Express-CBR
(Computer On Module)
Reference Manual

P/N 50-1Z040-1020

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Notice Page

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REVISION HISTORY

Revision	Reason for Change	Date
1000	Initial Release	June/10
1010	Updated PU/PD info in COM Express pinout tables; added BIOS Setup Menus section to Chapter 4	Feb/11
1.02	Added Running Time initialization procedure to "BIOS Main Setup Screen" on page 35; changed revision of this document from 1010 to 1.02 in compliance with converting the revision scheme from Ampro to ADLINK	Sept/15

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Audience

This manual provides reference only for computer design engineers, including but not limited to hardware and software designers and applications engineers. ADLINK Technology, Inc. assumes you are qualified to design and implement prototype computer equipment.

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Chapter 1 About This Manual

Purpose of this Manual

This manual is for designers of systems based on the Express-CBR (Computer On Module). This manual contains information that permits designers to create an embedded system based on specific design requirements.

Information provided in this reference manual includes:

- Express-CBR specifications
- Environmental requirements
- Major ICs and features implemented
- Express-CBR connector/pin numbers and definitions
- BIOS Setup information

Information not provided in this reference manual includes:

- Detailed chip specifications
- Internal component operation
- Internal registers or signal operations
- Bus or signal timing for industry standard busses and signals
- Pinout definitions for industry standard interfaces

References

The following list of references may be helpful for you to complete your custom design successfully.

Specifications

- COM Express Specification Revision 1.0

  Web site: http://www.picmg.org/
- PCI Specification Revision 2.3

  Web site: http://www.pcisig.com
- PCIe Specification Revision 1.1

  Web site: http://www.pcisig.com/specifications/pciexpress/base

Chip Specifications

- Intel® Corporation and the Core™ i7 -600 series CPU, used for the integrated processor core and graphics memory hub

  Web site: http://www.intel.com/products/processor/corei7/mobile/techdocs.htm
- Intel Corporation and the BD82QM57 chip, used for the Platform Controller Hub

  Datasheet: http://www.intel.com/Assets/PDF/datasheet/322169.pdf = PCH

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- Intel Corporation and the 82574IT chip used for the Gigabit Ethernet controller

  Datasheet: http://download.intel.com/design/network/datashts/82574.pdf

NOTE	If you are unable to locate the datasheets using the links provided, go to the manufacturer's web site where you can perform a search using the chip datasheet number or name listed, including the extension (htm for web page, pdf for file name, etc.)

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Chapter 2 Product Overview

This introduction presents general information about the COM Express™ architecture and the Express-CBR Computer-On-Module (COM). After reading this chapter you should understand:

- COM Express concept
- COM Express architecture
- Express-CBR features
- Express-CBR functional block diagram
- Express-CBR major components
- Express-CBR connectors
- Express-CBR specifications

COM Express Concept

COM Express is an open industry standard defined specifically for COMs (Computer On Modules). Its creation provides the ability to make a smooth transition from legacy parallel interfaces to the newest technologies based on serial buses available today. COM Express modules are available in the following form factors:

- Compact 95mm x 95mm
- Basic 125mm x 95mm
- Extended 155mm x 110mm

The COM Express specification 1.0 defines five different pinout types.

Table 2-1. COM Express Pinout Types

Types	Connector Rows	PCI Express Lanes	PCI	IDE Channels	LAN ports
Type 1	A-B	Up to 6			1
Type 2	A-B C-D	Up to 22	32 bit	1	1
Type 3	A-B C-D	Up to 22	32 bit		3
Type 4	A-B C-D	Up to 32		1	1
Type 5	A-B C-D	Up to 32			3

The Express-CBR utilizes the Type 2 pinout definition, equipped with two high performance connectors that ensure stable data throughput.

The COM (Computer On Module) integrates all the core components and is mounted onto an application specific baseboard. COM modules are legacy-free designs (no Super I/O, PS/2 keyboard, and PS/2 mouse) and provide most of the functional requirements for any application. These functions include, but are not limited to a rich complement of contemporary, high bandwidth serial interfaces such as PCI Express, Serial ATA, USB 2.0, and Gigabit Ethernet. The Type 2 pinout provides the ability to offer 32-bit PCI, Parallel ATA, and LPC options thereby expanding the range of potential peripherals. The robust thermal and mechanical concept, combined with extended power management capabilities, is perfectly suited for all applications.

Baseboard designers can utilize as little or as many of the I/O interfaces as necessary. The baseboard can therefore provide all the interface connectors required to attach the system to the application specific peripherals. This versatility allows the designer to create a dense and optimized package, which results in a more reliable product while simplifying system integration. Most importantly, COM Express modules are scalable, which means once an application has been created there is the ability to diversify the product range through the use of different performance class or form factor modules. Simply unplug one module and replace it with another. No redesign is necessary.

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COM Express Architecture

The COM Express specification was developed by the PCI Industrial Computer Manufacturing Group (PICMG) in close collaboration with many leading companies across the embedded industry in order to find an implementation solution to handle upcoming new high speed serial I/Os, processors, and chipsets. COM Express specifies three form factors, as well as five different types of connector pinouts.

The three form factors are referred to as Compact, Basic, and Extended. The Compact form factor is 95mm x 95mm designed to match the requirements of small applications. The Basic module footprint is 125mm x 95mm and focuses on space-constrained, low power systems which typically do not contain more than one horizontal mounted SODIMM. The Extended footprint is slightly larger at 155mm x 110mm and supports up to two full-size, vertically mounted DIMM modules to accommodate larger memory configurations for high-performance CPUs, chipsets and multiprocessor systems. The placement of the shielded 220-pin connectors and the mounting holes are identical between these three footprints.

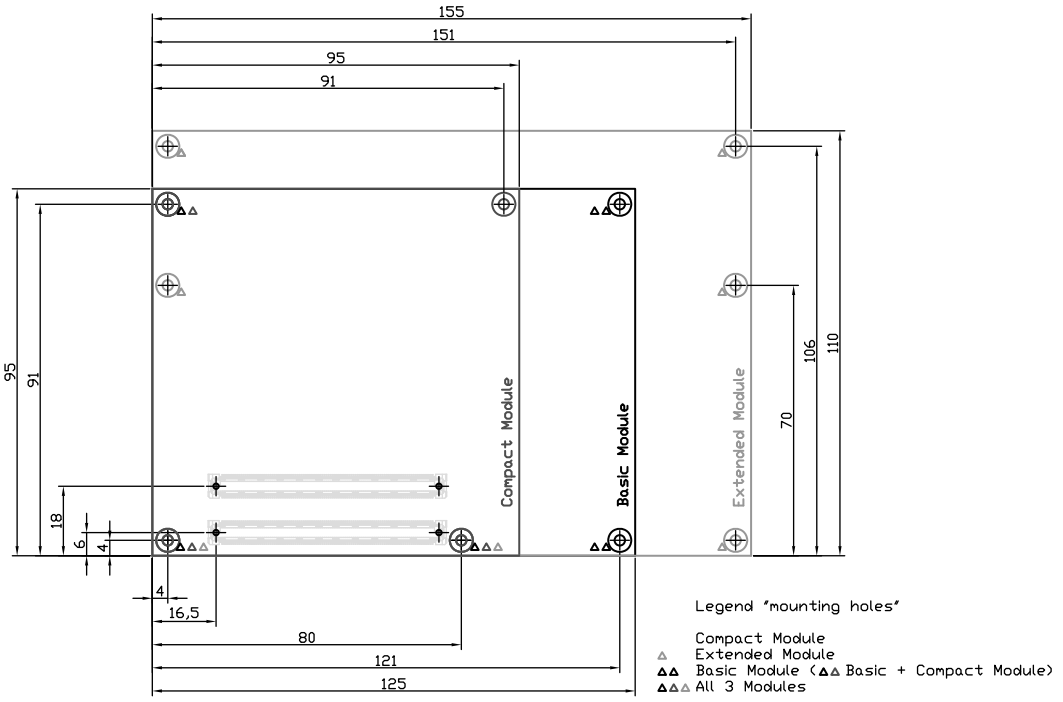


Figure 2-1. Compact, Basic and Extended Form Factors

Product Description

The Express-CBR is an exceptionally high integration, high performance, rugged Intel Core™ i7 processor based system compatible with the COM Express standard. This rugged and high quality module system contains all the component subsystems of an ATX motherboard.

The Intel Core i7 incorporates a dual processor core with an integrated Graphics and Memory Hub (GMH), providing a low-power, high-performance processor, a memory controller for up to 8GB of SODIMM memory, and a graphics controller for LVDS, VGA, and PCI Express graphics (PEG) signals.

The Intel BD82QM57 chipset provides controllers for the Platform Controller Hub (PCH) featuring eight USB ports, four SATA ports, eight GPIO ports, one Ultra DMA 33/66/100 IDE controller supporting two IDE drives, and one Gigabit Ethernet interface (external magnetics required).

Expansion for additional system functions is possible on the Express-CBR through the PCI, PCIe, and LPC expansion buses. The PCI bus operates at a clock speed of 33MHz.

The Express-CBR is particularly well suited to either embedded or portable applications and meets the size, power consumption, temperature range, quality, and reliability demands of embedded system applications.

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Module Features

- CPU
  - Intel 1.06GHz or 2.0GHz LV, Core i7 -600 series processor
  - DMI (Direct Media Interface) with 1 GB/s of bandwidth in each direction
  - Internal 4MB L2 cache
  - Enhanced Intel SpeedStep® Technology (EIST)
- Memory
  - Two standard 204-pin DDR3 SODIMM sockets
  - Supports +1.5V DDR3, 800/1066MHz RAM up to 8 GB total
  - Supports non-ECC, unbuffered memory
- Interface Buses
  - PCI between PCH and COM Express A-B connector
  - PCIe between PCH and COM Express C-D connector
  - DMI (Direct Media Interface) between processor and PCH
  - FDI (Flexible Display Interface) between graphics controller and PCH
  - LPC (Low Pin Count) for LPC devices
  - I^2C for fast mode I^2C devices
- COM Express Interface
  - IDE Interface
    - Supports one enhanced IDE device
    - Supports single master mode
    - Supports Ultra DMA 100/66/33 in master mode
    - Supports ATAPI and DVD peripherals
    - Supports IDE native and ATA compatibility modes
  - SATA Interface
    - Provides four SATA ports
    - Supports Native Command Queuing
    - Provides Auto Activate for DMA
    - Supports Hot Plug features
  - HD Audio
    - Provides Intel HD Audio controller
    - Provides 32-bit sample depth
    - Supports sample rates up to 192kHz
  - USB Port Interface
    - Supports two root USB hubs
    - Supports eight USB ports
    - Supports USB V2.0

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- Ethernet Interface
  - Intel 82574IT Ethernet controller chip
  - Supports one Gigabit Ethernet port
  - Supports IEEE 802.3 compatible physical layer
  - Supports Auto-negotiation for speed, duplex mode, and flow control
  - Supports full-duplex or half-duplex modes
    - Full-duplex mode supports transmit and receive frames simultaneously
    - Supports IEEE 802.3x flow control in full duplex mode
    - Half-duplex mode supports enhanced proprietary collision reduction mode

- Video Interfaces (VGA/LVDS/PEG)
  - Support VGA (up to 2048 x 1536 bpp at 75Hz)
  - 24-bit flat panel outputs (LVDS)
  - Digital Display Interface (SDVO B)
  - PCI Express Graphics (PEG) Interface

- Miscellaneous
  - Real Time Clock (RTC) with external replaceable battery
  - Watchdog Timer (WDT)
  - TPM (Trusted Platform Module) - **Optional**
  - CPU Temperature Monitor
  - Logo Screen Utility (Splash)

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Block Diagram

Figure 2-2 shows the functional components of the module.

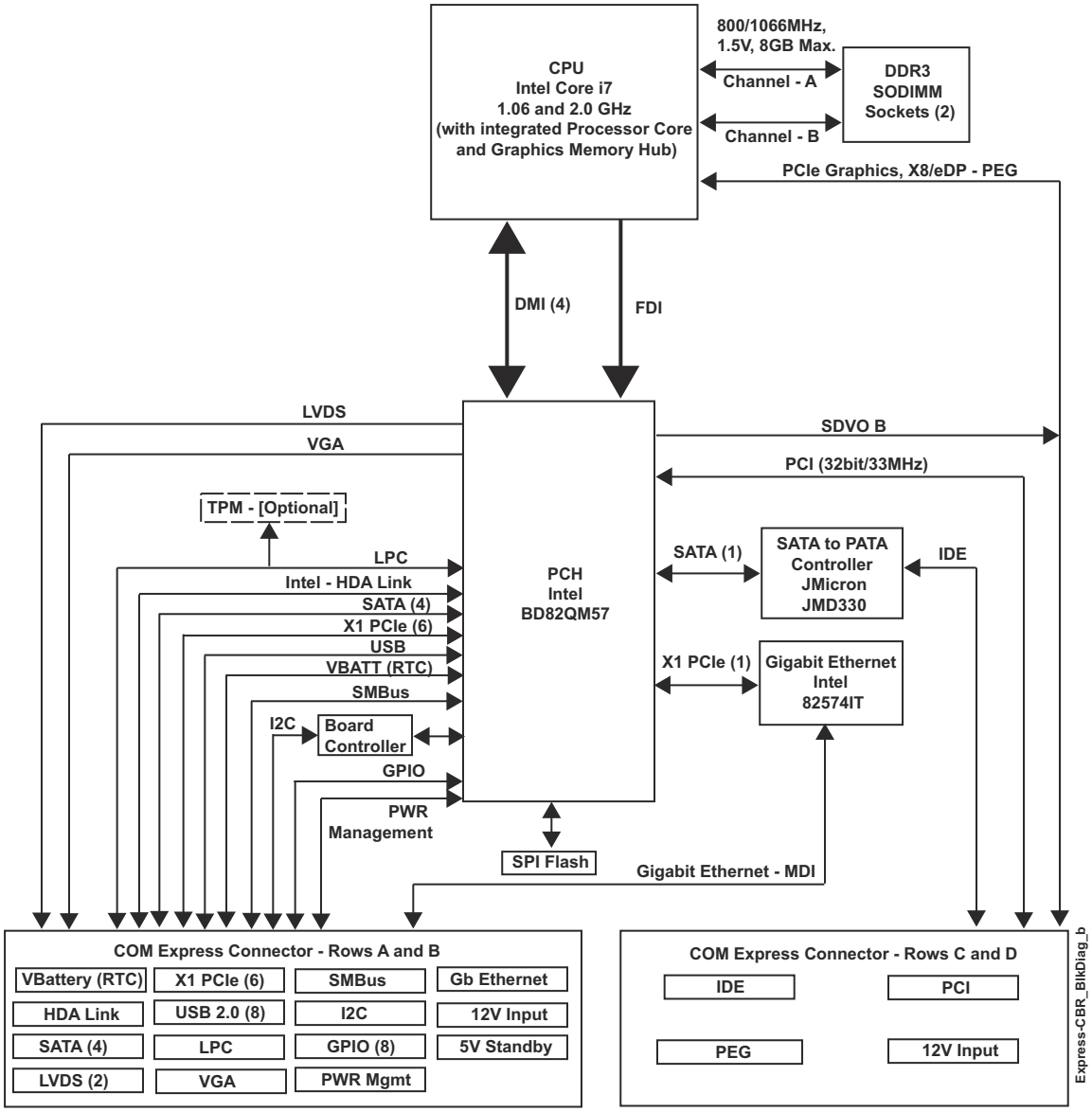


Figure 2-2. Functional Block Diagram

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Major Components (ICs)

Table 2-2 lists the major integrated circuits on the Express-CBR, including a brief description of each IC. Figures 2-3 and 2-4 show the locations of the major ICs.

Table 2-2. Major Integrated Circuit Descriptions and Functions

Chip Type	Mfg.	Model	Description	Function
CPU (U1)	Intel	Core i7	1.06GHz and 2.0GHz 512KB L2 cache processors	Integrated CPU, memory, and video
PCH (Platform Controller Hub [U3])	Intel	BD82QM57 (PCH)	Southbridge I/O controller functions	I/O functions
Ethernet Controller (U10)	Intel	82574IT	Ethernet Controller – This chip provides Gigabit Ethernet function	Ethernet
SATA to PATA Controller (U12)	JMicron	JMD330APC1-QIBD	Provides function for converting SATA signals to PATA signals	Signal Conversion
TPM (Trusted Platform Module [U35]) - **Optional**	Infineon	SLB9635TT1.2	Provides security functions **Caution:** Boards with the TPM option, feature only one temperature range from -20° to +70°C.	Security
Board Controller (U27)	Atmel	ATMEGA168V-10AU	Provides control for I²C, Watchdog Timer, and LVDS functions	Micro Controller

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Key:
U1 - CPU
U3 - PCH
U10 - Ethernet Controller
U12 - SATA to PATA Controller
U35 - TPM [Optional]

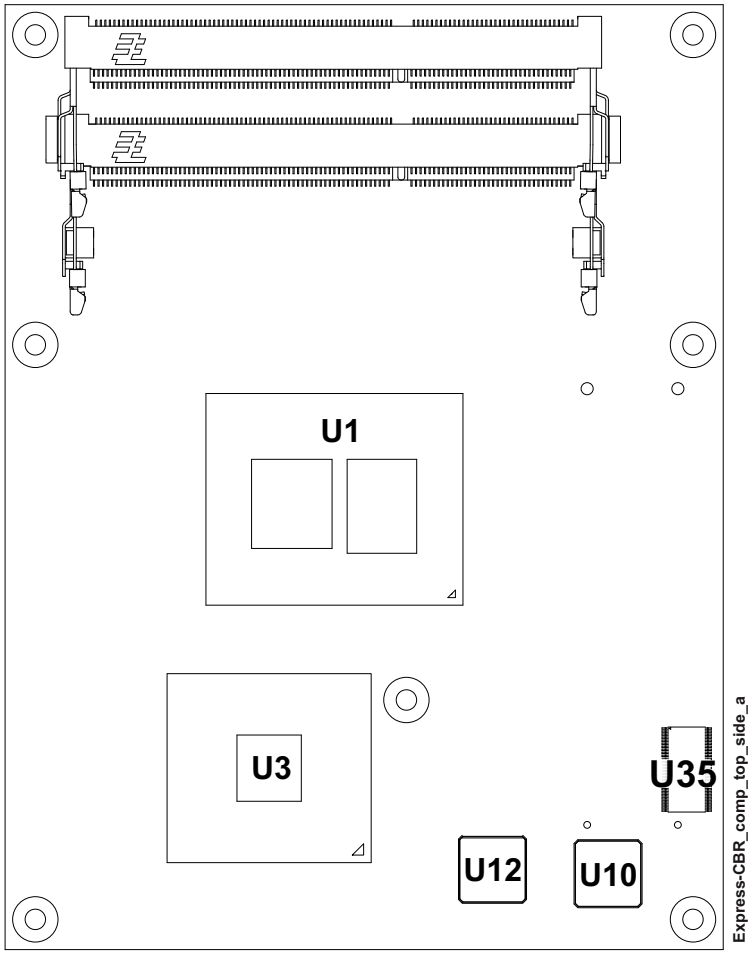


Figure 2-3. Component Locations (Top Side)

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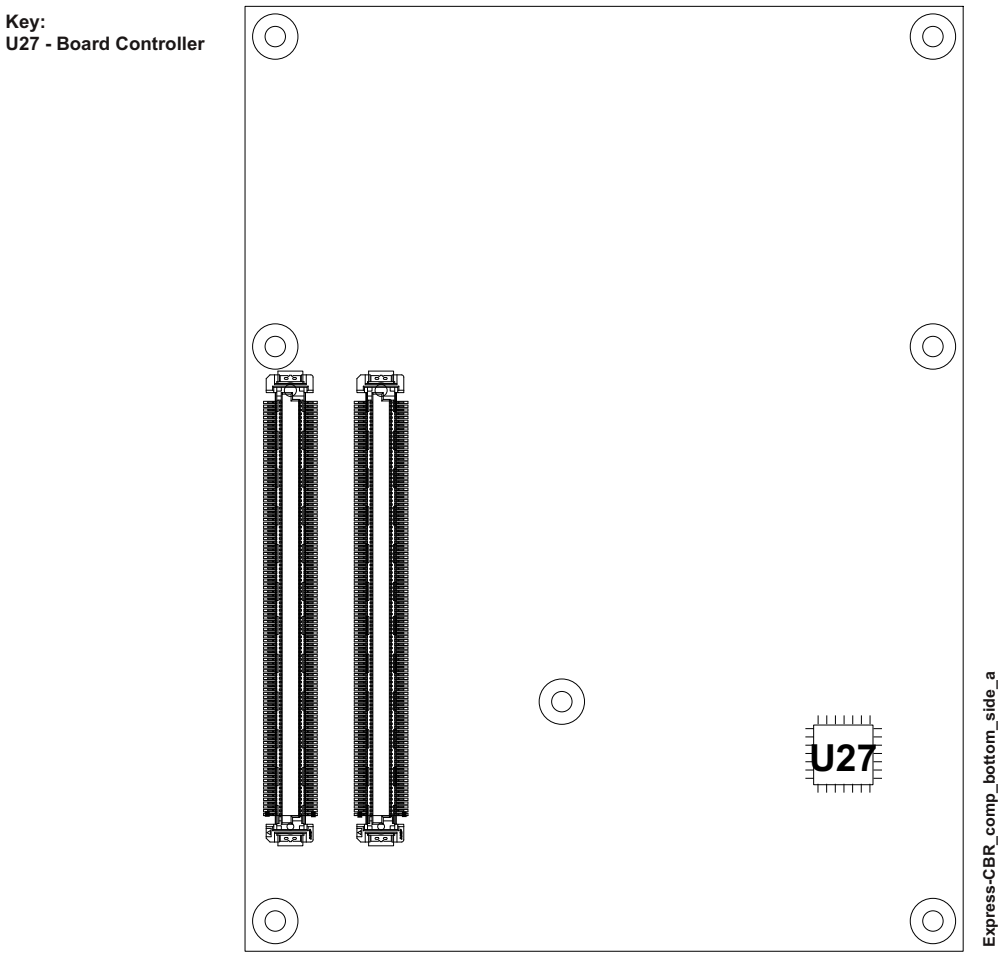


Figure 2-4. Component Locations (Bottom Side)

Connectors and Sockets

Table 2-3 describes the connectors and sockets shown in Figures 2-5 and 2-6.

Table 2-3. Module Connector and Socket Descriptions

Jack/Plug #	Board Access	Description
J5 – Memory	Top	204-pin socket for DDR3 SODIMM
J6 – Memory	Top	204-pin socket for DDR3 SODIMM
J4 – COM Express A-B (see Figure 2-6 on page 12.)	Bottom	220-pin connector for Northbridge Video and Southbridge I/O functions.
J4 – COM Express C-D (see Figure 2-6 on page 12.)	Bottom	220-pin connector for Northbridge Video and Southbridge I/O functions.

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Key:
J5 - DDR3 SODIMM Socket
J6 - DDR3 SODIMM Socket

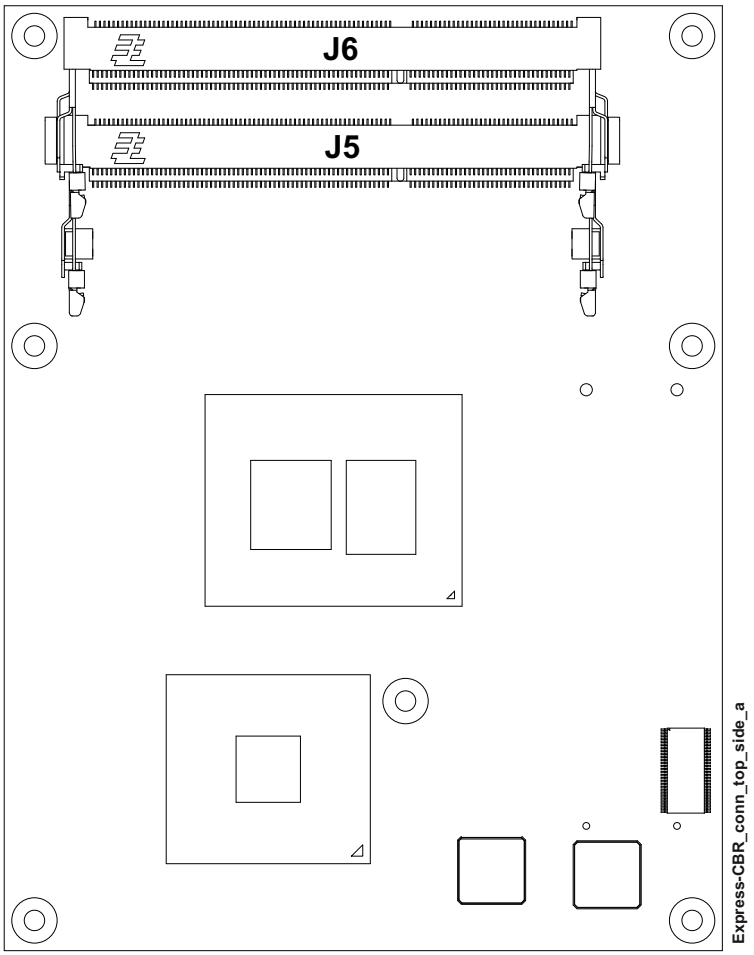


Figure 2-5. Connector Locations (Top Side)

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Key:
J4A - COM Express pins A1-A110
J4B - COM Express pins B1-B110
J4C - COM Express pins C1-C110
J4D - COM Express pins D1-D110

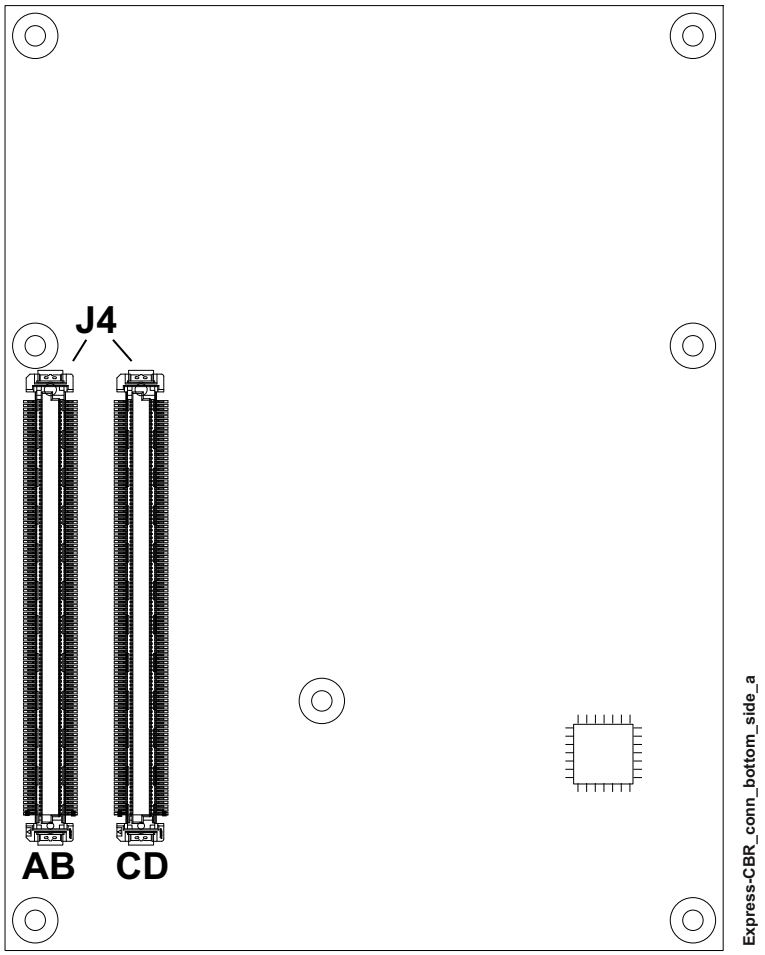


Figure 2-6. Connector Locations (Bottom Side)

Specifications

Physical Specifications

Table 2-4 lists the physical dimensions of the module.

Table 2-4. Weight and Footprint Dimensions

Item	Dimension
Weight	0.09 kg (0.20 lb)
Height (overall)	9.20 mm (0.36 inches)
Board thickness	2.362 mm (0.093 inches)
Width	95.00 mm (3.74 inches)
Length	125.00 mm (4.92 inches)

NOTE Overall height is measured from the upper board surface to the highest permanent component on the upper board surface. This measurement does not include the cooling solution, which can vary. The cooling solution could increase this dimension.

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Power Specifications

Tables 2-5 through 2-8 show the power requirements for the Express-CBR with 1.06 and 2.0 GHz CPU and a 430 watt power supply. Tables 2-5 and 2-6 describe the board with CPU Turbo Mode enabled. Tables 2-7 and 2-8 describe the board with CPU Turbo Mode disabled.

Table 2-5. Power Supply Requirements (1.06 GHz CPU with CPU Turbo Mode enabled)

Parameter	Baseboard: COM Express (EBX)		Baseboard: COM Express (ATX Types 1 and 2)	
Input Type (430 watt power supply)	+5V Standby	+12V Regulated DC	+5V Standby	+12V Regulated DC
In-rush Voltage & Current	2.550A	5.800A	2.150A	7.700A
Typical Idle Power (DOS 6.2)	0.200A (1.000W)	1.300A (15.600W)	0.020A (0.100W)	1.550A (18.600W)
Typical Idle Power (Windows XP)	0.200A (1.000W)	1.000A (12.000W)	0.020A (0.100W)	1.350A (16.200W)
BIT Voltage & Current	0.205A (1.020W)	1.650A (19.800W)	0.490A (2.450W)	2.100A (25.200W)
S3 Mode	0.940A (4.700W)	N/A	0.650A (3.250W)	N/A
S5 Mode	0.610A (3.050W)	N/A	0.490A (2.450W)	N/A

Table 2-6. Power Supply Requirements (2.0 GHz CPU with CPU Turbo Mode enabled)

Parameter	Baseboard: COM Express (EBX)		Baseboard: COM Express (ATX Types 1 and 2)	
Input Type (430 watt power supply)	+5V Standby	+12V Regulated DC	+5V Standby	+12V Regulated DC
In-rush Voltage & Current	2.650A	5.950A	2.250A	7.700A
Typical Idle Power (DOS 6.2)	0.200A (1.000W)	1.550A (18.600W)	0.030A (0.150W)	1.850A (21.600W)
Typical Idle Power (Windows XP)	0.200A (1.000W)	1.300A (15.600W)	0.020A (0.100W)	1.500A (18.000W)
BIT Voltage & Current	0.205A (1.020W)	2.600A (31.200W)	0.500A (2.500W)	2.650A (28.800W)
S3 Mode	0.940A (4.700W)	N/A	0.650A (3.250W)	N/A
S5 Mode	0.610A (3.050W)	N/A	0.490A (2.450W)	N/A

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Table 2-7. Power Supply Requirements (1.06 GHz CPU with CPU Turbo Mode disabled)

Parameter	Baseboard: COM Express (EBX)		Baseboard: COM Express (ATX Types 1 and 2)	
Input Type (430 watt power supply)	+5V Standby	+12V Regulated DC	+5V Standby	+12V Regulated DC
In-rush Voltage & Current	2.650A	5.800A	2.150A	7.700A
Typical Idle Power (DOS 6.2)	0.200A (1.000W)	1.250A (15.000W)	0.200A (1.000W)	1.500A (18.000W)
Typical Idle Power (Windows XP)	0.200A (1.000W)	1.000A (12.000W)	0.200A (1.000W)	1.350A (16.200W)
BIT Voltage & Current	0.205A (1.020W)	1.550A (18.600W)	0.490A (2.450W)	1.950A (23.400W)
S3 Mode	0.940A (4.700W)	N/A	0.650A (3.250W)	N/A
S5 Mode	0.610A (3.050W)	N/A	0.490A (2.450W)	N/A

Table 2-8. Power Supply Requirements (2.0 GHz CPU with CPU Turbo Mode disabled)

Parameter	Baseboard: COM Express (EBX)		Baseboard: COM Express (ATX Types 1 and 2)	
Input Type (430 watt power supply)	+5V Standby	+12V Regulated DC	+5V Standby	+12V Regulated DC
In-rush Voltage & Current	2.650A	5.950A	2.250A	7.700A
Typical Idle Power (DOS 6.2)	0.200A (1.000W)	1.550A (18.600W)	0.030A (0.150W)	1.800A (21.600W)
Typical Idle Power (Windows XP)	0.200A (1.000W)	1.200A (14.400W)	0.020A (0.100W)	1.500A (18.000W)
BIT Voltage & Current	0.205A (1.020W)	2.400A (28.800W)	0.500A (2.500W)	2.400A (28.800W)
S3 Mode	0.940A (4.700W)	N/A	0.650A (3.250W)	N/A
S5 Mode	0.610A (3.050W)	N/A	0.490A (2.450W)	N/A

Operating configurations:

- In-rush operating configuration includes video, baseboard, and 8GB DDR3 RAM.
- Idle (DOS 6.2) operating configuration includes the in-rush configuration as well as keyboard, mouse, and one PATA hard drive.
- Idle (Windows XP) operating configuration includes the in-rush configuration as well as two SATA drives (external power), boot up from SATA0.
- BIT = Burn-In-Test. Operating configuration includes the Idle (Windows XP) configuration as well as two USB thumb drives, two USB loop backs, one LPT loop back, two serial loop backs (four on EBX baseboard), one Ethernet loop back (two on EBX baseboard), and two USB Compact Flash readers with 64MB Compact Flash modules.
- S3 (Standby) operating configuration is the same as BIT operating configuration.
- S5 (Shutdown) operating configuration is the same as BIT operating configuration.

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Environmental Specifications

Table 2-9 provides the operating and storage temperature ranges required for this module.

Table 2-9. Environmental Requirements

Parameter	Conditions
Temperature	
Operating	–20° to +70°C (–4° to +158°F)
Extended (Optional)	–40° to +85°C (–40° to +185°F)
Storage	–55° to +85°C (–67° to +185°F)
Humidity	
Operating	5% to 90% relative humidity, non-condensing
Non-operating	5% to 95% relative humidity, non-condensing

Thermal/Cooling Requirements

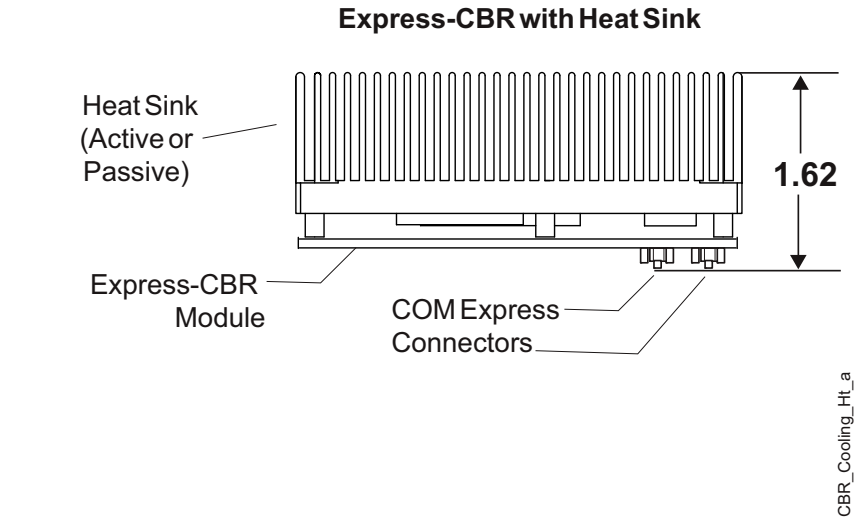
The Express-CBR is designed to operate at its maximum CPU speeds of 1.06GHz and 2.0GHz and requires a thermal solution to cool the CPU, PCH, and voltage regulators. ADLINK offers two optional cooling solutions as well as a heat spreader platform on which to build a cooling solution. (See Table 2-10 for descriptions of cooling options and Figure 2-7 for stack heights of the optional cooling assemblies.)

> **NOTE** The overall system design must keep the ICs within their operating temperature specifications.

Table 2-10. ADLINK Optional Cooling Solutions

Cooling Solution	Description
Passive Heat Sink (without fan)	Qualified to maintain optimal performance up to +70°C.
Active Heat Sink (with fan)	Qualified to maintain optimal performance up to +85°C.
Heat Spreader	Provides a simple thermal platform on which to build a cooling solution.

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*Pan head, top screws add 0.12 inches to this measurement.

Figure 2-7. Stack Heights of Cooling Assemblies (Side Views)

NOTE	All heights are given in inches.

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Mechanical Specifications

The following figure provides mechanical dimensions of the Express-CBR. Figure 2-8 shows the top-side view of the board with measurements between mounting holes.

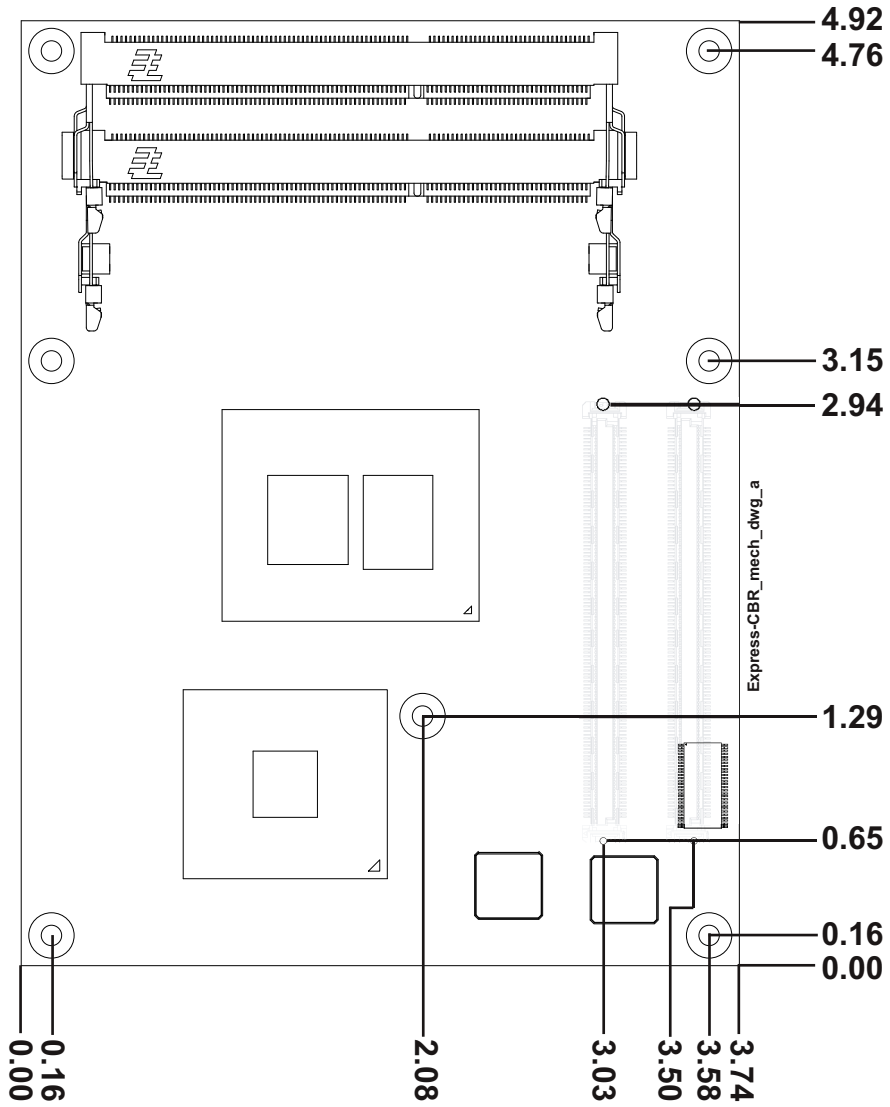


Figure 2-8. Mechanical Dimensions (Top Side)

NOTE	All dimensions are given in inches.

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Chapter 3 Hardware

Overview

This chapter discusses the module features in the following order:

- Interrupt Channel Assignments
- Memory Map
- I/O Address Map
- COM Express Connector A-B
  - LPC interface
  - SATA interface
  - USB interface
  - Power interface
  - Power Management
  - Video interface
  - HD Audio interface
  - Gigabit Ethernet interface
  - I²C interface
  - PCI Express
  - Express Card
  - SMBus
  - GPIO interface
- COM Express A-B Connector Signals
- COM Express Connector C-D
  - IDE interface
  - PCI interface
  - PCI Express Graphics (PEG) interface
  - SDVO
- COM Express C-D Connector Signals
- Watchdog Timer
- TPM (Trusted Platform Module) - **Optional**
- CPU Temperature Monitor

> **NOTE** ADLINK Technology, Inc. only supports the features/options tested and listed in this manual. The main chips used in the Express-CBR may provide more features or options than are listed for the Express-CBR, but some of these features/options are not supported on the module and will not function as specified in the chip documentation.

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Interrupt Channel Assignments

The interrupt channel assignments are shown in Table 3-1.

> **NOTE** Table 3-1 is only for reference. Interrupt channel assignments are tied to the specific legacy Super I/O device residing on the baseboard. This table can be used with the baseboard in ADLINK's Quick Start Kit.

Table 3-1. Interrupt Channel Assignments

Device vs IRQ No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Timer	X															
Keyboard*		X														
Secondary Cascade			X													
COM1*				O	D											
COM2*				D	O											
COM3**					O					O	O	D				
COM4**				O						O	D	O				
Floppy*							D									
Parallel*						O		D								
RTC									X							
IDE															D	O
Math Coprocessor														X		
PS/2 Mouse*													X			
Audio Controller	Automatically Assigned															
PCI INTA	Automatically Assigned															
PCI INTB	Automatically Assigned															
PCI INTC	Automatically Assigned															
PCI INTD	Automatically Assigned															
USB	Automatically Assigned															
VGA	Automatically Assigned															
Ethernet	Automatically Assigned															

*Located on the baseboard.

**Located only on the EBX baseboard.

Legend: D = Default, X = Fixed, O = Optional

> **NOTE** The IRQs for the Ethernet, Video, and USB are automatically assigned by the BIOS Plug and Play logic. Local IRQs assigned during initialization can not be used by external devices.

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Memory Map

The following table provides the common PC/AT memory allocations. Memory below 000500h is used by the BIOS.

Table 3-2. Memory Map

Base Address			Function
00000000h	-	0009FFFFh	Conventional Memory
000A0000h	-	000AFFFFh	Graphics Memory
000B0000h	-	000B7FFFh	Mono Text Memory
000B8000h	-	000BFFFFh	Color Text Memory
000C0000h	-	000CFFFFh	Standard Video BIOS
000D0000h	-	000DFFFFh	Reserved for Extended BIOS
000E0000h	-	000EFFFFh	Extended System BIOS Area
000F0000h	-	000FFFFFh	System BIOS Area (Storage and RAM Shadowing)
Top 32, 64, or 128MB of Physical Memory			Shared memory of Integrated Graphics enabled
FFE00000h	-	FFFFFFFFh	System Flash

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I/O Address Map

Table 3-3 shows the I/O address map.

> **NOTE** Table 3-3 is only for reference. I/O addresses are tied to the specific legacy Super I/O device residing on the baseboard. This table can be used with the baseboard in ADLINK's Quick Start Kit.

Table 3-3. I/O Address Map

Address (hex)	Subsystem
0000-000F	Primary DMA Controller
0020-0021	Master Interrupt Controller
0040-0043	Programmable Interrupt Timer (Clock/Timer)
004E-004F	TPM (Trusted Platform Module)
0060	Keyboard Controller*
0061	NMI, Speaker control
0063	NMI Controller
0064	Keyboard Controller*
0065	NMI Controller
0067	NMI Controller
0070-007F	CMOS RAM, NMI Mask Reg, RT Clock
0080	System reserved
0081-0083	DMA Page Registers
0084-0086	System reserved
0087	DMA Page Register
0088	System reserved
0089-008B	DMA Page Registers
008C-008E	System reserved
008F	DMA Page Register
0090-0091	System reserved
0092	Fast A20 gate and CPU reset*
0093-009F	System reserved
00A0-00A1	Slave Interrupt Controller
00A2-00BF	System reserved
00C0-00DF	Slave DMA Controller #2
00E0-00EF	System reserved
00F0-00FF	Math Coprocessor
01F0-01F7	IDE Hard Disk Controller
02E8-02EF	Serial Port 4 (COM4)*
02F8-02FF	Serial Port 2 (COM2)*
0378-037F	Parallel Port (Standard and EPP)*
03B0-03BB	Video (monochrome)
03C0-03DF	Video (VGA)

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Table 3-3. I/O Address Map (Continued)

03E8-03EF	Serial Port 3 (COM3)*
03F0-03F5	Floppy Disk Controller*
03F6	IDE Hard Disk Controller
03F7	Floppy Disk Controller*
03F8-03FF	Serial Port 1 (COM1)*
04D0-04D1	Edge/Level Trigger PIC
0778-077F	Parallel Port (ECP Extensions) (Port 378+400)*
0CF8-0CFF	PCI Configuration Registers
0CF9	Reset Control Register

*Located on the baseboard.

COM Express A-B Connector

This section provides descriptions of interfaces within the COM Express A-B connector. The COM Express connector interface comprises two identical 220-pin connectors (A-B and C-D). The COM Express A-B connector provides the following features:

- LPC interface
- SATA interface
- USB interface
- Power interface
- Power Management
- Video interface
- HD Audio interface
- Gigabit Ethernet interface
- I²C interface
- PCI Express
- Express Card
- SMBus
- GPIO

LPC Interface

The Express-CBR offers the LPC (Low Pin Count) bus through the Intel® BD82QM57 (PCH). Many devices already exist for this Intel defined bus. The LPC bus corresponds approximately to a serialized ISA bus yet with a significantly reduced number of signals. Because of the software compatibility to the ISA bus, I/O extensions such as additional serial ports can be easily implemented on an application specific baseboard using this bus.

SATA Interface

Four Serial ATA connections are provided through the Intel BD82QM57 (PCH). SATA is an enhancement of the parallel ATA therefore offering higher performance. As a result of this enhancement the traditional restrictions of parallel ATA are overcome with respect to speed and EMI. SATA starts with a transfer rate of 150 MB/s and can be expanded up to 300 MB/s in order to accommodate future developments. SATA is completely protocol and software compatible to parallel ATA.

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USB Interface

The PCH offers four UHCI USB host controllers and two EHCI USB host controllers. These controllers comply with USB standard 1.1 and 2.0 and offer a total of eight USB ports through connector A-B. All ports are high-speed and full-speed, and low-speed capable. The port routing logic determines whether a USB port is controlled by one of the UHCI controllers or by one of the EHCI controllers.

Power Interface

A 12V voltage rail on both A-B and C-D COM Express connectors accepts the voltages required for the board. The RTC 3.3V battery feed and 5V standby functions draw power through the A-B connector.

Power Management

The Express-CBR is ACPI 3.0b compliant. The board supports S0, S1, S3, S4, and S5 sleep states.

NOTE	Winbond-based baseboards do not support the S3 sleep state on the Express-CBR.

Video Interfaces

VGA

The Express-CBR graphics are driven by an Intel internal graphics interface which provides the interface for an analog display. A 300-MHz integrated, 24-bit RAM-based, Digital-to-Analog Converter (RAMDAC) converts up to 2048x1536 digital pixels at a maximum refresh rate of 60-Hz. Three 8-bit DACs provide R, G, B signals to the monitor.

LVDS

The Intel BD82QM57 PCH provides direct LVDS outputs. The outputs are independent of other panel interfaces. The LVDS interface will support 1 or 2 channels and can support four data pairs and one clock pair of LVDS (24-bit) in each channel.

Audio Interface

The A-B connector provides an interface that supports HD Audio codecs.

Ethernet Interface

The Express-CBR supports one Gigabit Ethernet interface, which can be enabled in BIOS Setup. The Ethernet interface is implemented from the 82574IT Ethernet controller and provides one GLAN interface which occupies PCI Express port 7. The Ethernet function supports multi-speed operation 10/100/1000 Mbps and operates in full-duplex at all supported speeds or half duplex at 10/100 Mbps while adhering to the IEEE 802.3x flow control specification.

I²C™ Bus

The I²C bus is implemented through the use of the Atmel ATmega168 board controller. The board controller provides a Fast Mode (400kHz max.) multi-master I²C bus that has maximum I²C bandwidth. Use the ADLINK Intelligent Device Interface (AIDI) Library for access to the I²C bus. AIDI driver information is available on the Express-CBR Product page at: http://www.adlinktech.com. An AIDI demo program and the AIDI User's Manual describing how to use the I²C bus also reside in the Utilities area of the Express-CBR Product page.

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PCI Express™

The Express-CBR offers seven (7) x1 PCI Express lanes through the PCH, which can be configured to support PCI Express edge cards or ExpressCards. One of the seven x1 PCI Express lanes is utilized by the onboard Ethernet controller therefore only six (6) x1 PCI Express lanes are available on the A-B connector. The PCI Express interface is based on the *PCI Express Specification 1.1*.

ExpressCard™

The Express-CBR supports the implementation of ExpressCards, which require the dedication of one USB port and one PCI Express lane for each ExpressCard used.

System Management Bus (SMBus)

The I/O Hub (PCH) contains an integrated SMBus controller with both a host and slave SMBus port; but the host cannot access the slave internally. The slave port allows an external master access to the I/O Hub through the COM Express A-B connector. Table 3-4 lists the device names and corresponding reserved addresses on the SMBus.

Table 3-4. SMBus Reserved Addresses

Component	Address (hex)
SODIMM EPROM	A0h
Clock Generator	D2h
CPU Temperature Sensor	4CH

GPIO

The Express-CBR provides GPIO (General Purpose I/O) pins for custom use through the COM Express A-B connector. Use the ADLINK Intelligent Device Interface (AIDI) Library to configure the GPIO interface. AIDI driver information is available on the Express-CBR Product page at: http://www.adlinktech.com. An AIDI demo program and the AIDI User's Manual describing how to use the GPIO pins also reside in the Utilities area of the Express-CBR Product page.

For more information about GPIO pin operation, refer to the Intel 5 Series Chipset Datasheet for the PCH (BD82QM57) controller. Refer to "References" on page 1 for a hyper link to the datasheet.

Table 3-5 provides the pin signals for the COM Express A-B connector.

Table 3-5. COM Express A-B Connector Signal Descriptions

Pin #	Row A	Pin #	Row B
A1	GND	B1	GND
A2	GBE0_MDI_3-	B2	GBE0_ACT#
A3	GBE0_MDI3+	B3	LPC_FRAME#
A4	GBE0_LINK100# (Ethernet Speed LED)	B4	LPC_AD0
A5	GBE0_LINK1000# (Ethernet Speed LED)	B5	LPC_AD1
A6	GBE0_MDI2-	B6	LPC_AD2
A7	GBE0_MDI2+	B7	LPC_AD3
A8	GBE0_LINK#	B8	LPC_DRQ0# (Int. PD 20k in PCH)
A9	GBE0_MDI1-	B9	LPC_DRQ1# (Int. PD 20k in PCH)
A10	GBE0_MDI1+	B10	LPC_CLK
A11	GND	B11	GND
A12	GBE0_MDI0-	B12	PWRBTN# (Int. PU 20k in PCH)
A13	GBE0_MDI0+	B13	SMB_CK (PU 2.2k 3.3V S5 Standby)

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Table 3-5. COM Express A-B Connector Signal Descriptions (Continued)

A14	GBE0_CTREF	B14	SMB_DAT (PU 2.2k 3.3V S5 Standby)
A15	SUS_S3# (PU 10k 3.3V S5 Standby)	B15	SMB_ALERT# (PU 10k 3.3V S5 Standby)
A16	SATA0_TX+	B16	SATA1_TX+
A17	SATA0_TX-	B17	SATA1_TX-
A18	SUS_S4# (PU 10k 3.3V S5 Standby)	B18	SUS_STAT#
A19	SATA0_RX+	B19	SATA1_RX+
A20	SATA0_RX-	B20	SATA1_RX-
A21	GND	B21	GND
A22	SATA2_TX+	B22	SATA3_TX+
A23	SATA2_TX-	B23	SATA3_TX-
A24	SUS_S5# (PU 10k 3.3V S5 Standby)	B24	PWR_OK
A25	SATA2_RX+	B25	SATA3_RX+
A26	SATA2_RX-	B26	SATA3_RX-
A27	BATLOW# (PU 8.2k 3.3V S5 Standby)	B27	WDT
A28	ATA_ACT# (PU 10k 3.3V)	B28	AC_SDIN2 (Int. PD 20k in PCH)
A29	AC_SYNC (Int. PD 20k in PCH)	B29	AC_SDIN1 (Int. PD 20k in PCH)
A30	AC_RST# (Int. PD 20k in PCH)	B30	AC_SDIN0 (Int. PD 20k in PCH)
A31	GND	B31	GND
A32	AC_BITCLK (Int. PD 20k in PCH)	B32	SPKR (Int. PD 20k in PCH)
A33	AC_SDOUT (Int. PD 20k in PCH)	B33	I2C_CK (PU 10k 3.3V S5 Standby)
A34	BIOS_DISABLE# (PU 10k 5V S5 Standby)	B34	I2C_DAT (PU 10k 3.3V S5 Standby)
A35	THRMTRIP# (PU 330R 3.3V)	B35	THRM# (Not Connected)
A36	USB6- (Int. PD 20k in PCH)	B36	USB7- (Int. PD 20k in PCH)
A37	USB6+ (Int. PD 20k in PCH)	B37	USB7+ (Int. PD 20k in PCH)
A38	USB_6_7_OC# (PU 10k 3.3V S5 Standby)	B38	USB_4_5_OC# (PU 10k 3.3V S5 Standby)
A39	USB4- (Int. PD 20k in PCH)	B39	USB5- (Int. PD 20k in PCH)
A40	USB4+ (Int. PD 20k in PCH)	B40	USB5+ (Int. PD 20k in PCH)
A41	GND	B41	GND
A42	USB2- (Int. PD 20k in PCH)	B42	USB3- (Int. PD 20k in PCH)
A43	USB2+ (Int. PD 20k in PCH)	B43	USB3+ (Int. PD 20k in PCH)
A44	USB_2_3_OC# (PU 10k 3.3V S5 Standby)	B44	USB_0_1_OC# (PU 10k 3.3V S5 Standby)
A45	USB0- (Int. PD 20k in PCH)	B45	USB1- (Int. PD 20k in PCH)
A46	USB0+ (Int. PD 20k in PCH)	B46	USB1+ (Int. PD 20k in PCH)
A47	VCC_RTC	B47	EXCD1_PERST# (PU 10k 3.3V S5 Standby)
A48	EXCD0_PERST# (PU 10k 3.3V S5 Standby)	B48	EXCD1_CPPE# (PU 10k 3.3V)
A49	EXCD0_CPPE# (PU 10k 3.3V)	B49	SYS_RESET# (PU 10k 5V S5 Standby)
A50	LPC_SERIRQ (PU 10k 3.3V)	B50	CB_RESET# (PU 10k 3.3V S5 Standby)
A51	GND	B51	GND
A52	PCIE5_TX+	B52	PCIE5_RX+
A53	PCIE5_TX-	B53	PCIE5_RX-

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Table 3-5. COM Express A-B Connector Signal Descriptions (Continued)

A54	GPI0 (PU 10k 3.3V S5 Standby)	B54	GPO1 (PU 10k 3.3V)
A55	PCIE4_TX+	B55	PCIE4_RX+
A56	PCIE4_TX-	B56	PCIE4_RX-
A57	GND	B57	GPO2 (PU 10k 3.3V)
A58	PCIE3_TX+	B58	PCIE3_RX+
A59	PCIE3_TX-	B59	PCIE3_RX-
A60	GND	B60	GND
A61	PCIE2_TX+	B61	PCIE2_RX+
A62	PCIE2_TX-	B62	PCIE2_RX-
A63	GPI1 (PU 10k 3.3V S5 Standby)	B63	GPO3 (PU 10k 3.3V)
A64	PCIE1_TX+	B64	PCIE1_RX+
A65	PCIE1_TX-	B65	PCIE1_RX-
A66	GND	B66	WAKE0# (PU 10k 3.3V S5 Standby)
A67	GPI2 (PU 10k 3.3V S5 Standby)	B67	WAKE1# (PU 10k 3.3V S5 Standby)
A68	PCIE0_TX+	B68	PCIE0_RX+
A69	PCIE0_TX-	B69	PCIE0_RX-
A70	GND	B70	GND
A71	LVDS_A0+	B71	LVDS_B0+
A72	LVDS_A0-	B72	LVDS_B0-
A73	LVDS_A1+	B73	LVDS_B1+
A74	LVDS_A1-	B74	LVDS_B1-
A75	LVDS_A2+	B75	LVDS_B2+
A76	LVDS_A2-	B76	LVDS_B2-
A77	LVDS_VDD_EN (PD 100k)	B77	LVDS_B3+
A78	LVDS_A3+	B78	LVDS_B3-
A79	LVDS_A3-	B79	LVDS_BKLT_EN (PD 100k)
A80	GND	B80	GND
A81	LVDS_A_CK+	B81	LVDS_B_CK+
A82	LVDS_A_CK-	B82	LVDS_B_CK-
A83	LVDS_I2C_CK (PU 2.2k 3.3V)	B83	LVDS_BKLT_CTRL
A84	LVDS_I2C_DAT (PU 2.2k 3.3V)	B84	VCC_5V_SBY
A85	GPI3 (PU 10k 3.3V S5 Standby)	B85	VCC_5V_SBY
A86	KBD_RST# (PU 8.2k 3.3V)	B86	VCC_5V_SBY
A87	KBD_A20GATE (PU 8.2k 3.3V)	B87	VCC_5V_SBY
A88	PCIE_CK_REF+	B88	RSVD (Not Connected)
A89	PCIE_CK_REF-	B89	VGA_RED (PD 150R)
A90	GND	B90	GND
A91	RSVD	B91	VGA_GRN (PD 150R)
A92	RSVD	B92	VGA_BLU (PD 150R)
A93	GPO0 (PU 10k 3.3V)	B93	VGA_HSYNC

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Table 3-5. COM Express A-B Connector Signal Descriptions (Continued)

A94	RSVD		B94	VGA_VSYNC	
A95	RSVD		B95	VGA_I2C_CK	(PU 2.2k 3.3V)
A96	GND		B96	VGA_I2C_DAT	(PU 2.2k 3.3V)
A97	VCC_12V	(Not Connected)	B97	TV_DAC_A	(SPI_CS1 for Carrier)
A98	VCC_12V	(Not Connected)	B98	TV_DAC_B	(Not Connected)
A99	VCC_12V	(Not Connected)	B99	TV_DAC_C	(Not Connected)
A100	GND		B100	GND	
A101	VCC_12V	(Not Connected)	B101	VCC_12V	(Not Connected)
A102	VCC_12V	(Not Connected)	B102	VCC_12V	(Not Connected)
A103	VCC_12V	(Not Connected)	B103	VCC_12V	(Not Connected)
A104	VCC_12V		B104	VCC_12V	
A105	VCC_12V		B105	VCC_12V	
A106	VCC_12V		B106	VCC_12V	
A107	VCC_12V		B107	VCC_12V	
A108	VCC_12V		B108	VCC_12V	
A109	VCC_12V		B109	VCC_12V	
A110	GND		B110	GND	

COM Express C-D Connector

The COM Express C-D connector is a 220-pin connector providing the following features:

- IDE interface
- PCI interface
- PCI Express Graphics (PEG) interface
- SDVO functionality

IDE Interface

The JMD330 controller provides a fast IDE interface that supports two IDE devices, including IDE hard drives and ATAPI devices with independent timings. The IDE interface supports PIO IDE transfers up to 16 MB/second, Ultra DMA transfers up to 133 MB/second, and employs DASP (Drive Active Slave Present) signals.

PCI Interface

The PCI bus complies with PCI specification Rev. 2.3 and provides a 32-bit parallel PCI bus that is capable of operating at 33MHz.

PCI Express Graphics (PEG)

The Express-CBR supports the implementation of a x8 link for an external high-performance PCI Express Graphics card. It supports a theoretical bandwidth of up to 4GB/s. Each lane of the PEG Port consists of a receive and transmit differential signal pair designated from PEG_RX8 (+ and -) to PEG_RX15 (+ and -) and correspondingly from PEG_TX8 (+ and -) to PEG_TX15 (+ and -).

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SDVO

The PCH provides Serial Digital Video Output (SDVO) functionality and may be alternatively used for one third party SDVO compliant device connected to Channel B.

Table 3-6 provides the pin signals for the COM Express C-D connector.

Table 3-6. COM Express C-D Connector Signal Descriptions

Pin #	Row C		Pin #	Row D	
C1	GND		D1	GND	
C2	IDE_D7	(PD 10k)	D2	IDE_D5	
C3	IDE_D6		D3	IDE_D10	
C4	IDE_D3		D4	IDE_D11	
C5	IDE_D15		D5	IDE_D12	
C6	IDE_D8		D6	IDE_D4	
C7	IDE_D9		D7	IDE_D0	
C8	IDE_D2		D8	IDE_REQ #	(PD 5.6k)
C9	IDE_D13		D9	IDE_IOW#	
C10	IDE_D1		D10	IDE_ACK#	
C11	GND		D11	GND	
C12	IDE_D14		D12	IDE_IRQ	(PD 10k)
C13	IDE_IORDY	(PU 4.7k 3.3V)	D13	IDE_A0	
C14	IDE_IOR#		D14	IDE_A1	
C15	PCI_PME#		D15	IDE_A2	
C16	PCI_GNT2#		D16	IDE_CS1#	
C17	PCI_REQ2#	(PU 8.2k 3.3V)	D17	IDE_CS3#	
C18	PCI_GNT1#	(PD 1K)	D18	IDE_RESET#	
C19	PCI_REQ1#	(PU 8.2k 3.3V)	D19	PCI_GNT3#	
C20	PCI_GNT0#	(PD 1K)	D20	PCI_REQ3#	(PU 8.2k 3.3V)
C21	GND		D21	GND	
C22	PCI_REQ0#	(PU 8.2k 3.3V)	D22	PCI_AD1	
C23	PCI_RESET#		D23	PCI_AD3	
C24	PCI_AD0		D24	PCI_AD5	
C25	PCI_AD2		D25	PCI_AD7	
C26	PCI_AD4		D26	PCI_C/BE0#	
C27	PCI_AD6		D27	PCI_AD9	
C28	PCI_AD8		D28	PCI_AD11	
C29	PCI_AD10		D29	PCI_AD13	
C30	PCI_AD12		D30	PCI_AD15	
C31	GND		D31	GND	
C32	PCI_AD14		D32	PCI_PAR	
C33	PCI_C/BE1#		D33	PCI_SERR#	(PU 8.2k 3.3V)
C34	PCI_PERR#	(PU 8.2k 3.3V)	D34	PCI_STOP#	(PU 8.2k 3.3V)
C35	PCI_LOCK#	(PU 8.2k 3.3V)	D35	PCI_TRDY#	(PU 8.2k 3.3V)

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Table 3-6. COM Express C-D Connector Signal Descriptions (Continued)

C36	PCI_DEVSEL#	(PU 8.2k 3.3V)	D36	PCI_FRAME#	(PU 8.2k 3.3V)
C37	PCI_IRDY#	(PU 8.2k 3.3V)	D37	PCI_AD16	
C38	PCI_C/BE2#		D38	PCI_AD18	
C39	PCI_AD17		D39	PCI_AD20	
C40	PCI_AD19		D40	PCI_AD22	
C41	GND		D41	GND	
C42	PCI_AD21		D42	PCI_AD24	
C43	PCI_AD23		D43	PCI_AD26	
C44	PCI_C/BE3#		D44	PCI_AD28	
C45	PCI_AD25		D45	PCI_AD30	
C46	PCI_AD27		D46	PCI_IRQC#	(PU 8.2k 3.3V)
C47	PCI_AD29		D47	PCI_IRQD#	(PU 8.2k 3.3V)
C48	PCI_AD31		D48	PCI_CLKRUN#	(PU 8.2k 3.3V)
C49	PCI_IRQA#	(PU 8.2k 3.3V)	D49	PCI_M66EN#	(PD 10k; Fixed to 33 Mhz)
C50	PCI_IRQB#	(PU 8.2k 3.3V)	D50	PCI_CLK	
C51	GND		D51	GND	
C52	PEG_RX0+	(Only SDVO supported)	D52	PEG_TX0+	(Only SDVO Supported)
C53	PEG_RX0-	(Only SDVO supported)	D53	PEG_TX0-	(Only SDVO Supported)
C54	TYPE0#	(Not Connected)	D54	PEG_LANE_RV#	(Not Connected)
C55	PEG_RX1+	(Only SDVO supported)	D55	PEG_TX1+	(Only SDVO Supported)
C56	PEG_RX1-	(Only SDVO supported)	D56	PEG_TX1-	(Only SDVO Supported)
C57	TYPE1#	(Not Connected)	D57	TYPE2#	(Not Connected)
C58	PEG_RX2+	(Only SDVO supported)	D58	PEG_TX2+	(Only SDVO Supported)
C59	PEG_RX2-	(Only SDVO supported)	D59	PEG_TX2-	(Only SDVO Supported)
C60	GND		D60	GND	
C61	PEG_RX3+	(PD 100k)	D61	PEG_TX3+	(Only SDVO Supported)
C62	PEG_RX3-	(Not Connected)	D62	PEG_TX3-	(Only SDVO Supported)
C63	RSVD		D63	RSVD	(Not Connected)
C64	RSVD		D64	RSVD	(Not Connected)
C65	PEG_RX4+	(Not Connected)	D65	PEG_TX4+	(Not Connected)
C66	PEG_RX4-	(Not Connected)	D66	PEG_TX4-	(Not Connected)
C67	RSVD	(Not Connected)	D67	GND	
C68	PEG_RX5+	(Not Connected)	D68	PEG_TX5+	(Not Connected)
C69	PEG_RX5-	(Not Connected)	D69	PEG_TX5-	(Not Connected)
C70	GND		D70	GND	
C71	PEG_RX6+	(Not Connected)	D71	PEG_TX6+	(Not Connected)
C72	PEG_RX6-	(Not Connected)	D72	PEG_TX6-	(Not Connected)
C73	SDVO_DATA		D73	SDVO_CLK	
C74	PEG_RX7+	(Not Connected)	D74	PEG_TX7+	(Not Connected)
C75	PEG_RX7-	(Not Connected)	D75	PEG_TX7-	(Not Connected)

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Table 3-6. COM Express C-D Connector Signal Descriptions (Continued)

C76	GND	D76	GND
C77	RSVD (Not Connected)	D77	IDE_CBLID# (PD 10k)
C78	PEG_RX8+	D78	PEG_TX8+
C79	PEG_RX8-	D79	PEG_TX8-
C80	GND	D80	GND
C81	PEG_RX9+	D81	PEG_TX9+
C82	PEG_RX9-	D82	PEG_TX9-
C83	RSVD (Not Connected)	D83	RSVD (Not Connected)
C84	GND	D84	GND
C85	PEG_RX10+	D85	PEG_TX10+
C86	PEG_RX10-	D86	PEG_TX10-
C87	GND	D87	GND
C88	PEG_RX11+	D88	PEG_TX11+
C89	PEG_RX11-	D89	PEG_TX11-
C90	GND	D90	GND
C91	PEG_RX12+	D91	PEG_TX12+
C92	PEG_RX12-	D92	PEG_TX12-
C93	GND	D93	GND
C94	PEG_RX13+	D94	PEG_TX13+
C95	PEG_RX13-	D95	PEG_TX13-
C96	GND	D96	GND
C97	RSVD (Not Connected)	D97	PEG_ENABLE# (PU 8.2k 3.3V)
C98	PEG_RX14+	D98	PEG_TX14+
C99	PEG_RX14-	D99	PEG_TX14-
C100	GND	D100	GND
C101	PEG_RX15+	D101	PEG_TX15+
C102	PEG_RX15-	D102	PEG_TX15-
C103	GND	D103	GND
C104	VCC_12V	D104	VCC_12V
C105	VCC_12V	D105	VCC_12V
C106	VCC_12V	D106	VCC_12V
C107	VCC_12V	D107	VCC_12V
C108	VCC_12V	D108	VCC_12V
C109	VCC_12V	D109	VCC_12V
C110	GND	D110	GND

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Watchdog Timer

The Watchdog Timer (WDT) restarts the system if a mishap occurs, ensuring proper start-up after the interruption. Possible problems include failure to boot properly, the application software's loss of control, failure of an interface device, unexpected conditions on the bus, or other hardware or software malfunctions. Use the ADLINK Intelligent Device Interface (AIDI) Library to configure the WDT interface. AIDI driver information is available on the Express-CBR Product page at: http://www.adlinktech.com. An AIDI demo program and the AIDI User's Manual showing how to use the WDT function also reside in the Utilities area of the Express-CBR Product page.

The WDT (Watchdog Timer) can be used both during the boot process and during normal system operation.

- During the Boot process – If the OS fails to boot in the time interval set in the BIOS, the system will reset.

  Enable the WDT in the Custom Configuration Screen of BIOS Setup. Set the WDT for a time-out interval in seconds, between 1 and 255, in one second increments. Ensure you allow enough time for the boot process to complete and for the OS to boot. The OS or application must tickle the WDT as soon as it comes up. This can be done by accessing the hardware directly or through a BIOS call.

- During System Operation – The user can set up the WDT hardware through a BIOS call or by accessing the hardware directly using the AIDI Library. The BIOS call must tickle the WDT in the time set when the WDT is initialized or the system will be reset.

  The BIOS implements interrupt 15 function 0C3h to manipulate the WDT.

- Watchdog Code example – ADLINK provides a source code example (AIDI demo program) on the Express-CBR Product page of the web site illustrating how to control the WDT. The code example can be easily copied to your development environment to compile and test or make any desired changes before compiling.

TPM (Trusted Platform Module [Optional])

The Express-CBR provides an optional hardware chip called a Trusted Platform Module which is dedicated for security functions. Trusted Computing is an industry standard created for personal computer security. The BIOS allows you to enable or disable the TPM.

CPU Temperature Monitor

The processor core of the Intel Core i7 provides a Digital Thermal Sensor (DTS), which detects the instantaneous temperature of the processor core. When the DTS detects a processor core temperature that exceeds the core's specified temperature limit, the core's power consumption is reduced until its temperature returns to below its specified limit. The AIDI Library provides simple APIs at the application level to support this function when CPU temperature levels exceed the upper or lower limits set by the user. AIDI driver information for the Express-CBR is available on the Express-CBR Product page at: http://www.adlinktech.com. An AIDI demo program and the AIDI User's Manual showing how to use the Temperature Monitor also reside in the Utilities area of the Express-CBR Product page.

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Chapter 4 BIOS Setup

Introduction

This section assumes the user is familiar with general BIOS Setup and does not attempt to describe the BIOS functions. Refer to BIOS Setup Menus in this chapter for a map of the BIOS Setup settings. If ADLINK has added to or modified any of the standard BIOS functions, these functions will be described.

Entering BIOS Setup (VGA Display)

To enter BIOS Setup using a VGA display for the Express-CBR:

1. Turn on the VGA monitor and the power supply to the Express-CBR.
2. Start Setup by pressing the [Del] key, when the following message appears on the boot screen.

```
Hit <Del> if you want to run SETUP
```

> **NOTE** If the setting for *Fast Boot* is set to Enabled, you may not see this prompt appear on screen if the monitor is too slow to display it on start up. If this happens, press the <Del> key early in the boot sequence to enter BIOS Setup.

3. Use the <Enter> key to select the screen menus listed in the Opening BIOS screen.
4. Follow the instructions at the bottom of each screen to navigate through the selections and modify any settings.

OEM Logo Utility (Splash Screen)

The Express-CBR BIOS supports a graphical logo utility, which can be customized by the user and displayed when enabled through the BIOS Setup Utility. The graphical image can be a company logo or any custom image the user wants to display during the boot process. The custom image can be displayed as the first image displayed on screen during the boot process and remain there, depending on the options selected in BIOS Setup, while the OS boots.

Logo Image Requirements

The user's image may be customized with any bitmap software editing tool, but must be converted into an acceptable format with the tools (files and utilities) provided by ADLINK. If the custom image is not converted with the utilities provided, then the image will not display properly when this field is selected in BIOS Setup.

> **NOTE** Do not use other logo screen conversion tools because they will render an image that is not compatible with the Express-CBR BIOS.

The Express-CBR Logo Screen Utility supports the following image formats:

- Bitmap image
  - 16-Color, 640x480 pixels
  - 256-Color, 640x480 pixels
- JPG image
  - 16-Color, 640x480 pixels

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- PCX image
  - 256-Color, 640x480 pixels
- A file size no larger than 64kB

BIOS Setup Menus

This section provides illustrations of the six main setup screens in the Express-CBR BIOS Setup Utility. Below each illustration is a bullet list of the screen's submenus and setting selections. The setting selections are presented in brackets after each submenu or menu item and the default settings are presented in bold. Refer to right hand columns of your actual BIOS screens for descriptions of the selected settings.

Table 4-1. BIOS Setup Menus

BIOS Setup Utility Menu	Item/Topic
Main	BIOS, Memory, and Board information, System Date and Time
Advanced	Launch PXE OpROM, Launch Storage OpROM, PCI Subsystem, ACPI, Trusted Computing, CPU, USB, SATA, Video, Super IO, Hardware Monitor, Thermal, Remote Access settings
Chipset	North Bridge and South Bridge settings
Boot	Boot Up, GateA20, Option ROM Messages, Interrupt 19 Capture, Boot Order settings
Security	Setting or Changing Passwords
Save & Exit	Exiting, Saving, Resetting, Save Options, Boot Override settings

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BIOS Main Setup Screen

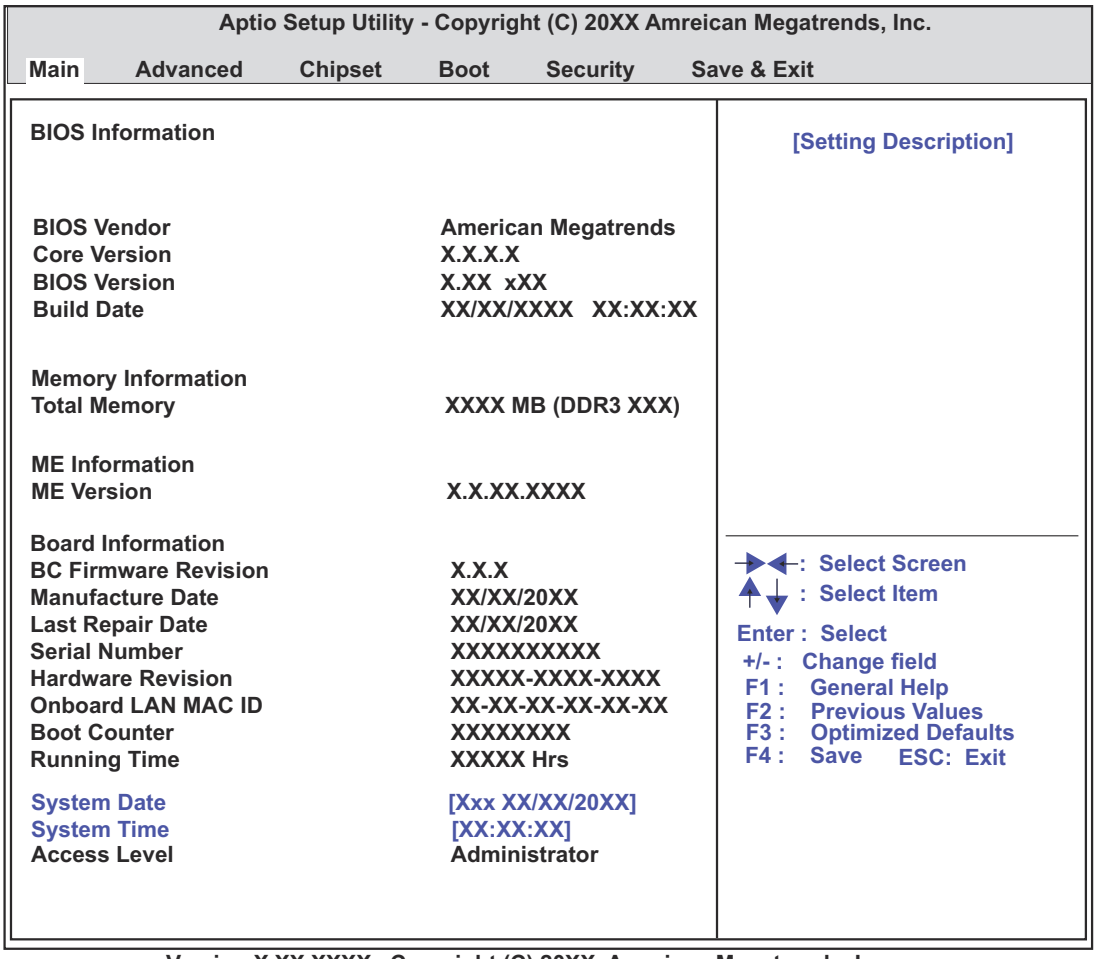


Figure 4-1. BIOS Main Setup Screen

> **NOTE** Use the following steps to initialize the Running Time feature:
>
> 1. Power on the system and enter the BIOS Setup Utility.
> 2. Wait for the system to run in BIOS for at least one hour.
> 3. Turn off the AC power to the system.
> 4. Power on the system.

- **System Date & Time**
  - System Date (day of week, mm:dd:yyyy) – This field requires the alpha-numeric entry of the day of week, day of the month, calendar month, and all 4 digits of the year, indicating the century plus year (*Fri XX/XX/20XX*).
  - System Time (hh:mm:ss) – This is a 24-hour clock setting in hours, minutes, and seconds.

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BIOS Advanced Setup Screen

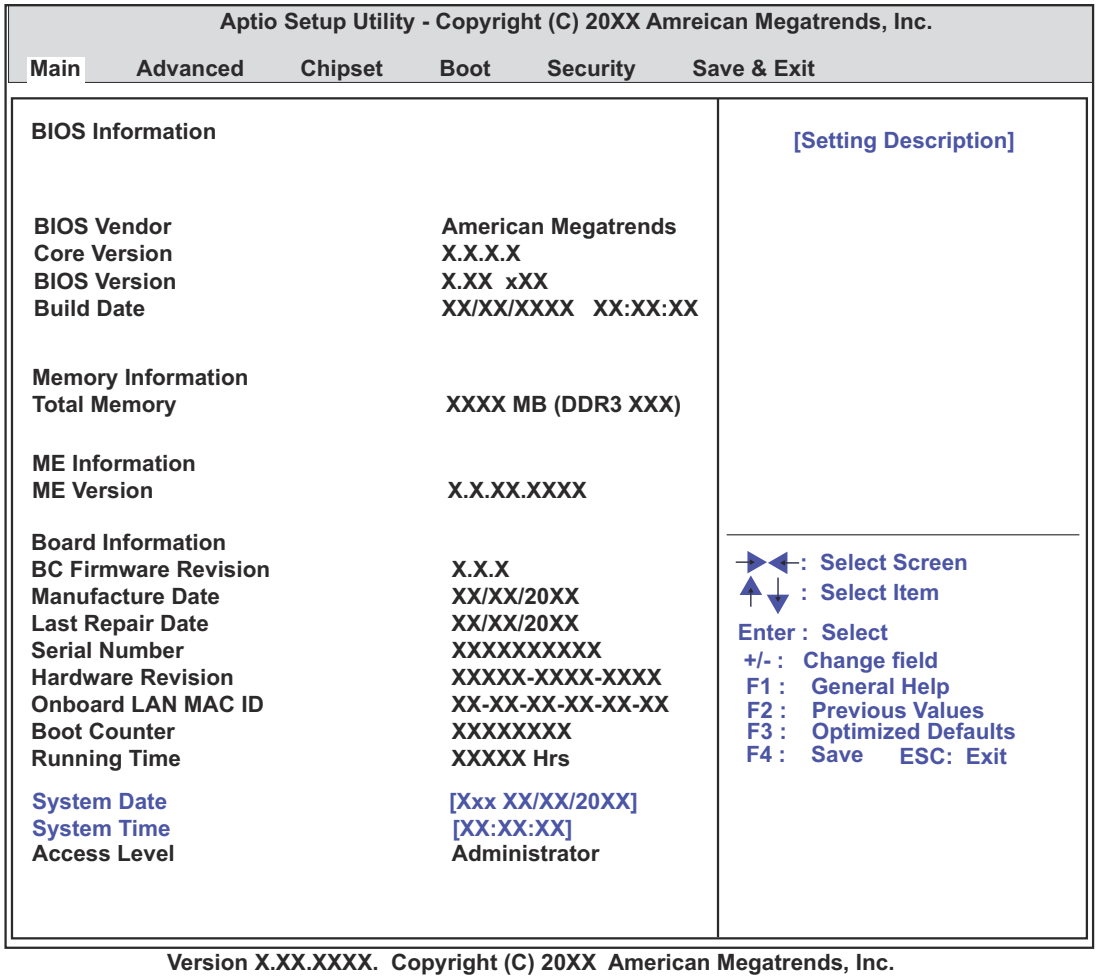


Figure 4-2. BIOS Advanced Setup Screen

- **Legacy OpROM Support**
  - Launch PXE OpROM [**Disabled**; Enabled]
  - Launch Storage OpROM [Disabled; **Enabled**]
- **PCI Subsystem Settings**
  - PCI Bus Driver Version V X.XX.XX
    - PCI ROM Priority [64 PCI Bus Clock; **EFI Compatible**]
  - PCI Common Settings
    - CPI Latency Timer [**32 CPI Bus Clocks**; 64 CPI Bus Clocks; 96 CPI Bus Clocks; 128 CPI Bus Clocks; 160 CPI Bus Clocks; 192 CPI Bus Clocks; 224 CPI Bus Clocks; 248 CPI Bus Clocks]
    - VGA Palette Snoop [**Disabled**; Enabled]
    - PERR# Generation [**Disabled**; Enabled]
    - SERR# Generation [**Disabled**; Enabled]
  - PCI Express Device Settings
    - Relaxed Ordering [**Disabled**; Enabled]
    - Extended Tag [**Disabled**; Enabled]

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- No Snoop [Disabled; **Enabled**]
- Maximum Payload [**Auto**; 128 Bytes; 256 Bytes; 512 Bytes; 1024 Bytes; 2048 Bytes; 4096 Bytes]
- Maximum Read Request [**Auto**; 128 Bytes; 256 Bytes; 512 Bytes; 1024 Bytes; 2048 Bytes; 4096 Bytes]

♦ PCI Express Link Settings

- ASPM Support [**Disabled**; Auto; Force L0]
  WARNING: Enabling ASPM may cause some PCI-E devices to fail
- Extended Synch [**Disabled**; Enabled]

• **ACPI Settings**

♦ Enable ACPI Auto Configuration [**Disabled**; Enabled]

♦ Enable Hibernation [Disabled; **Enabled**]

♦ ACPI Sleep State [Suspend Disabled; S1 (CPU Stop Clock); **S3 (Suspend to RAM**)]

♦ Trusted Computing

- TPM SUPPORT [**Disabled**; Enabled]
- Current TPM Status Information [depends on board model]

• **CPU Configuration**

♦ Processor Type Intel(R) Core(TM) i7 CPU

♦ EMT64 Supported

♦ Processor Speed XXXX MHz

♦ Processor Stepping XXXXX

♦ Microcode Revision X

♦ Processor Cores X

♦ Intel HT Technology Supported

♦ Hyper-Threading [Disabled; **Enabled**]

♦ Active Processor Cores [**All**; 1; 2]

♦ Limit CPUID Maximum [**Disabled**; Enabled]

♦ Hardware Prefetcher [Disabled; **Enabled**]

♦ Adjacent Cache Line Prefetch [Disabled; **Enabled**]

♦ Intel Virtualization Technology [**Disabled**; Enabled]

♦ Power Technology [Disable; **Energy Efficient**; Custom]

• SATA Configuration

♦ SATA Port0 [depends on board model]

♦ SATA Port1 [depends on board model]

♦ SATA Port2 [depends on board model]

♦ SATA Port3 [depends on board model]

♦ SATA Port4 [depends on board model]

♦ SATA Port5 [depends on board model]

♦ SATA Mode [Disable; **IDE Mode**; AHCI Mode; RAID Mode]

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- SATA-to-PATA Controller [**Disable**; Enable]
- Serial-ATA Controller 0 [Disable; Enhanced; **Compatible**]
- Serial-ATA Controller 1 [Disable; **Enhanced**]

- **Intel Video Configuration**
  - DVTM/FIXED Memory [128MB; **256MB**; Maximum]
  - IGD - Boot Type [**CRT**; LVDS; CRT+LVDS; SDVO-LVDS]
  - LCD Panel Type [640x480 LVDS; 800x600 LVDS; **1024x768 LVDS**; 1280x1024 LVDS; 1400x1050 LVDS1; 1400x1050 LVDS2; 1600x1200 LVDS; 1366x768 LVDS; 1680x1050 LVDS; 1920x1200 LVDS; 1440x900 LVDS; 1600x900 LVDS; 1280x800 LVDS; 1920x1080 LVDS; 2048x1536 LVDS]
  - Panel Scaling [**Auto**; Force Scaling; Off; Maintain Aspect Ratio]
  - backlight Control [**PWM Inverted**; PWM Normal; GMBus Inverted; GMBus Normal]
  - Spread Spectrum Clock Chip [**Off**; Hardware; Software]
  - ALS Support [Enabled; **Disabled**]
  - Gfx Low Power Mode [**Enabled**; Disabled]
  - Active LFP [No LVDS; **Int-LVDS**; SDVO LVDS; eDP Port-A; eDP Port-D]
  - Panel Color Depth [**18 Bit**; 24 Bit]
- **USB Configuration**
  - USB Devices:
    - 1 Hub
  - Legacy USB Support [**Enabled**; Disabled; Auto]
  - EHCI Hand-Off [Disabled; **Enabled**]
  - Device Reset Timeout [10 sec; **20 sec**; 30 sec; 40 sec]
  - Controller Timeout [1 sec; 5 sec; 10 sec; **20 sec**]
- **Super IO Chip (SMSC SCH 3114)**
  - Serial Port 1 Configuration
    - Serial Port [Disabled; **Enabled**]
    - Device Settings IO=3F8h; IRQ=4
    - Change Settings [**IO=3F8h; IRQ=4**
IO=2F8h; IRQ=3
IO=3E8h; IRQ=11
IO=2E8h; IRQ=10]
  - Serial Port 2 Configuration
    - Serial Port [Disabled; **Enabled**]
    - Device Settings IO=2F8h; IRQ=3
    - Change Settings [IO=3F8h; IRQ=4
IO=2F8h; IRQ=3
IO=3E8h; IRQ=11
IO=2E8h; IRQ=10]
  - Serial Port 3 Configuration
    - Serial Port [Disabled; **Enabled**]
    - Device Settings IO=3E8h; IRQ=11

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- Change Settings [IO=3F8h; IRQ=4
  IO=2F8h; IRQ=3
  IO=3E8h; IRQ=11
  IO=2E8h; IRQ=10]

♦ Serial Port 4 Configuration

- Serial Port [Disabled; **Enabled**]
- Device Settings IO=2E8h; IRQ=10
- Change Settings [IO=3F8h; IRQ=4
  IO=2F8h; IRQ=3
  IO=3E8h; IRQ=11
  IO=2E8h; IRQ=10]

♦ Parallel Port Configuration

- Parallel Port [Disabled; **Enabled**]
- Device Settings IO=378h; IRQ=7
- Change Settings [**IO=378h; IRQ=7**
  IO=278h; IRQ=7
  IO=3BCh; IRQ=7
  IO=378h; IRQ=5
  IO=278h; IRQ=5
  IO=3BCh; IRQ=5
- Device Mode [**STD Printer Mode**
  SPP Mode
  EPP-1.9 and SPP Mode
  EPP-1.7 and SPP Mode
  ECP Mode
  ECP and EPP 1.9 Mode
  ECP and EPP 1.7 Mode]

♦ H/W Monitor

- FAN (Pin 120) Speed : XXXX
- FAN (Pin 119) Speed : XXXX
- FAN (Pin 118) Speed : XXXX
- +2.5V (Pin 128) : X.XX
- Vccp (Pin 127) : XXXX
- +3.3V (Pin 29) : X.XX
- +5.0V (Pin 2) : X.XX
- +12V (Pin 1) : X.XX
- VTR (Pin 44) : X.XX
- Vbat (Pin 35) : X.XX

• **Thermal Configuration**

♦ Platform Thermal Configuration

- ME SMBus Thermal Reporting [Disabled; **Enabled**]
- SMBus Buffer Length [1; 2; 5; 9; 10; 14; **20**]
- Thermal Reporting EC PEC [**Disabled**; Enabled]

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- Select slots with TS on DIMM [No TS on DIMM
  TS on DIMM in Slot SODIMM0
  TS on DIMM in Slot SODIMM1
  TS on DIMM in Slot SODIMM0 and SODIMM1]
- PCH Thermal Device
  - MCH Temp Read [Disabled; **Enabled**]
  - PCH Temp Read [Disabled; **Enabled**]
  - CPU Energy Read [Disabled; **Enabled**]
  - CPU Temp Read [Disabled; **Enabled**]
  - Alert Enable Lock [**Disabled**; Enabled]
  - CPU Alert [**Disabled**; Enabled]
  - MCH Alert [**Disabled**; Enabled]
  - PCH Alert [**Disabled**; Enabled]
  - DIMM Alert [**Disabled**; Enabled]

♦ Intelligent Power Sharing

- Intelligent Power Sharing [Disabled; **Enabled**]
  - MCH Turbo [Disabled; **Enabled**]
  - PPEC Config [0]
  - IPS Policy [**DRIVER**; PROCESSOR; BALANCED; GRAPHICS]
  - Core Temp Limit [**Disabled**; Enabled]
  - MCH Power Limit [**Disabled**; Enabled]
  - Processor Power Limit [**Disabled**; Enabled]
  - Core Power Limit [**Disabled**; Enabled]
  - Run Time Interface [EC uses SMBus; **BIOS uses MMIO**]

• **Serial Port Console Redirection**

♦ COM1

- Console Redirection [**Disabled**; Enabled]
- Console Redirection Settings

♦ COM2

- Console Redirection [**Disabled**; Enabled]
- Console Redirection Settings

♦ Serial Port for Out-of-Band Management/
Windows Emergency Management Services (EMS)

- Console Redirection [**Disabled**; Enabled]
- Out-of-Band Mgmt Port [**COM1**; COM2]
- Data Bits 8
- Parity None
- Stop Bits 1
- Terminal Type [VT-UTF8]

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BIOS Chipset Setup Screen

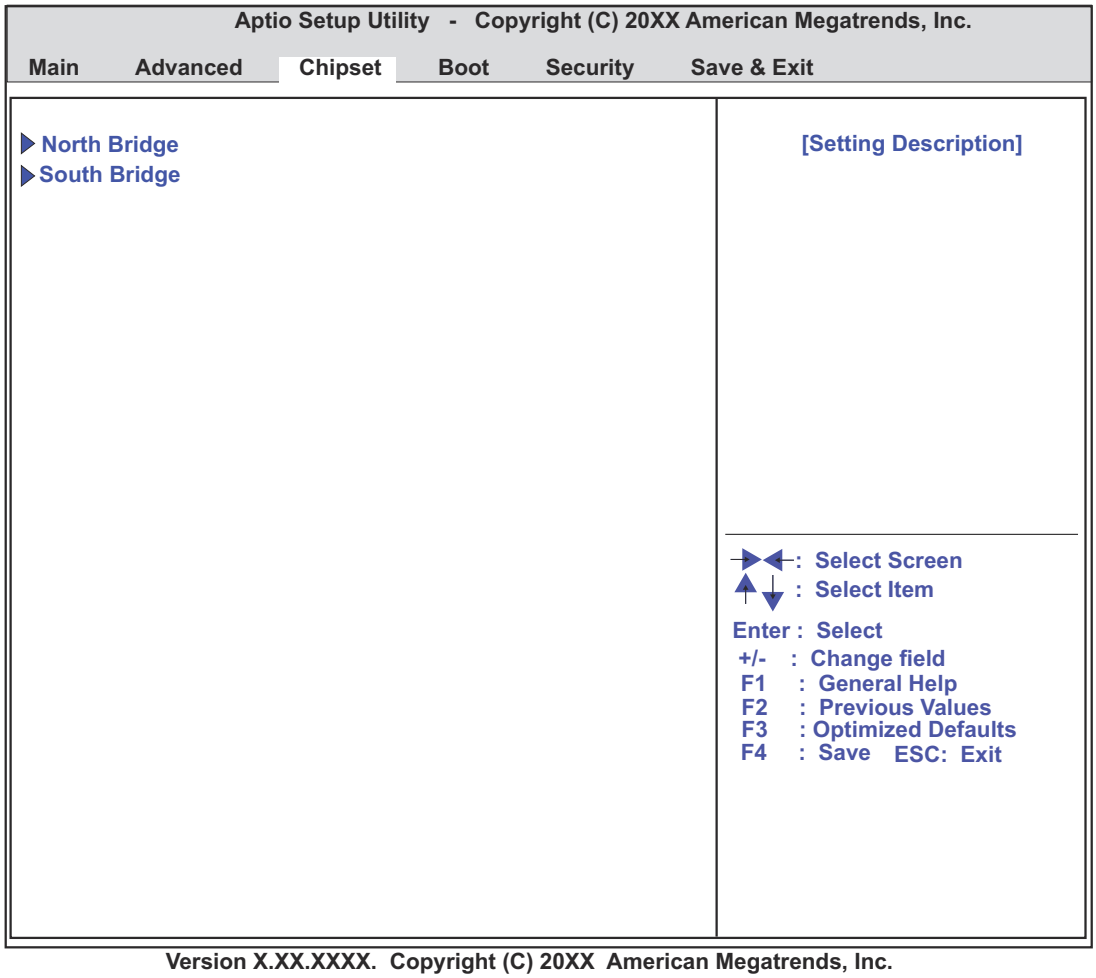


Figure 4-3. BIOS Chipset Setup Screen

- **North Bridge**
  - Memory Information
    - CPU Type Xxxxxxxxxxxxx
    - Total Memory XXXX MB (DDR3 XXX)
    - Memory Slot (Lower) X MB (DDR3 XXX)
    - Memory Slot (Upper) XXXX MB (DDR3 XXX)
    - CAS# Latency (tCL) X
    - RAS# Active Time (tRAS) XX
    - Row Precharge Time (tRCD) X
    - RAS# to CAS# Delay (tRCD X
    - Write Recovery Time (tWR) X
    - Row Refresh Cycle Timea (tRFC) XX
    - Write to Read Delay (tWTR) X
    - Active to Active Delay (tRRD) X
    - Read CAS# Precharge (tRTP) X

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- Low MMIO Align [**64M**; 1024M]
- Initiate Graphic Adapter [IGD
  PCI/IGD
  PCI/PEG
  PEG/IGD
  PEG/PCI]
- Graphics Turbo IMON Current 31
- VT-d [**Disabled**; Enabled]
- PCI Express Compliance Mode [**Disabled**; Enabled]
- PCI Express Port [Disabled; Enabled; **Auto**]
- IGD Memory [Disable; **32M**; 64M; 128M]
- PAVP Mode [**Disabled**; Enabled]
- PEG Force Gen1 [**Disabled**; Enabled]

- **South Bridge**
  - South Bridge Chipset Configuration
    - SMBUS Controller [Disable; **Enable**]
    - Restore AC Power Loss [**Power Off**; Power On; Last State]
    - SLP_S4 Assertion Stretch Enable [Disable; **Enable**]
    - SLP_S4 Assertion Width [1-2 Seconds
      2-3 Seconds
      3-4 Seconds
      4-5 Seconds]
  - Audio Configuration
    - Azalia HD Audio [Disabled; **Enabled**]
    - Azalia internal HDMI codec [**Disable**; Enable]
  - High Precision Event Timer Configuration
    - High Precision Timer [Disabled; **Enabled**]
  - PCI Express Ports Configuration
    - PCI Express Port 1 [Disable; Enable; **Auto**]
    - PCI Express Port 2 [Disable; Enable; **Auto**]
    - PCI Express Port 3 [Disable; Enable; **Auto**]
    - PCI Express Port 4 [Disable; Enable; **Auto**]
    - PCI Express Port 5 [Disable; Enable; **Auto**]
    - PCI Express Port 6 [**Auto**]
    - PCI Express Port 7 [Disable; Enable; **Auto**]
  - USB Configuration
    - All USB Devices [Disabled; **Enabled**]
    - EHCI Controller 1 [Disabled; **Enabled**]
    - USB Port 0 [Disabled; **Enabled**]
    - USB Port 1 [Disabled; **Enabled**]

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- USB Port 2 [Disabled; **Enabled**]
- USB Port 3 [Disabled; **Enabled**]
- USB Port 4 [Disabled; **Enabled**]
- USB Port 5 [Disabled; **Enabled**]
- USB Port 6 [Disabled; **Enabled**]
- USB Port 7 [Disabled; **Enabled**]

BIOS Boot Setup Screen

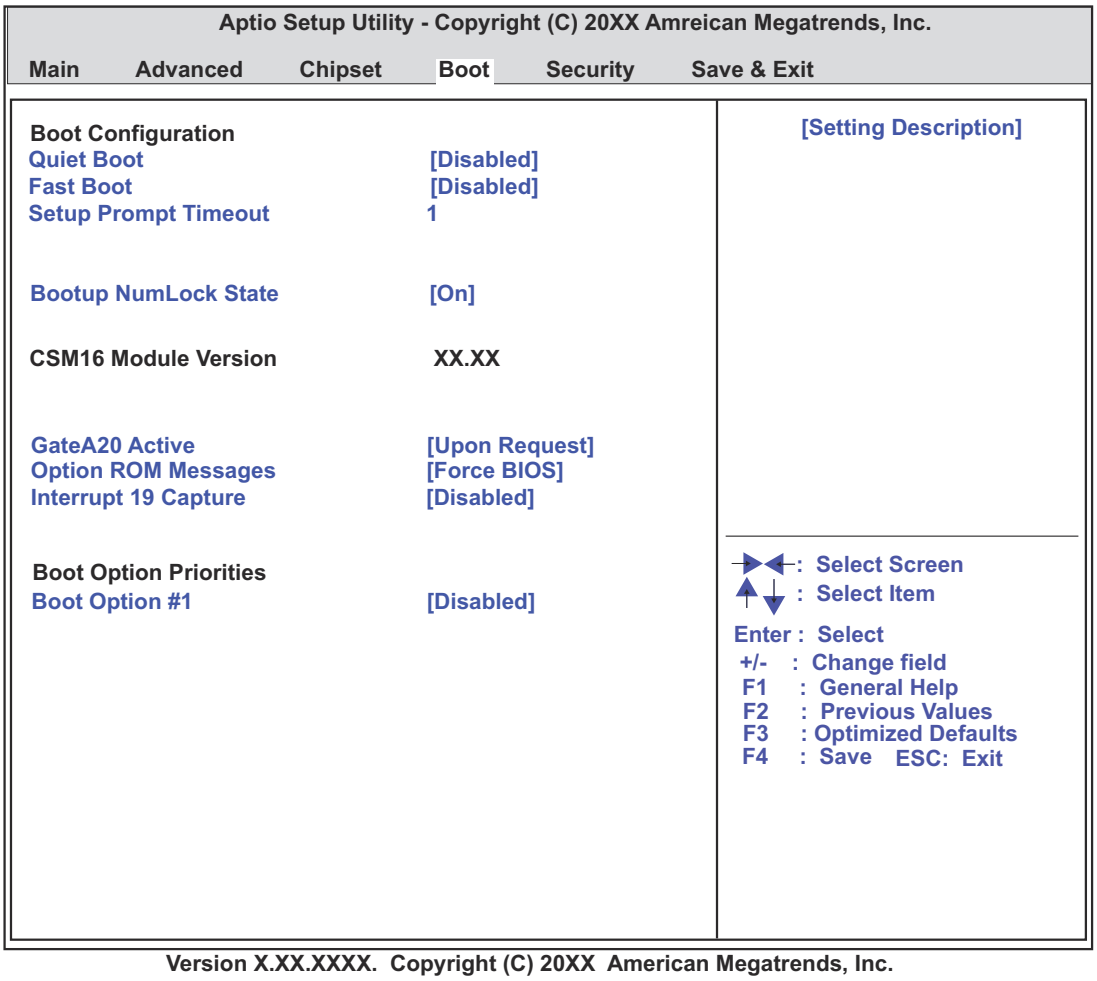


Figure 4-4. BIOS Boot Setup Screen

- **Boot Configuration**
  - Quiet Boot [**Disabled**; Enabled]
  - Fast Boot [**Disabled**; Enabled]
  - Setup Prompt Timeout 1
  - Bootup NumLock State [**On**; Off]
- CSM16 Module Version 07.60
  - Gate A20 Active [**Upon Request**; Always]
  - Option ROM Messages [**Force BIOS**; Keep Current]

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- Interrupt 19 Capture [**Disabled**; Enabled]

- **Boot Option Priorities**
  - Boot Option #1 [Built-in EFI Shell; **Disabled**]

BIOS Security Setup Screen

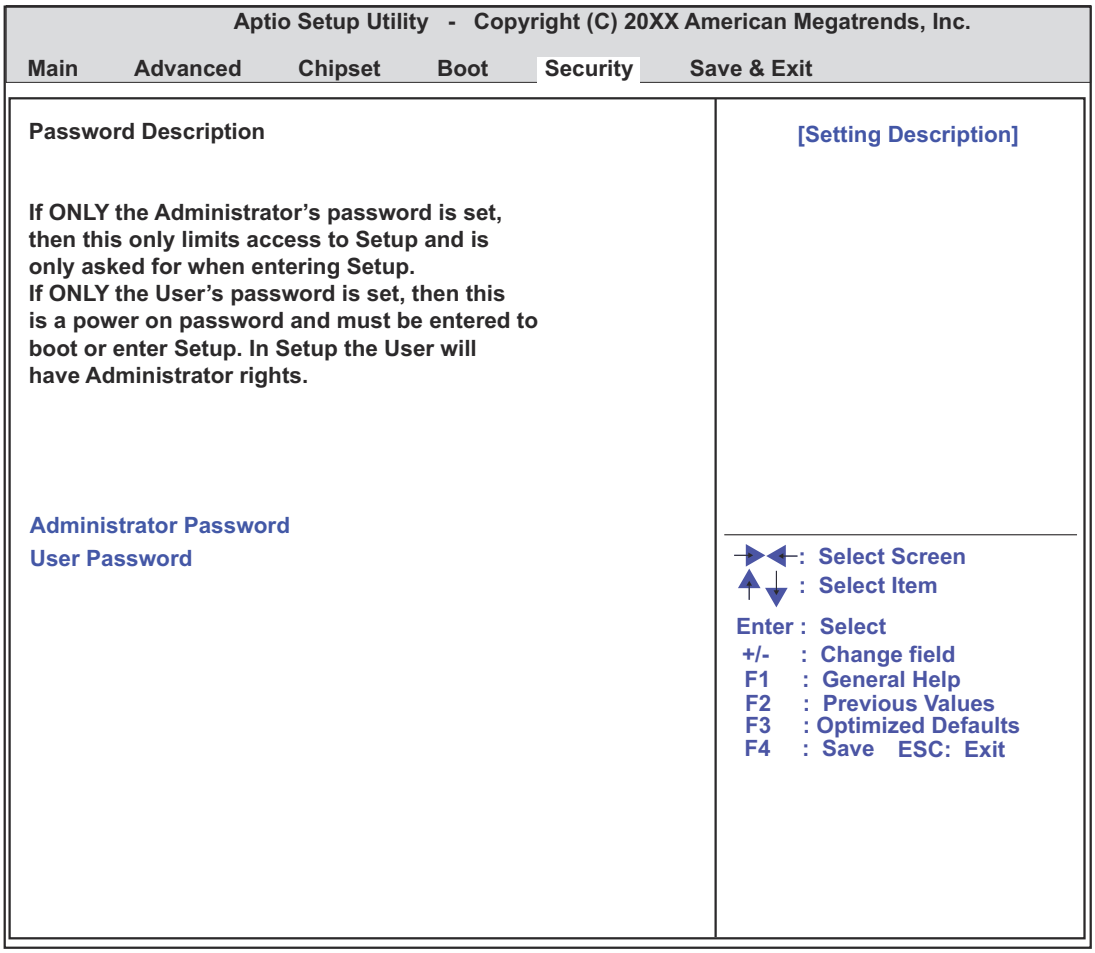


Figure 4-5. BIOS Security Setup Screen

- **Administrator Password** [Create New Password]
- **User Password** [Create New Password]

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BIOS Save & Exit Setup Screen

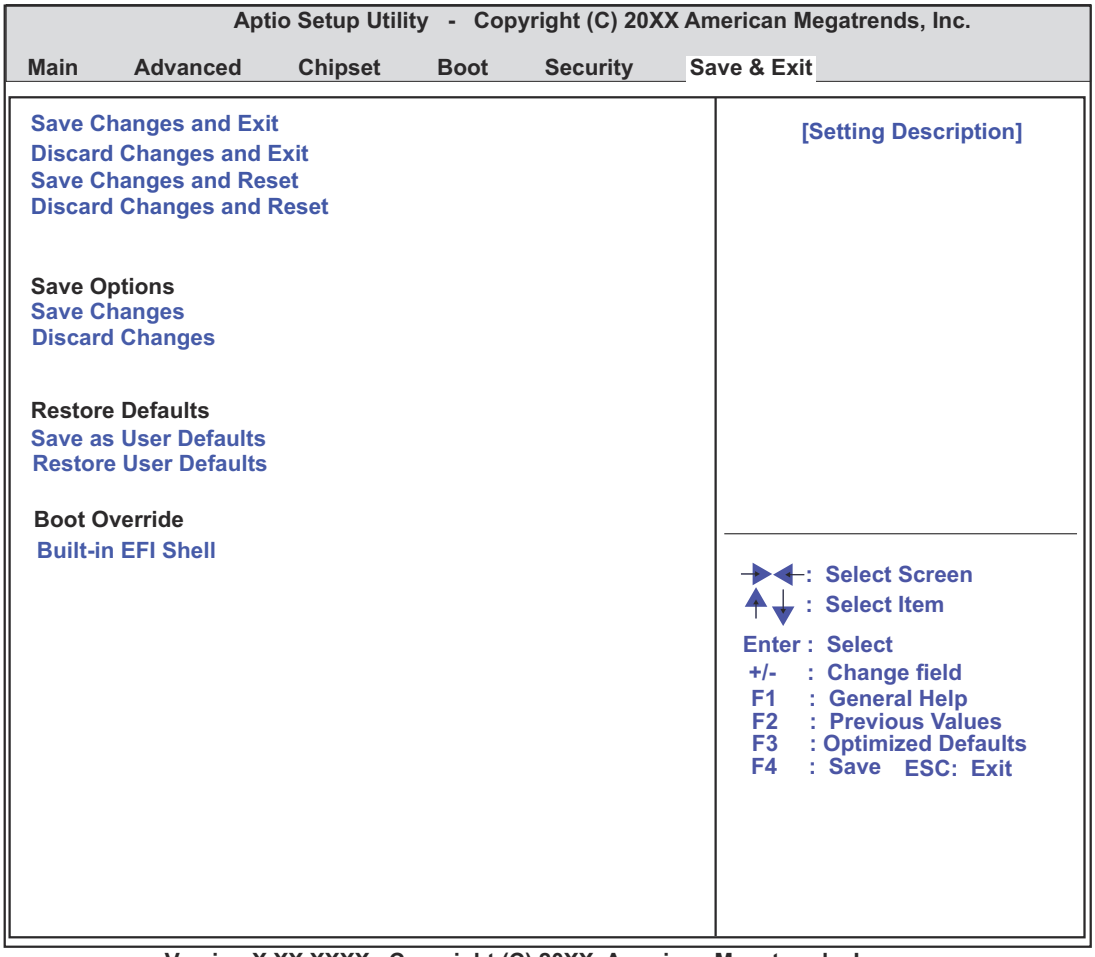


Figure 4-6. BIOS Save & Exit Setup Screen

- Save Changes and Exit
  - Save configuration and exit? [**Yes**; No]
- Discard Changes and Exit
  - Quit without saving? [**Yes**; No]
- Save Changes and Reset
  - Save configuration and reset? [**Yes**; No]
- Discard Changes and Reset
  - Reset without saving? [**Yes**; No]

- **Save Options**
  - Save Changes
    - Save configuration [**Yes**; No]
  - Discard Changes
    - Load Previous Values [**Yes**; No]
  - Restore Defaults
    - Load Optimized Defaults [**Yes**; No]

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- Save as User Defaults
  - Save configuration? [**Yes**; No]
- Restore User Defaults
  - Restore User Defaults? [**Yes**; No]

- **Boot Override**
  - Built-in EFI Shell

NOTE	Selecting this setting enters the system into the EFI Shell mode screen.

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Appendix A Technical Support

ADLINK Technology, Inc. provides a number of methods for contacting Technical Support listed in the Table A-1 below. Requests for support through the Ask an Expert are given the highest priority, and usually will be addressed within one working day.

- ADLINK Ask an Expert – This is a comprehensive support center designed to meet all your technical needs. This service is free and available 24 hours a day through the Ampro By ADLINK web page at http://www.adlinktech.com/AAE/. This includes a searchable database of Frequently Asked Questions, which will help you with the common information requested by most customers. This is a good source of information to look at first for your technical solutions. However, you must register online if you wish to use the Ask a Question feature.

  ADLINK strongly suggests that you register with the web site. By creating a profile on the ADLINK web site, you will have a portal page called "My ADLINK" unique to you with access to exclusive services and account information.

- Personal Assistance – You may also request personal assistance by creating an Ask an Expert account and then going to the Ask a Question feature. Requests can be submitted 24 hours a day, 7 days a week. You will receive immediate confirmation that your request has been entered. Once you have submitted your request, you must log in to go to the My Question area where you can check status, update your request, and access other features.

- Download Service – This service is also free and available 24 hours a day at http://www.adlinktech.com. For certain downloads such as technical documents and software, you must register online before you can log in to this service.

Table A-1. Technical Support Contact Information

Method	Contact Information
Ask an Expert	http://www.adlinktech.com/AAE/
Web Site	http://www.adlinktech.com
Standard Mail	Contact us should you require any service or assistance. **ADLINK Technology, Inc.** Address: 9F, No.166 Jian Yi Road, Zhonghe District New Taipei City 235, Taiwan 新北市中和區建一路 166 號 9 樓 Tel: +886-2-8226-5877 Fax: +886-2-8226-5717 Email: service@adlinktech.com **Ampro ADLINK Technology, Inc.** Address: 5215 Hellyer Avenue, #110, San Jose, CA 95138, USA Tel: +1-408-360-0200 Toll Free: +1-800-966-5200 (USA only) Fax: +1-408-360-0222 Email: info@adlinktech.com **ADLINK Technology (China) Co., Ltd.** Address: 上海市浦东新区张江高科技园区芳春路 300 号 (201203) 300 Fang Chun Rd., Zhangjiang Hi-Tech Park, Pudong New Area, Shanghai, 201203 China Tel: +86-21-5132-8988 Fax: +86-21-5132-3588 Email: market@adlinktech.com

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Table A-1. Technical Support Contact Information (Continued)

ADLINK Technology Beijing
Address: 北京市海淀区上地东路 1 号盈创动力大厦 E 座 801 室(100085)
Rm. 801, Power Creative E, No. 1 Shang Di East Rd.
Beijing, 100085 China
Tel: +86-10-5885-8666
Fax: +86-10-5885-8626
Email: market@adlinktech.com

ADLINK Technology Shenzhen
Address: 深圳市南山区科技园南区高新南七道 数字技术园
A1 栋 2 楼 C 区 (518057)
2F, C Block, Bldg. A1, Cyber-Tech Zone, Gao Xin Ave. Sec. 7
High-Tech Industrial Park S., Shenzhen, 518054 China
Tel: +86-755-2643-4858
Fax: +86-755-2664-6353
Email: market@adlinktech.com

LiPPERT ADLINK Technology GmbH
Address: Hans-Thoma-Strasse 11, D-68163
Mannheim, Germany
Tel: +49-621-43214-0
Fax: +49-621 43214-30
Email: emea@adlinktech.com

ADLINK Technology, Inc. (French Liaison Office)
Address: 6 allée de Londres, Immeuble Ceylan
91940 Les Ulis, France
Tel: +33 (0) 1 60 12 35 66
Fax: +33 (0) 1 60 12 35 66
Email: france@adlinktech.com

ADLINK Technology Japan Corporation
Address: 〒101-0045 東京都千代田区神田鍛冶町 3-7-4
神田 374 ビル 4F
KANDA374 Bldg. 4F, 3-7-4 Kanda Kajicho,
Chiyoda-ku, Tokyo 101-0045, Japan
Tel: +81-3-4455-3722
Fax: +81-3-5209-6013
Email: japan@adlinktech.com

ADLINK Technology, Inc. (Korean Liaison Office)
Address: 137-881 서울시 서초구 서초대로 326, 802 (서초동, 모인터빌딩)
802, Mointer B/D, 326 Seocho-daero, Seocho-Gu,
Seoul 137-881, Korea
Tel: +82-2-2057-0565
Fax: +82-2-2057-0563
Email: korea@adlinktech.com

ADLINK Technology Singapore Pte. Ltd.
Address: 84 Genting Lane #07-02A, Cityneon Design Centre
Singapore 349584
Tel: +65-6844-2261
Fax: +65-6844-2263
Email: singapore@adlinktech.com

ADLINK Technology Singapore Pte. Ltd. (Indian Liaison Office)
Address: #50-56, First Floor, Spearhead Towers
Margosa Main Road (between 16th/17th Cross)
Malleswaram, Bangalore - 560 055, India
Tel: +91-80-65605817, +91-80-42246107
Fax: +91-80-23464606
Email: india@adlinktech.com

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Table A-1. Technical Support Contact Information (Continued)

	ADLINK Technology, Inc. (Israeli Liaison Office) Address: 27 Maskit St., Corex Building PO Box 12777 Herzliya 4673300, Israel Tel: +972-54-632-5251 Fax: +972-77-208-0230 Email: israel@adlinktech.com **ADLINK Technology, Inc. (UK Liaison Office)** Tel: +44 774 010 59 65 Email: UK@adlinktech.com

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