-E3100

Mini-ITX Motherboard

Technical Manual

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Technical Manual Thunderbird-E3100

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1. Overview

1.1 Introduction

The brand name for the product is defined as **Thunderbird-E3100.**

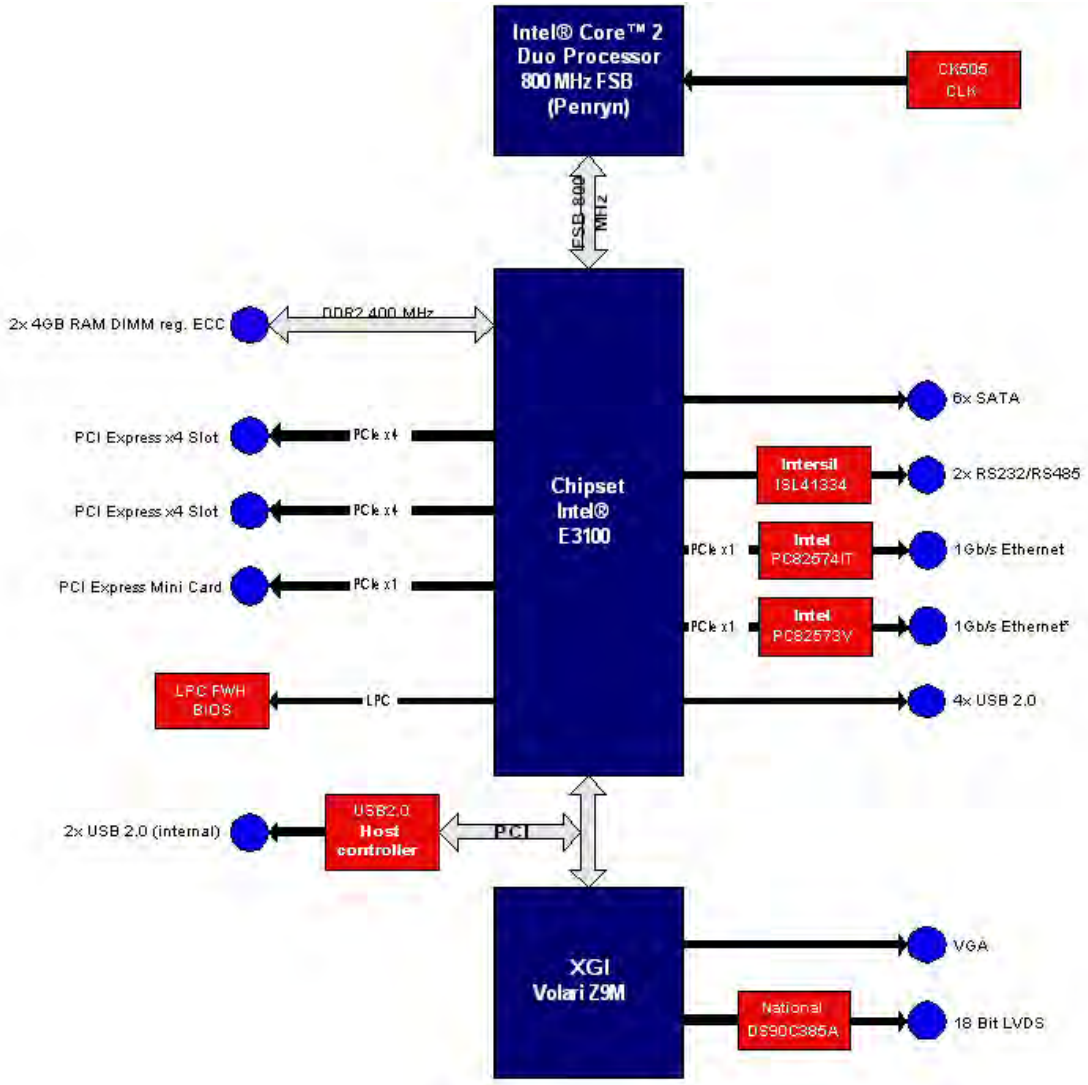
The Mini ITX board Thunderbird-E3100 is designed for applications where a high performance x86 compatible dual core processor board is necessary. The board concept offers a lot of standard I/O interfaces.

The Thunderbird-E3100 is designed by using the E3100 chipset technology platform from Intel. The CPU/chipset will be found on Intel's embedded roadmap ensuring long time availability.

Features

- Intel Core 2 Duo T9400 (FSB 800MHz, 6MB Cache) with Intel E3100 chipset
- VGA, 1600 x 1200 Pixels
- LVDS, 18 Bit, 1600 x 1200 Pixels (optional)
- Gigabit LAN with ASF support
- Gigabit LAN
- 4 x USB 2.0
- 2 x USB 2.0 internal (µDOC)
- 6 x SATA 1.5Gbit/s
- 2 x RS232 or RS422/RS485, software selectable
- 1 x Mini-Card PCIe x1 (+ 1x USB 2.0)
- 2 x PCI Express x4 Slot
- 2 x DDR2 400MHz DIMM Sockets (up to 2 x 4GB modules), registered ECC
- LEMT management functions
- System Panel Header
- Low power consumption
- Optionally extended temperature range -40 ... +85°C

Block Diagram



* incl. Management Capabilities

1.2 Ordering Information

Thunderbird-E3100 Models

Order number	Description
705-0010-10	Thunderbird-E3100 Mini-ITX CPU board with T9400 Intel Core 2 Processor (1.9 GHz, 6MB L2 cache, 800 MHz FSB) Operating temp. range: 0°C … +60°C
705-0010-11	Thunderbird-E3100 Mini-ITX CPU board with T7500 Intel Core 2 Processor (2.2 GHz, 4MB L2 cache, 800 MHz FSB) Operating temp. range: 0°C … +60°C

Cable Sets and Accessories

Order number	Description
862-0055-10	Cable, IDC10 (2.54mm) to 2x USB (A)
323-0038-00	I/O Panel, Thunderbird-E3100, standard
323-0039-00	I/O Panel, Thunderbird-E3100, shifted

1.3 Specifications

Electrical Specifications

Supply voltage	12V ± 5% or ATX power supply +3.3V, +5V, +5VSB, +12V
Rise time	< 10 ms
Supply voltage ripple	± 50 mV
Inrush current	12 V Power supply: 3A
Power consumption	
705-0010-10	ATX Power supply: typical values +5VSB: 0.17A +5V: 0.7A +3.3V: 0.4A +12V: 1.5A
	12 V Power supply: typical value +12V: 2.0 A
	Power consumption depending on usage and operating system typical 24 W

Environmental Specifications

Temperature range	0 … 60 °C (standard, for models with serial numbers 7xx-xxxx-xx)
	-20 … 60 °C (standard, for models with serial numbers 8xx-xxxx-xx)
	-40 … 85 °C (extended, for models with serial numbers 9xx-xxxx-xx)
Storage temperature	-40 … 85 °C
Temperature change	max. 10K / 30 minutes
Humidity (relative)	10 … 90 % (non-condensing)
Pressure	450 … 1100 hPa

MTBF

MTBF at 25°C	178.802 hours
MTBF at 40°C	138.553 hours

Mechanical

Dimensions (L x W)	170 mm x 170 mm (6.689 x 6.689-inch) 6.689" by 6.689"
Height	approx. 37 mm with CPU / chipset cooler above PCB approx. 4 mm below PCB PCB thickness 1.6 mm total height approx. 42.6 mm
Weight	500 gr
Mounting	6 mounting holes:
	4 mounting holes for mounting in Mini-ITX case with support of one PCI Express x 4 Slot at the bracket
	2 additional mounting holes for shifted mounting in ATX case with support of two PCI-Express x 4 Slots at the brackets

Caution

Never create a short circuit with the components located around the mounting holes when the board is mounted on metal spacers. This can damage the board!

Mounting in Mini-ITX enclosure

In a Mini-ITX enclosure the board is mounted by using the 4 standard mounting holes. Only one PCI Express x 4 Slot is useable at the slot bracket.
Please use standard I/O shield, part number 323-0038-00.

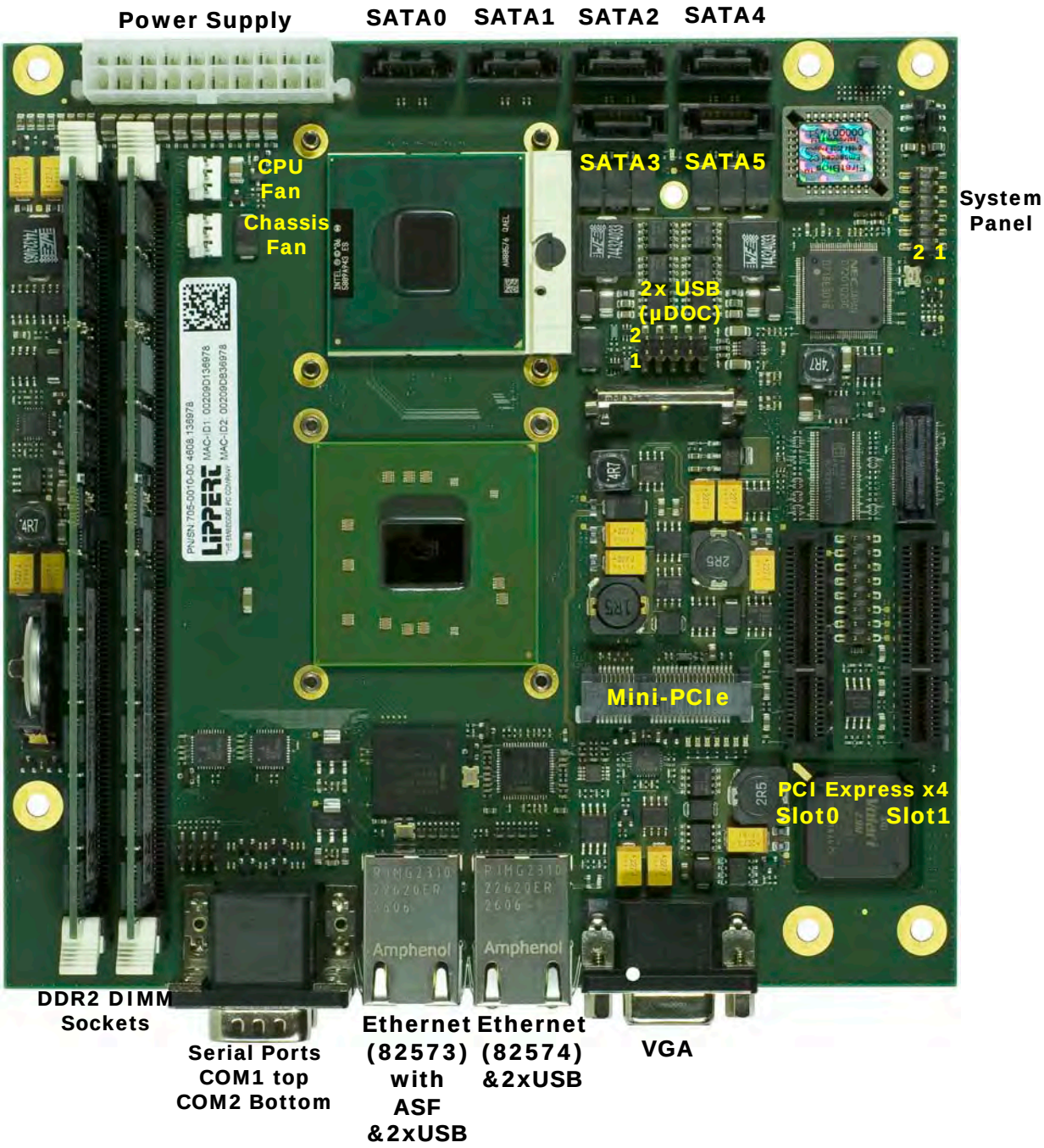
Mounting in ATX enclosure

In an ATX or Micro ATX enclosure the board can be mounted by using the 2 inner mounting holes. The board is shifted to the right and both PCI Express x 4 Slots are useable at the slot brackets.
Please use shifted I/O shield, part number 323-0039-00.

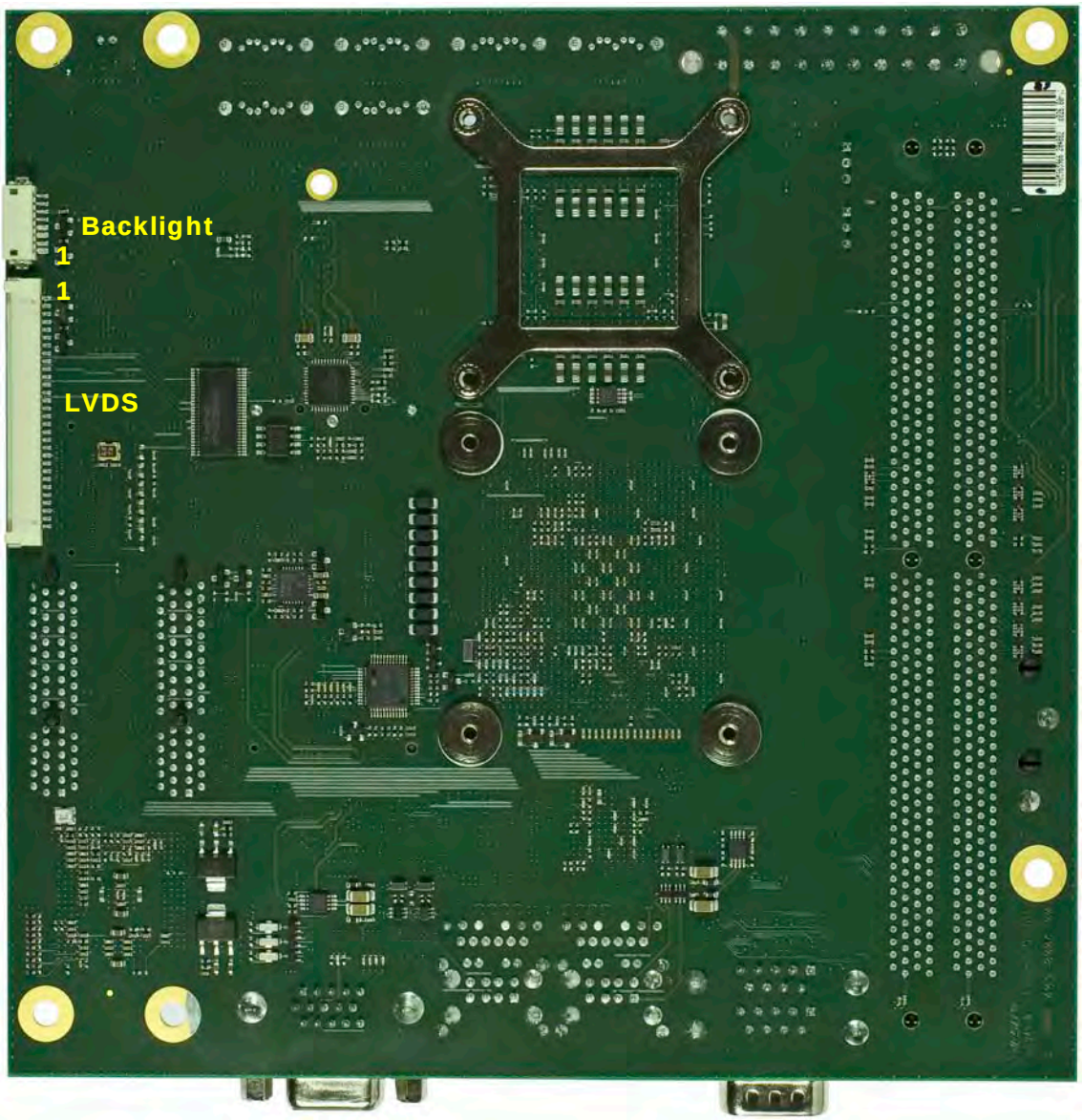
2. Getting Started

2.1 Connector Locations

Top

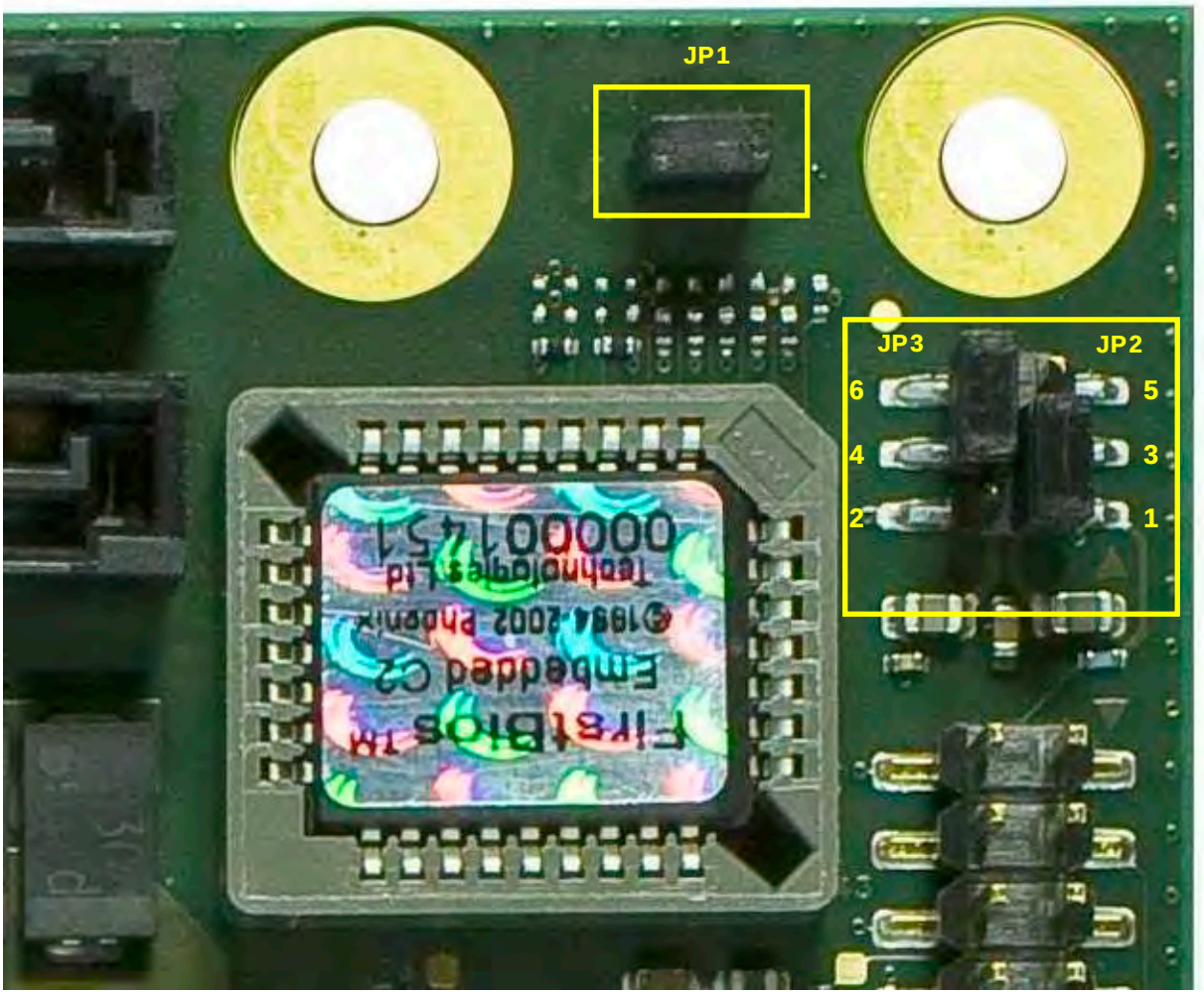


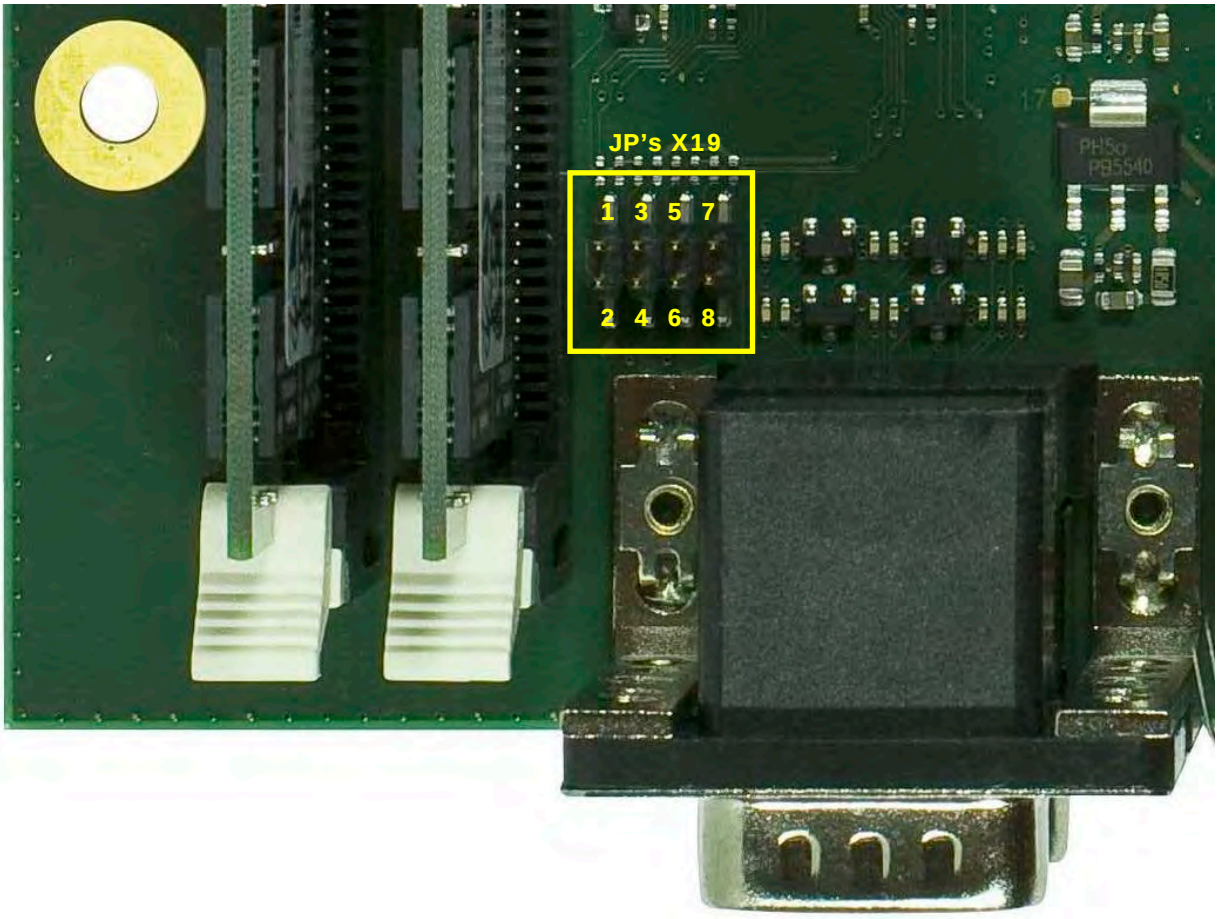
Bottom



2.2 Jumper Locations

Jumper	Jumper-Pos.	Function
1	1 – 2	Init CMOS – load setup def. –
	1 – 2	Init CMOS NL (def.)
2	1 – 3	LCD Voltage Selection 3.3V (def.)
	3 – 5	LCD Voltage Selection 5V
3	2 – 4	Backlight Voltage Selection 12V (def.)
	4 – 6	Backlight Voltage Selection 5V
X19	1 – 2 & 3 – 4	RS485 termination of COM1
	5 – 6 & 7 – 8	RS485 termination of COM2

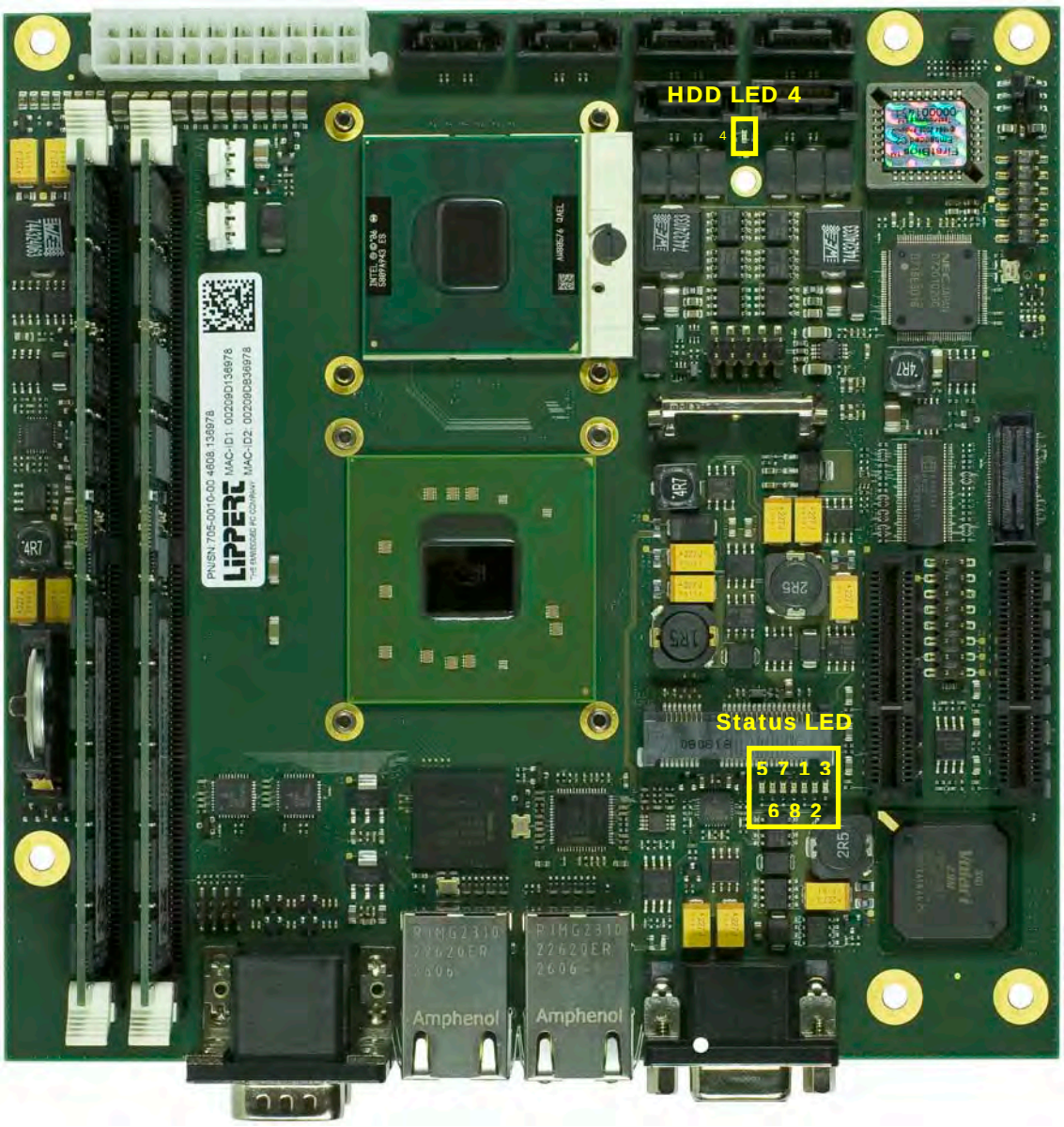



JP's X19
1 3 5 7
2 4 6 8

2.3 LED Indicators

To facilitate problem solving, the Thunderbird-E3100 provides LED indicators for the following conditions:

LED	Name	Function
1	WWAN	Status of wireless add-in card (WAN)
2	WLAN	Status of wireless add-in card (LAN)
3	WPAN	Status of wireless add-in card (PAN)
4	HDD	Harddisk: SATA accesses
5	P10 (SBY)	Standby Power Supply
6	P11 (PM)	Power Mode
7	P12 (MAIN)	Main Power Supply
8	WD	Watchdog activated



2.4 Hardware Setup

Installing the Thunderbird-E3100 is very straightforward. First, unpack the board observing the usual electrostatic discharge (ESD) precautions.

Caution

Before you touch the board, make sure that you have discharged yourself and your gear towards a grounded terminal. Damages due to ESD are usually not immediately visible and will only show up later as failures in the field.

Mount the cooling device.

Caution

Never operate the Thunderbird-E3100 without suitable cooling devices. Failing this can destroy the module.

Check the RAM module assembly. The RAM modules must be installed properly in the sockets.

Note

The Thunderbird-E3100 is using registered DDR2 ECC DIMM. If only one DIMM is used it must be installed in the outside RAM socket near the board edge because of the termination of the memory bus.

Connect a display monitor to the VGA connector and keyboard and mouse to USB connectors. Add a suitable hard drive and/or a CD drive to the configuration.

Caution

Never connect or disconnect peripherals like hard drives while the board's power supply is connected and switched on!

Connect a standard ATX supply and switch on the power.

The display shows the BIOS messages. If you want to change the standard BIOS settings, press the <DEL> key to enter the BIOS menu. See BIOS chapter for more details.

If you need to load the BIOS default values, press the <Insert> key during startup. This forces the BIOS to load the factory settings from FlashPROM.

The Thunderbird-E3100 can boot from CD drives, USB floppy, USB stick, harddisk, or network. Provided that any of these is connected and contains a valid operating system image, the display then shows the boot screen of your operating system.

Note

Not all USB devices are suitable to boot the Thunderbird-E3100.

If there are problems, please try to use another device from another manufacturer.

3. Module Description

3.1 Processor

Intel® Core™ 2 Duo Processor, 1.9 GHz (T9400) … 2.2 GHz (T7500).

The Penryn processor on 45-nanometer process technology is the next generation high-performance, low-power mobile processor based on the Intel® Core™ microarchitecture. Available in:

- Dual Core Extreme edition (DC-XE)
- Standard voltage (SV)
- Low voltage (LV)
- Ultra-low voltage (ULV)

In this document, the Penryn processor will be referred to as the processor and the chipset will be referred to as the MCH. The following list provides some of the key features on this processor:

- Supports L1 cache-to-cache (C2C) transfer
- On-die, primary 32-kB instruction cache and 32-kB write-back data cache in each core
- The Penryn processor in DC-XE, SV and LV have an On-die, up to 6-MB second level shared cache with Advanced Transfer Cache architecture
- The Penryn processor in ULV have an On-die, up to 3-MB second-level shared cache with Advanced Transfer Cache architecture
- Streaming SIMD extensions 2 (SSE2), streaming SIMD extensions 3 (SSE3), supplemental streaming SIMD extensions 3 (SSSE3) and SSE4.1 instruction sets
- The Penryn processor in DC-XE, SV and LV are offered at 1066-MHz source synchronous front side bus (FSB)
- The Penryn processor in ULV are offered at 800-MHz source-synchronous front side bus (FSB)
- Advanced power management features including Enhanced Intel Speed Step® Technology and dynamic FSB frequency switching
- Digital thermal sensor (DTS)
- Intel® 64 architecture
- Intel® Dynamic Acceleration Technology and Enhanced Multi Threaded Thermal Management (EMTTM)
- Supports PSI2 functionality
- The Penryn processor in SV is offered in Micro-FCPGA and Micro-FCBGA packaging technologies
- The Penryn SFF processor in LV and ULV are offered in Micro-FCBGA packaging technologies only
- Execute Disable Bit support for enhanced security
- C6 Low Power Feature with P_LVL6 I/O Support

3.2 Intel® 3100 Chipset

The Intel® 3100 Chipset is a single integrated chip that contains the functionality of a Memory Controller Hub and an I/O Controller Hub. In this document the Memory Controller Hub unit and I/O Controller Hub unit in the Intel® 3100 Chipset are referenced as IMCH (Integrated Memory Controller Hub) and IICH (Integrated I/O Controller Hub) respectively. The IMCH and IICH units are connected internally through the NSI (North South Interface). The NSI is an internal bus that is not externally accessible.

The Intel® 3100 Chipset provides customers an integrated system controller with an ECC memory solution in combination with high-performance, low-power processors to enable small form factor designs in the Storage, Wireless, Wire-line and Security market segments. To accomplish this, the Intel® 3100 Chipset implements numerous RASUM (Reliability, Availability, Serviceability, Usability and Manageability) features on multiple interfaces.

A Intel® 3100 Chipset system implementation consists of:

- One processor socket operating at 100/133/167/200 MHz
- One Intel® 3100 Chipset
- One to four DDR2-400 DIMMs (a maximum of 4 ranks are supported)
- Bridge devices providing I/O subsystem connectivity
- Several I/O devices such as USB, SATA, etc.

The Intel® 3100 Chipset also provides one x8 PCI Express interface, which may be split into a pair of independent x4 PCI Express interfaces. Additionally, the Intel® 3100 Chipset provides one x4 PCI Express interface, which may be configured as four independent x1 PCI Express interfaces.

I/O Controller Hub (IICH) functions are integrated into the Intel® 3100 Chipset, eliminating the requirement for a legacy I/O bridge.
The Intel® 3100 Chipset also supports:

- Four USB 2.0 ports
- Six SATA ports
- One LPC bus
- Two UART port
- Two SMBus ports

3.3 Graphics Controller (xgi, Volari™ Z9M Series)

Volari™ Z9M GPU is the extreme programmable GPU of the XGI™ 2D GPU family that comes in a 297-ball, 23mmx23mm BGA package (lead-free). The Volari™ Z9M integrates a PCI 2.2 controller and a 64-bit 2D graphics engine. It integrates a 16-bit DDR memory. The Z9M also incorporates a configurable 3.3V/2.5V DVO digital interface to support a third party LVDS/TMDS transmitter. It can achieve high 2D performance with a memory interface supporting a bandwidth of up to 0.33 GB/s (DDR @166MHz).

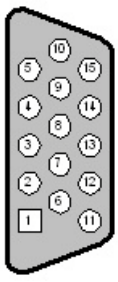
Volari™ Z9M GPU Features:

- PCI Bus Interface
- High Performance 2D Accelerator
- High Efficient BroadBahn™ Memory Architecture
- High Performance Flat Panel Display Interface
- High Integration
- Resolution, Color & Frame Rate
- Power Management
- Multimedia Application

VGA Connector

Connector type: DSUB15 HD
Matching connector: DSUB15 connector, male

Pin	Signal	Pin	Signal
1	Red	2	Green
3	Blue	4	Reserved
5	GND	6	GND
7	GND	8	GND
9	+5V	10	GND
11	Reserved	12	DDC_DAT
13	HSYNC	14	VSYNC
15	DDC_CLK		



Caution: The 5 VDC signal at pin 9 is protected by a 3A fuse. The fuse gets damaged if this pin is shorted to ground!

LVDS Transmitter / Connector (optional)

Note

The LVDS and VGA port are using same timing and resolution parameters. The VGA controller does not support using both interfaces at the same time, either VGA is active (standard) or LVDS is active (optional). Therefore the LVDS port is intended to be used in special consumer applications only. The LVDS and backlight connector is not equipped on the standard version of the board. Please contact us regarding a special offer for a board with LVDS and backlight connector and a necessary VGA bios adaption if the LVDS port is planned to be used.

Connector type: Hirose DF14 30 pin header 1.25 mm, single row
Matching connector: Hirose DF14-30S-1.25C, Part number 538-0012-3 00

Pin	Signal	Pin	Signal
1	VCC_LCD	2	VCC_LCD
3	GND	4	GND
5	TX3-	6	TX3+
7	TXCLK-	8	TXCLK+
9	GND	10	TX2-
11	TX2+	12	TX1-
13	TX1+	14	TX0-
15	TX0+	16	GND
17	NC	18	NC
19	NC	20	NC
21	GND	22	NC
23	NC	24	NC
25	NC	26	NC
27	NC	28	GND
29	DDC_CLK	30	DDC_DAT

Caution: Maximum current on all supply pins is 1A!

Display Backlight Connector (optional)

Connector type: Hirose DF13 8 pin header 1.25 mm
Matching connector: Hirose DF13-8S-1.25C, part number 536-0007-0 00

Pin	Signal
1	+12V
2	+12V
3	+5V
4	+5V
5	EN
6	VCC_BL
7	GND
8	GND

Caution: Maximum current on all supply pins is 1A!
VCC_BL is switched Inverter Power.
EN is Backlight Enable Signal with 3.3V leveling.

Display Voltage Selector

Connector type: IDC6 pin header 2.0 mm
Matching connector: 2.0 mm jumper

Use a jumper between 1-3 or 3-5 to select the backlight voltage.

Use a jumper between 2-4 or 4-6 to select the display voltage.

Pin	Signal	Pin	Signal
1	+12V	2	+5V
3	Backlight Voltage	4	Display Voltage
5	+5V	6	+3,3V

Default setup is 3,3V for LVDS display and 12V for the inverter.

3.4 Gigabit Ethernet

There are two Ethernet ports available on two standard 3-port stackable ETH/USB connectors. One Ethernet by 82573V with ASF and the other by 82574IT

Connector type: Amphenol G71M132611AEU
Matching connector: 8P8C (RJ45) plug

Pin	Signal	Pin	Signal
1	MX1+	2	MX1-
3	MX2+	4	MX2-
5	MX3+	6	MX3-
7	MX4+	8	MX4-
LED A	Link	LED B	Activity

3.5 USB 2.0 Ports

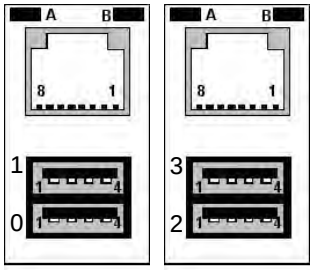
There are 6 USB 2.0 ports available on three different connectors.

USB 0...3

Four USB ports from the chipset are available on two standard 3-port stackable ETH/USB connectors.

Connector type: Amphenol G71M132611AEU
Matching connector: 8P8C (RJ45) plug

Pin	Signal	Pin	Signal
1	USB_VCC	2	USB-
3	USB+	4	USB_GND

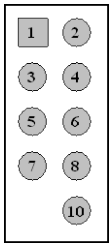


USB 4...5

Two additional USB ports from the PCI USB controller are available on IDC header. This connector can also be used to mount an USB flash device.

Connector type: IDC10 pin header 2.54 mm
Matching connector: IDC10 pin female connector 2.54 mm

Pin	Signal	Pin	Signal
1	USB_VCC4	2	USB_VCC5
3	USB4-	4	USB5-
5	USB4+	6	USB5+
7	USB_GND4	8	USB_GND5
9	Key	10	NC



This connector is prepared for µDOC (uDiskOnChip from different vendors) in horizontal version.

The µDOC is a high-speed flash disk with USB 2.0 Interface. It can be plugged directly on the header and mounted with a screw.

An adapter cable with two standard USB connectors is also available for this pin header.

Note

The bios supports only booting from the chipset USB ports USB 0...3. The USB ports 4...5 can not be used for booting an operating system.

3.6 SATA Ports

There are six SATA ports available for the application on six SATA connectors.

Connector type: SATA THT MOLEX 67800-8001
Matching connector: 7 pin Serial ATA plug

Pin	Signal RS232
1	GND
2	A+
3	A-
4	GND
5	B-
6	B+
7	GND

3.7 Serial Ports

Two serial ports are located on the board. They can either work in RS232 or in RS422/RS485 mode, selectable via BIOS setting. When entering **Integrated Peripherals -> Super IO Device** the I/O address, IRQ and Mode for each COM Port can be selected. Termination resistors for RS485 Mode can be set with Jumpers on pin headers as described in chapter 4.15.

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 following settings are possible for COM1 and COM2:

- 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)

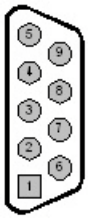
COM Connector

Connector type: 2x Combo DSUB9
Matching connector: DSUB9 connector, female

COM1: top connector

COM2: bottom connector

Pin	Signal RS232	Signal RS485	Pin	Signal RS232	Signal RS485
1	DCD#	NC	2	RXD	RXD-
3	TXD	TXD-	4	DTR#	NC
5	GND	GND	6	DSR#	RXD+
7	RTS#	TXD+	8	CTS#	NC
9	NC	NC			



RS485-Termination Jumpers

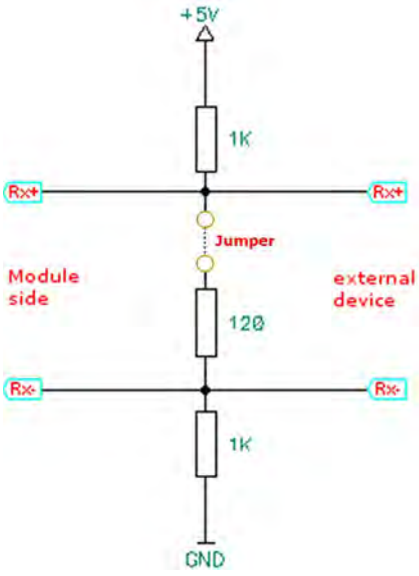
Connector type: IDC8 pin header 2.0 mm (X19)
Matching part: 2.0 mm jumper

Use 2 mm jumpers to terminate lines correctly.

There are two jumpers COM1 and COM2, respectively.

The RS485 termination jumpers are located at the top of the printed circuit board, see chapter 2.2

Pin	Signal	Pin	Signal
1	TX1+	2	TX1-
3	RX1+	4	RX1-
5	TX2+	6	TX2-
7	RX2+	8	RX2-



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

Additionally, positive/negative receive lines are pulled up/down with 10kW to 5V/GND in order to protect the transceivers of the Thunderbird-E3100 from over voltages.

It is recommended to protect the ports of the external device in the same way!

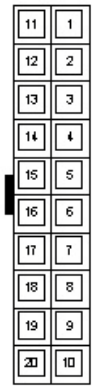
Caution: Termination Resistors **should not** be used in RS232 Mode! Otherwise, the serial ports will not work.

3.8 On Board Power Supply

Power Connector

Connector type: ATX-Power connector (X26)
Matching connector: Molex Mini-Fit Jr.™ Receptacle Housing, Dual Row, UL 94V-2, 20 Circuits, 5556 series and Mini-Fit Plus HCS™ Crimp Terminal 45750

Pin	Signal	Pin	Signal
11	+3,3 V	1	+3,3 V
12	-12 V	2	+3,3 V
13	GND	3	GND
14	Power Supply ON	4	+5 V
15	GND	5	GND
16	GND	6	+5 V
17	GND	7	GND
18	-5 V	8	Power OK
19	+5 V	9	+5 V (stand by)
20	+5 V	10	+12 V



Note

In 12V-only mode, the power supply must be connected to +12V (Pin 10) and GND (e.g. Pin 7). The other pins must be left open.

Real Time Clock Backup

There is a changeable battery on board. This battery is necessary to power the real-time clock (RTC) if the power supply is switched off.

Battery Type: **CR2032**, 3 Volt

3.9 System Panel Connector

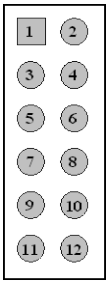
That connector is used by a different kind of signals. There is no standard cable adapter available.

Connector type: IDC12 pin header 2.54 mm (X27)
Matching connector: IDC12 pin female connector 2.54 mm

Power-Button

The Power-Button signal is located on the IDC10 Header. To power up/down the board the signal Power-Button must be pulled to GND.

Pin	Signal	Pin	Signal
1	+3,3V	2	+3.3V (via 330 R)
3	HDD_LED-	4	n.c.
5	PWR_BTN+	6	GND
7	GND	8	MICH_INTRUDER#
9	RST_BTN+	10	+3.3V (via 330 R)
11	GND	12	Watchdog#



Power-LED

The "POWER LED" signal is located on the IDC10 Header. A Power LED can be connected between Pin2 and Pin6

Pin	Signal	Pin	Signal
1	+3,3V	2	+3.3V (via 330 R)
3	HDD_LED-	4	n.c.
5	PWR_BTN+	6	GND
7	GND	8	MICH_INTRUDER#
9	RST_BTN+	10	+3.3 (via 330R)V
11	GND	12	Watchdog#

Reset-In

The Reset-Button signal is located on the IDC10 Header. To reset the board, the signal Reset-Button must be pulled to GND.

Pin	Signal	Pin	Signal
1	+3,3V	2	+3.3V (via 330 R)
3	HDD_LED-	4	n.c.
5	PWR_BTN+	6	GND
7	GND	8	MICH_INTRUDER#
9	RST_BTN+	10	+3.3V (via 330 R)
11	GND	12	Watchdog#

HDD-LED

The "HDD LED" signal is located on the IDC10 Header. To see the HDD activation, the signal "HDD LED" must be pulled to +3.3V.

Pin	Signal	Pin	Signal
1	+3,3V	2	+3.3V (via 330 R)
3	HDD_LED-	4	n.c.
5	PWR_BTN+	6	GND
7	GND	8	MICH_INTRUDER#
9	RST_BTN+	10	+3.3V (via 330 R)
11	GND	12	Watchdog#

Watchdog-LED

The "Watchdog-LED" signal is located on the IDC10 Header. A LED can be connected between Pin10 and Pin12. The signal WATCHDOG will go low on a watchdog event.

Pin	Signal	Pin	Signal
1	+3.3V	2	+3.3V (via 330 R)
3	HDD_LED-	4	n.c.
5	PWR_BTN+	6	GND
7	GND	8	MICH_INTRUDER#
9	RST_BTN+	10	+3.3 V (via 330R)
11	GND	12	Watchdog#

Intruder-Detect

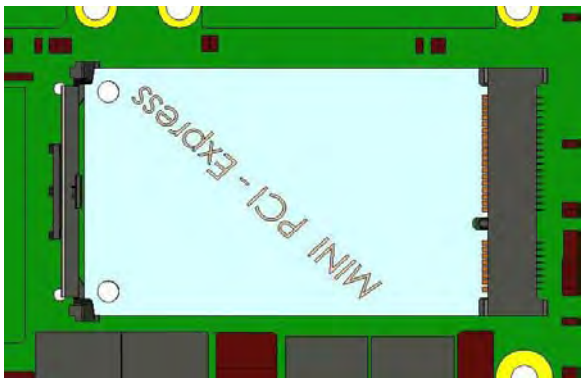
The INTRUDER Detect input signal is located on the IDC10 Header. This signal can be used to recognize the removal of the system cover. It must be connected to GND by a switch at the system cover to generate an ASF alert, TCO interrupt or SMI.

Pin	Signal	Pin	Signal
1	+3.3V	2	+3.3V (via 330 R)
3	HDD_LED-	4	n.c.
5	PWR_BTN+	6	GND
7	GND	8	MICH_INTRUDER#
9	RST_BTN+	10	+3.3 V (via 330R)
11	GND	12	Watchdog#

3.10 Mini-PCIe

Connector type: Mini-PCIe
Matching part: Mini-PCI-Express Card / MiniCard

PIN	Signal	PIN	Signal
1	WAKE#	2	3V3
3	Reserved	4	GND
5	Reserved	6	1V5
7	CLKREQ#	8	UIM_PWR
9	GND	10	UIM_DATA
11	REFCLK-	12	UIM_CLK
13	REFCLK+	14	UIM_RESET
15	GND	16	UIM_VPP
17	Reserved	18	GND
19	Reserved	20	W_DISABLE#
21	GND	22	PERST#
23	PERn0	24	3V3aux
25	PERp0	26	GND
27	GND	28	1V5
29	GND	30	SMB_CLK
31	PETn0	32	SMB_DATA
33	PETp0	34	GND
35	GND	36	USB_D-
37	Reserved	38	USB_D+
39	Reserved	40	GND
41	Reserved	42	LED_WWAN#
43	Reserved	44	LED_WLAN#
45	Reserved	46	LED_WPAN#
47	Reserved	48	1V5
49	Reserved	50	GND
51	Reserved	52	3V3



3.11 PCI Express x4 Slots

Two PCI Express x4 ports are located on the board.

Connector type: Molex 0877159102
Matching part: PCI-Express x4, x2, x1

Pin	Side A	Side B	Pin	Side A	Side B
1	PRSNT1#	+12V	17	PERn0	PRSNT2#
2	+12V	+12V	18	GND	GND
3	+12V	+12V	19	Reserved	PETp1
4	GND	GND	20	GND	PETn1
5	TCK	SMB_CLK	21	PERp1	GND
6	TDI	SMB_DAT	22	PERn1	GND
7	TDO	GND	23	GND	PETp2
8	TMS	+3,3V	24	GND	PETn2
9	+3,3V	TRST#	25	PERp2	GND
10	+3,3V	+3,3V_AUX	26	PERn2	GND
11	PERST#	WAKE#	27	GND	PETp3
12	GND	Reserved	28	GND	PETn3
13	REFCLK+	GND	29	PERp3	GND
14	REFCLK-	PETp0	30	PERn3	Reserved
15	GND	PETn0	31	GND	PRSNT2#
16	PERp0	GND	32	Reserved	GND

Deep PCI bus hierarchy by BIOS (up to 128 “layers”) and add-on PCI Express cards is supported.

3.12 LEMT functions

The onboard Microcontroller implements power sequencing and LEMT (**L**iPPERT **E**nhanced **M**anagement **T**echnology) functionality. The microcontroller communicates via the System Management Bus with the CPU/Chipset. The following functions are implemented:

- Total operating hours counter
  Counts the number of hours the module has been run in minutes.
- On-time minutes counter
  Counts the seconds since last system start.
- Temperature monitoring of CPU and Board temperature
  Min. and max. temperature values of CPU and board are stored in flash.
- Power cycles counter
- Watchdog Timer
  Set / Reset / Disable Watchdog Timer.
- System Restart Cause
  Power loss / Watchdog / External Reset.
- Flash area
  1kB Flash area for customer data
- Fan
  CPU-Fan is controlled by LEMT. Fan-Speed is readable in RPM.
- Voltage Monitor
- Protected Flash area
  128 Bytes for Keys, ID's, etc. can stored in a write- and clear-protectable region.
- Board Identify
  Vendor / Board / Serial number

Board Specific LEMT function - Get Voltage

The onboard Microcontroller of the Thunderbird-E3100 implements a Voltage Monitor and samples 7 Onboard-Voltages. The Voltages can be ready by calling the LEMT function “Get Voltages”. The function returns a 16 Bit value divided in Hi-Byte and Lo-Byte. The Channels are assigned to the Voltages in the following way:

ADC Channel	Voltage [16-bit value]
0	---
1	0.9V
2	1.8V
3	1.05V
4	1.5V
5	CPU-Vcore
6	5V
7	12V

The system voltages can be expressed as following equation:

Vx = ADC_CHANNEL_[1..5]*3.3/1024

The higher system voltages 5V and 12V can be expressed as following equation:

V5 = ADC_CHANNEL_[6]*22/12*3.3/1024

V12 = ADC_CHANNEL_[7]*62/15*3.3/1024

3.13 ASF System Management

The Thunderbird-E3100 provides remote access and manageability even in low-power and OS-absent states using the DMTF ASF standard.

ASF alerting capabilities include heartbeat signals to indicate the system is up and running on the network. Also included are environmental notifications such as thermal status of CPU, voltages and fan alerts, which send proactive warnings that something is wrong with the hardware. In addition, asset security is provided by cover tamper message (see INTRUDER Detect).

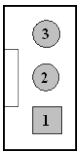
Remote-control capabilities allow to remotely power up, power down, power cycle, reset or reboot the system.

3.14 CPU Fan Supply

The Thunderbird-E3100 provides a connector to power a CPU fan, if the module is actively cooled. The output voltage is minimum 7V and is regulated to the temperature of the CPU.

Connector type: AMP-640456-3Pin
Matching connector: Molex 2.54mm (.100") Pitch KK® Crimp Terminal Housing, 3 Circuits

Pin	Signal
1	Speed Signal from fan (yellow)
2	+12VDC (red)
3	GND (black)

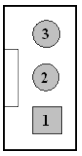


3.15 Chassis Fan Supply

The Thunderbird-E3100 provides a connector to power a Chassis fan.

Connector type: AMP-640456-3Pin
Matching connector: Molex 2.54mm (.100") Pitch KK® Crimp Terminal Housing, 3 Circuits

Pin	Signal
1	Speed Signal from fan (yellow)
2	+12VDC (red)
3	GND (black)



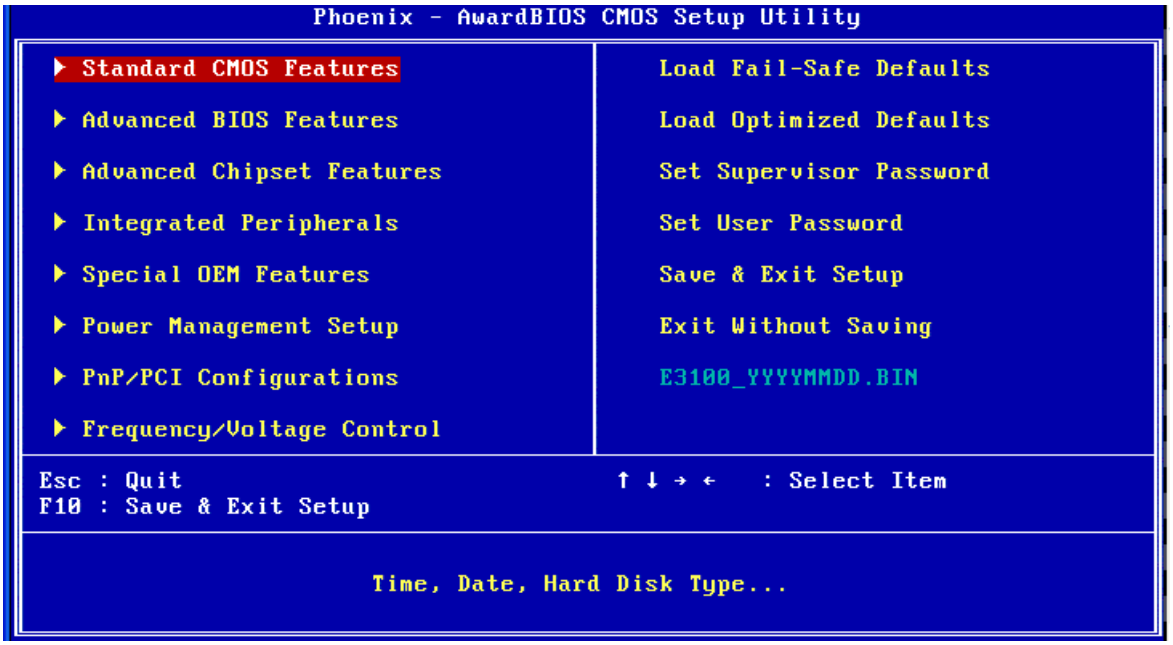
4. Using the Module

4.1 BIOS

The Thunderbird-E3100 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.

Setup

Pressing <**F2**> or <**DEL**> at power-up starts the setup utility.



Initialize BIOS at first startup

It is important to initialize the BIOS setting at first startup of the board.

Call setup by pressing <**F2**> or <**DEL**> at power-up and executed **Load Optimized Defaults**. Then use **Save & Exit Setup** to save and activate the new settings.

The "Optimized Defaults" is the optimized BIOS setup for the Cool RoadRunner-PM

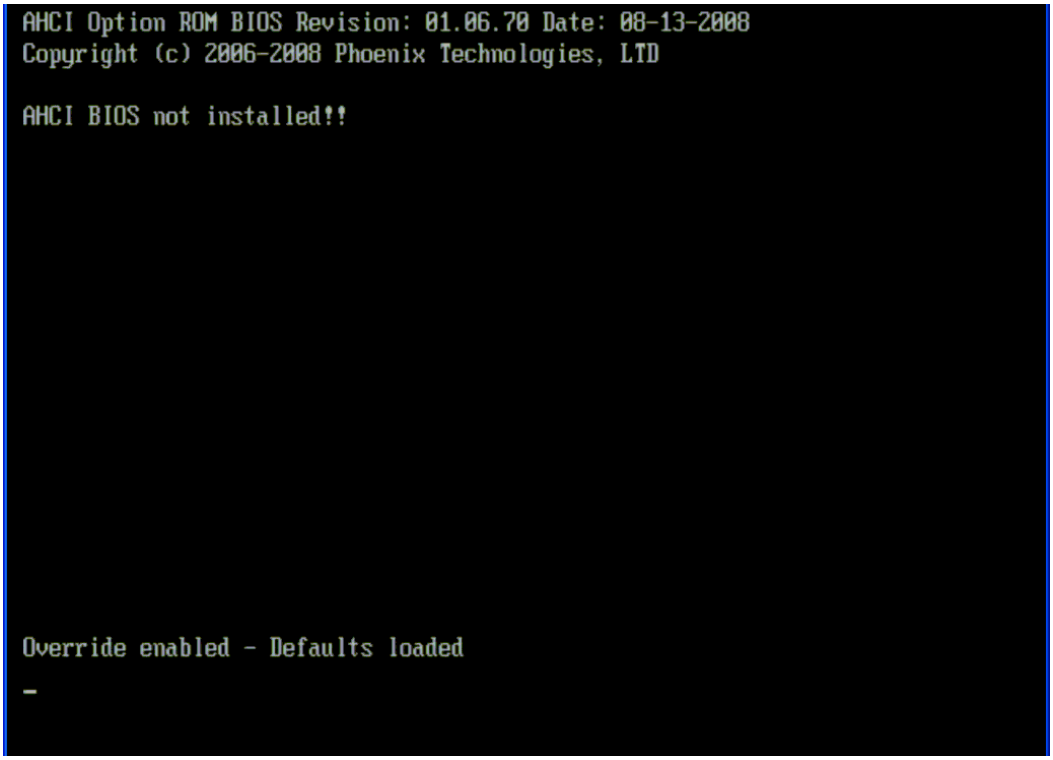
Booting from alternative device

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

Reload default BIOS values

To reload the default values automatically at power up JP1 must be plugged before power up. On power up the bios will recognize plugged JP1 and load the setup defaults.

You will see the following message :

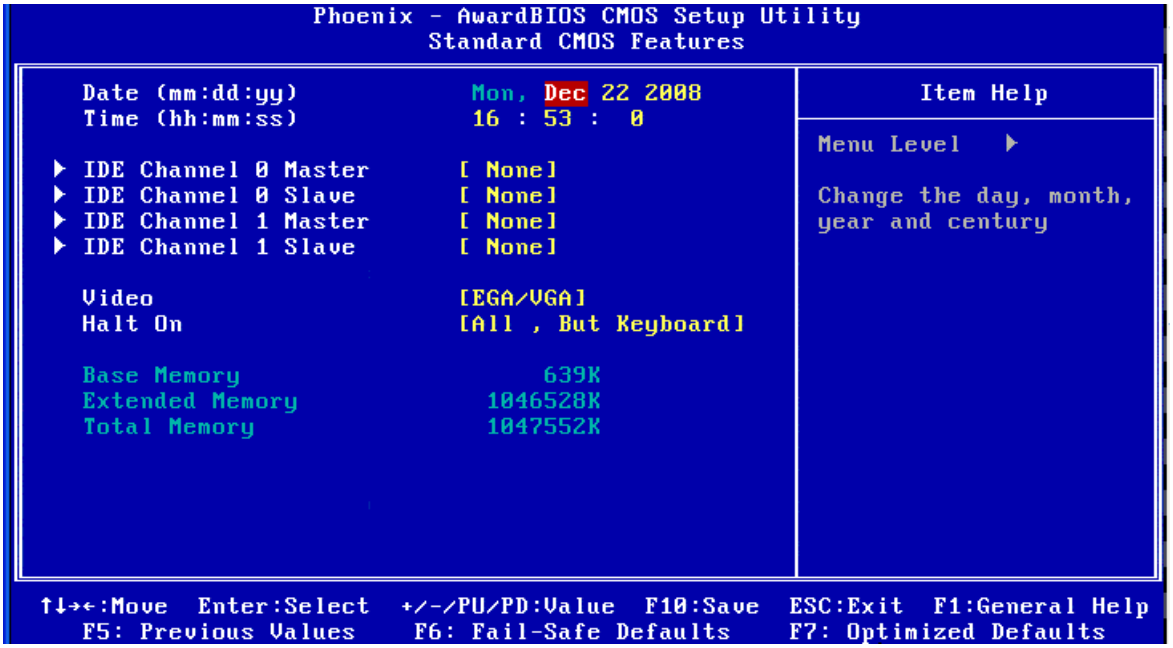


Then press <F1> to continue with default setup values and remove JP1 again.

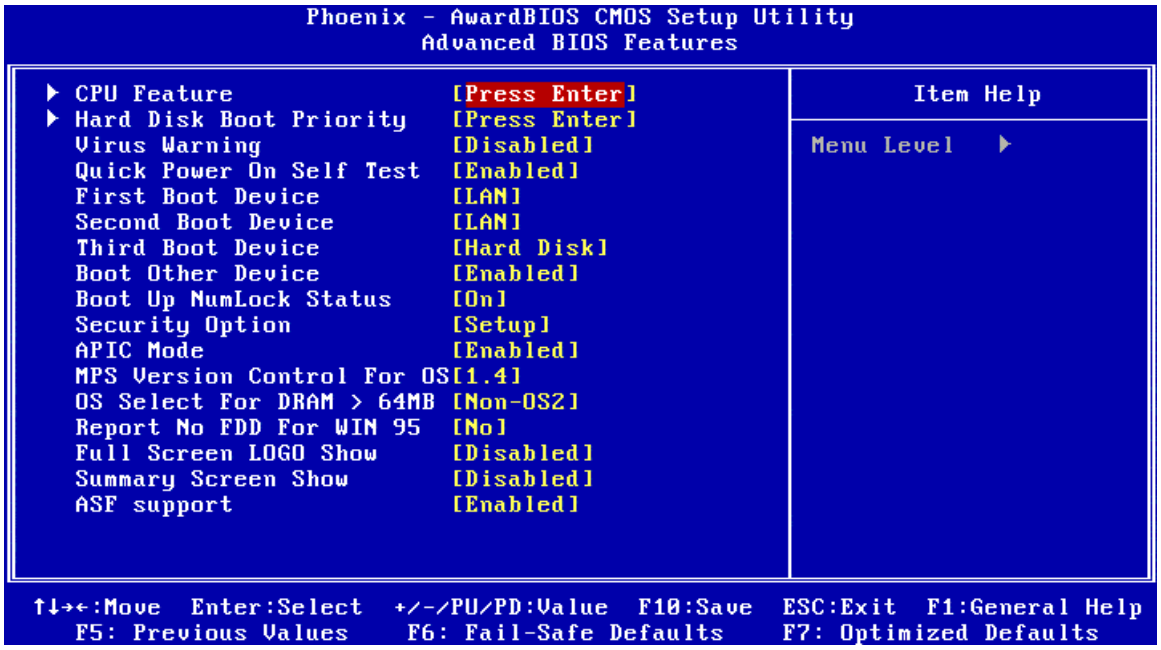
BIOS Screens

The BIOS setup utility allows setting of various board parameters. The following pictures show the different setup menus. The Cool RoadRunner-PM specific settings are explained here.

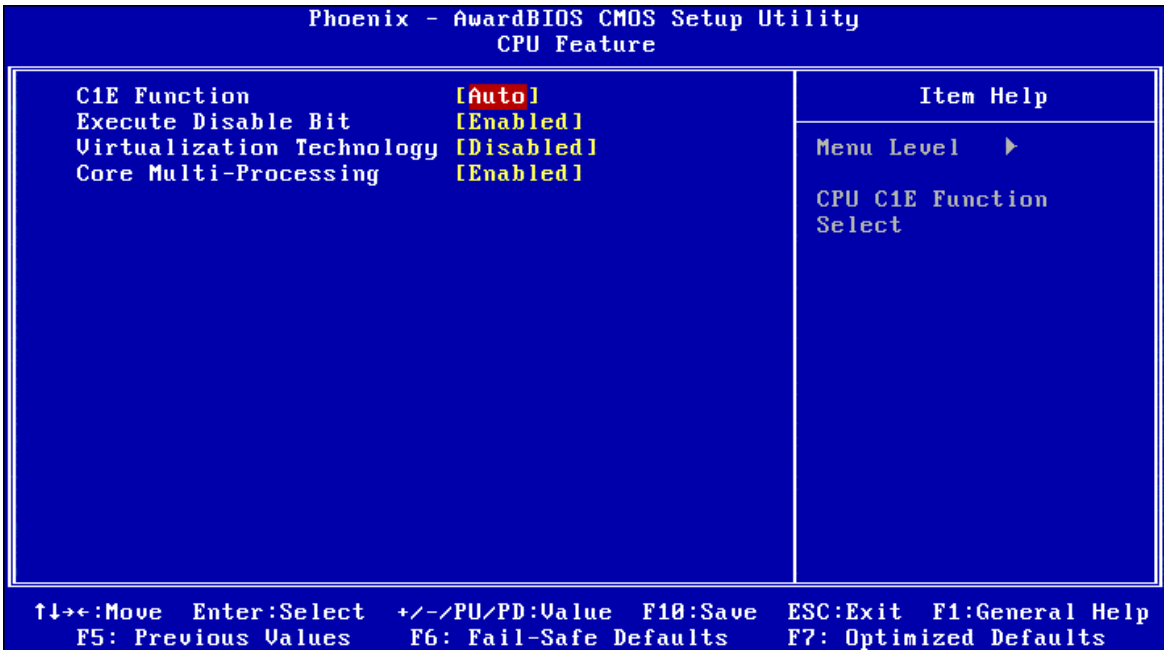
Standard CMOS Features



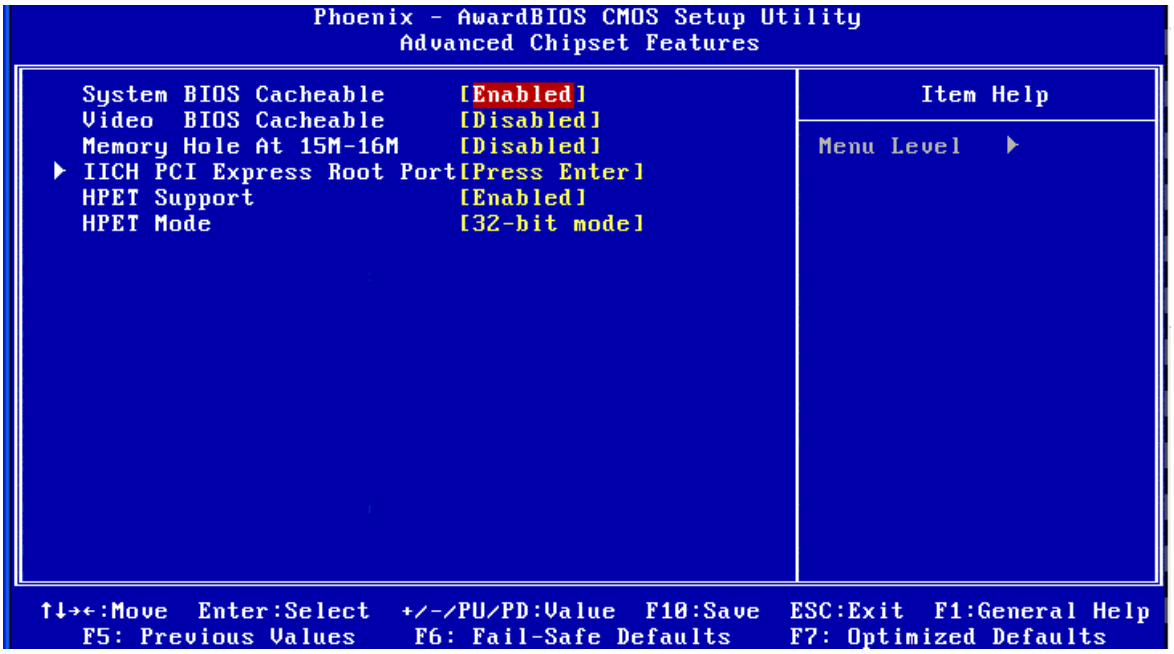
Advanced BIOS Features



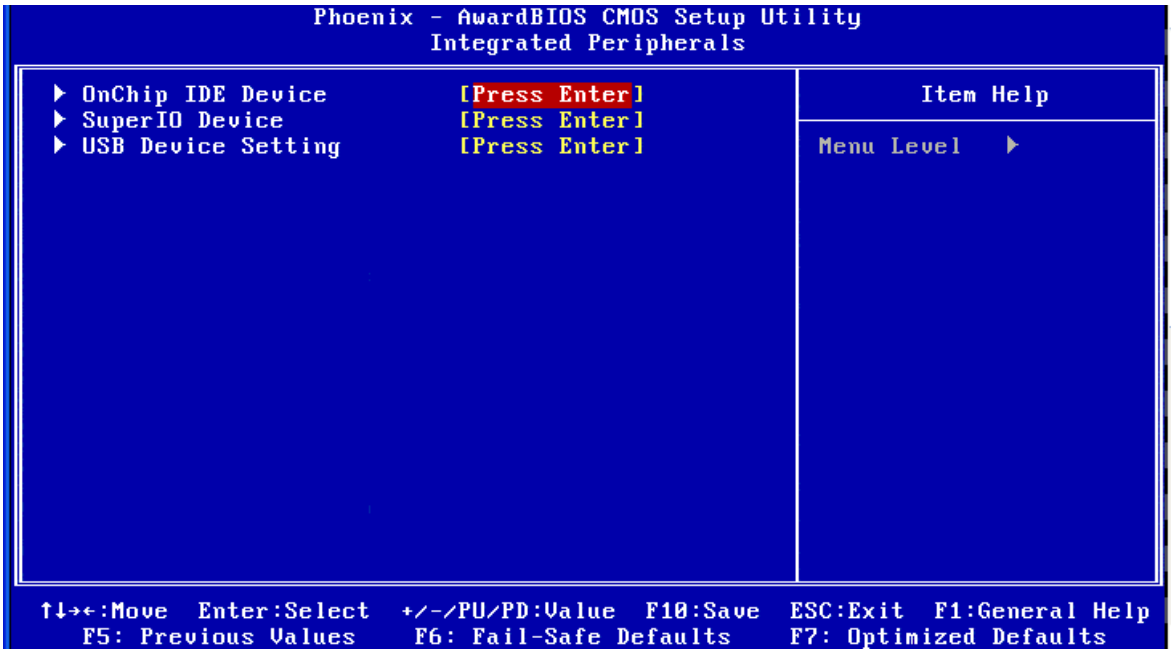
Advanced BIOS Features – CPU Feature



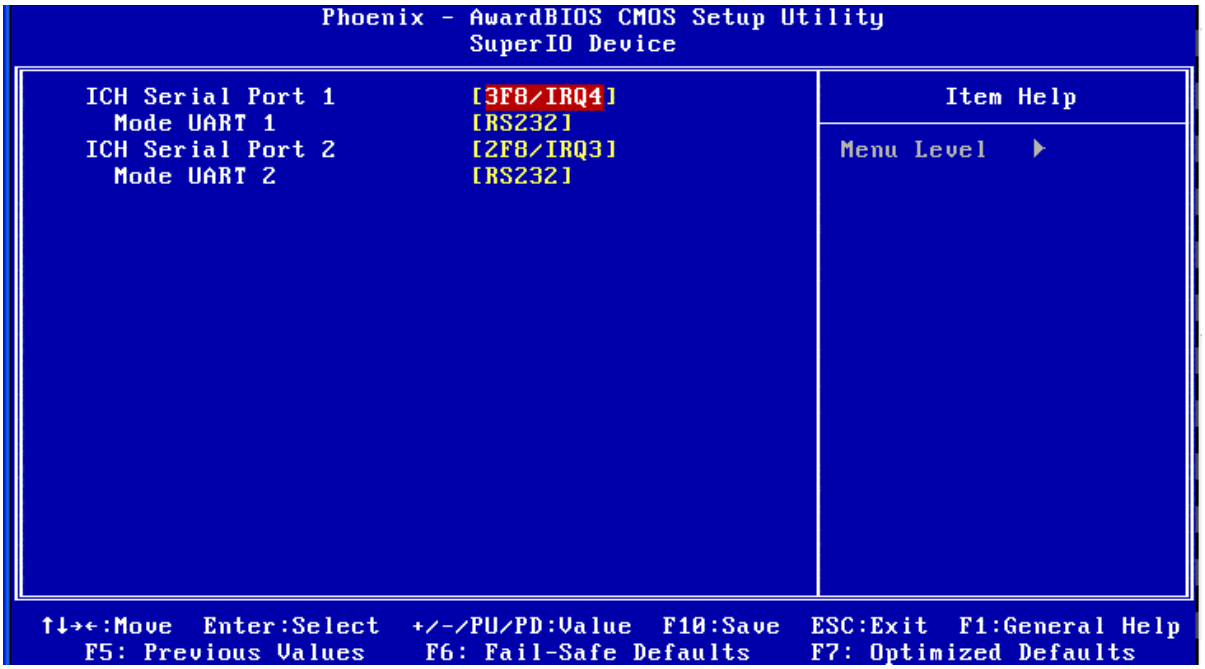
Advanced Chipset Features



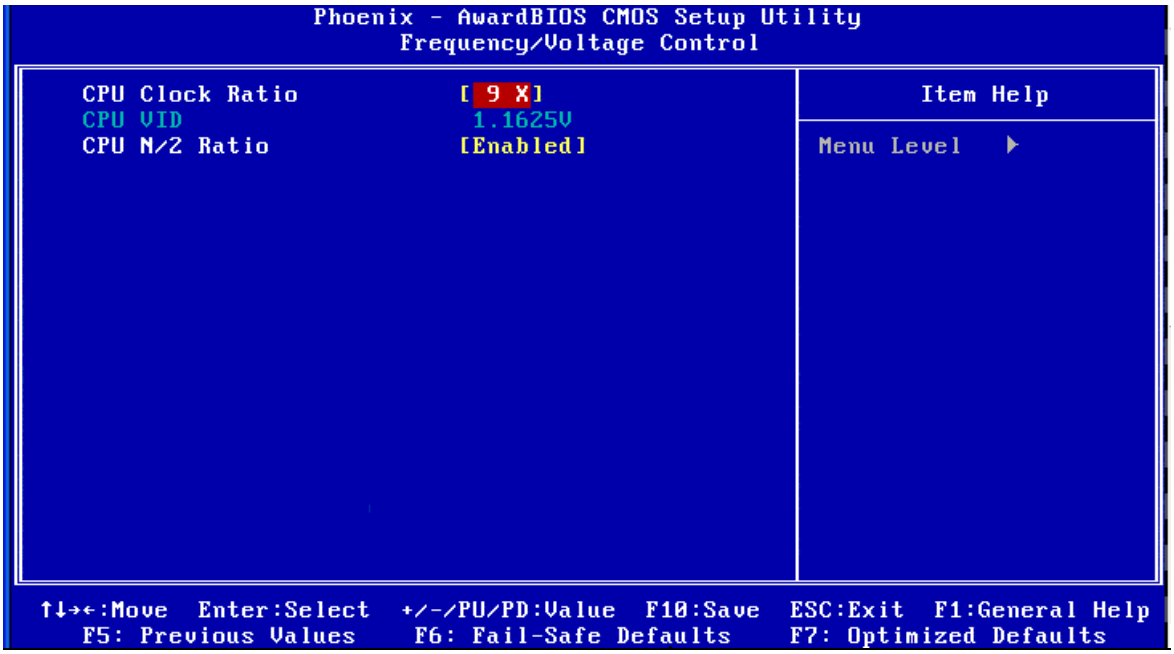
Integrated Peripherals

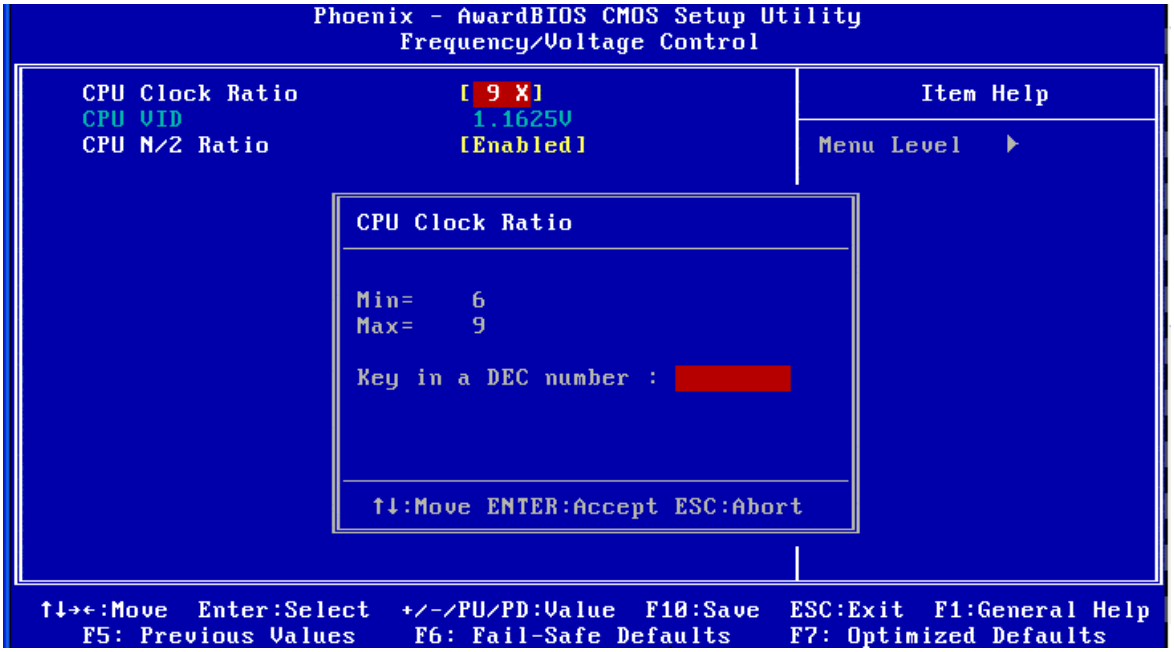


Integrated Peripherals – SuperIO Device



Frequency/Voltage Control



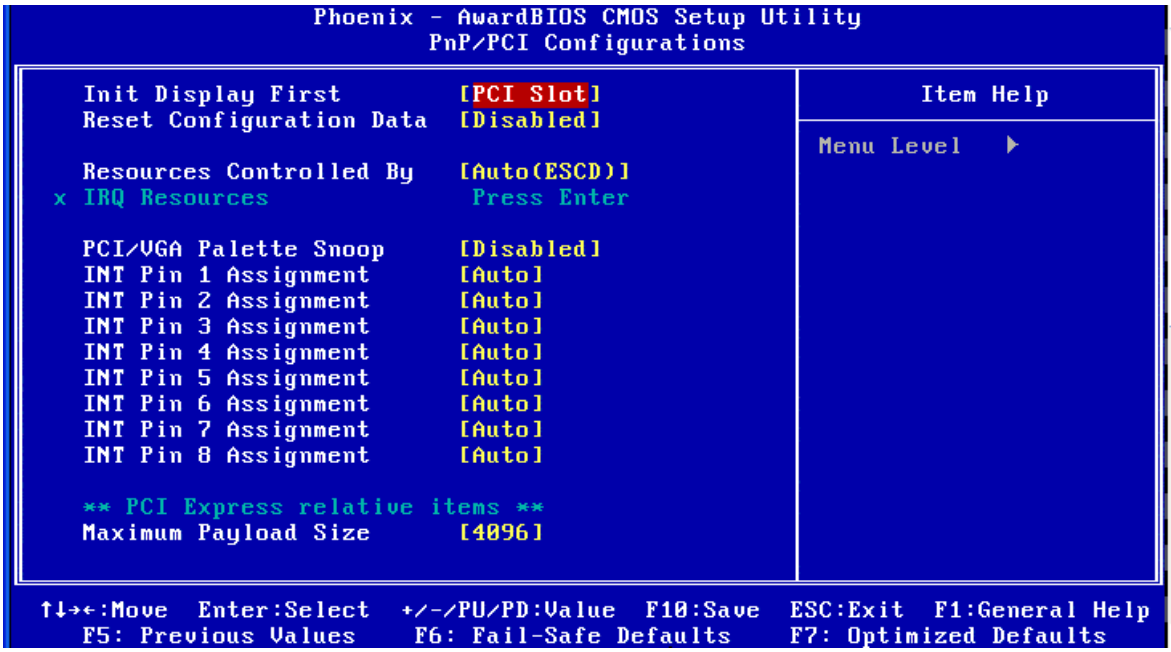


The CPU clock ratio is set by the BIOS, depending on the processor version used. Usually, this is the best setting possible. Changing these values is only recommended for very experienced users and should only be attempted after studying the processor's datasheet.

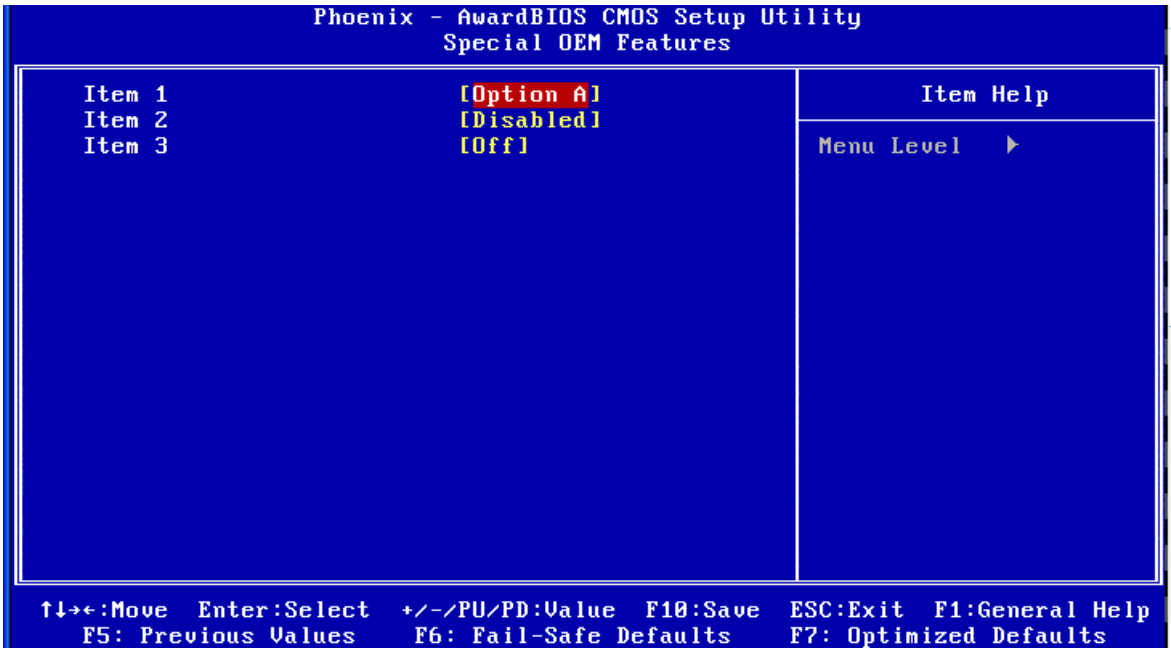
Caution

Use this feature on your own risk.

PnP/PCI Configurations

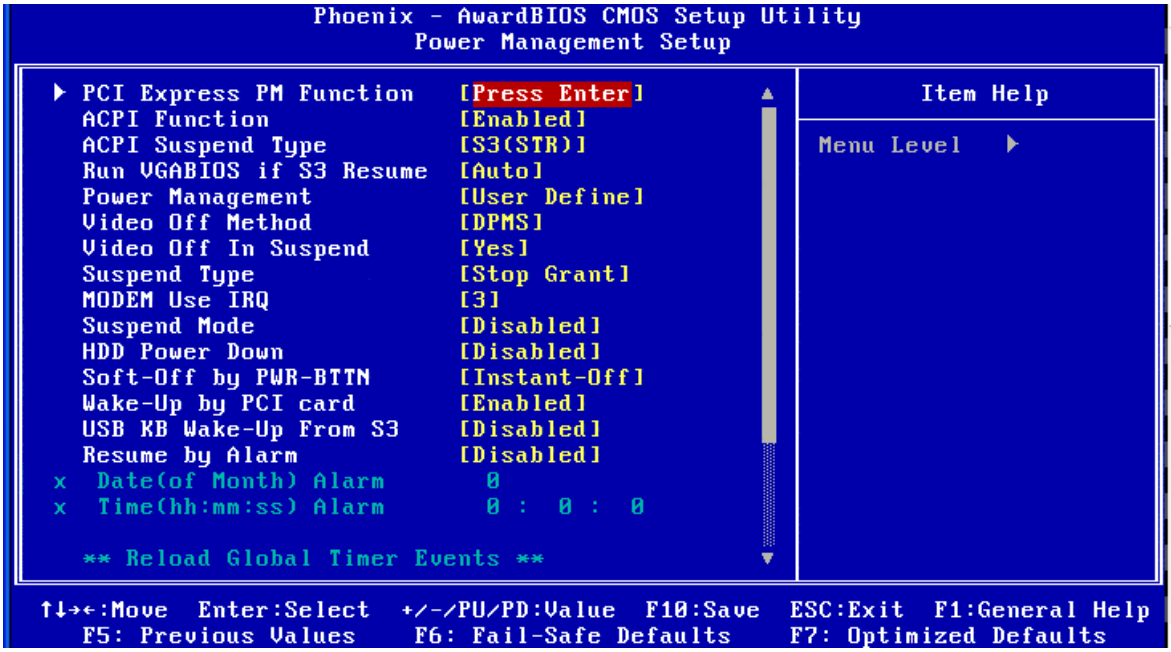


Special Features



This page is reserved for upcoming special features of the board.

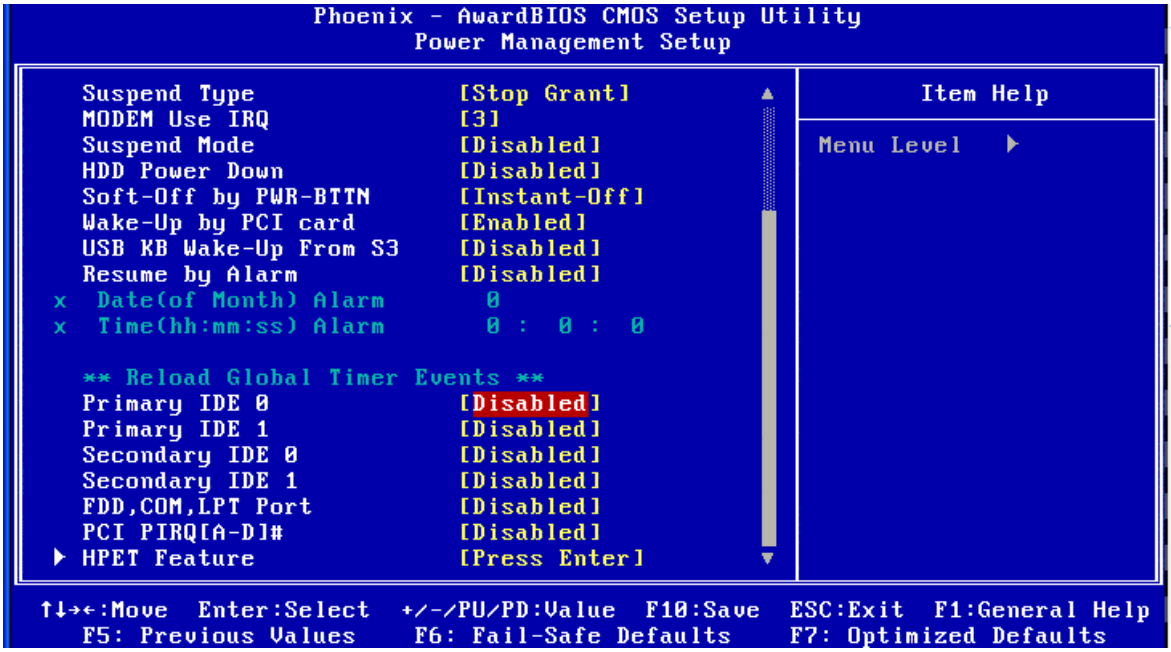
Power Management Setup, part 1



S1: POS – Power On Suspend
No instructions are executed by the processor, RAM contents are preserved

S3: Suspend To RAM (STR), Standby
The current processor context is saved to RAM, the processor itself and most peripherals are switched off. RAM content is preserved by hardware.

Power Management Setup, part 2



When enabled, the Reload Global Timer Events allow restarting the global standby timer when such an event occurs.

5. Address Maps

This section describes the mapping of the CPU memory and I/O address spaces. Also covered in this section is 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 (Hex)	Description
000000–09FFFF	Conventional Memory
0A0000–0AFFFF	VGA Adapter
0B0000–0BFFFF	VGA Adapter
0C0000–0DFFFF	Adapter ROM
0E0000–0EFFFF	System
0F0000–0FFFFF	System Bios
3FEE0000-3FEFFFFF	Motherboard resources
FEC00000-FFB7FFFF	Motherboard resources
FFB80000-FFBFFFFF	Intel FWH
FFF00000-FFFFFFFF	Motherboard resources
FFB80000-FFBFFFFF	Firmware Hub

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)	Description
0000-000F	DMA Controller 1 (8237)
0020-0021	Interrupt Controller 1 (8259)
0040-0043	Timer Controller (8254)
0060	Keyboard Controller Data Byte
0061	Speaker Control
0062-0063	Motherboard resources
0064	Kbd Ctlr, CMD,STAT Byte
0065-006F	Motherboard resources
0070-0073	Real Time Clock
0074-007F	Motherboard resources
0080-009F	DMA Page Registers
00A0-00A1	Interrupt Controller 2 (8259)
00C0-00DF	DMA Controller 1 (8237)
00F0-00FF	Math Coprocessor
0170-0177	Secondary IDE
01F0-01F7	Primary IDE
02F8-02FF	Serial Port 2
0376	Secondary IDE
03B0-03BB	VGA Controller
03C0-03DF	VGA Controller
03F6	Primary IDE
03F8-03FF	Serial Port 1
0400-04BF	Motherboard resources
04D0-04D1	Motherboard resources
0500-051F	SM Bus controller
0800-087F	Motherboard resources
0880-088F	Motherboard resources
0A000-0AFFF	PCI Express Port
0ACE0-0ACFF	82574 Ethernet Controller
0B000-0BFFF	PCI Express Port
0BCE0-0BCFF	82573 Ethernet Controller
0CF00-0CF7F	VGA Controller
0D000-0EFFF	PCI Express Port

Address Range (Hex)	Description
0FD00-0FD0F	IDE Controller
0FE00-0FE1F	USB Controller
0FF00-0FF1F	USB Controller

Interrupts

IRQ (Bus)	System Resource
NMI	Parity Error
0 (ISA)	Timer
3 (ISA)	Serial Port 2
4 (ISA)	Serial Port 1
6 (ISA)	Not used
7 (ISA)	Not used
8 (ISA)	Real Time Clock
9 (ISA)	ACPI Controller
10 (PCI)	Motherboard ressources
11 (PCI)	SM Bus Controller
12 (ISA)	Not used
13 (ISA)	Math Coprozessor
14 (ISA)	Primary IDE controller
15 (ISA)	Secondary IDE controller
16 (PCI)	USB Controller
16 (PCI)	PCI Express Port
16 (PCI)	Ethernet Controller 82573
17 (PCI)	Ethernet Controller 82574
19 (PCI)	USB Controller
20 (PCI)	USB Controller
23 (PCI)	USB Controller

DMA Channels

DMA	System Resource
0	User available
1	User available
2	User available
3	User available
4	DMA Controller
5	User Available
6	User Available
7	User Available

6. Troubleshooting

First steps if the Board does not boot:

- Check the status LED's P10 – P12 on the board. Is P11 blinking? Are all input voltages properly available?
- 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 on CPU Board?
- 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.
- Remove all additional devices from the system. Only the processor board, power supply, monitors and the keyboard should remain in the system.
- Replace the system RAM
- Assure your cooling measures work correctly and keep the processor at a reasonable temperature.
- 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.

If you need to send the board to LiPPERT for repair, be sure you get a Return Material Authorization number (RMA) first.
Check also Appendix B (Getting Help).

Appendix A, Contact Information

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Fax	+1 (678) 417 6273
E-mail	ussales@lippertembedded.com
	support@lippertembedded.com
Website	www.lippertembedded.com

Appendix B, Getting Help

Should you have technical questions that are not covered by the respective manuals, please contact our support department at **support@lippertembedded.com**.

Please allow one working day for an answer!

Technical manuals as well as other literature for all LiPPERT products can be found in the *Products* section of LiPPERT's website www.lippertembedded.com. Simply locate the product in question and follow the link to its manual.

Returning Products for Repair

To return a product to LiPPERT for repair, you need to get a Return Material Authorization (RMA) number first.
Please print the RMA Request Form from http://www.lippertembedded.com/service/repairs.html fill in the blanks and fax it to +49 621 4321430. We'll return it to you with the RMA number.

Deliveries without a valid RMA number are returned to sender at his own cost!

LiPPERT has a written Warranty and Repair Policy, which can be retrieved from http://www.lippertembedded.com/service/warranty.html

It describes how defective products are handled and what the related costs are. Please read this document carefully before returning a product.

Appendix C, Further Resources

http://www.lippertembedded.com

LiPPERT Embedded Computers' website with news and detailed information.

http://www.intel.com

Datasheet of the CPU, Chipset and Ethernet-Controller.

http://www.smbus.org

Information about the System Management Bus (SMBus)

http://www.phoenix.com/en/customer+services/bios/awardbios

Additional BIOS information.

Appendix D, Revision History

Filename	Date	Edited by	Change
TME-ITX-E3100-R0V0	2008-12-22	Ulrich Walther Matthias Fellhauer	Prerelease
TME-ITX-E3100-R0V1	2008-12-29	Matthias Fellhauer	Added: 1.3. Power consumption values 1.3 Mounting options 3.9 Intruder Detect input
TME-ITX-E3100-R0V2	2009-02-03	Jürgen Stauffer	3.1. Small corrections 3.12. LEMT functions corrected 3.12. Board specific LEMT added 3.13. ASF System Management added 4.1. Screen Shots “Advanced BIOS Features” and “Advanced BIOS Features - CPU Feature” corrected
TME-ITX-E3100-R0V3	2009-08-25	PK	Phone number and links corrected
TME-ITX-E3100-R0V4	2009-09-16	Jürgen Stauffer	1.3. MTBF added 3.8. Note for 12V-only added 3.14. CPU Fan Supply is regulated 6. Status check with LED's P10-P12
TME-ITX-E3100-R0V5	2010-01-26	MF	3.3 LVDS and backlight connector is not assembled on standard version 3.5 Note on USB booting support
TME-ITX-E3100-R0V6	2010-01-27	MF	Layout corrected
TME-ITX-E3100-R0V7	2010-07-29	MS/OF	Matching parts / connectors added Corrected CPU speed
TME-ITX-E3100-R0V8	2011-04-27	MF	2.4 Included note for hardware setup if only one RAM module is used