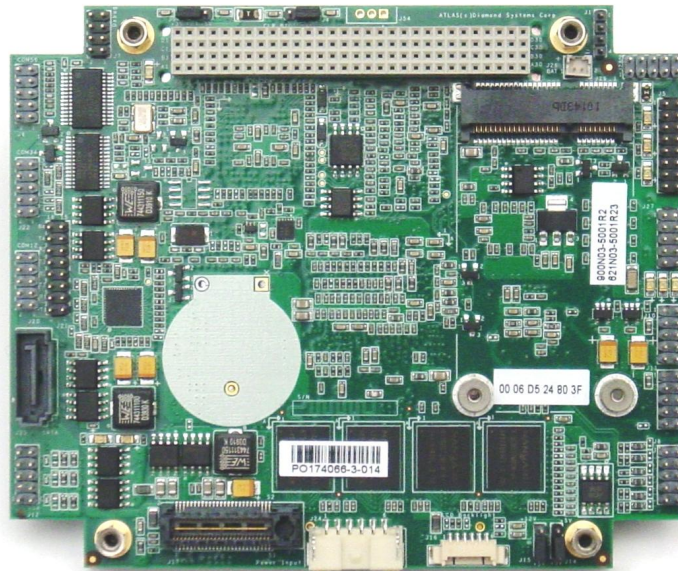




# ATLAS Single Board Computer

PCI/104-Express SBC with Intel Atom N2800 Cedar Trail CPU



Revision	Date	Comments
Rev A.00	1/17/2014	Initial Release
Rev A.03	12/16/14	Updated Cable Kit, DK and SDK information
Rev A.04	5/01/17	Updates to development kit

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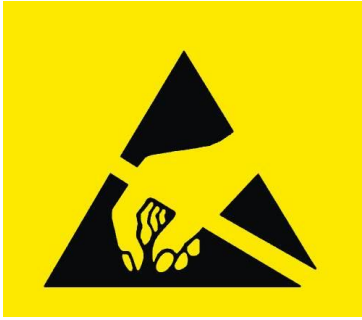
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## IMPORTANT SAFE-HANDLING INFORMATION



**WARNING: ESD-Sensitive Electronic Equipment!**

**Observe ESD-safe handling procedures when working with this product.**

**Always use this product in a properly grounded work area and wear appropriate ESD-preventive clothing and/or accessories.**

**Always store this product in ESD-protective packaging when not in use.**

### ***Safe Handling Precautions***

Atlas contains numerous I/O connectors that connect to sensitive electronic components. This creates many opportunities for accidental damage during handling, installation and connection to other equipment. The list here describes common causes of failure found on boards returned to Diamond Systems for repair. This information is provided as a source of advice to help you prevent damaging your Diamond (or any vendor's) embedded computer boards.

**ESD damage** – This type of damage is almost impossible to detect, because there is no visual sign of failure or damage. The symptom is that the board simply stops working, because some component becomes defective. Usually the failure can be identified and the chip can be replaced.

To prevent ESD damage, always follow proper ESD-prevention practices when handling computer boards.

**Damage during handling or storage** – On some boards we have noticed physical damage from mishandling. A common observation is that a screwdriver slipped while installing the board, causing a gouge in the PCB surface and cutting signal traces or damaging components.

Another common observation is damaged board corners, indicating the board was dropped. This may or may not cause damage to the circuitry, depending on what is near the corner. Most of our boards are designed with at least 25 mils clearance between the board edge and any component pad, and ground / power planes are at least 20 mils from the edge to avoid possible shorting from this type of damage. However these design rules are not sufficient to prevent damage in all situations.

A third cause of failure is when a metal screwdriver tip slips, or a screw drops onto the board while it is powered on, causing a short between a power pin and a signal pin on a component. This can cause overvoltage / power supply problems described below. To avoid this type of failure, only perform assembly operations when the system is powered off.

Sometimes boards are stored in racks with slots that grip the edge of the board. This is a common practice for board manufacturers. However our boards are generally very dense, and if the board has components very close to the board edge, they can be damaged or even knocked off the board when the board tilts back in the rack. Diamond recommends that all our boards be stored only in individual ESD-safe packaging. If multiple boards are stored together, they should be contained in bins with dividers between boards. Do not pile boards on top of each other or cram too many boards into a small location. This can cause damage to connector pins or fragile components.

**Power supply wired backwards** – Our power supplies and boards are not designed to withstand a reverse power supply connection. This will destroy each IC that is connected to the power supply. In this case the board will most likely will be unrepairable and must be replaced. A chip destroyed by reverse power or by excessive power will often have a visible hole on the top or show some deformation on the top surface due to vaporization inside the package. **Check twice before applying power!**

**Bent connector pins** – This type of problem is often only a cosmetic issue and is easily fixed by bending the pins back to their proper shape one at a time with needle-nose pliers. This situation can occur when pulling a ribbon cable off of a pin header. Note: If the pins are bent too severely, bending them back can cause them to weaken unacceptably or even break, and the connector must be replaced.

# 1. INTRODUCTION

Atlas is a high performance, highly integrated small form factor single board computer in the PCI/104-Express form-factor. Atlas incorporates a wealth of standard PC-style I/O plus on-board digital I/O. Atlas provides PCIe/104 I/O expansion by means of a new miniature, cost-effective expansion connector that supports most PCIe/104 I/O modules. A PCIe MiniCard socket is available for additional add-on I/O. An integrated, bottom-mounted heatspreader dissipates heat efficiently to the system enclosure. This configuration leaves the SBC's top side free for easy access to memory, on-board I/O, and expansion sockets.

Key feature highlights include:

- Compact, low-power, high-performance, stackable SBC
- 1.86GHz Intel N2800 CPU
- 2GB or 4GB soldered 64-bit DDR3 SDRAM
- Comprehensive set of I/O interfaces:
  - 4 USB 2.0 ports
  - 4 RS-232/422/485 and 2 RS-232 serial ports
  - 1 Gigabit Ethernet port
  - 1 SATA port
  - 18-bit LVDS LCD with dual independent displays
  - VGA CRT
  - ALC892 Codec based High Definition Audio with Stereo Line-Out, Stereo Line-In and Microphone
  - USB keyboard and mouse support
  - 8 programmable general purpose I/O lines
  - Programmable watchdog timer
- PCIe MiniCard socket auto-selects for either PCIe MiniCard module or mSATA flashdisk module
- PC/104-Plus form factor (4.55" x 3.775") with wings
- Stackable I/O expansion flexibility
  - PCI-104
  - PCIe/104
- -40°C to +75°C operating temperature

<b><i>Atlas Models</i></b>	<b><i>Processor Type</i></b>	<b><i>Processor Clock</i></b>	<b><i>On-board RAM</i></b>
ATLN2800-4G	Intel Atom N2800 CPU	1.86GHz	4GB DDR3 DRAM
ALTN2800-2G	Intel Atom N2800 CPU	1.86GHz	2GB DDR3 DRAM

## 1.1 Atlas SBC Features

Atlas is a compact, rugged, single board computer that features the Intel Atom N2800 Cedar Trail processor in the PC/104-*Plus* form factor.

### Functions

- Intel Atom N2800 processor clocked at 1.86GHz
- Cooling: Fanless design incorporates heatspreader and conduction cooling to the enclosure
- Memory: 2GB or 4GB DDR3 memory soldered on board
- Display options:

The video circuit consists of Intel's GMA500 controller integrated into the processor. This circuit offers dual independent simultaneous display support with both VGA and LVDS outputs. The video controller shares main memory for its frame buffer.

  - 18-bit LVDS flat panel interface supports dual independent displays; 1366 x 768 maximum resolution
  - LVDS backlight power: +5V or +12V jumper selectable
  - VGA CRT; 1280 x 1024 maximum resolution
- 4 USB 2.0 ports on headers
- 6 serial ports; Ports 1-4 supports TX, RX, RTS and CTS with RS-232/422/485 capability and Ports 5 & 6 support TX, RX, RTX and CTS RS-232 only
- Networking: One Intel 82574IT based Gigabit Ethernet port on pin header, with on-board magnetics
- Mass storage:
  - One SATA port
  - mSATA flashdisk mounting location supporting up to 64GB
- Keyboard/Mouse: support for USB
- Realtek ALC892 Codec based High Definition Audio with Stereo Line-Out, Stereo Line-In and Microphone.
- 8 general purpose I/O lines
- Programmable watchdog timer
- Expansion socket: PCIe MiniCard full size auto-selects for either PCIe MiniCard module or mSATA flashdisk module
- Stackable I/O expansion buses: PCI-104 and PCIe/104
- Input power: 5VDC  $\pm$ 5%
- Power consumption: 7.53W idle
- Operating temperature: -40°C to +75°C (-40°F to +167°F)
- PC/104-*Plus* form factor with wings: mm x mm (4.550" x 3.775")
- Weight: 7.6oz (215.5 grams) with heatspreader
- RoHS: Compliant

## LED Indicators

Atlas provides a set of LED indicators for various features as follows. All LEDs are located near their respective function.

Power input:	Green LED when +5VDC is applied
Power on:	Green LED when SBC is powered on
Ethernet:	Green / yellow / orange; link, activity, and speed
Programmable LED:	Blue, connected to a GPIO line on the SCH3116 super I/O chip; this LED is off during power-up and is turned on in the BIOS to indicate a successful system BIOS startup.
PCIe MiniCard socket:	3 LEDs to support WWAN, WPAN, WLAN signals from the connector

## Operating System Support

- Windows Embedded Standard 7
- Windows Embedded CE
- Linux 2.6.xx

## 1.2 Thermal Considerations

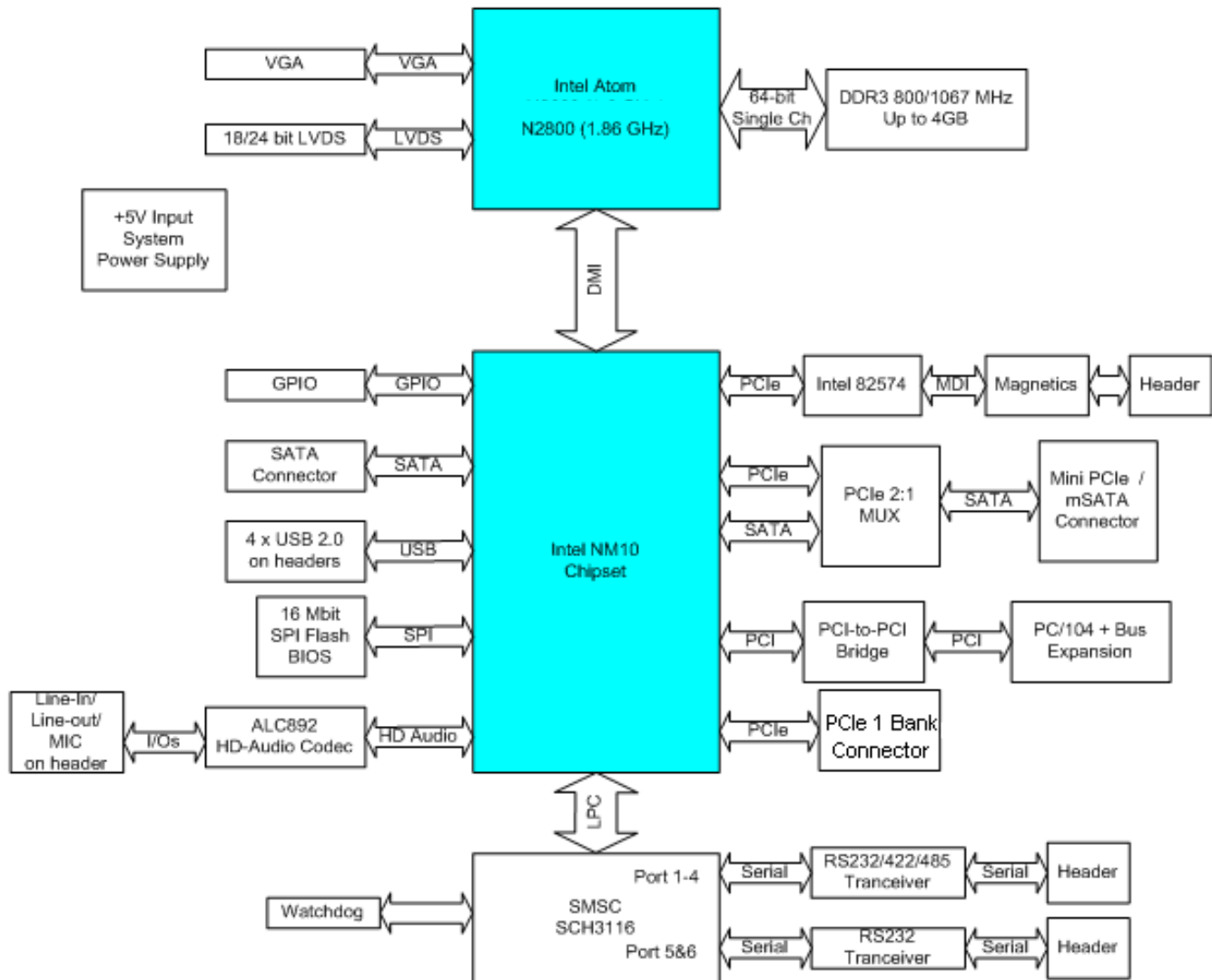
All models of Atlas are specified for a  $-40^{\circ}\text{C}$  to  $+75^{\circ}\text{C}$  operating range, the temperature being measured at the outside surface of the heatspreader. Diamond Systems provides a heatspreader attached to the Atlas single board computer as a conductive cooled thermal layer. However, this heatspreader by itself does not constitute the complete thermal solution necessary for any specific implementation, but provides a common interface between the single board computer and the customer's implementation-specific thermal solution.

The outside surface of the Atlas heatspreader must be kept at a temperature not to exceed  $+75^{\circ}\text{C}$ . If your environment causes the temperature on the outside surface of the heatspreader to exceed this temperature, you are responsible for removing the additional heat from the system through either an additional passive thermal solution or fan solution.

## 2. FUNCTIONAL OVERVIEW

### 2.1 Block Diagram

Figure 2 shows Atlas' functional blocks.

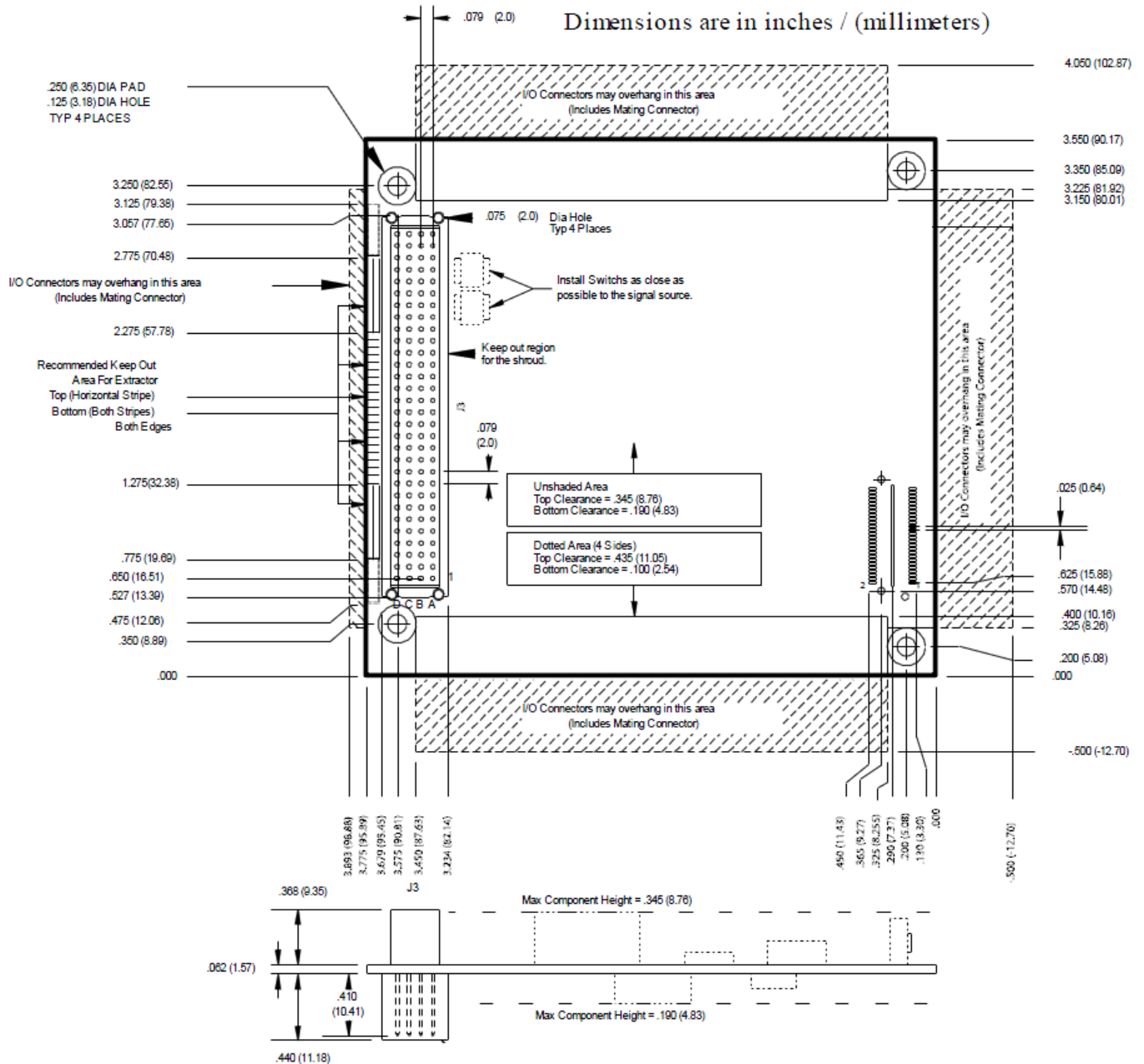


**Figure 2: Atlas SBC Functional Block Diagram**



## 2.2 Atlas Dimensions

Figure 3 shows the overall dimensions of the Atlas SBC. Atlas conforms to PC/104 specifications for the 4 corners and 4 mounting holes as well as component height limits on the top and bottom sides. Wings, or extensions on the left and right sides, provide additional room for I/O connectors. The wings extend 0.5" past the standard PC/104 board edges as shown in the drawing below.



**Figure 3: Atlas Dimensions, inches**

### 2.3 Connector and Jumper Locations

Figure 4 illustrates the position of interface connectors, bus connectors, and jumper blocks located on the Atlas SBC, which features PCI-104 and PCIe/104 stackable I/O.

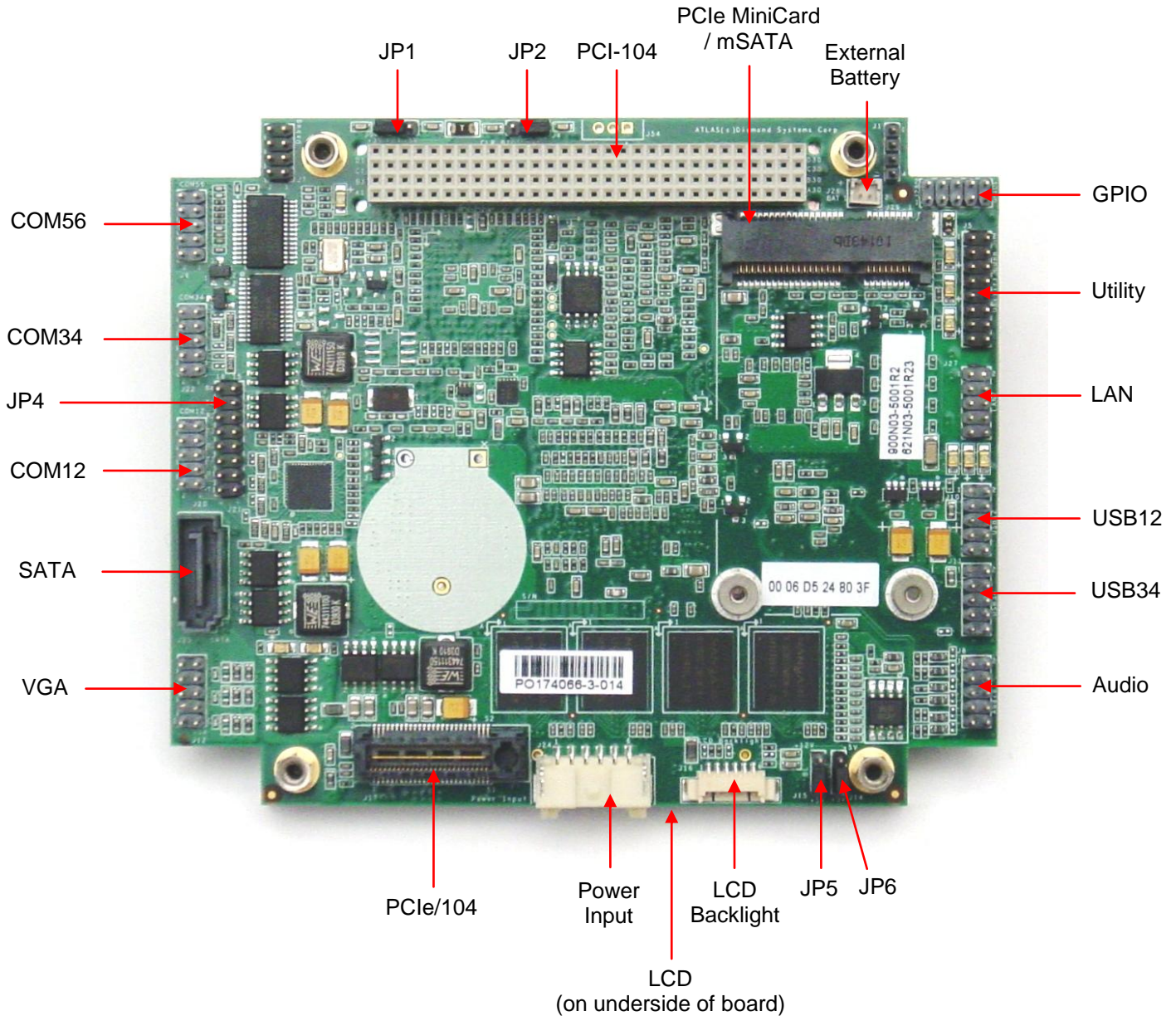


Figure 4: Atlas SBC Connector & Jumper Locations

### 2.3.1 Connector Summary

The following table summarizes the functions of Atlas's interface, utility, and power connectors. Signal functions relating to all of Atlas's interface connectors are discussed in greater detail in Section 4 of this document. Diamond offers an optional Atlas Cable Kit (number CK-ATLAS-01), which provides mating cable assemblies for most of Atlas' I/O interface connectors.

<b>Connector Function</b>	<b>Silkscreen Label</b>
External Battery	BAT
SATA	SATA
Gigabit Ethernet	LAN
Serial Ports 1 & 2	COM12
Serial Ports 3 & 4	COM34
Serial Ports 5 & 6	COM56
USB Ports	USB12 & USB34
Utility Signals	Utility
LCD Backlight	LCD Backlight
LCD (LVDS) Panel	LCD
PCIe/104	PCIe/104
PCI-104	PCI-104
Power Input	Power Input
GPIO	GPIO
PCIe MiniCard / mSATA	PCIe MiniCard
Audio	Audio
VGA	VGA

### 2.3.2 Configuration Jumper Summary

The Atlas SBC contains jumper blocks for configuring the following features. The board also contains locations for installation of 0-ohm resistors in place of all valid jumper positions for a rugged configuration. The 0-ohm resistors are oriented and labeled in a way that provides easy understanding of their use and easy interpretation of their settings.

Atlas' configuration jumpers are listed below. Refer to Section 5 of this document for details regarding the configuration of these jumper groups.

<b>Jumper Group Function</b>	<b>Jumper Block</b>	<b>Array Size</b>
PCI voltage (default: +5V)	JP1	1 X 3
CMOS RAM Reset (default: no clear)	JP2	1 X 3
Serial Port 1 RS-422/485 mode differential termination resistor: Enable or Disable (default: Disable)	JP4	1 X 8
LCD backlight power: 5V or 12V (default: 5V) (+12V provided through the input power connector)	JP5	1 X 3
LCD panel supply voltage: 3.3V or 5V (default: 3.3V)	JP6	1 X 3

### 3. GETTING STARTED

First-time Atlas SBC users normally receive the product as part of Diamond’s Atlas Development Kit, DK-ATLN-LNX, which provides everything needed to ensure rapid application development. This section of the Atlas User Manual covers basic hardware setup, power connection, system boot-up, and initial software configuration. After Atlas is up and running, refer to the later sections of this manual for the detailed hardware and software reference information needed to adapt the product to specific applications.

**Important Safe-Handling Information**



**WARNING:** ESD-Sensitive Electronic Equipment!

Observe ESD-safe handling procedures when working with this product.

Always use this product in a properly grounded work area and wear appropriate ESD-preventive clothing and/or accessories.

Always store this product in ESD-protective packaging when not in use.

Please refer to page 4 of this manual (“Important Safe-Handling Information”) for further details.

#### 3.1 Introducing the Atlas Development Kit

The Atlas Development Kit, DK-ATLN-LNX, provides everything required for Atlas-based rapid application development. The table on the next page lists the boards, cables, and other items included. Each kit contains an Atlas SBC, the Atlas Linux Software Development Kit, the Atlas Cable Kit, and a DVD with a Linux image.

<i>Item</i>	<i>Diamond P/N</i>	<i>Description</i>
1	ATLN2800-2G	Atlas SBC with 2GB DDR3 SDRAM on-board
2	8890673	16GB mSATA flashdisk with a bootable Linux image
3	6710673	DVD Linux image for Atlas SBC
4	CK-ATLAS-01	Atlas Cable Kit
5	7480673	Atlas Quick Start Guide
6	DOC-PKG	Diamond Systems Document Package

### 3.1.1 Atlas Cable Kit

The Atlas Cable Kit (number CK-ATLAS-01) provides convenient access to most of Atlas's I/O features. The kit's cable assemblies are shown in the photo below, and identified in the table that follows.



<i>Item</i>	<i>Qty</i>	<i>Description</i>	<i>Diamond P/N</i>	<i>Connects to...</i>
1	1	Power input cable	6981074	Power Input
2	3	Dual serial cable	6981075	COM12, COM34 & COM56
3	1	HD Audio cable	6981076	Audio
4	1	Digital I/O cable	6981077	GPIO
5	1	Utility cable	6981078	Utility
6	1	Gigabit Ethernet cable to RJ45	6981080	LAN
7	2	Dual USB cable	6981082	USB12 & USB34
8	1	VGA cable	6981084	VGA

**Note:** On each interface cable, the end of the cable connector that has a red wire going to it should be oriented toward the end of the board connector that is labeled "pin 1" (typically the pin with a square pad on the PCB).

## 3.2 System Setup

This section outlines a simple process for preparing Atlas for first-time operation using the Atlas Development Kit. Additional details regarding Atlas's interface functions and connections may be found in Section 4 of this document.

### 3.2.1 Keyboard and Mouse

Atlas supports operation using a USB-based keyboard and mouse devices. Plug the USB keyboard connector and USB mouse cable into the Atlas Cable Kit cable number 6981082 and the end of the cable into connector USB12 on the Atlas SBC.

### 3.2.2 mSATA Flashdisk

Install the mSATA flashdisk, part number 8890673, onto the mSATA connector located on the top side of the Atlas SBC. Remove the two screws from the mounting standoffs, insert the flashdisk into the mSATA connector, re-installed the two screws into the standoffs securing the flashdisk to the Atlas SBC.

### 3.2.3 Mass Storage Devices

If you want to use an external SATA hard drive, connect a SATA hard drive to Atlas by connecting a SATA cable to the SATA connector and then to the SATA drive. Atlas can operate with a combination of SATA and CD-ROM drives, and can boot from either of them.

**Caution!** Be sure the PS-5V-04 AC power adapter is disconnected from its AC power source prior to performing the following step.

### 3.2.4 Connecting Power

Connect cable 6981074 to an ATX power supply. Connect the other end of the 6981074 cable to the Power Input connector on the Atlas SBC.

### 3.2.5 Display

Atlas provides interfaces for both LVDS flat panel displays and VGA output. Connect the VGA cable, 6981084, between the VGA connector and a VGA-compatible display.

### 3.2.6 Installing Atlas in an Enclosure (optional)

Install the Atlas single board computer in an enclosure that has an appropriate mounting-hole pattern (2.8" square).

Atlas' heatspreader has four #6-32 threaded holes on 2.8" centers for mounting. Select four #6-32 threaded screws of the proper length and head type to work with your enclosure. Allow a minimum of 0.25" and maximum of 0.40" screw length for insertion into Atlas's heatspreader. The total screw length will depend on the thickness of your enclosure wall.

### 3.3 Booting the System

Power-up the VGA video monitor. Then plug an AC power adapter to an AC outlet. Atlas should begin its boot-up sequence immediately, as evidenced by BIOS messages on the connected VGA display. You can run the BIOS Setup utility and proceed to install an operating system on the boot drive just as you would on a normal desktop PC.

#### 3.3.1 BIOS Setup

Atlas's BIOS provides a wide range of configuration options. When you power up Atlas for the first time, you should immediately enter the BIOS "Setup" utility in order to adjust BIOS settings to match your system's peripheral devices and other requirements, and to configure various other hardware and software parameters.

Options configurable via Setup typically include:

- Number and type of mass storage devices
- Boot device priority
- Video display type and resolution
- IDA, SATA, serial, and parallel interface modes and protocols
- PCI and PnP configuration
- Power management setup
- Automatic power-up after LAN connection, RTC alarm, power resumption, etc.
- System monitoring and security functions

#### 3.3.2 Operating System Drivers

Using the operating system drivers provided on the CD in the Development Kit, create a bootable image of the operating system, incorporating in any additional drivers desired for your system configuration. Atlas will boot and run the operating system from the specified boot drive in the BIOS. Atlas should now be fully operational.

If you desire to run a different operating system, depending on the operating system to be installed, it may be necessary to install software drivers for on-board interface controllers. Drivers for Windows Embedded Standard 7, Windows Embedded CE, and Linux 2.6, if required, are included on the Software and Documentation CD that is included in the Atlas Development Kit.

## 4. INTERFACE CONNECTOR DETAILS

This section describes the functions associated with the Atlas SBC, bus expansion, utility, I/O interfaces, and power connectors in greater detail. Section 3.1.1 contains a list of ready-to-use interface cables included in Diamond's Atlas Cable Kit.

### 4.1 External Battery (BAT)

Atlas has provision for an external battery connection via connector BAT, a two-pin connector.

A connector and jumper are provided to disable the on-board battery and enable use of an external battery instead. The external battery voltage requirement is 3.3V +/-10%. The jumper also clears the CMOS RAM when it is removed and no external battery is connected.

1	Ground
2	Battery+

**Connector type:** HIROSE, DF13-2P-1.25DSA(50)

### 4.2 SATA (SATA)



The SATA connector is an industry-standard right-angle connector. It is mounted flush with the edge of the board so as to plug the SATA cable to an external hard drive.

1	Ground
2	Transmit+
3	Transmit-
4	Ground
5	Receive-
6	Receive+
7	Ground

**Connector type:** SAMTEC



### 4.3 Ethernet (LAN)

This connector provides access to the board's Gigabit Ethernet port.

NC	1	2	<b>Key</b>
DA+	3	4	DA-
DB+	5	6	DB-
DC+	7	8	DC-
DD+	9	10	DD-

**Connector type:** 2x5 2mm pitch vertical pin header with 4.0mm min high posts and gold flash plating

### 4.4 Serial Ports (COM12, COM34 & COM56)

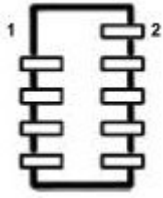
Atlas provides six serial ports of which Ports 1-4 support RS-232/422/485 multiprotocol with the TX, RX, RTS and CTS signals. Ports 5 and 6 support RS-232 with the TX, RX, RTS and CTS signals as shown in the pinouts below. In RS-232 mode ports 1-4 offer 4 wires plus ground (TX, RX, RTS, CTS, GND) and operate at speeds up to 115.2kbps. Console redirection can be set up in the BIOS for Port 1. TX/RX 121ohm line termination resistors are jumper-selectable for Ports 1-4 in RS-422/485 mode.

The serial ports are provided on 2x5 pin headers with 2 ports per header labeled as COM12, COM34, and COM56. The pin definition depends on the serial protocol selected. The pinouts below describe each protocol.

RS-232				RS-422				RS-485			
TX1	1	2	RTS1	TX1+	1	2	TX1-	TX1/RX1+	1	2	TX1/RX1-
RX1	3	4	CTS1	RX1+	3	4	RX1-	NC	3	4	NC
GND	5	6	GND	GND	5	6	GND	GND	5	6	GND
TX2	7	8	RTS2	TX2+	7	8	TX2-	TX2/RX2+	7	8	TX2/RX2-
RX2	9	10	CTS2	RX2+	9	10	RX2-	NC	9	10	NC
TX3	1	2	RTS3	TX3+	1	2	TX3-	TX3/RX3+	1	2	TX3/RX3-
RX3	3	4	CTS3	RX3+	3	4	RX3-	NC	3	4	NC
GND	5	6	GND	GND	5	6	GND	GND	5	6	GND
TX4	7	8	RTS4	TX4+	7	8	TX4-	TX4/RX4+	7	8	TX4/RX4-
RX4	9	10	CTS4	RX4+	9	10	RX4-	NC	9	10	NC
TX5	1	2	RTS5								
RX5	3	4	CTS5								
GND	5	6	GND								
TX6	7	8	RTS6								
RX6	9	10	CTS6								

**Connector type:** 2x5 2mm pitch vertical pin headers with 4.0mm min high posts and gold flash plating

## 4.5 USB 1-2 (USB12)

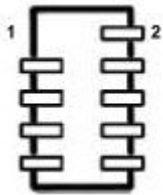


This connector provides access to two of the board's four USB 2.0 ports, USB1 and USB2. The shield pin is tied to system ground.

<b>NC (Key)</b>	<b>1</b>	<b>2</b>	Shield
USB2 GND	<b>3</b>	<b>4</b>	USB1 GND
USB2 Data+	<b>5</b>	<b>6</b>	USB1 Data+
USB2 Data-	<b>7</b>	<b>8</b>	USB1 Data-
USB2 Pwr	<b>9</b>	<b>10</b>	USB1 Pwr

**Connector type:** 2x5 2mm pitch vertical pin headers with 4.0mm min high posts and gold flash plating

## 4.6 USB 3-4 (USB34)



This connector provides access to two of the board's four USB 2.0 ports, USB3 and USB4. The shield pin is tied to system ground.

<b>NC (Key)</b>	<b>1</b>	<b>2</b>	Shield
USB4 GND	<b>3</b>	<b>4</b>	USB3 GND
USB4 Data+	<b>5</b>	<b>6</b>	USB3 Data+
USB4 Data-	<b>7</b>	<b>8</b>	USB3 Data-
USB4 Pwr	<b>9</b>	<b>10</b>	USB3 Pwr

**Connector type:** 2x5 2mm pitch vertical pin headers with 4.0mm min high posts and gold flash plating

## 4.7 Utility Signals (Utility)

This connector provides utility signals and LED indicator signals for Atlas as follows.

Gnd	<b>1</b>	<b>2</b>	Reset-
Gnd	<b>3</b>	<b>4</b>	PWRBTN-
NC	<b>5</b>	<b>6</b>	NC
+5V	<b>7</b>	<b>8</b>	Speaker
+3.3V	<b>9</b>	<b>10</b>	Power On LED
+3.3V	<b>11</b>	<b>12</b>	LAN Activity LED
+3.3V	<b>13</b>	<b>14</b>	LAN Link 100 LED
+3.3V	<b>15</b>	<b>16</b>	Lan Link 1000 LED

Speaker	PC speaker. Connect a speaker between this pin and +5V.
Power LED	Referenced to +3.3V. Does not require any external series resistor. Connect LED directly between this pin and +3.3V pin.
LAN Link 100	Illuminated for 100Mbps Ethernet operation
LAN Link 1000	Illuminated for 1000Mbps Ethernet operation
LAN Activity	Illuminated during any Ethernet activity
Reset-	Connection between this pin and ground will generate a system reset condition. It is intended for use with a momentary switch.
PWRBTN-	A momentary connection between this pin and ground will power-up/power-down the board.

**Connector type:** 2x8 2mm pitch vertical pin header with 4.0mm min high posts and gold flash plating

## 4.8 LCD Backlight (LCD Backlight)

This connector provides the backlight power and control for the optional LCD panel.

Note: If needed, +12V must be provided on the input power connector.

<b>1</b>	Power +5V/+12V, jumper selectable (default +5V), fused
<b>2</b>	Power +5V/+12V, jumper selectable (default +5V), fused
<b>3</b>	Ground
<b>4</b>	Ground
<b>5</b>	Enable (GPIO output), 0 = off, open circuit = on
<b>6</b>	Brightness, 0-5VDC variable; 0V = max, 5V = min

The brightness control for the LCD backlight has a weak pull-down resistor to ensure maximum brightness when it is not connected externally. Brightness may be controlled by a GPIO pin on the CPU or embedded microcontroller or by pin 6 on this connector. A jumper selects the source of the brightness signal to this pin.

**Connector type:** Molex 53261-0671 or equivalent

**Mating connector:** Socket: Molex 51021-0600 or equivalent

Terminals: Molex 50058 / 50079 series or equivalent

## 4.9 LCD Panel (LVDS Interface) (LCD)

This connector is mounted on the top side of Atlas. It provides connection to an LVDS LCD display. The LCD panel power is jumper selectable for 3.3V (default) or 5V.

LVDS_DATA3+	1	2	LVDS_DATA3-
SCAN_DIRECTION	3	4	LVDS_MAP
GND	5	6	LVDS_CLK+
LVDS_CLK-	7	8	GND
LVDS_DATA2+	9	10	LVDS_DATA2-
GND	11	12	LVDS_DATA1+
LVDS_DATA1-	13	14	GND
LVDS_DATA0+	15	16	LVDS_DATA0-
GND	17	18	GND
VCC_LCD, fused	19	20	VCC_LCD, fused

**Connector type:** Hirose part number DF14-20P-1.25H(20) or equivalent

**Cable-mount socket:** Hirose part number DF14-20S-1.25C or equivalent

## 4.10 PCI-104

The PCI-104 (PCI) bus connector is provided on the top side to enable the mounting of additional I/O boards. The PCI connector is non-stack through (top side only) and is located in the standard PCI-104 location. Its pinout is as defined in the *PC/104-Plus* specification available on [www.pc104.org](http://www.pc104.org). The  $V_{IO}$  pins are jumper-selected and are protected with a polswitch resettable fuse.

## 4.11 PCIe/104 Connector

This connector is implemented to facilitate I/O expansion modules to be plugged onto the Atlas SBC.

USB-OC-	1	+ 5 V  T A B	2	PCIe Reset-
+3.3V	3		4	+3.3V
USB 5+	5		6	USB 6+
USB 5-	7		8	USB 6-
Gnd	9		10	Gnd
PCIe 4 T+	11		12	PCIe 1 T+
PCIe 4 T-	13		14	PCIe 1 T-
Gnd	15		16	Gnd
	17		18	
	19		20	
Gnd	21		22	Gnd
PCIe 1 R+	23		24	PCIe 0 R+
PCIe 1 R-	25		26	PCIe 0 R-
Gnd	27		28	Gnd
	29		30	
	31		32	
Gnd	33		34	Gnd
PCIe 4 Clk+	35		36	PCIe 1 Clk+
PCIe 4 Clk-	37		38	PCIe 1 Clk-
+5V_SB	39		40	+5V_SB
	41		42	
	43		44	
Gnd	45		46	
SMB Data	47		48	
SMB Clk	49		50	
SMB Alert-	51		52	

## 4.12 Power Input (Power Input)

The power signals on the connector labeled Power Input come from a connector leading to the output from a DC/DC power supply installed in the system. The +12V input is routed to the PCI/104 connector and the LCD backlight connector but is not required for board operation.

1	+5VDC
2	+5VDC
3	GND
4	+12V
5	GND
6	Ext_Batt

**Connector type:** 2.0mm pitch Right angle connector, JST SM06B-PASS-TBT or similar

### 4.13 GPIO (GPIO)

Atlas provides eight general purpose I/O lines on a pin header derived from the NM10 chipset. These I/O lines are protected with ESD devices to minimize potential damage to the NM10 from environmental conditions. The GPIO connector provides the digital IO signals as shown below.

GPIO0	<b>1</b>	<b>2</b>	GPIO1
GPIO2	<b>3</b>	<b>4</b>	GPIO3
GPIO4	<b>5</b>	<b>6</b>	GPIO5
GPIO6	<b>7</b>	<b>8</b>	GPIO7
+3.3V (fused)	<b>9</b>	<b>10</b>	Ground

**Connector type:** 2x5 2mm pitch vertical pin header with 4.0mm min high posts and gold flash plating

### 4.14 PCIe MiniCard / mSATA

This is a shared socket for either full sized PCIe MiniCards or mSATA storage modules. The PCIe MiniCard socket provides the facility to plug-in third party Mini-PCIe cards such as WiFi, Bluetooth, etc. The pinout below shows both PCIe MiniCard and mSATA pinouts. The signals in bold are selected automatically based on the type of card inserted into the socket.

PCIe MiniCard	mSATA	mSATA / PCIe MiniCard
		<b>1</b> <b>2</b> +3.3V
		<b>3</b> <b>4</b> Gnd
		<b>5</b> <b>6</b> +1.5V
Clkreq-	Clkreq-	<b>7</b> <b>8</b>
Gnd	Gnd	<b>9</b> <b>10</b>
PCIe Clk-	PCIe Clk-	<b>11</b> <b>12</b>
PCIe Clk+	PCIe Clk+	<b>13</b> <b>14</b>
Gnd	Gnd	<b>15</b> <b>16</b>
		<b>KEY</b>
		<b>17</b> <b>18</b> Gnd
		<b>19</b> <b>20</b> Disable-
Gnd	Gnd	<b>21</b> <b>22</b> PCIe Reset-
<b>PCIe RX-</b>	<b>SATA 0 RX-</b>	<b>23</b> <b>24</b> +3.3V
<b>PCIe RX+</b>	<b>SATA 0 RX+</b>	<b>25</b> <b>26</b> Gnd
Gnd	Gnd	<b>27</b> <b>28</b> +1.5V
Gnd	Gnd	<b>29</b> <b>30</b> SMB Clk
<b>PCIe TX-</b>	<b>SATA 0 TX-</b>	<b>31</b> <b>32</b> SMB Data
<b>PCIe TX+</b>	<b>SATA 0 TX+</b>	<b>33</b> <b>34</b> Gnd
Gnd	Gnd	<b>35</b> <b>36</b> USB 4-
Gnd	Gnd	<b>37</b> <b>38</b> USB 4+
+3.3V	+3.3V	<b>39</b> <b>40</b> Gnd
+3.3V	+3.3V	<b>41</b> <b>42</b> WWAN LED-
PCIe Select-		<b>43</b> <b>44</b> WLAN LED-
		<b>45</b> <b>46</b> WPAN LED-
		<b>47</b> <b>48</b> +1.5V
Pull-up to +3.3V	Pull-up to +3.3V	<b>49</b> <b>50</b> Gnd
		<b>51</b> <b>52</b> +3.3V

**Connector type:** JAE MM60-52B1-E1-R650

## 4.15 Audio (Audio)

The Audio connector has the Stereo Line-In, Stereo Line-Out and Mono Microphone signals from the ALC892 HD-Audio Codec. External speakers, headphones and a microphone can be interfaced to this connector.

LineOut – L	1	2	LineOut – R
GND_AUDIO	3	4	GND_AUDIO
LineIn – L	5	6	LineIn – R
GND_AUDIO	7	8	GND_AUDIO
MIC_L	9	10	MIC_R

**Connector type:** 2x5 2mm pitch vertical pin header with 4.0mm min high posts and gold flash plating

## 4.16 VGA (VGA)

The VGA connector provides support for standard VGA CRTs.

Red	1	2	Ground
Green	3	4	<b>Key</b>
Blue	5	6	Ground
HSync	7	8	DDC-Data
VSync	9	10	DDC-Clock

**Connector type:** 2x5 2mm pitch vertical pin header with 4.0mm min high posts and gold flash plating

## 5. CONFIGURATION JUMPER DETAILS

This section explains the use of the jumper options on the Atlas SBC.

Atlas contains jumper blocks for configuring the following features. The board also contains locations for installation of 0-ohm resistors in place of all valid jumper positions for a rugged configuration. The 0-ohm resistors are oriented and labeled in a way that provides easy understanding of their use and easy interpretation of their settings.

<b>Jumper Group Function</b>	<b>Jumper Block</b>	<b>Array Size</b>
PCI-104 $V_{IO}$ voltage (default: +5V)	JP1	1 X 3
CMOS RAM Reset (default: no clear)	JP2	1 X 3
Serial Port RS-422/485 mode differential termination resistors: Enable or Disable (default: Disable)	JP4	1 X 8
LCD backlight power: 5V or 12V (default: 5V) (+12V provided through the input power connector)	JP5	1 X 3
LCD panel supply voltage: 3.3V or 5V (default: 3.3V)	JP6	1 X 3

### 5.1 PCI-104 Voltage (JP1)

JP1 enables selection of 3.3V or 5V for  $V_{IO}$  on the PCI-104 connector. This power is protected with a polyswitch resettable fuse.

<b>Setting</b>	<b><math>V_{IO}</math> Power</b>
1 - 2	+3.3V (default)
2 - 3	+5V

### 5.2 CMOS RAM Reset (JP2)

JP2 provides for a reset of the BIOS settings and CMOS RAM on power up. The jumper connects both on-board and external backup batteries to the backup power connection for the CMOS settings. Using the jumper resets the settings to their programmed default values and also resets the on-board real-time clock.

To reset the settings, turn the power off, move the jumper to the reset position, turn power on and booth the system.

<b>Setting</b>	<b>Reset</b>
1 - 2	No reset on power on (default)
2 - 3	CMOS reset at power on



### 5.3 RS-422/485 Termination Resistors (JP4)

All the serial ports feature independent selection of protocol (RS-232/422/485) and IRQ in BIOS. For RS-422 and RS-485 modes, 120 ohm termination resistors may be enabled on the receiver lines with jumpers found on jumper block JP4.

<b>Setting</b>	<b>Termination Enable/Disable</b>	<b>Protocol</b>
Open	Termination Disable (default)	RS-233
1 – 2	COM1 RS-485 Termination Enable	RS-485
3 – 4	COM1 RS-422 Termination Enable	RS-422
5 – 6	COM2 RS-485 Termination Enable	RS-485
7 – 8	COM2 RS-422 Termination Enable	RS-422
9 – 10	COM3 RS-485 Termination Enable	RS-485
11 – 12	COM3 RS-422 Termination Enable	RS-422
13 – 14	COM4 RS-485 Termination Enable	RS-485
15 – 16	COM4 RS-422 Termination Enable	RS-422

### 5.4 LCD Backlight Power Select – INV VSEL (JP5)

Jumper block JP5 selects the LCD backlight inverter DC power voltage as either +5V or +12V. This power is protected with a polyswitch resettable fuse.

<b>Setting</b>	<b>LCD Backlight Power</b>
1 – 2	+5V (default)
2 – 3	+12V

### 5.5 LCD Panel Power Select – LVDS VSEL (JP6)

Jumper block JP6 must be configured according to input voltage required by the type of LCD panel that will be attached to Atlas's LCD panel interface connector. The jumper sets the LCD panel power as either +3.3V or +5V. This power is protected with a polyswitch resettable fuse.

<b>Setting</b>	<b>LCD Panel Voltage</b>
1 - 2	+3.3V (default)
2 - 3	+5V

## 6. BIOS

Atlas' BIOS provides access to many valuable features including:

- ◆ Boot from LAN (PXE) as well as USB, SATA, and mSATA ports
- ◆ Free boot sequence configuration to allow different boot sequences as first, second and third boot devices.
- ◆ Support for various LCD configurations supported by the video chipset ( default should be 1024x768 )
- ◆ LCD brightness control adjustment
- ◆ Console (display and keyboard) redirection to one or more COM ports
- ◆ DSC-configurable default settings in battery-less configurations
- ◆ Customizable splash screen
- ◆ POST message displays the board name and BIOS version. The BIOS version is displayed as "Major.Minor-rev – Date Built" format. For example "Version 1.01 – 10/12/2012".
- ◆ Enable/disable for individual COM ports and a master enable/disable for the super I/O chip completely.
- ◆ Protocol selection for each of the 6 COM ports to select serial port protocol on SP336 using DIO lines. Default for all 6 ports is RS-232.
- ◆ Watchdog timer enable/disable and timeout period selection.

The following instructions describe how to enter the BIOS, set up features, and restore the BIOS to its default settings.

### 6.1 Entering the BIOS

The BIOS may be entered during startup by pressing the **ESC** key on an attached keyboard. Press the key repeatedly right after power-on or reset until the BIOS screen appears.

After a certain amount of time during startup, the BIOS will ignore the ESC key. If you wait too long and the system does not respond, simply reset the system (or power down) and try again.

### 6.2 Viewing and Modifying the BIOS Settings

During SBC startup, press function key ESC to enter BIOS setup mode.

The main page displays the following menu options:

- Continue
  - Selects the first boot option device
- Boot Manager
  - Lists all the bootable EFI and legacy devices
  - Select the boot device
- Device Manager
- Boot From File
  - Lists all the FAT format message devices
  - Select one EFI formatted file to run
- Setup Utility
  - Offers full configuration options

Select the menu option to view or modify the BIOS settings for the desired configuration area. The screens displayed for each area are described, below.

The following keyboard controls are available on any page for navigating the screen.

<b>Key</b>	<b>Function</b>
Esc	Exit current screen, return to previous screen
up-/down-arrow	Select setup item
left-/right-arrow	Select menu item
plus/minus symbols (+/-)	Change values
Enter	Select item / Execute command

At any time, select Save & Exit to exit BIOS setup mode. Use the up/down arrow keys, followed by carriage return, to apply one of the exit actions.

### 6.3 Restoring Default BIOS Settings

In order to load the default BIOS settings, enter the BIOS settings and select **Save and Exit** menu. Then select Restore Defaults, and save/exit. This will restore the BIOS to the default state.

### 6.4 Setup Utility Settings

This section describes the screen displays for the Setup Utility section. The data in the fields are examples only and may be different depending on future product releases from Diamond Systems or the user's configuration.

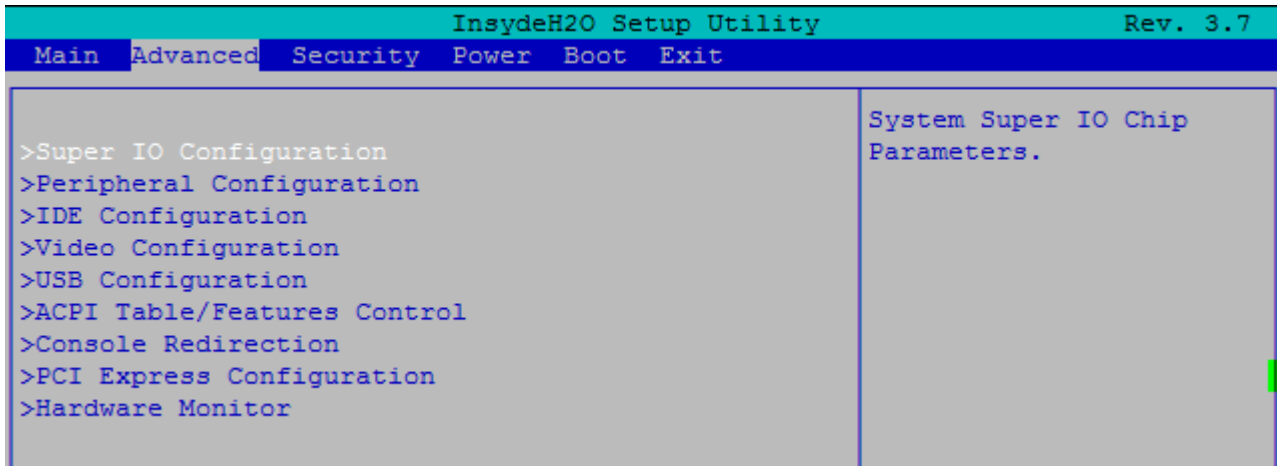
#### 6.4.1 Main Menu

The Main menu provides a quick overview of basic system information. It provides the ability to change the BIOS display language, system time and system date.

InsydeH2O Setup Utility		Rev. 3.7
Main Advanced Security Power Boot Exit		
Build Date	07/31/2013	Select the current default language used by the InsydeH2O.
Product Name	DM-PC104-CV	
Motherboard Manufacturer	Diamond Systems	
Ethernet 1 MAC	00-12-55-FD-FD-26	
Processor Type	Intel(R) Atom(TM) CPU N2600 @ 1.60GHz	
System Bus Speed	400 MHz	
System Memory Speed	800 MHz	
Cache RAM	512 KB	
Total Memory	2048 MB	
Channel A		
SODIMM 0	[Not Installed]	
SODIMM 1	2048 MB	
Channel B		
SODIMM 0	[Not Installed]	
SODIMM 1	[Not Installed]	
Language	<English>	

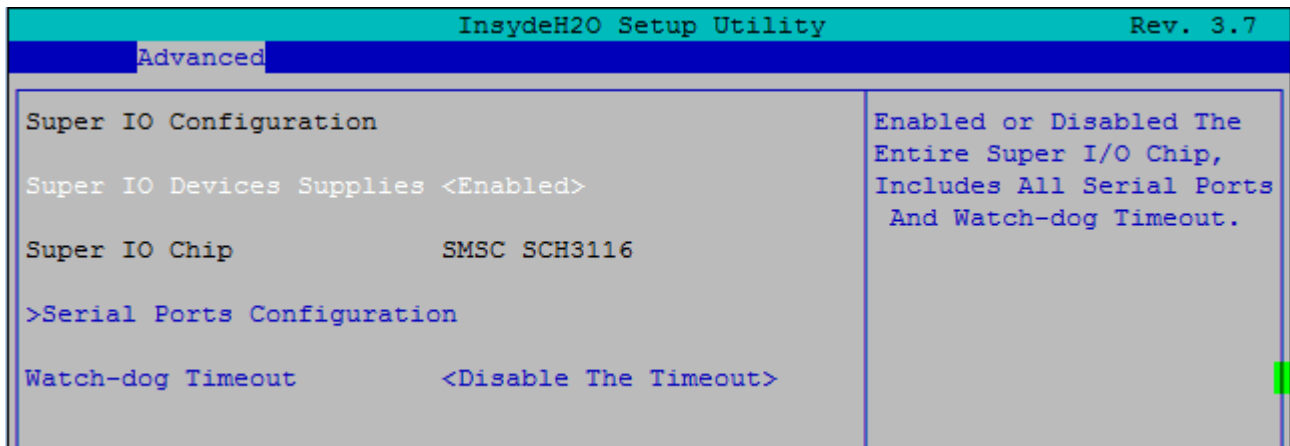
## 6.4.2 Advanced Menu

The Advanced menu allows the user to configure advanced system settings such as super I/O, peripheral, USB and console redirection settings.



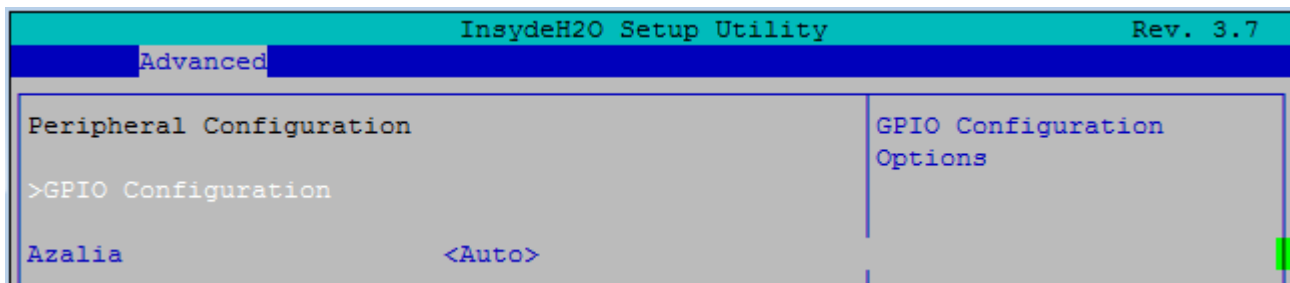
### 6.4.2.1 Super I/O Configuration Menu

Available from the Advanced menu, the Super I/O menu allows the user to enable or disable the Super I/O chip, enable and set addresses for each serial port, and set the watchdog timer.



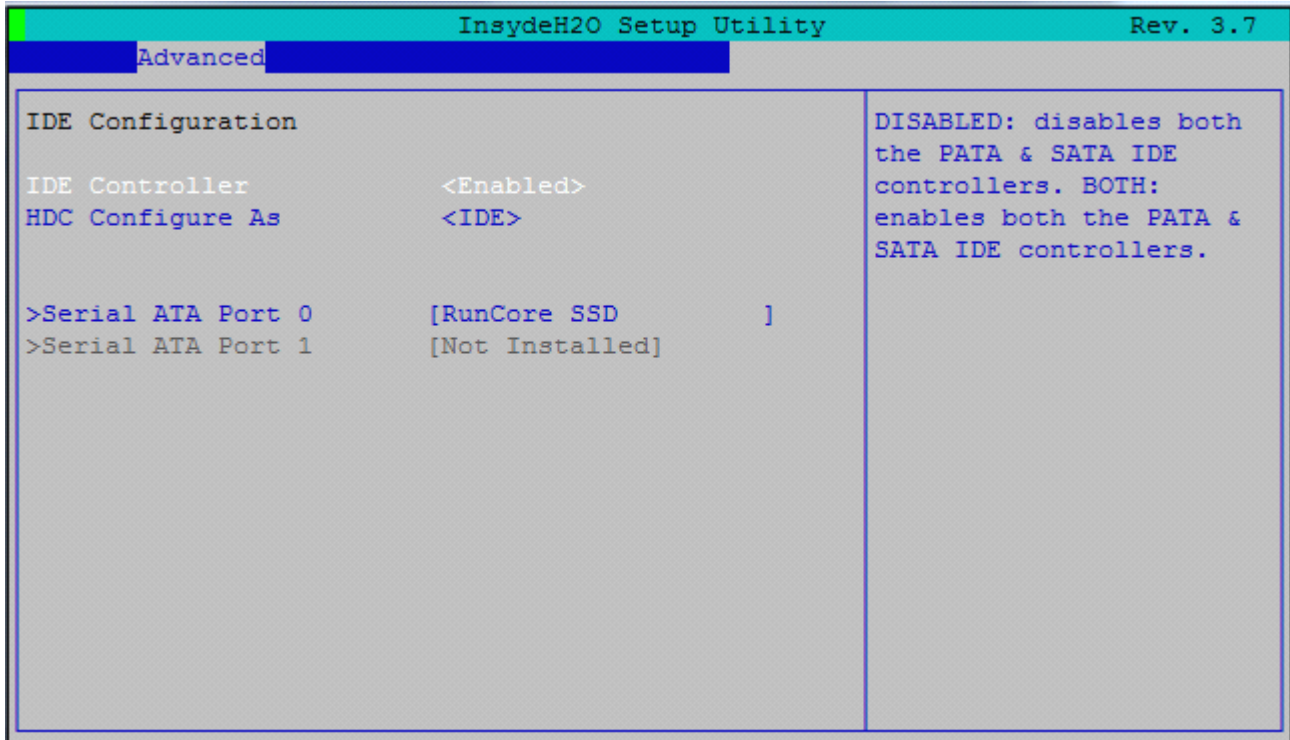
### 6.4.2.2 Peripheral Configuration Menu

Available from the Advanced menu, the Peripheral Configuration menu provides for configuration of the digital I/O lines. Selecting the GPIO Configuration sub menu provides line-by-line configurability.



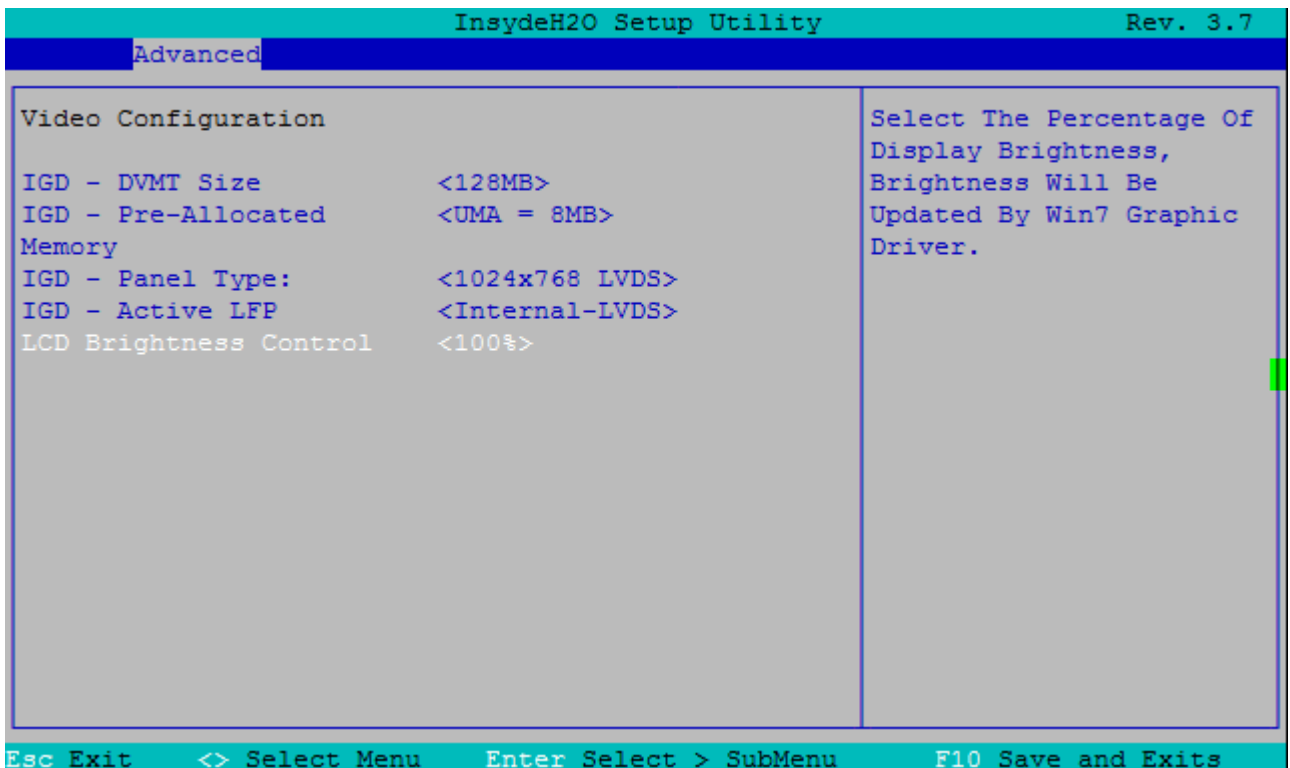
### 6.4.2.3 IDE Configuration Menu

Available from the Advanced menu, the IDE Configuration menu allows the user to select the IDE controller and hard disk drive type.



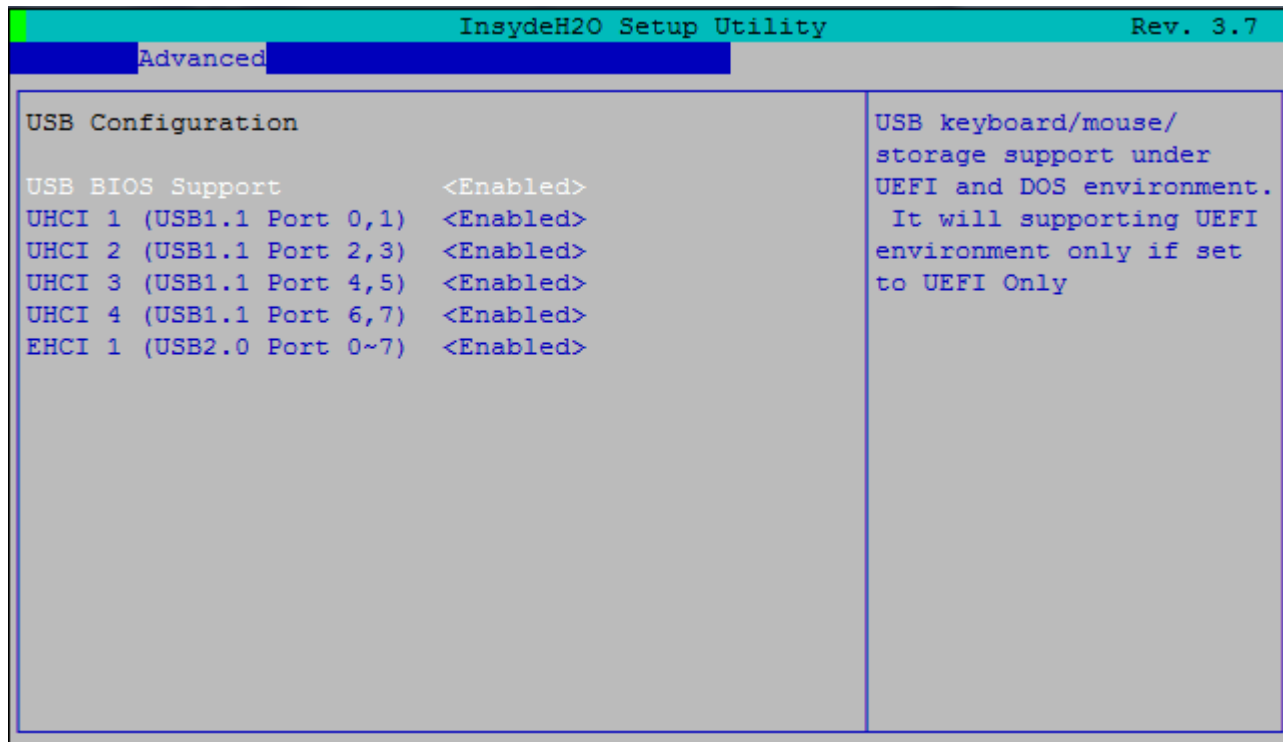
### 6.4.2.4 Video Configuration Menu

Available from the Advanced menu, the Video Configuration menu allows the user to configure the video output including the display type and resolution.



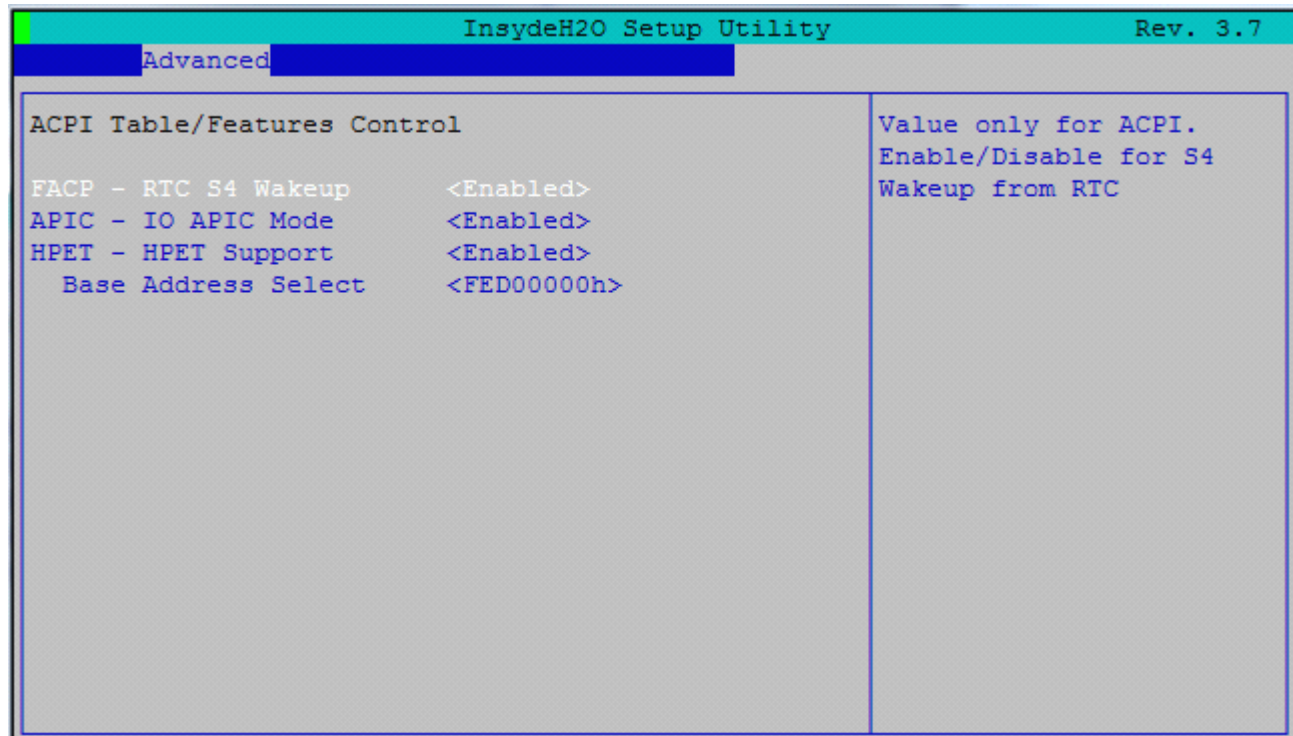
### 6.4.2.5 USB Configuration Menu

Available from the Advanced menu, the USB Configuration menu allows the user to configure each USB port.



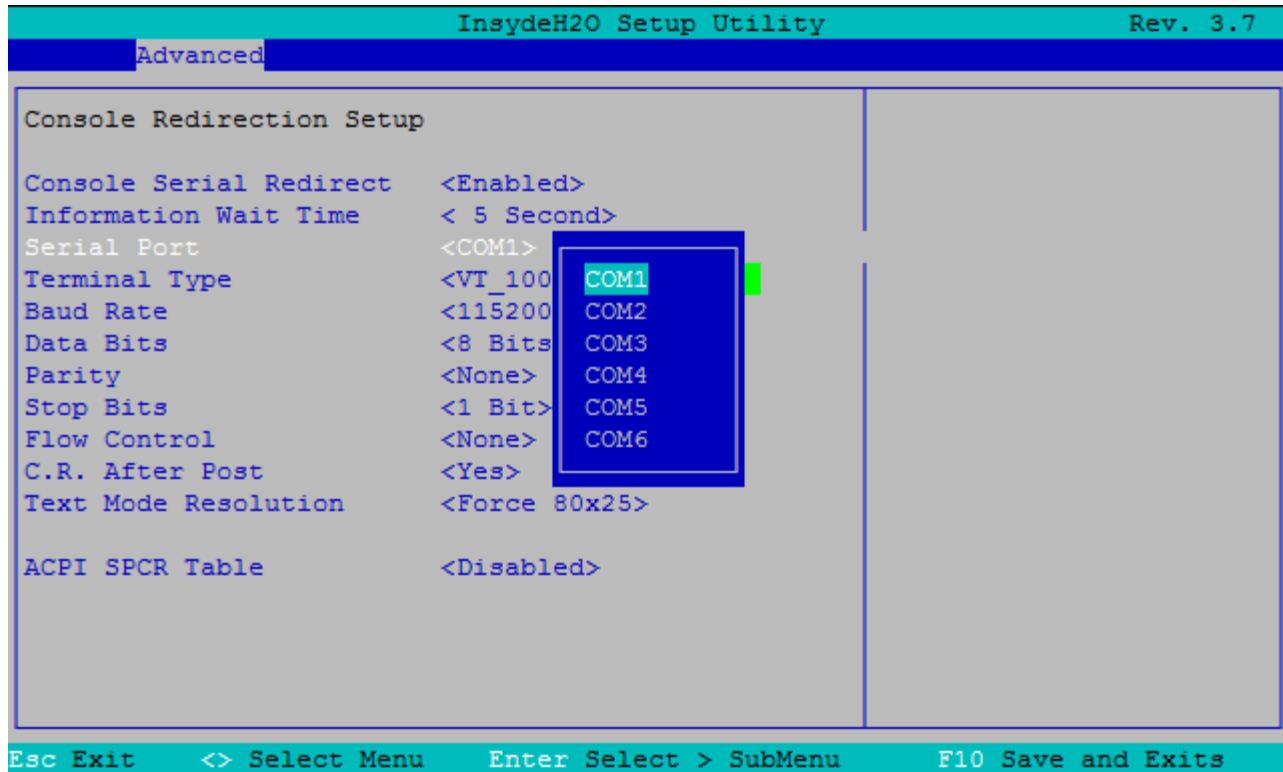
### 6.4.2.6 ACPI Table/Features Control Menu

Available from the Advanced menu, the ACPI Table/Features Control menu allows the user to enable or disable the ACPI features.



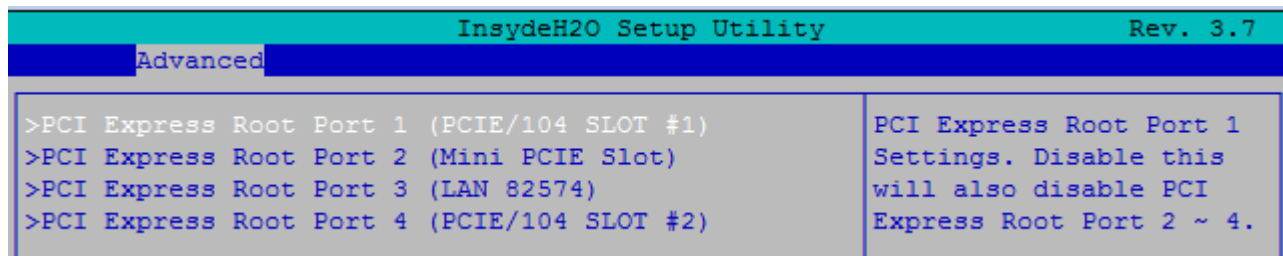
### 6.4.2.7 Console Redirection Setup Menu

Available from the Advanced menu, the Console Redirection Setup menu allows the user to set up and configure console redirection for remote access via a serial port.

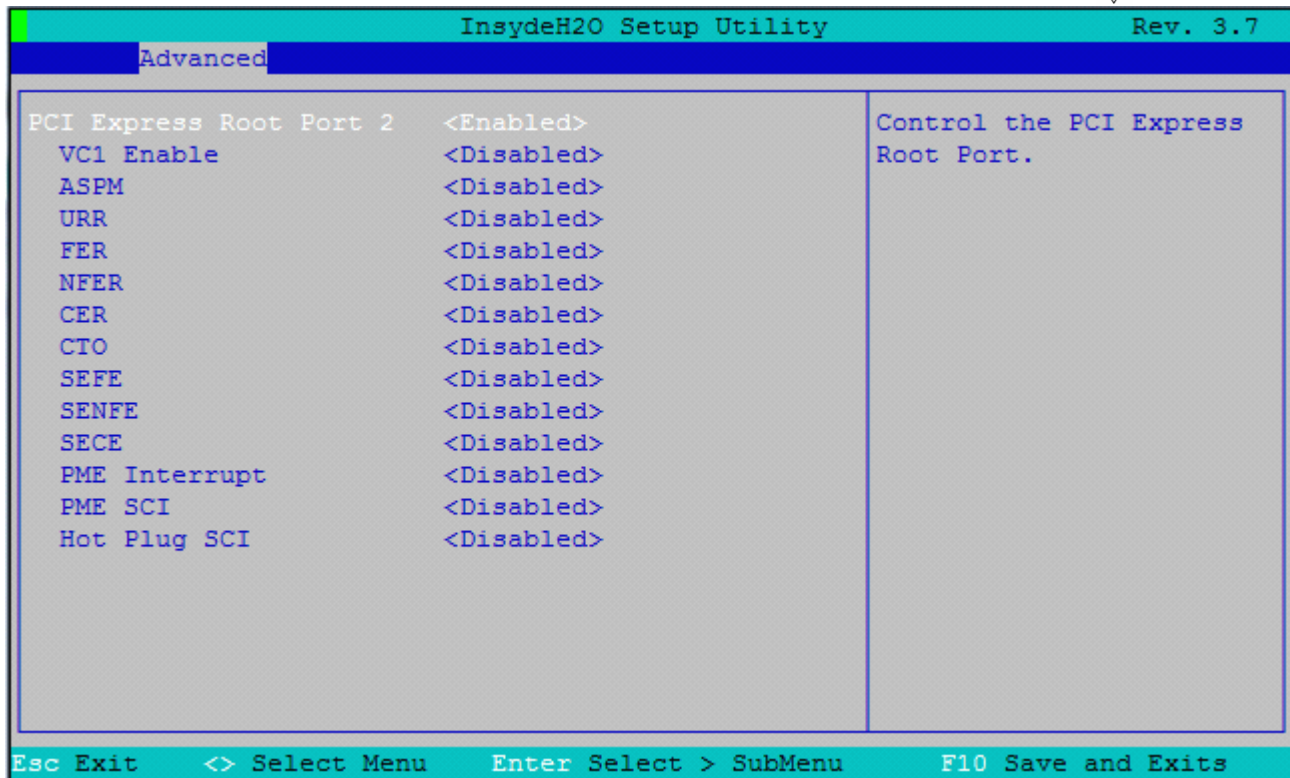


### 6.4.2.8 PCI Express Configuration Menu

Available from the Advanced menu, the PCI Express Configuration Setup menu allows the user to set up and configure console redirection for remote access.

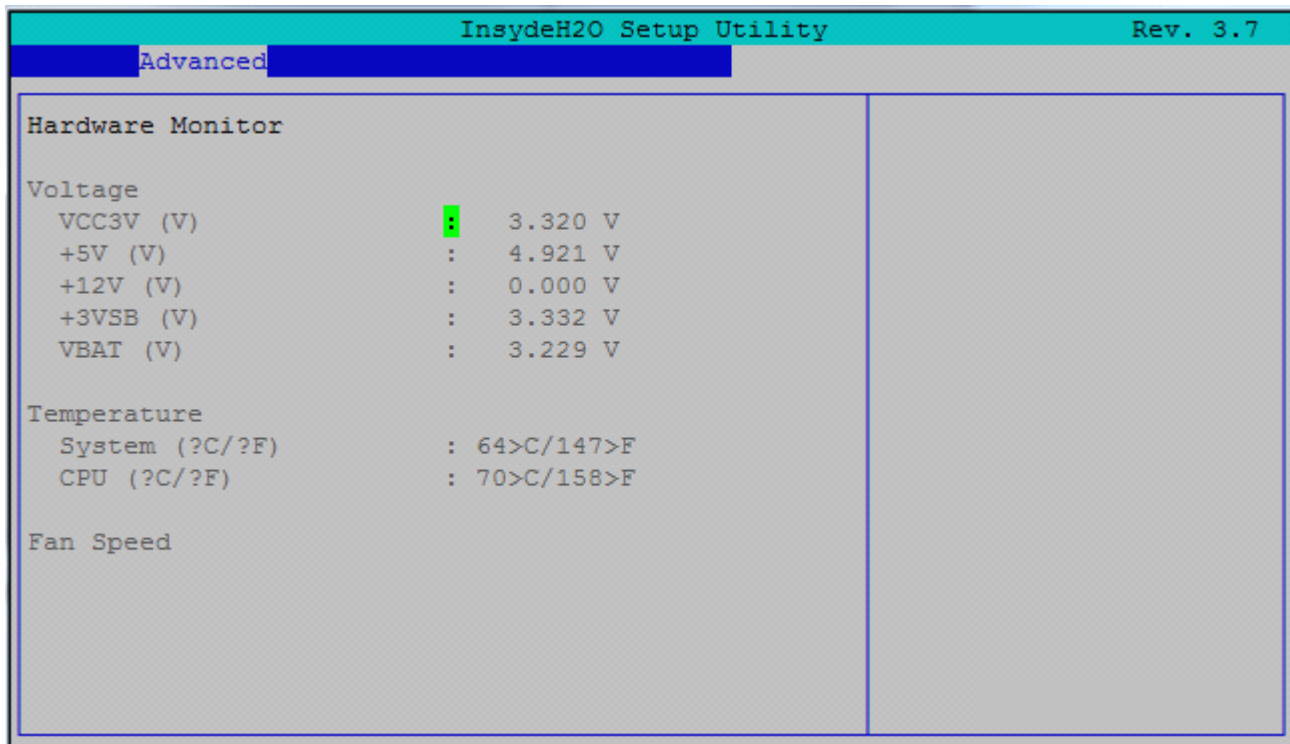


The detailed screen on the next page shows the PCIe configuration options for each port.



#### 6.4.2.9 Hardware Monitor

This screen displays the current health status of the SBC including temperature and various voltage levels.





### 6.4.3 Security Menu

The Security Menu provides configuration for the system's password settings.

```

InsydeH2O Setup Utility                               Rev. 3.7
Main  Advanced  Security  Power  Boot  Exit
-----
Supervisor Password      Installed
Set Supervisor Password
Power on Password        <Disabled>

                                     1
                                     [Not Installed]

Esc Exit  <> Select Menu  Enter Select > SubMenu  F10 Save and Exits
  
```

### 6.4.4 Power Menu

The Power Menu provides configuration options used to manage the consumption of system power.

```

InsydeH2O Setup Utility                               Rev. 3.7
Main  Advanced  Security  Power  Boot  Exit
-----
>Advanced CPU Control
>Platform Power Management
>Intel Fast Flash Standby Configuration

ACPI S3                  <Enabled>
Deep Stand-by            <Disabled>
Auto Wake on S5          <Disabled>

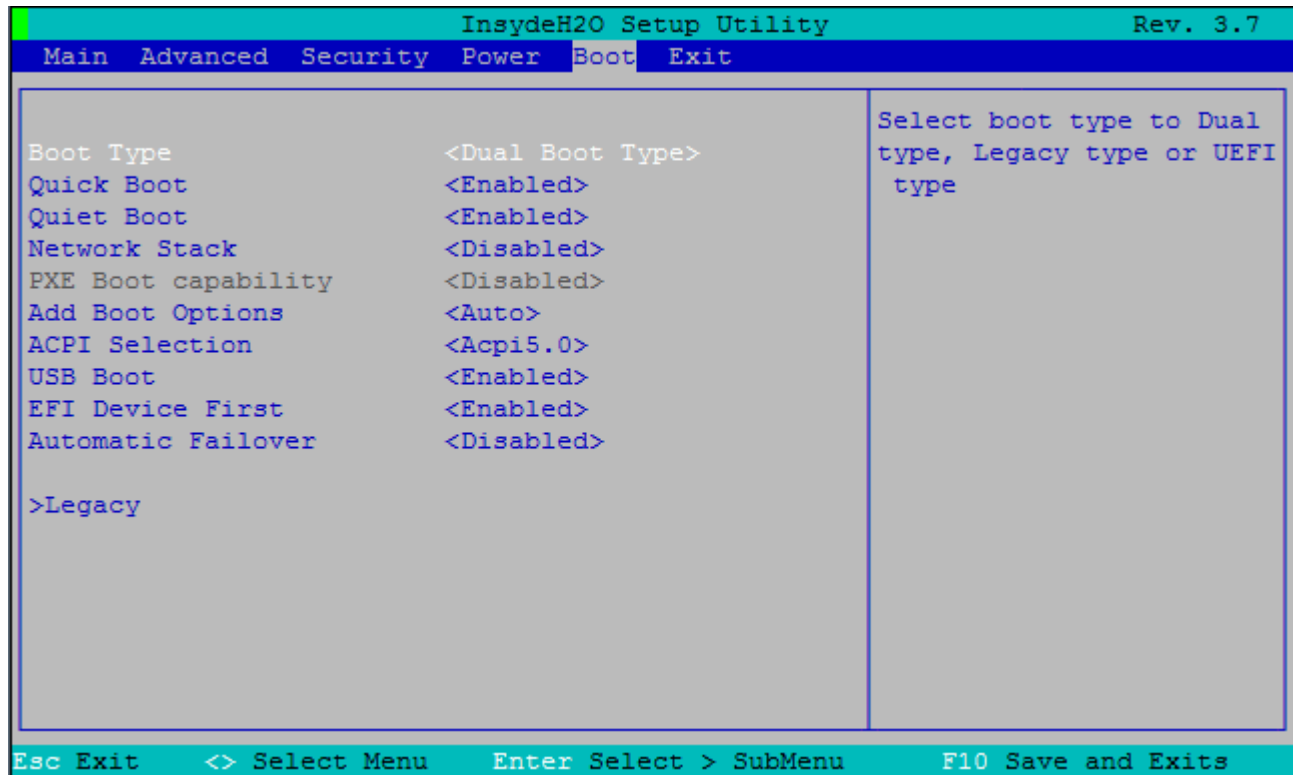
Power Loss Configuration <Always Off>

                                     These items control
                                     various CPU parameters.

Esc Exit  <> Select Menu  Enter Select > SubMenu  F10 Save and Exits
  
```

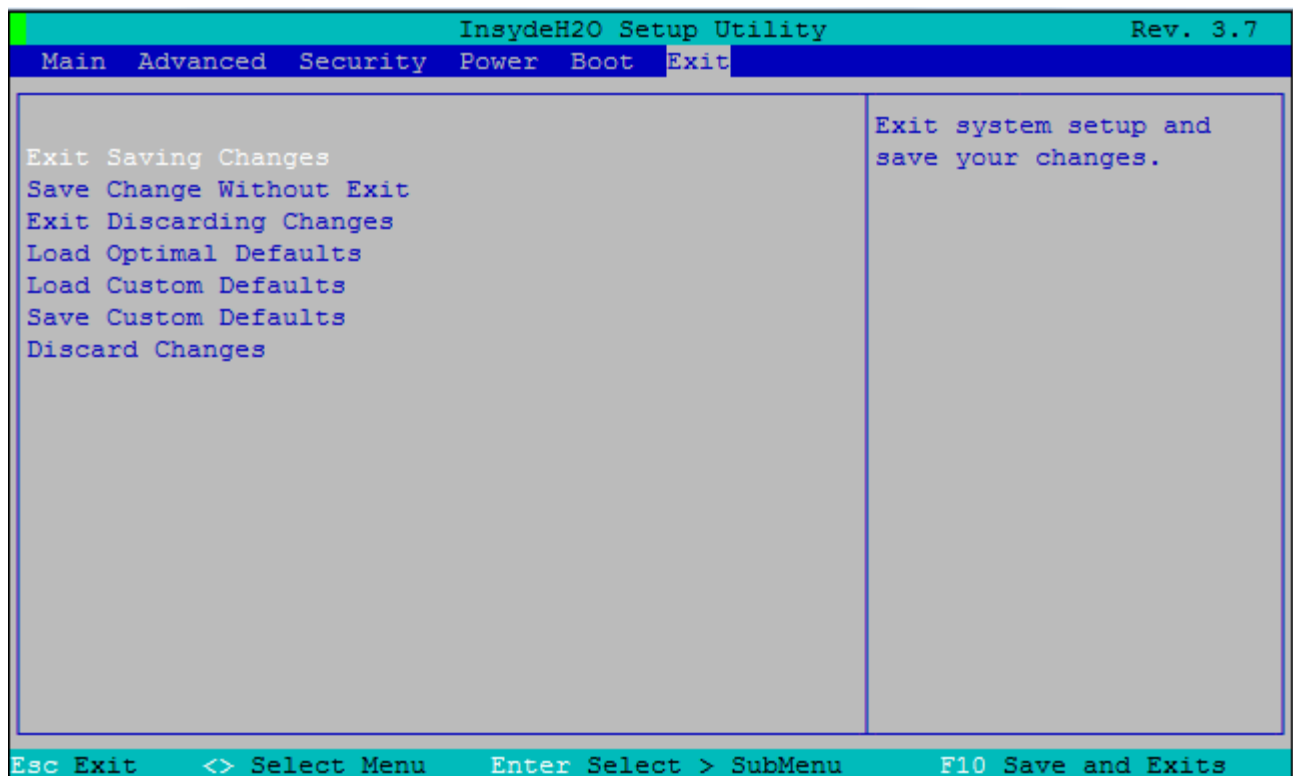
### 6.4.5 Boot Menu

The Boot Menu provides configuration and sequencing of various boot devices.



### 6.4.6 Exit Menu

The Exit Menu provides various options for saving and exiting, and for loading default settings.



## 7. WATCHDOG TIMER

Atlas provides a watchdog timer (WDT) circuit with programmable delay time based on the WDT in the SCH3116. The WDT can be enabled, disabled, and retriggered in the BIOS. If the WDT times out before it is retriggered, it will cause a system reset. The watchdog timer circuit timeout period is programmable from 0 to 255 seconds with 1 second or better resolution.

The BIOS uses CMOS bank 1 register (index port = 0x70, data port = 0x71, register = 0x6F) to record the watchdog timeout value. A user could send SW SMI 0x13 to reset the watchdog timeout value as below:

```
IOWrite8(0xB2, 0x13); //0xB2 = SW SMI IO Port, 0x13 = SMI value
```

## 8. FLASHDISK MODULES

### 8.1 Overview

Atlas is designed to accommodate an optional wide-temperature solid-state MLC or SLC mSATA flashdisk module for rugged mass storage in place of a notebook hard drive or commercial flashdisk. This module contains 8GB to 64GB of solid-state non-volatile memory that operates like any hard disk drive without requiring additional driver software support. It features automatic wear leveling and 1,000,000 write cycles minimum.



**mSATA Flashdisk**

### 8.2 Models and Capacities

<i>Model</i>	<i>MLC/SLC</i>	<i>Capacity</i>
FDMM-64G-XT	MLC	64GB
FDMM-32G-XT	MLC	32GB
FDMM-16G-XT	MLC	16GB
FDMS-64G-XT	SLC	64GB
FDMS-32G-XT	SLC	32GB
FDMS-16G-XT	SLC	16GB
FDMS-8G-XT	SLC	8GB

## 8.3 Features

The flashdisk module works just like a disk drive and requires no drivers. It provides high-speed nonvolatile mass storage in capacities of 8GB to 64GB. It is available in both MLC and SLC versions. The flashdisk plugs in to the PCIe MiniCard / mSATA socket and is held in place with two spacers and screws (included). It operates over the full -40°C to +85°C operating temperature range.

mSATA flashdisk features:

- mSATA compatible interface
- Sustained read performance of 30MB/s
- Sustained write performance of 20MB/s
- Implements dynamic wear-leveling algorithms to substantially increase longevity
- BCH (6/12 bit) Error Detection Code/Error Correction Code (EDC/ECC0)
- Intrinsic data integrity after power loss
- Wear leveling algorithm provides more reliable data storage over time
- Write protection setting by jumper for prevention of data overwrites
- Supports boot function for Windows Embedded Standard 7, Windows Embedded CE, and Linux
- Low power consumption, typical 110mA when active and 0.45mA in sleep mode
- -40°C to +85°C operation
- RoHS compliant

## 8.4 Installation

Installing an mSATA flashdisk module on Atlas is straightforward using the following steps.

1. Ensure power is disconnected from Atlas.
2. Remove the two screws from the standoffs located across from the PCIe MiniCard / mSATA connector.
3. Align the flashdisk at a 45 degree upward slant with its edge finger edge aligned with the pins on the connector, the memory chips on the top side, and the mounting holes align above the standoffs.
4. Slide the flashdisk into the connector and downward onto the standoffs.
5. Reinstall the two screws, securing the flashdisk module to Atlas.

## 9. POWER SUPPLY

Atlas requires only +5VDC input voltage as per the PC/104 Specification. It supports routing of +12VDC from the input power connector to various other connectors. The +5V supply comes from an external source via the Power Input connector. All the other on-board supply voltages are derived from the +5VDC main input.

A +5VDC/+12VDC source must be connected to the Atlas SBC power connector. An ATX power supply can be used to power the Atlas SBC. The +5VDC/+12VDC power source is interfaced to the board on the locking connector labeled Power Input. The +5VDC is used by the Atlas SBC for all its power subsystems. The +12VDC is used for the LVDS panel backlight inverter.

## 10. BATTERY BACKUP

Atlas includes a backup battery for CMOS RAM and real-time clock backup. The 3.0V lithium battery is mounted on the board to provide the RTC voltage to the CMOS/RTC. The battery is a CR-2354/GUN or equivalent type with 3 pins. The battery provides minimum 5 years lifetime based on  $T_a=25^{\circ}\text{C}$  and 0% power duty cycle. The battery is soldered on the top side of the board. The battery is an integrated unit with soldered terminals and soldered on the top of the board. It is not a field replaceable battery. Connector BAT is provided to enable the use of an external battery.

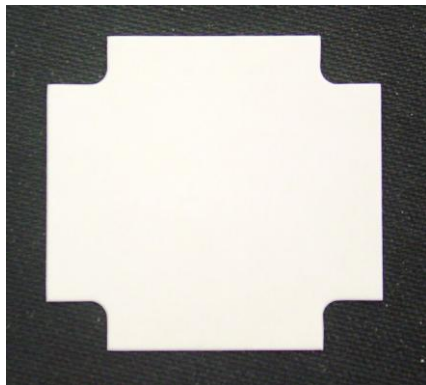
## 11. THERMAL PAD

A thermal pad is included with every Atlas. It is the same size as the heatspreader and attaches to the bottom of the heatspreader, but is shipped loose with the product. Customers can choose to affix the thermal pad or not depending on their needs. The specifications for the thermal pad are as follows.

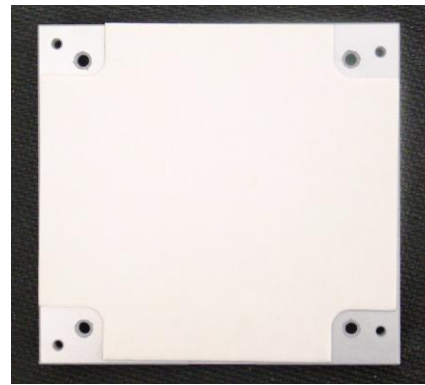
- Material: 3M 5590H
- Color: Light Grey
- Thickness: 0.5/1.0 mm
- Thermal Conductivity: 3.0 W/m-K

To affix the thermal pad:

- Remove the clear plastic film from the adhesive side of thermal pad
- Align the thermal pad above the heatspreader so all four edges are flush with the heatspreader edges and the adhesive side is facing the heatspreader
- Press to attach as shown in the photo below



Thermal pad



Thermal pad on heatspreader

## 12. SPECIFICATIONS

- 1.86GHz Intel Atom N2800 Cedar Trail CPU
- CPU Passmark: 653
- Cooling : Heatspreader, fanless
- 2GB or 4GB 64-bit DDR3 memory soldered on board
- Display options:
  - 18-bit LVDS flat panel interface with support for dual independent displays; 1366 x 768 maximum display size
  - LVDS backlight power: +5V or +12V jumper selectable
  - VGA CRT, 1280 x 1024 maximum display size
- Keyboard/Mouse USB
- USB: 4 USB 2.0 ports on headers
- Serial: 6 serial ports; Ports 1-4 supports TX, RX, RTS and CTS with RS-232/422/485 capability and Ports 5 & 6 support TX, RX, RTX and CTS RS-232 only
- Networking: One Intel 82574IT based Gigabit Ethernet port on pin header, with on-board magnetics
- Mass storage:
  - 1 SATA port
  - mSATA flashdisk mounting location
- ALC892 Codec based High Definition Audio with Stereo Line-Out, Stereo Line-In and Microphone.
- 8 GPIOs from the PIC Microcontroller
- Programmable watchdog timer
- PCIe MiniCard / mSATA shared socket
- PCI-104 and PCIe/104 stackable expansion connectors

### 1.1 Operating System Support

- Windows Embedded Standard 7
- Windows CE
- Linux 2.6.xx

### 1.2 Mechanical, Electrical, Environmental

- PC/104-*Plus* form factor
- Heatspreader, for the processor and chipset on the bottom PCB surface, with 2.8" x 2.8" mounting pattern
- -40°C to +75°C ambient operating temperature without a fan
- Power input requirements: +5VDC +/- 5%
- Power consumption: 7.53W idle
- MTBF: 437,675 hours at 25°C
- Optional +12VDC for the LCD backlight ONLY. No on-board circuits can depend on +12VDC.
- Dimensions: 4.55" x 3.775" x 0.9" (125mm x 96mm x 23mm)
- Weight: 7.6oz (215.5 grams) with heatspreader