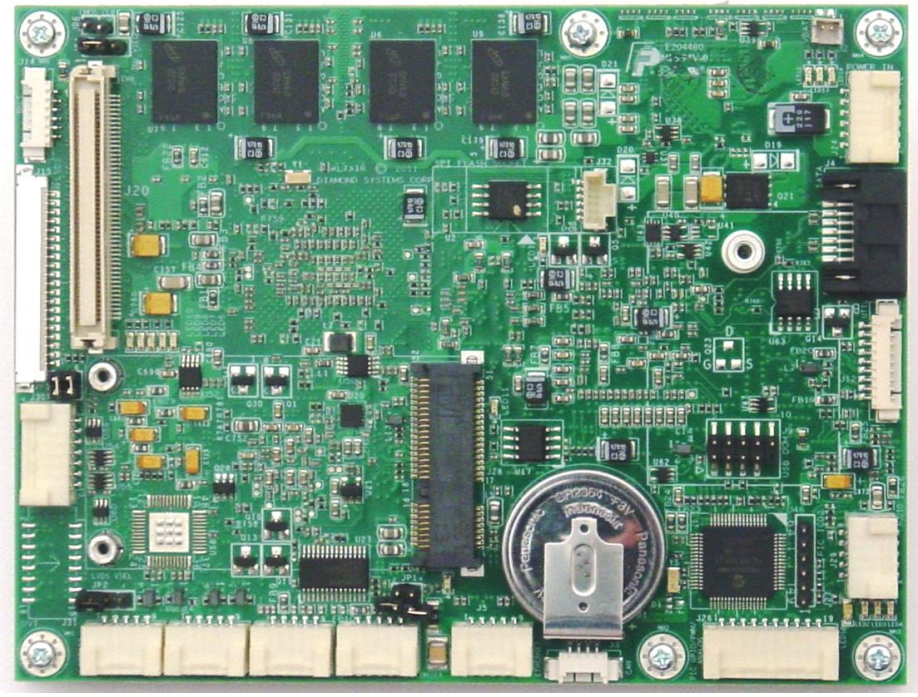
ALTAIR Single Board Computer

COM Express Form Factor Intel Atom E-Series SBC with EMX Stackable I/O Expansion



Revision	Date	Comments
A.00	12/6/2012	Initial Release
A.01	9/3/2015	Minor updates
A.02	5/01/2017	Minor updates

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CONTENTS

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

Altair 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

Altair is a high performance, highly integrated small form factor single board computer in the COM Express form factor. Altair incorporates a wealth of standard PC-style I/O plus on-board digital I/O and accepts EMX add-on I/O modules. 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
- Intel Atom E-Series CPU at 1.6GHz
  (1.3GHz and 600MHz special order options)
- 1GB or 2GB soldered DDR2 DRAM
- Comprehensive set of I/O interfaces:
  - 4 USB 2.0 ports
  - 1 RS-232/422/485 and 3 RS-232 serial ports
  - 1 Gigabit Ethernet port
  - 1 SATA port
  - LVDS and VGA display interfaces
  - ALC262 Codec based High Definition Audio with Stereo Line-Out, Stereo Line-In and Microphone
  - USB keyboard and mouse support
  - 10 programmable general purpose I/O lines
  - Watchdog timer
- Optional on-board USB flashdisk up to 8GB
- COM Express form factor (125mm x 95mm)
- System expansion flexibility
  - EMX stackable I/O
  - PCIe MiniCard
- -40°C to +85°C operating temperature

Altair's features are summarized on the next page.

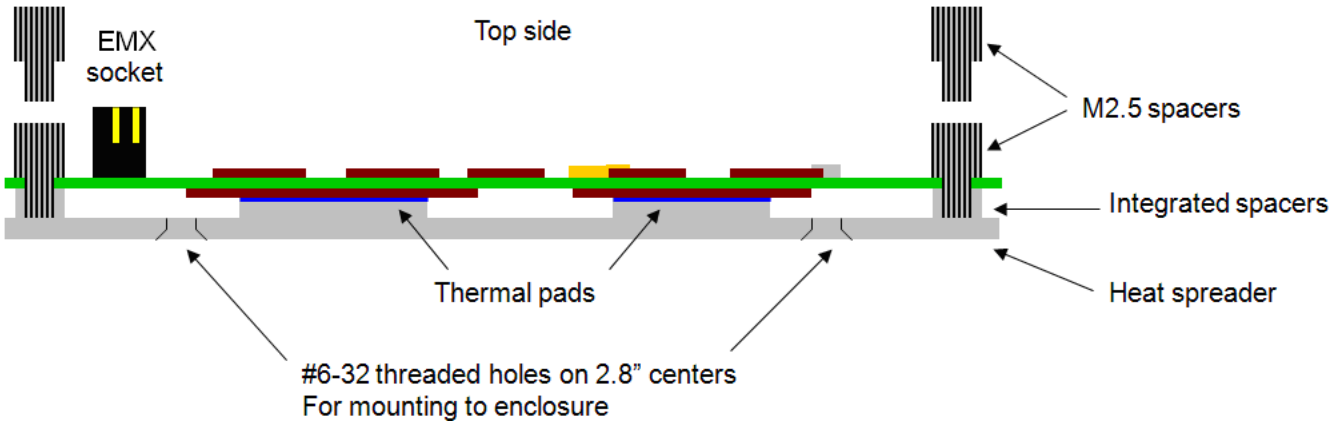

Figure 1: Edge View of the Altair SBC

Altair Models	*Processor Type*	*Processor Clock*	*SO-DIMM RAM*
ALT1600-2G-XT	Intel Atom E680T CPU	1.6GHz	2GB DDR2 DRAM
ALT1600-1G-XT	Intel Atom E680T CPU	1.6GHz	1GB DDR2 DRAM
ALT1300-2G-XT *	Intel Atom E660T CPU	1GHz	2GB DDR2 DRAM
ALT1300-1G-XT *	Intel Atom E660T CPU	1GHz	1GB DDR2 DRAM
ALT600-2G-XT *	Intel Atom E620T CPU	600MHz	2GB DDR2 DRAM
ALT600-1G-XT *	Intel Atom E620T CPU	600MHz	1GB DDR2 DRAM

* Special Order Option

1.1 Altair SBC Features

Altair is a compact, rugged, single board computer that features the “Tunnel Creek” Atom E-series processors in the COM Express form factor. It provides multiple I/O expansion options by means of the EMX expansion connector.

Functions

- Intel Atom “Tunnel Creek” processors (Queensbay platform), clocked at 1.6GHz standard, 1.3GHz and 600MHz special order options
- Cooling: Fanless design incorporates heatspreader and conduction cooling to the enclosure
- Memory: 1GB or 2GB DDR2 memory soldered on board
- Display options:
  - LVDS flat panel interface
  - One on-board SDVO-to-VGA converter to a VGA connector. SDVO-to-DVI converter option also provided.
  - LVDS backlight power: +5V or +12V jumper selectable
- 4 USB 2.0 ports on headers (Additionally an USB Hub is implemented to facilitate three ports for the EMX expansion connector and one port for the PCIe MiniCard socket)
- 4 serial ports; Port 1 supports TX, RX, RTS and CTS with RS-232/422/485 capability and Ports 2, 3, 4 support TX/RX RS-232 only
- Networking: One Intel 82574IT based Gigabit Ethernet port on pin header, with on-board magnetics
- Mass storage:
  - One SATA port
  - USB flashdisk mounting location supporting up to 8GB
- Keyboard/Mouse: support for USB
- ALC262 Codec based High Definition Audio with Stereo Line-Out, Stereo Line-In and Microphone.
- 10 GPIOs from the PIC Microcontroller
- 1 CAN port
- Programmable watchdog timer
- Expansion buses: EMX stackable I/O; PCIe MiniCard
- Input power: 5VDC ±5%
- Power consumption: 15W fully loaded

- Operating temperature: -40°C to +85°C (-40°F to +185°F)
- COM Express form factor: 125mm x 95mm (4.92” x 3.74”)
- Weight: 10.8oz (306.2grams) with heatspreader
- RoHS: Compliant

Operating System Support

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

1.2 Thermal Considerations

All models of Altair are specified for a -40°C to +85°C operating range, the temperature being measured at the outside surface of the heatspreader. Diamond Systems provides a heatspreader attached to the Altair 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 Altair heatspreader must be kept at a temperature not to exceed +85°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 Altair's functional blocks.

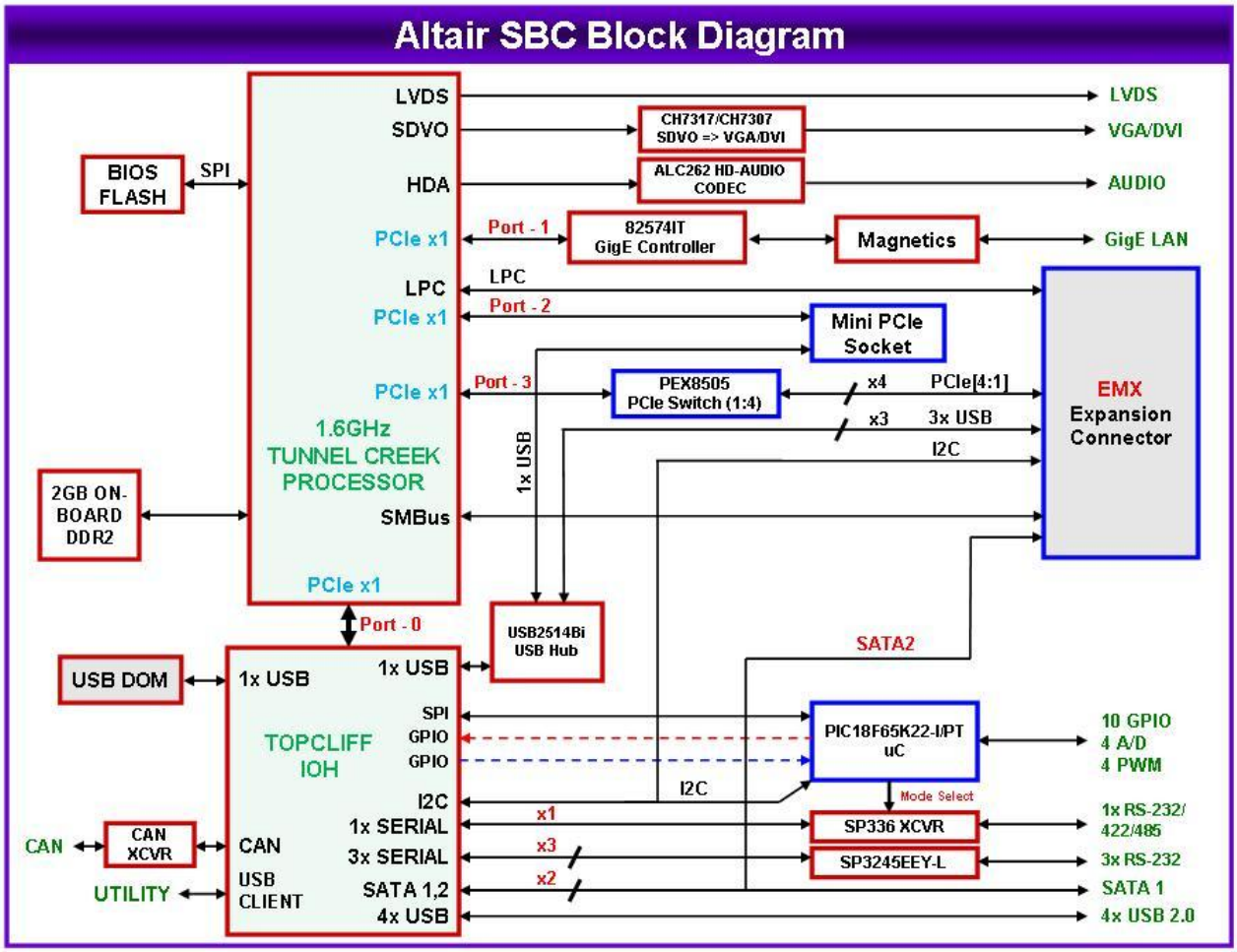

Figure 2: Altair SBC Functional Block Diagram

2.2 Altair Dimensions

Figure 3 shows the overall dimensions of the Altair SBC measured in thousandths of inches.

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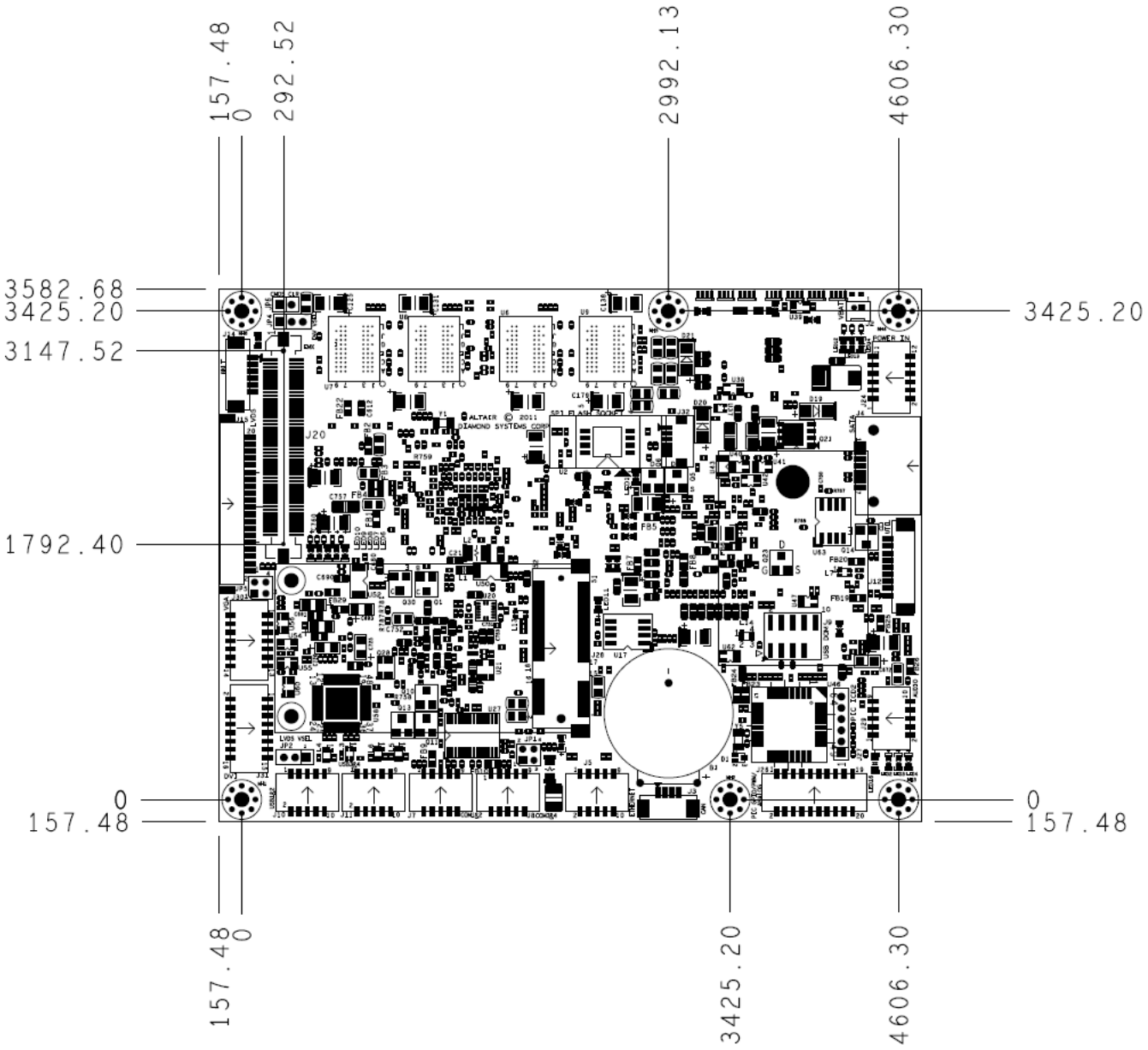

Figure 3: Altair Dimensions, thousandths of inches

2.3 Connector Locations

Figure 4 illustrates the position of interface and bus connectors jumpers located on the top side of the Altair SBC, which features EMX stackable I/O and an EMX connector. The connector for the EMX expansion bus is located on the top side of the board.

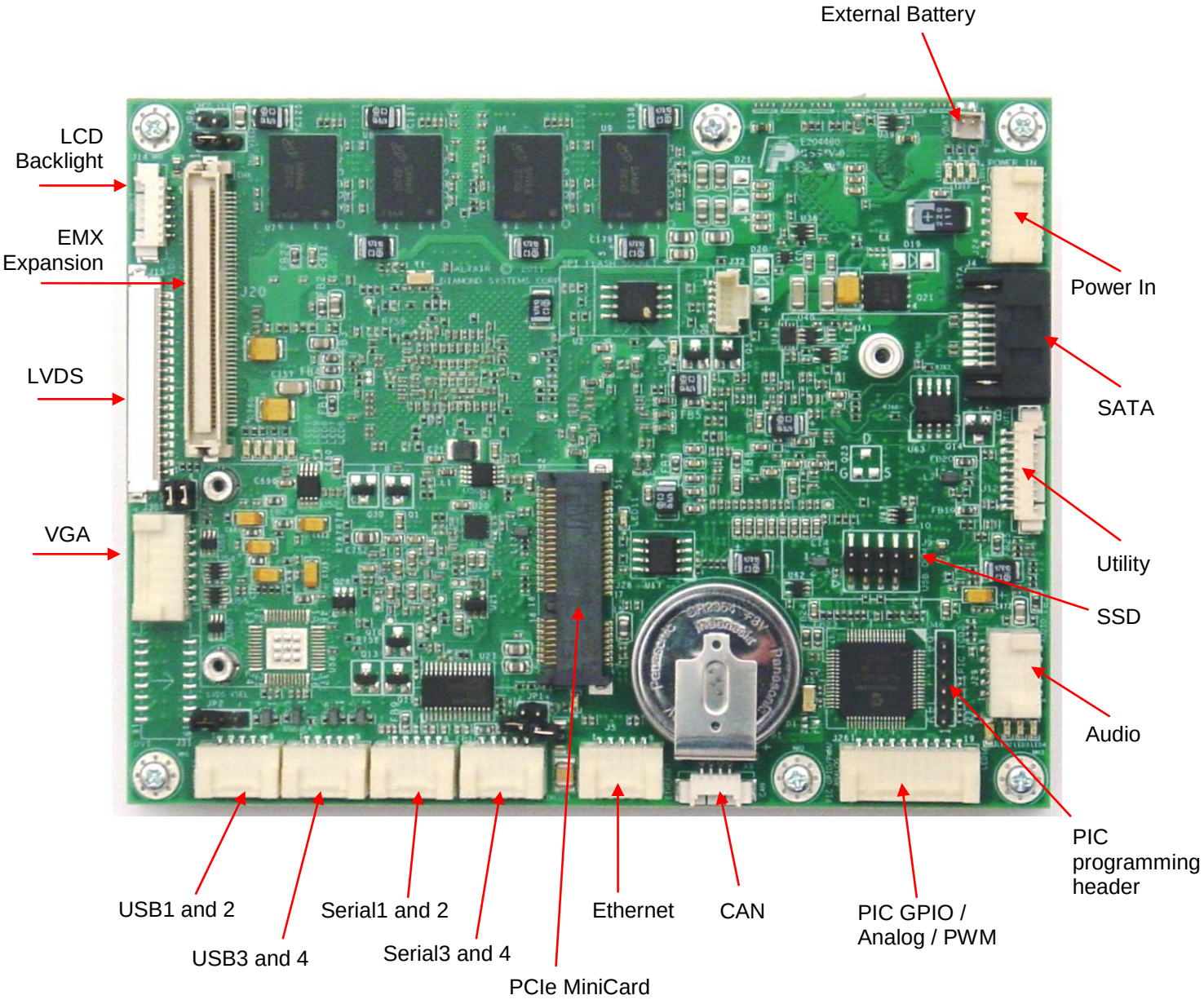

Figure 4: Altair SBC Connector Locations

2.3.1 Connector Summary

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

Connector Function	*Silkscreen Label*
External Battery	J2
CAN	J3
SATA	J4
Ethernet	J5
Serial Ports	J7, J8
USB Flashdisk	J9
USB Ports	J10, J11
Utility Signals	J12
LCD Backlight	J14
LCD (LVDS) Panel	J15
EMX I/O	J20
Power Input	J24
GPIO	J26
PIC Programming	J27
PCIe MiniCard	J28
Audio	J29
VGA	J30

2.4 Configuration Jumpers

Figure 5 shows the configuration jumper groups that are located on the topside of the Altair SBC. Refer to Section 5 for details on the functions and configuration options associated with each jumper group.

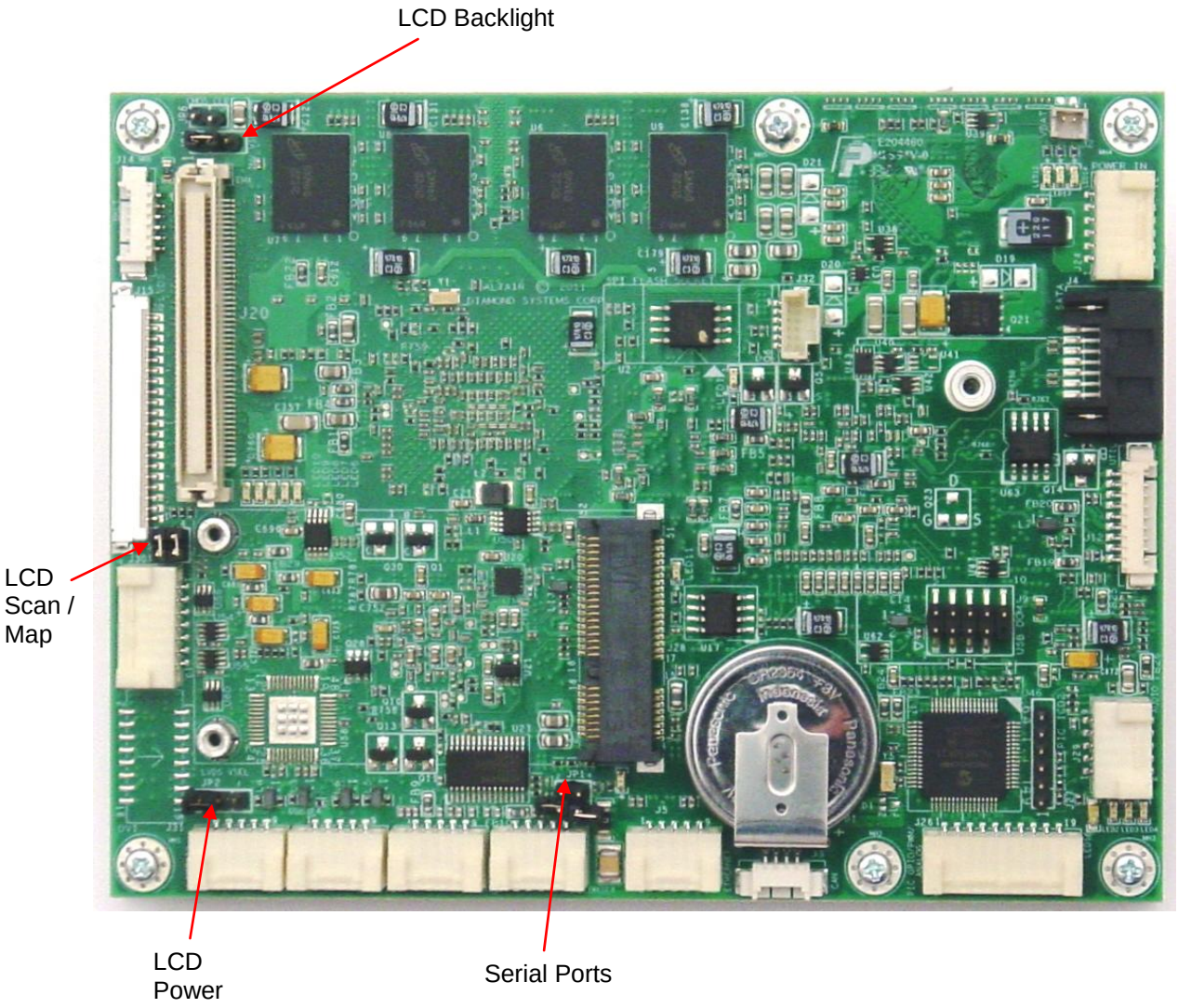

Figure 5: Altair SBC Configuration Jumper Groups

2.4.1 Configuration Jumper Summary

The Altair 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.

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

Jumper Group Function	*Silkscreen Label*	*Array Size*
Serial Port 1 RS-422/485 mode differential termination resistor: Enable or Disable (default: Disable)	JP1	2 X 2
LCD panel supply voltage: 3.3V or 5V (default: 3.3V)	JP2	1 X 3
LCD backlight power: 5V or 12V (+12V provided through the input power connector) (default: 5V)	JP4	1 X 3
LCD Panel Scan Direction: Normal Scan or Reverse Scan (default: Normal) LVDS Mapping: Map-A or Map-B (default: Map-A)	JP5	2 X 2

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3. GETTING STARTED

First-time Altair users normally receive the product as part of Diamond's Altair Development Kit, which provides everything needed to ensure rapid application development. This section of the Altair User Manual covers basic hardware setup, power connection, system boot-up, and initial software configuration. After Altair 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 Altair Development Kit

The Altair Development Kit (DK-ALT-xxx) provides everything required for Altair-based rapid application development. The table on the next page lists the boards, cables, and other items included. The xxx denotes the operating system of choice, either Linux (LNX) or Windows Embedded Standard 7 (WE7).

Item	Diamond P/N	Description
1	ALT1600-1G-XT	Altair SBC with 1.6GHz Atom E680T CPU, 1GB SDRAM
2	889061x	8GB USB flashdisk with bootable OS pre-loaded
3	C-ALT-KIT	Altair Cable Kit
4	7461611	Altair Quick Start Guide (not shown)
5	671061x	DVD with backup image and software files
6	DOC-PKG	Diamond Systems Document Package (not shown)

3.1.1 Altair Cable Kit

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

Item	Qty	Description	Diamond P/N	Connects to…
1	1	Gigabit Ethernet cable to RJ45	6981315	J5
2	2	Dual serial cable	6981316	J7 and J8
3	2	Dual USB cable	6981317	J10 and J11
4	1	Utility cable	6981318	J12
5	1	Power input cable	6981321	J24
6	1	Digital I/O cable	6981322	J26
7	1	HD Audio cable	6981323	J29
8	1	VGA cable	6981324	J30

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 Altair for first-time operation using the Altair Development Kit. Additional details regarding Altair's interface functions and connections may be found in Section 4 of this document (Interface Connector Details).

3.2.1 Keyboard and Mouse

Altair supports operation using a USB-based keyboard and mouse devices. Plug the USB keyboard connector and USB mouse cable into the Altair Cable Kit cable number 6981317 and the end of the cable into connector J10 on Altair.

3.2.2 USB Flashdisk Socket

Altair provides a location for on-board installation of an optional USB flashdisk on connector J9. Plug the USB flashdisk module in the Development Kit into connector J9 on Altair. Remove the screw from the mounting stand-off before installing the flashdisk. Secure the flashdisk to Altair with the screw once the flashdisk is installed.

3.2.3 Mass Storage Devices

If desired, connect SATA hard drives to Altair by connecting a SATA cable to SATA connector J4 and then to the SATA drive. Altair 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 6981321 to the PS-5V-04 AC power adapter or an ATX power supply. Connect the other end of the 6981321 cable to connector J24 on the Altair SBC.

3.2.5 Display

Altair provides interfaces for both LVDS flat panel displays and SDVO output. VGA CRTs can also be used, as the board includes an SDVO to VGA converter.

Connect the VGA cable, 6981324, between the VGA connector, J30, and a VGA-compatible display.

3.2.6 Installing Altair in an Enclosure (optional)

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

Altair's 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 Altair'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 the PS-5V-04 AC power adapter to an AC outlet. Altair 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

Altair's BIOS provides a wide range of configuration options. When you power up Altair 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

Altair will boot and run the operating system from the USB flashdisk. Altair 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 Altair Development Kit.

4. INTERFACE CONNECTOR DETAILS

This section describes the functions associated with the Altair EMX SBC, EMX 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 Altair Cable Kit.

4.1 External Battery (J2)

Altair has provision for an external battery connection via J2, 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 CAN (J3)

The CAN signals from the Intel Topcliff I/O Hub are available at this 1X4 1.25mm connector.

1	CAN_H
2	CAN_L
3	+5V
4	GND

Connector type: MOLEX, 532610471

4.3 SATA (J4)

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

4.4 Ethernet (J5)

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

DA+	1	2	DB+
DA-	3	4	DB-
DC+	5	6	DD+
DC-	7	8	DD-
NC	9	10	NC

Connector type: JST, SM10B-ZPDSS-TF

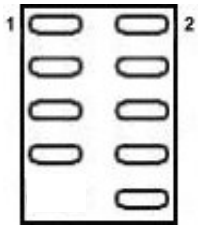
4.5 Serial Ports (J7, J8)

Altair provides four serial ports of which Port 1 supports RS-232/422/485 multiprotocol with the TX, RX, RTS and CTS signals. Ports 2, 3 and 4 support RS-232 only with the TX/RX only as shown in the pinouts below.

Protocol / Port#	RS-232				RS-422 Full Duplex				RS-485 Half Duplex			
SERIAL 1	TX1	1	2	RX1	TX1+	1	2	RX1+	TX1+/RX1+	1	2	NC
	KEY	3	4	GND	KEY	3	4	GND	KEY	3	4	GND
	RTS1	5	6	CTS1	TX1-	5	6	RX1-	TX1-/RX1-	5	6	NC
SERIAL 2	NC	7	8	NC	NC	7	8	NC	NC	7	8	NC
	RX2	9	10	TX2	NC	9	10	NC	NC	9	10	NC
SERIAL 3	TX3	1	2	RX3	NC	1	2	NC	NC	1	2	NC
	KEY	3	4	GND	KEY	3	4	KEY	KEY	3	4	KEY
SERIAL 4	NC	5	6	NC	NC	5	6	NC	NC	5	6	NC
	NC	7	8	NC	NC	7	8	NC	NC	7	8	NC
	RX4	9	10	TX4	NC	9	10	NC	NC	9	10	NC

Connector type: JST, SM10B-ZPDSS-TF or equivalent

4.6 USB Flashdisk (J9)

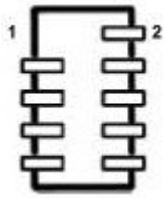


This connector is used for the USB on-board flashdisk interface. This is a dedicated USB port.

+5V	1	2	NC
USB Data-	3	4	NC
USB Data+	5	6	NC
USB GND	7	8	NC
Key	9	10	NC

Connector type: Sullins, NRPN052MAMS-RC

4.7 USB 0-1 (J10)

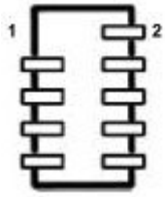


This connector provides access to two of the board's four USB 2.0 ports, USB0 and USB1. The shield pin is tied to system ground.

NC	1	2	Shield
USB1 GND	3	4	USB0 GND
USB1 Data+	5	6	USB0 Data+
USB1 Data-	7	8	USB0 Data-
USB1 Pwr+	9	10	USB0 Pwr+

Connector type: JST, SM10B-ZPDSS-TF

4.8 USB 2-3 (J11)



This connector provides access to two of the board's four USB 2.0 ports, USB2 and USB3. The shield pin is tied to system ground.

NC	1	2	Shield
USB3 GND	3	4	USB2 GND
USB3 Data+	5	6	USB2 Data+
USB3 Data-	7	8	USB2 Data-
USB3 Pwr+	9	10	USB2 Pwr+

Connector type: JST, SM10B-ZPDSS-TF

4.9 Utility Signals (J12)

This connector provides utility signals for Altair as follows.

1	USB_DEV_PWR
2	USB_DEV_D_N
3	USB_DEV_D_P
4	GND
5	SPKR
6	+5V
7	/PWRBTN
8	GND
9	/RESET

Connector type: MOLEX, 532610971

4.10 LCD Backlight (J14)

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.

1	Power +5V/+12V, jumper selectable, default +5V
2	Power (same as pin 1)
3	Ground
4	Ground
5	Enable (GPIO output), 0 = off, open circuit = on
6	Brightness, 0-5VDC variable; 0V = max, 5V = min (PWM control implemented)

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

4.11 LCD Panel (LVDS Interface) (J15)

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

1	Ground / D3+, depending on video chip
2	Ground / D3-, depending on video chip
3	Scan Direction (High = Reverse Scan, Low/open = Normal Scan)
4	LVDS Mapping (High = Map-B, Low = Map-A)
5	Signal Ground
6	Pixel Clock +
7	Pixel Clock -
8	Signal Ground
9	D2+
10	D2-
11	Signal Ground
12	D1+
13	D1-
14	Signal Ground
15	D0+
16	D0-
17	Power Ground
18	Power Ground
19	Vcc 3.3V / 5V (jumper configured)
20	Vcc 3.3V / 5V (jumper configured)

Connector type: JAE part no. FI-SE20P-HFE or equivalent
Cable-mount socket: JAE part no. FI-SE20S-2-L or equivalent

4.12 EMX Expansion Bus (J20)

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

Gnd	1	2	Gnd	USB2+	51	52	SATA-R+
PE4T+	3	4	PE1T+	USB2-	53	54	SATA-R-
PE4T-	5	6	PE1T-	+3.3V	55	56	+3.3V
Gnd	7	8	Gnd	Reserved	57	58	Reserved
PE3T+	9	10	PE2T+	Reserved	59	60	Reserved
PE3T-	11	12	PE2T-	+5V	61	62	+5V
Gnd	13	14	Gnd	Reserved	63	64	Reserved
PE4R+	15	16	PE1R+	Reserved	65	66	Reserved
PE4R-	17	18	PE1R-	+5V	67	68	+5V
Gnd	19	20	Gnd	Reserved	69	70	SMB-Clk
PE3R+	21	22	PE2R+	Reserved	71	72	SMB-Data
PE3R-	23	24	PE2R-	+5V	73	74	SMB-Alert-
Gnd	25	26	Gnd	Reserved	75	76	+5V
PE4C+	27	28	PE1C+	Reserved	77	78	+5V
PE4C-	29	30	PE1C-	+5VSB	79	80	LPC-AD0
Gnd	31	32	Gnd	+5VSB	81	82	LPC-AD1
PE3C+	33	34	PE2C+	VBat	83	84	LPC-AD2
PE3C-	35	36	PE2C-	Wake-	85	86	LPC-AD3
+3.3V	37	38	+3.3V	IOControl1	87	88	LPC-FRAME-
PE4clkreq-	39	40	PE1clkreq-	IOControl2	89	90	LPC-SERIRQ-
PE3clkreq-	41	42	PE2clkreq-	USB-OC-	91	92	LPC-DRQ
+3.3V	43	44	+3.3V	IOReady	93	94	LPC-CLK1
USB1+	45	46	SATA-T+	Device Reset-	95	96	LPC-CLK2
USB1-	47	48	SATA-T-	Host Reset-	97	98	Gnd
+3.3V	49	50	+3.3V	Gnd	99	100	Gnd

Connector type: Molex, 52901-1074

4.13 Power Input (J24)

The power signals on this connector come from a connector leading to the output from a DC/DC power supply installed in the system.

Ground	1	2	+5VDC
Ground	3	4	+5VDC
Ground	5	6	+5VDC
Ground	7	8	+5VDC
Ground	9	10	+12VDC
NC	11	12	NC

Connector type: JST, SM12B-ZPDSS-TF

4.14 GPIO (J26)

This connector provides the digital IO, PWM and analog signals from the PIC microcontroller.

GPIO1 - Digital	1	2	GPIO0 - Digital
GPIO3 – Digital	3	4	GPIO2 - Digital
GPIO5 – Digital	5	6	GPIO4 - Digital
GPIO7 – Digital	7	8	GPIO6 - Digital
GPIO9 - Digital	9	10	GPIO8 - Digital
PWM – B	11	12	PWM – A
PWM – D	13	14	PWM – C
DGND	15	16	AGND
ANALOG IN – 1	17	18	ANALOG IN – 0
ANALOG IN – 3	19	20	ANALOG IN – 2

Connector type: JST, SM20B-ZPDSS-TF

4.15 PIC Programming (J27)

This header is used to program (ICSP) the on-board PIC Microcontroller.

1	MCLR
2	+3V3
3	GND
4	PGD
5	PGC
6	NC

Connector type: Aptos, LTY-06S2-VB-040/028-FG

4.16 PCIe MiniCard (J28)

The PCIe MiniCard socket provides the facility to plug-in third party Mini-PCIe cards such as WiFi, Bluetooth, etc.

WAKE#	1	2	+3.3VAUX_3	GND3	21	22	PERST#	GND8	43	44	LED_WLAN#
COEX1	3	4	GND9	PERN0	23	24	+3.3VAUX_4	RSVD1	45	46	LED_WPAN#
COEX2	5	6	+1.5V_1	PERP0	25	26	GND11	RSVD2	47	48	+1.5V_3
CLKREQ#	7	8	UIM_PWR	GND4	27	28	+1.5V_2	RSVD3	49	50	GND14
GND1	9	10	UIM_DATA	GND5	29	30	SMB_CLK	RSVD4	51	52	+3.3VAUX_5
REFCLK-	11	12	UIM_CLK	PETN0	31	32	SMB_DATA				
REFCLK+	13	14	UIM_RESET	PETP0	33	34	GND12				
GND2	15	16	UIM_VPP	GND6	35	36	USB_D-				
	KEY			GND7	37	38	USB_D+				
RSVD(UIM_C8)	17	18	GND10	+3.3VAUX_1	39	40	GND13				
RSVD(UIM_C4)	19	20	W_DISABLE#	+3.3VAUX_2	41	42	LED_WWAN#				

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

4.17 Audio (J29)

The Audio connector has the Stereo Line-In, Stereo Line-Out and Mono Microphone signals from the ALC262 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 IN	9	10	GND_AUDIO

Connector type: JST, SM10B-ZPDSS-TF

4.18 VGA (J30)

The VGA connector has the VGA signals connected to it from the SDVO to VGA converter. A VGA monitor can be connected to this.

RED	1	2	VGA GND
GREEN	3	4	VGA GND
BLUE	5	6	VGA GND
GND	7	8	HSYNC
VSYNC	9	10	GND
DDC DATA	11	12	DDC CLK
NC	13	14	**GND**

Connector type: JST, SM14B-ZPDSS-TF

5. CONFIGURATION JUMPER DETAILS

This section explains the use of several jumper options on the Altair Baseboard.

The board 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.

Jumper Group Function	*Silkscreen Label*	*Reference*	*Array Size*
Serial Port 1 RS-422/485 mode differential termination resistor; Enable or Disable		JP1	2 X 2
LCD panel supply voltage: 3.3V or 5V	LVDS VSEL	JP2	1 X 3
LCD backlight power: 5V or 12V (+12V provided through the input power connector)	INV VSEL	JP4	1 X 3
LCD Panel Scan Direction; Normal Scan or Reverse Scan LCD Panel Map; Map-A or Map-B		JP5	2 X 2

5.1 Serial Port 1 RS-422/485 Termination (JP1)

Setting	*Termination Enable/Disable*	*Protocol*
Open	Termination Disable (default)	RS-233
1 – 2	RS-422 Termination Enable	RS-422
3 – 4	RS-485 Termination Enable	RS-485

5.2 LCD Panel Power Select – LVDS VSEL (JP2)

This jumper group must be configured according to input voltage required by the type of LCD panel that will be attached to Altair's LCD panel interface connector.

Setting	*LCD Panel Voltage*
1 - 2	+5V
2 - 3	+3.3V (default)

5.3 LCD Backlight Power Select – INV VSEL (JP4)

This jumper group selects the LCD backlight inverter DC power voltage.

Setting	*LCD Backlight Power*
1 – 2	+5V (default)
2 – 3	+12V

5.4 LCD Scan Direction & LVDS Map Select (JP5)

This jumper group controls the LCD panel scan direction and frame rate control. These settings depend on the LCD panel manufacturer. Every panel has its own setting logic.

Setting	*LCD Scan Direction*
1 - 2	Normal Scan Direction (default)
Open	Reverse Scan Direction

Setting	*LCD Map*
3 – 4	Map – A (default)
Open	Map – B

6. BIOS

Altair's BIOS provides access to many valuable features. These instructions show 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 **DEL/F2** 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 DEL or F2 key. If you wait too long and the system does not respond, simply reset the system (or power down) and try again.

6.2 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.

6.3 Setting the Date and Time

The date and time are set in the BIOS. Select **Main** menu, then enter the date and time at the bottom of the screen. This screen also displays the CPU speed and memory capacity of the board.

6.4 Boot Priority

To select Boot devices and set their priority, go to the **Boot** menu. Set the boot option priorities on this page.

6.5 Chipset

The chipset menu is provided to define and change the North / South Bridge options such as Graphic Adapter Modes, flat panel type (default is 800x600) etc.,

The Chipset menu also has various other options such as GPIO settings, enabling/disabling the audio controllers, PCIe root port configurations.

6.1 Console Redirection

In the **Advanced** menu, the user can select any of the serial ports for console redirection with different speeds ranging from 115200bps to 9600bps. Select the Serial Port Console Redirection sub menu.

When set to Enabled, the console re-direction is activated on COM1 by default at 115200,n,8,1 communication settings. The remote access configuration can be enabled on any of the four COM ports. Baud rates supported are 115200 (default when enabled), 57600, 38400, 19200 and 9600.

6.2 Viewing and Modifying the BIOS Settings

During board startup, press function key <F2> to enter BIOS setup mode.

The main page displays the following menu options:

- Main
- Advanced
- GPIO Wake Configuration
- Chipset
- Boot
- Security
- Save & Exit

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, as displayed at the bottom of each page.

Key	*Function*
F1	Help
Esc	Exit current screen
up-/down-arrow	Select setup item
left-/right-arrow	Select menu item
plus/minus symbols (+/-)	Change values
Enter	Execute command
F9	Save default values
F10	Save changes and exit BIOS setup mode

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 BIOS Screen Descriptions

This section describes the screen displays for each BIOS setup area. 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. Sub-menus are prefixed with a ▶.

Main

BIOS Information	
BIOS Vendor	American Megatrends
Product Name	Altair
Motherboard Manufacturer	Diamond Systems
MRC Version	01.00
Total Memory	1024 MB (DDR2)
Platform Information	
System Language	[English]
System Date	[Tue 11/13/2012]
System Time	[12:37:18]
Access Level	Administrator

Advanced

Legacy OpROM Support	
Launch PXE OpROM	[Disabled]
Launch Storage OpROM	[Enabled]
▶ PCI Subsystem Settings	
▶ ACPI Settings	
▶ Windows CE	
▶ CPU Configuration	
▶ Wake On Lan Configuration	
▶ Thermal Configuration	
▶ USB Configuration	
▶ SIO Configuration	
▶ Hardware Health Monitor	
▶ Serial Port Console Redirection	

GPIO Wake Configuration

GPIO Wake Configuration	
Wake on GPIO0	[Disabled]
Wake on GPIO1	[Disabled]

Chipset

▶ North Bridge Chipset Configuration
▶ South Bridge Chipset Configuration
▶ IOH Configuration

Boot

Boot Configuration	
Quiet Boot	[Disabled]
Fast Boot	[Disabled]
Setup Prompt Timeout	1
Bootup NumLock State	[On]
CSM16 Module Version	07.65
GateA20 Active	[Upon Request]
Option ROM Messages	[Force BIOS]
Interrupt 19 Capture	[Disabled]
Boot Option Priorities	
Boot Option #1	[PMAP]
Boot Option #2	[Built-in EFI Shell]
Boot Option #3	[UEFI: PMAP]
Hard Drive BBS Priorities	

Security

Administrator Password
User Password

Save & Exit

Boot to Windows CE
Save Changes and Exit
Discard Changes and Exit
Save Changes and Reset
Discard Changes and Reset
Save Options
Save Changes
Discard Changes
Restore Defaults
Save as User Defaults
Restore as User Defaults
Boot Override
Built-in EFI Shell
PMAP
UEFI: PMAP

7. PIC MICROCONTROLLER

The Altair SBC contains a PIC microcontroller that is used to provide various functions including serial port configuration, general purpose I/O lines, A/D lines, pulse width modulators, generate wake events, and others. This section describes the command sets that can be used to communicate with the PIC controller.

The list below describes the constants that have been used in this section.

- MESSAGE_SIG 0x3232
- COMMAND_AREYOU 0x01
- COMMAND_WRITE_EPROM 0x03
- COMMAND_READ_EPROM 0x05
- COMMAND_CONFIG_DIOPORT 0x07
- COMMAND_DIO_OUTPUT 0x09
- COMMAND_DIO_READ 0x0B
- COMMAND_ANALOG_READ 0x0D
- COMMAND_CONFIG_PWM 0x0F
- COMMAND_WATCHDOG_SET 0x17
- COMMAND_WATCHDOG_READ 0x19
- COMMAND_WATCHDOG_TRIGGER 0x1B
- COMMAND_CALENDAR_WAKEUP 0x1D
- COMMAND_MTBF_DATA 0x1F
- COMMAND_MTBF_POWER 0x21
- COMMAND_RTC_READ 0x23
- COMMAND_RTC_WRITE 0x25
- COMMAND_SET_COM_MODE 0x27
- COMMAND_GET_COM_MODE 0x29
- COMMAND_BOARD_VOLTAGE 0X2B
- COMMAND_CONFIG_READ_DIOPORT 0x2F
- COMMAND_RECEIVER_AREYOUTHERE 0x02
- COMMAND_RECEIVER_EPROMDATA 0x04
- COMMAND_RECEIVER_DIODATA 0x0C
- COMMAND_RECEIVER_ANALOG_DATA 0x0E
- COMMAND_RECEIVER_WATCHDOG_SETTINGS 0x1A
- COMMAND_RECEIVER_ACK 0x1C
- COMMAND_RECEIVER_MTBF_DATA 0x1E
- COMMAND_RECEIVER_MTBF_POWER 0x20
- COMMAND_RECEIVER_RTC_DATA 0x22
- COMMAND_RECEIVER_GET_COM_MODE 0x24
- COMMAND_RECEIVER_BOARD_VOLTAGE 0X26
- COMMAND_RECEIVER_CONFIG_READ_DIOPORT 0x2A

7.1 Are you there

Command Description:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_AREYOU: Command id for the “are you there command”
3	1	0: No extra data sent

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_AREYOUTHERE
3	1	Specifies the length of the buffer as 1 byte long
4	1	Version Number of the firmware

Comments:

This command is used to retrieve the firmware version running on the target system. If the firmware version is 2, then the message sent is 3232010 and the received message is 3232020102.

7.2 Configure DIO Port Command

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_CONFIG_DIOPORT: Command id for the message
3	1	1
4	1	Pin number

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operation

Comments:

This command is used to toggle the configuration direction of a digital IO pin. The value of the pin number must be between 0 and 9.

7.3 DIO Read

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_DIO_READ: Command id for the message
3	1	0

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_DIODATA: Command id for the message
3	1	2: Indicating 2 bytes data
4	2	The state of all the DIO pins from 0 to 9

Comments:

This command reads the data from all the pins starting from 0 and ending with 9. The response contains the data for all the pins encoded in 2 bytes of data. Bit 0 to 7 for the first data byte will contain the data for DIO 0 to 7 and bit 0 and 1 of second data byte will contain the data for DIO 8 and 9.

7.4 DIO Output

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_DIO_OUTPUT: Command id for the message
3	1	1
4	1	Pin number

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operation

Comments:

This command toggles the current state of the selected pin from LOW to HIGH, or HIGH to LOW. The response is an acknowledgement for the successful completion of the command.

7.5 EEPROM Read

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_READ_EPROM: Command id of the message
3	1	2: Indicating the 2 byte address to be read from the EEPROM
4	2	Contains the address to be read

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_EPROMDATA: Indicating the following data is from reading EEPROM data
3	1	1: Indicating one byte of data to be read
4	1	The data that is requested by the read request

Comments:

The command will be 6 bytes long in which the first two bytes is the command signature, the third byte is the command id, the fourth byte is the length of the data buffer, and the fifth byte is the data which contains the address location. For example, to read location 0x0130 the message will look like this [0x3232] [0x05] [0x02] [0x0130].

7.6 EEPROM WRITE

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_WRITE_EPROM: Command id for the message
3	1	3: Indicating 3 bytes of data is sent
4	2	Contains the address location where the data is to be written
6	1	The 1 byte of data that is to be written to the EEPROM section

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operation

Comments:

This command is used to write data to the EEPROM. The first four bytes will contain the data, just like other commands, only the command id and length will be different. The firmware has to know the address of the memory location where data will be written and the data itself. Hence for specifying the address, two bytes are used. One byte for the data is filled in the data section. For writing multiple bytes or bulk data, this command can be issued multiple times.

7.7 MTBF POWER CYCLE

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_MTBF_POWER: Command id
3	1	0: Indicating no data is sent

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_MTBF_POWER: Indicating the command to process
3	1	4: Indicating 4 bytes of data to follow
4	4	4 byte long counter to be returned as response to this command

Comments:

MTBF data gives the count of the number of power restarts that have occurred in the system. The first two bytes contains the same meaning as the previous commands. The third byte contains the command id for the operation. This command does not need any parameter; hence its data length is zero. To retrieve MTBF data, the message will look like [0x3232] [0x1F] [0x00].

7.8 Watchdog Timeout Set

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_WATCHDOG_SET: Sets the watchdog timeout to predefined values
3	1	1: Indicating 1 byte of data follows
4	1	The time value set depending on the following set of values: Value — Time interval 0: 1 sec 1: 2 sec 2: 4 sec 3: 8 sec 4: 16 sec 5: 32 sec 6: 1 min. 7: 2 min. 8: 4 min. 9: 9 min. 10: 17 min. 11: 35 min. 12: 70 min. 13: Disable

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operation

Comments:

This command is used to set the time out value for the microcontroller. This feature is useful to reset the microcontroller from a non-responsive state, or when the master system has lost connectivity with the firmware. The first four bytes are organized just like the previous messages and interpreted in the same way in the firmware. The fifth byte contains data specifying the timeout length. For example, to set a 16 second time out value, the message will looks like [0x3232] [0x17] [0x01] [0x04].

7.9 Watchdog Trigger

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_WATCHDOG_TRIGGER
3	1	0: Indicating no data is sent

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operation

Comments:

The first three bytes contains data just like the previous commands. There is no extra data required to execute the command, so the fourth byte is 0. The message for a watchdog trigger will look like [0x3232] [0x1B] [0x00].

7.10 Watchdog Read

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_WATCHDOG_READ
3	1	1: Indicating 1 byte of data to be read

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_WATCHDOG_SETTINGS: Response ID
3	1	0: Indicating no data is sent
4	1	The time value set depending on the following set of values: Value Time interval 0: 1 sec 1: 2 sec 2: 4 sec 3: 8 sec 4: 16 sec 5: 32 sec 6: 1 min. 7: 2 min. 8: 4 min. 9: 9 min. 10: 17 min. 11: 35 min. 12: 70 min. 13: Disable.

Comments:

The command returns an integer as its response, which represents a timeout value depending on the value-time interval chart given above.

7.11 MTBF Power Data:

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_MTBF_DATA: Indicating the command to process
3	1	0: Indicating no data is sent

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_MTBF_DATA: Indicating the command to process
3	1	4: Indicating 4 bytes of data

Comments:

This command is similar to the watchdog timeout read command described earlier. It is also 4 bytes long. Only the command id is different. The response of this command returns the boot up time in seconds.

7.12 RTC Read

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RTC_READ
3	1	0: Indicating no data is sent

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_RTC_DATA: Indicating the command to process
3	1	7: Specifying 7 bytes following
4	1	0 – 99 specifying the year's last two digits
5	1	1 – 12 specifying Month: 1 for January, 3 for March, 11 for November, and so on
6	1	1 – 31 Date
7	1	1 – 7 Day of week. 1 for Sunday, 3 for Tuesday, 7 for Saturday, and so on
8	1	0 – 23 Hours
9	1	0 – 59 Minutes
10	1	0 – 59 Seconds

Comments:

This command reads the RTC timer on the microcontroller. Before reading the data, the RTC must be configured with some starting time or else it will give incorrect data. The command structure and description is similar to the watch dog read command or the MTBF power data retrieval command. The command looks like [3232] [19] [00].

7.13 RTC Write

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RTC_WRITE
3	1	7: Specifying 7 bytes following this
4	1	0 – 99 specifying the year's last two digits
5	1	1 – 12 specifying Month: 1 for January, 3 for March, 11 for November, and so on
6	1	1 – 31 Date
7	1	1 – 7 Day of week. 1 for Sunday, 3 for Tuesday, 7 for Saturday, and so on
8	1	0 – 23 Hours
9	1	0 – 59 Minutes
10	1	0 – 59 Seconds

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operation

Comments:

This command is always ten bytes long. The first four bytes contain information just like other commands. The next seven bytes of information contain data regarding date information as described in the table above. This command configures and starts the RTC module in the firmware. For example to set 29th Feb 2012 5:00:17 PM (Wednesday is day of the week), the command is [0x3232] [0x25] [0x07] [12] [02] [04] [17] [00] [17]. While reading the RTC data, the time information will appear in this format.

7.14 Set COM Mode

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_SET_COM_MODE
3	1	1: Indicating 1 more byte to be read
4	1	1: Indicates RS-232 protocol to be used 2: Indicates RS-485 protocol to be used 3: SPI (Serial Peripheral Interface) protocol to be used

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1: Some problem in the operations

Comments:

This command is used to specify what protocol is used by the firmware. This won't be immediately reflected in the firmware; the protocol will be updated after the device is reset. The default protocol is set as SPI communication (The host windows application is uses the SPI protocol). To set the protocol to RS-232, the message looks like [0x3232] [0x27] [0x01] [0x01].

7.15 Get COM Mode

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_GET_COM_MODE
3	1	0: Indicating no data is sent

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_GET_COM_MODE: Indicating the command to process
3	1	1: Indicating 1 byte of data to be read
4	1	1: Indicates RS-232 protocol to be used 2: Indicates RS-485 protocol to be used 3: SPI (Serial Peripheral Interface) protocol to be used

Comments:

This command is used to retrieve the protocol used for sending data, or getting data from firmware. The default communication mode is the SPI. The firmware will use the last used protocol (the protocol used for before the last rest) when initializing the firmware

7.16 READ ANALOG DATA

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_ANALOG_READ: Command ID
3	1	0: Indicating no data

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ANALOG_DATA: Response ID
3	1	8: Indicating 8 bytes of data
4	8	8 bytes of data buffer containing the analog values for channels 0 to 3

Comments:

This command retrieves the analog voltage values of channels 0 to 3. The response consists of eight bytes of data which contain the analog voltage for channels 0 to 3 in hex. The data consists of the following values:

1st byte: Lower byte of the voltage value of channel 0

2nd byte: Higher byte of the voltage value of channel 0

3rd byte: Lower byte of the voltage value of channel 1

4th byte: Higher byte of the voltage value of channel 1

5th byte: Lower byte of the voltage value of channel 2

6th byte: Higher byte of the voltage value of channel 2

7th byte: Lower byte of the voltage value of channel 3

8th byte: Higher byte of the voltage value of channel 3

7.17 BOARD VOLTAGES

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_BOARD_VOLTAGE: Command ID
3	1	0: Indicating no data

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_BOARD_VOLTAGE: Command ID
3	1	10: Indicating 10 bytes of data

Comments:

This command retrieves the analog voltage values of channels 6 to 10. The response consists of eight bytes of data which contain the analog voltage for channels 6 to 10 in hex. The data consists of the following values:

1st byte: Lower byte of the voltage value of channel 6

2nd byte: Higher byte of the voltage value of channel 6

3rd byte: Lower byte of the voltage value of channel 7

4th byte: Higher byte of the voltage value of channel 7

5th byte: Lower byte of the voltage value of channel 8

6th byte: Higher byte of the voltage value of channel 8

7th byte: Lower byte of the voltage value of channel 9

8th byte: Higher byte of the voltage value of channel 9

9th byte: Lower byte of the voltage value of channel 10

10th byte: Higher byte of the voltage value of channel 10

7.18 PWM CONTROL

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_CONFIG_PWM: Command ID
3	1	4: Indicating 4 bytes of data
4	4	4 bytes of data: channel number, 2 bytes of frequency, duty cycle percentage between 0 to 100

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1 or non-zero: Some problem in the operations

Comments:

This command enables PWM channels to generate PWM signals of certain frequency and duty cycle. The output pins for different channels are as follows:

Channel #1: P1A/RC2 pin

Channel #2: P1B/RE6 pin

Channel #3: P1C/RE5 pin

Channel #4: P1D/REG4 pin

The response is a status message for successful completion of the command.

7.19 READ DIO CONFIG

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_CONFIG_READ_DIOPORT: Command ID
3	1	0: Indicating no data

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_CONFIG_READ_DIOPORT: Command ID
3	1	2: Indicating 2 bytes of data

Comments:

This command reads the configuration direction for all the pins starting from pin 0 and going to pin 9. The response contains the data for all the pins encoded in 2 bytes of data. Bit 0 to 7 for the first data byte contains the data for DIO 0 to 7, and bit 0 and 1 of second data byte contains the data for DIO 8 and 9.

7.20 CALENDAR WAKEUP

Command:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_CALENDAR_WAKEUP: Command ID
3	1	6: Indicating 6 bytes of data
4	6	6 bytes of data containing hour, minute, second, day, month and day of week respectively

Response:

Byte	Length	Value and Description
0	2	MESSAGE_SIG: Message signature
2	1	COMMAND_RECEIVER_ACK: Command id for the message
3	1	1
4	1	Return status for the command 0: Operation completed successfully 1 or non-zero: Some problem in the operations

Comments:

This command configures the RTC module to generate an alarm on the date and time set in the six bytes of data in the command. An alarm pulse is generated at pin RG4 at the specified time and date. The response is a status response signaling successful completion of command processing.

8. FLASHDISK MODULES

8.1 Overview

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

USB Flashdisk

8.2 Models and Capacities

Model	*Capacity*
FDU-1G-XT	1GB
FDU-2G-XT	2GB
FDU-4G-XT	4GB
FDU-8G-XT	8GB

8.3 Features

The flashdisk module works just like a USB disk drive and requires no drivers. It provides high-speed nonvolatile mass storage in capacities of 1GB to 8GB. The flashdisk mounts on connector J9 and is held in place with a spacer and screw (included). It includes a write protection jumper and operates over -40ºC to +85ºC.

USB flashdisk features:

- USB 2.0 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
- -40ºC to +85ºC operation
- RoHS compliant

8.4 Flashdisk Installation

Installing a USB flashdisk module on Altair is straightforward using the following steps.

1. Ensure power is disconnected from Altair.
2. Remove the screw from the standoff located between the flashdisk connector, USB3, and the PC/104 connector.
3. Align the flashdisk so that its female connector aligns with the pins on connector USB3 and the mounting hole aligns above the standoff.
4. Press the flashdisk downward onto connector USB3.
5. Reinstall the screw, securing the flashdisk module to Altair.

8.5 Power Routing

A +5VDC/+12VDC source can be connected to the Altair SBC power connector. An ATX power supply can be used to power the Altair SBC along with the stock cables.

There is also a 3.0V lithium battery mounted on the board to provide the RTC voltage to the CMOS/RTC on Altair. The battery is a CR-2354/GUN or equivalent type with 3 pins.

The +5VDC/+12VDC power source is interfaced to the board on the locking connector J24. The +5VDC is used by the Altair SBC for all its power subsystems. The +12VDC is used for the LVDS panel backlight inverter.

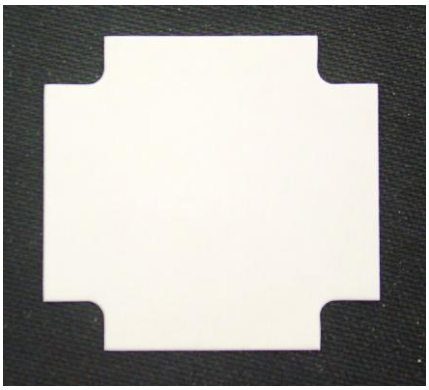
9. THERMAL PAD

A thermal pad is included with every Altair. 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.

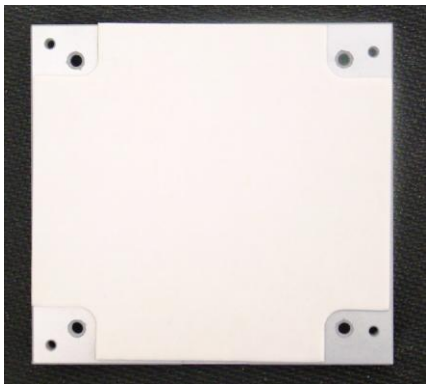
- Material: 3M 5590H
- Color: Light Grey
- Thickness: 0.5/1.0 mm
- Thermal Conductivity: 3.0 W/m-K

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

10. SPECIFICATIONS

- Intel Atom “Tunnel Creek” processors (Queensbay platform), clocked at 1.6GHz standard, 1.0GHz and 600MHz optional
- Cooling : Heatspreader, fanless
- 1GB or 2GB DDR2 memory soldered on board
- Display options:
    - LVDS flat panel interface
    - VGA
    - DVI optional
    - LVDS backlight power: +5V or +12V jumper selectable
- Keyboard/Mouse USB
- USB: 4 USB 2.0 ports on headers (Additionally an USB Hub is implemented to facilitate three ports for the EMX Expansion Connector and one port for the MiniPCIe socket)
- Serial: 4 serial ports; Port 1 supports TX, RX, RTS and CTS with RS-232/422/485 capability and Ports 2, 3, 4 support TX/RX RS-232 only
- Networking: One Intel 82574IT based Gigabit Ethernet port on pin header, with on-board magnetics
- Mass storage:
    - USB flashdisk mounting location (supporting both sizes)
    - 1 SATA port
- ALC262 Codec based High Definition Audio with Stereo Line-Out, Stereo Line-In and Microphone.
- 10 GPIOs from the PIC Microcontroller
- Programmable watchdog timer
- EMX expansion I/O connector
- Mini-PCI Express: 1 PCIe x1 lane

1.1 Operating System Support

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

1.2 Mechanical, Electrical, Environmental

- COM Express form factor: 125mm x 95mm (4.92” x 3.74”)
- Heatspreader, for the processor and chipset on the bottom PCB surface, with 2.8” x 2.8” mounting pattern
- -40°C to +85°C ambient operating temperature without a fan
- Power input requirements: +5VDC +/- 5%
- Optional +12VDC for the LCD backlight ONLY. No on-board circuits can depend on +12VDC.
- MTBF: xxxxxx hours
- Dimensions: 4.92" x 3.74" x 0.9” (125mm x 95mm x 23mm)
- Weight: 10.8oz (306.2grams) with heatspreader