CAPA840

Intel® Atom™ Processor E3845/E3827 Capa Board

User's Manual

Disclaimers

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CAUTION

If you replace wrong batteries, it causes the danger of explosion. It is recommended by the manufacturer that you follow the manufacturer's instructions to only replace the same or equivalent type of battery, and dispose of used ones.

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ESD Precautions

Computer boards have integrated circuits sensitive to static electricity. To prevent chipsets from electrostatic discharge damage, please take care of the following jobs with precautions:

- Do not remove boards or integrated circuits from their anti-static packaging until you are ready to install them.
- Before holding the board or integrated circuit, touch an unpainted portion of the system unit chassis for a few seconds. It discharges static electricity from your body.
- Wear a wrist-grounding strap, available from most electronic component stores, when handling boards and components.

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Table of Contents

Disclaimers ii
ESD Precautions iii

Chapter 1 Introduction 1

1.1 Features 2
1.2 Specifications 2
1.3 Utilities Supported 3

Chapter 2 Board and Pin Assignments 5

2.1 Board Dimensions and Fixing Holes 5
2.2 Board Layout 7
2.3 Jumper Settings 9
2.3.1 LVDS Brightness Control Mode Setting (JP1) 10
2.3.2 LVDS Voltage Selection (JP2 and JP3) 10
2.3.3 Restore BIOS Optimal Defaults (JP4) 10
2.3.4 COM1 Data/Power Selection (JP6) 10
2.3.5 Auto Power On (JP7) 11
2.4 Connectors 12
2.4.1 Digital I/O Connector (CN1) 13
2.4.2 CPU Fan Connector (CN2) 13
2.4.3 SATA Power Connector (CN4) 13
2.4.4 Front Panel Connector (CN6) 14
2.4.5 Inverter Connector (CN7) 15
2.4.6 Internal USB 2.0 Port (CN8) 15
2.4.7 LVDS Connector (CN9) 16
2.4.8 Audio Connector (CN10) 18
2.4.9 Ethernet Port (CN11) 18
2.4.10 USB Ports (CN12 and CN13) 18
2.4.11 HDMI Connector (CN14) 19
2.4.12 SMBus Connector (CN15) 19
2.4.13 VGA Connector (CN16) 19
2.4.14 COM Connectors (CN17 and CN18) 20
2.4.15 SATA Connector (CN19) 20
2.4.16 ATX Power Connector (CN20) 21
2.4.17 PCI-Express Mini Card (USB) and mSATA Connector (SCN1) 21
2.4.18 PCI-Express Mini Card Connector (SCN2) 22
2.4.19 ZIO Expansion Connector (SCN5) 23

Chapter 3 Hardware Description 25

3.1 Microprocessors 25
3.2 BIOS 25
3.3 System Memory 25
3.4 I/O Port Address Map 25
3.5 Interrupt Controller (IRQ) Map 26
3.6 Memory Map 29

Chapter 4 AMI BIOS Setup Utility 31

4.1 Starting 31
4.2 Navigation Keys 31
4.3 Main Menu 33
4.4 Advanced Menu 34
4.5 Chipset Menu 49
4.6 Security Menu 54
4.7 Boot Menu 55
4.8 Save & Exit Menu 56

Appendix A Watchdog Timer 59

A.1 About Watchdog Timer 59
A.2 How to Use Watchdog Timer 59
A.3 Sample Program 60

Appendix B Digital I/O 63

B.1 About Digital I/O 63
B.2 Digital I/O Programming 63

Appendix C Window® 7 Installation Guide 67

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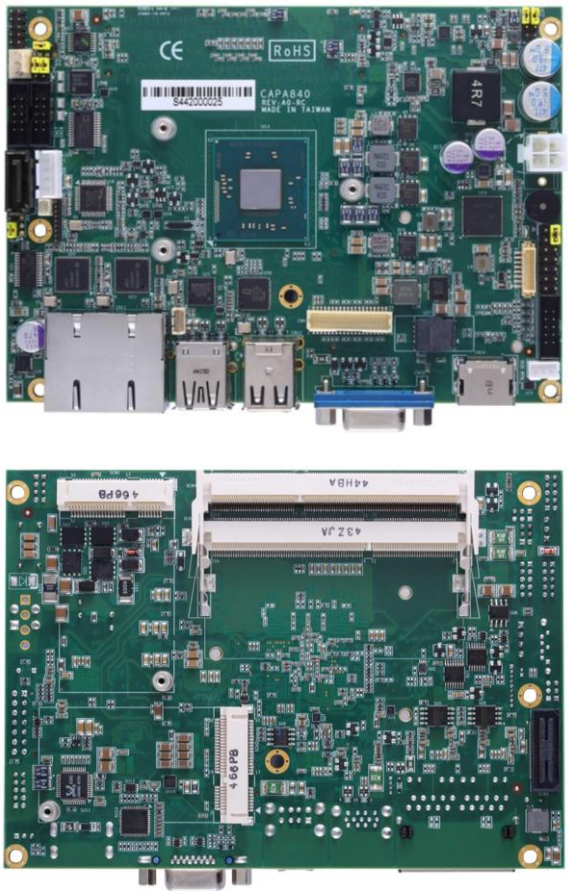
Chapter 1
Introduction



The CAPA840, a 3.5” board, supports Intel® Atom™ E3845/E3827 processors. It delivers outstanding system performance through high-bandwidth interfaces, multiple I/O functions for interactive applications and various embedded computing solutions.

The CAPA840 comes with two 204-pin unbuffered SO-DIMM sockets for dual channel DDR3L 1333/1066MHz memory, maximum memory capacity up to 8GB. There are two Gigabit/Fast Ethernet ports, one SATA port with transfer rate up to 3Gb/s, one USB 3.0 super speed and four USB 2.0 high speed compliant, and built-in HD audio codec that can achieve the best stability and reliability for industrial applications. Additionally, it provides you with unique embedded features, such as two serial ports (one RS-232/422/485 and one RS-232) and 3.5” form factor that applies an extensive array of PC peripherals.

1.1 Features

- Intel® Atom™ quad core E3845 (1.91GHz) and dual core E3827 (1.75GHz)
- 2 DDR3L SO-DIMM supports up to 8GB memory capacity
- 4 USB 2.0 ports
- 1 USB 3.0 port
- 2 COM ports
- 2 PCI-Express Mini Cards
- +12V~+24V DC-in supported
- Wide operating temperature supported

1.2 Specifications

- **CPU**
  - Intel® Atom™ quad core E3845 1.91GHz.
  - Intel® Atom™ dual core E3827 1.75GHz.

- **Thermal Solution**
  - Passive.

- **Operating Temperature**
  - -20°C~70°C.

- **BIOS**
  - American Megatrends Inc. UEFI (Unified Extensible Firmware Interface) BIOS.
  - 64Mbit SPI Flash, DMI, Plug and Play.
  - PXE Ethernet Boot ROM.

- **System Memory**
  - Two 204-pin unbuffered DDR3L SO-DIMM sockets.
  - Maximum up to 8GB DDR3L 1333/1066MHz memory.

Note ***Please make sure the lower SO-DIMM socket must be inserted and both memory modules are of the same size, chip width, density and rank. It is suggested to insert the 4GB DDR3L module on each SO-DIMM socket for better performance.***

- **Onboard Multi I/O**
  - Controller: Fintek F81803U.
  - Serial Ports: One port for RS-232/422/485 and one port for RS-232.

- **Serial ATA**
  - One SATA-300 connector.
  - mSATA supported

- **USB Interface**
  - Four USB ports on the rear I/O: One for USB 3.0 and three for USB 2.0.
  - One USB 2.0 port in 4-pin internal connector.

- **Display**
  - One 15-pin D-Sub as VGA connector.
  - One 2x20-pin connector for 18/24-bit single/dual channel LVDS and one 8-pin inverter connector. LVDS resolution is up to 1920x1200 in 24-bit dual channels.
  - One HDMI.

- **Trusted Platform Module (TPM)**
  - Controller: ST ST33TPM12LPC via LPC bus interface.
  - Complies with TPM1.2 main and PC client specification.

- **Watchdog Timer**
  - 1~255 seconds or minutes; up to 255 levels.

- **Ethernet**
  - Two RJ-45 LAN ports: Intel® i211AT supports 1000/100/10Mbps Gigabit/Fast Ethernet with Wake-on-LAN and PXE Boot ROM.

- **Audio**
  - HD audio compliant with Realtek ALC662.
  - Line-out and line-in/MIC-in via box header connector.

- **Expansion Interface**
  - One full-size PCI-Express Mini Card socket complies with PCI-Express Mini Card Spec. V1.2 but only support USB 2.0.
  - One full-size PCI-Express Mini Card Socket complies with PCI-Express Mini Card Spec. V1.2.

- **Power Input**
  - One 2x2-pin connector.
  - +12V~+24V DC-in.
  - AT auto power on function supported.

- **Power Management**
  - ACPI (Advanced Configuration and Power Interface).

- **Form Factor**
  - 3.5” form factor.

Note

All specifications and images are subject to change without notice.

1.3 Utilities Supported

- Chipset and graphics driver
- Ethernet driver
- Audio driver
- XHCI driver
- Trusted Execution Engine
- Sideband Fabric Device

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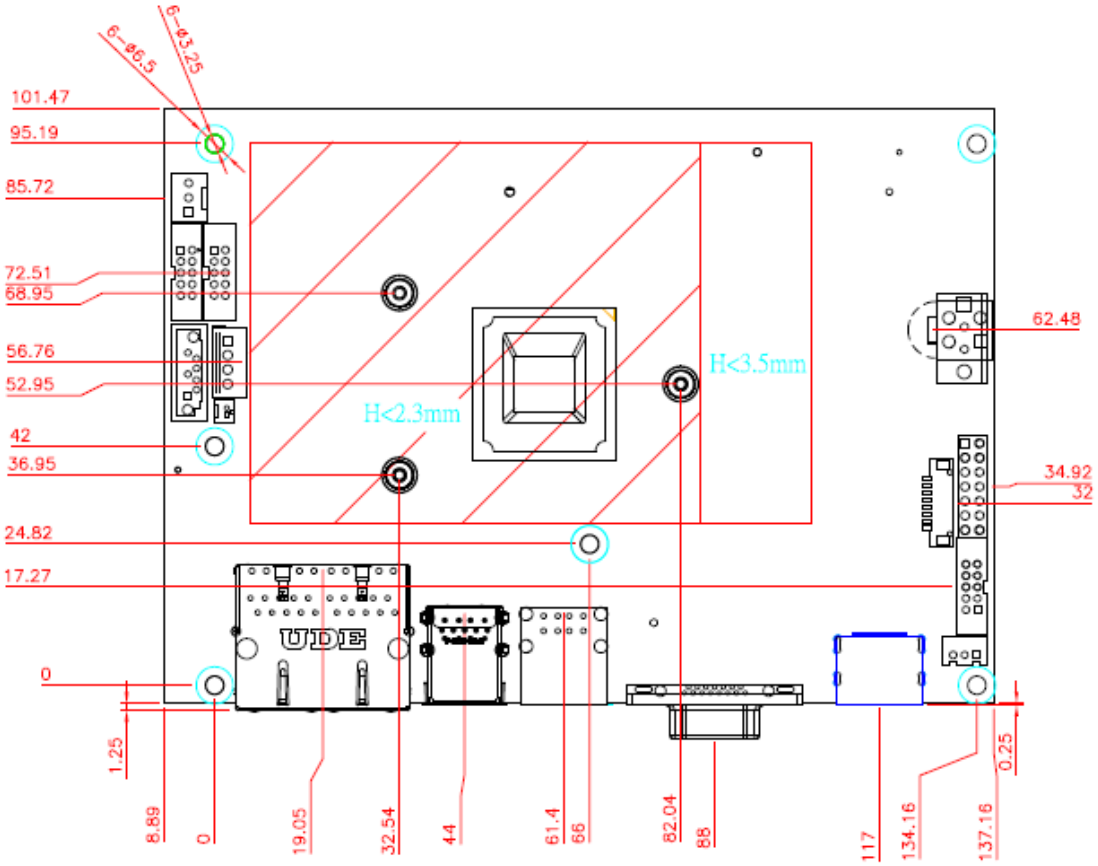
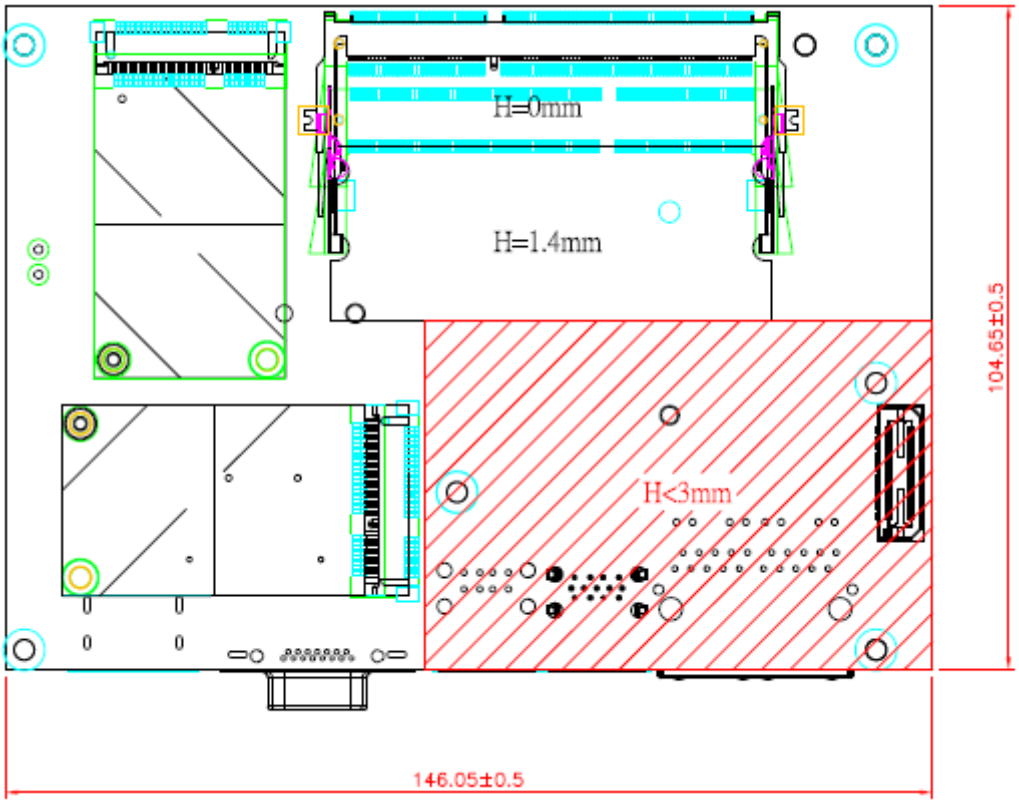
Chapter 2
Board and Pin Assignments

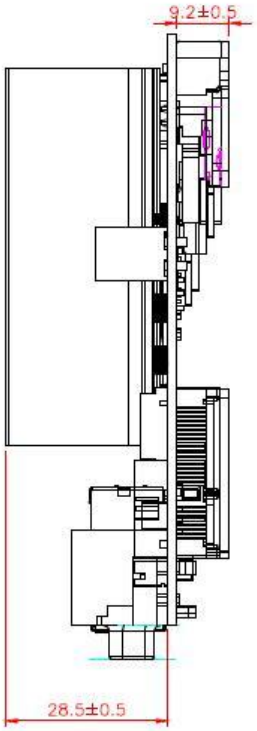
2.1 Board Dimensions and Fixing Holes



Top View

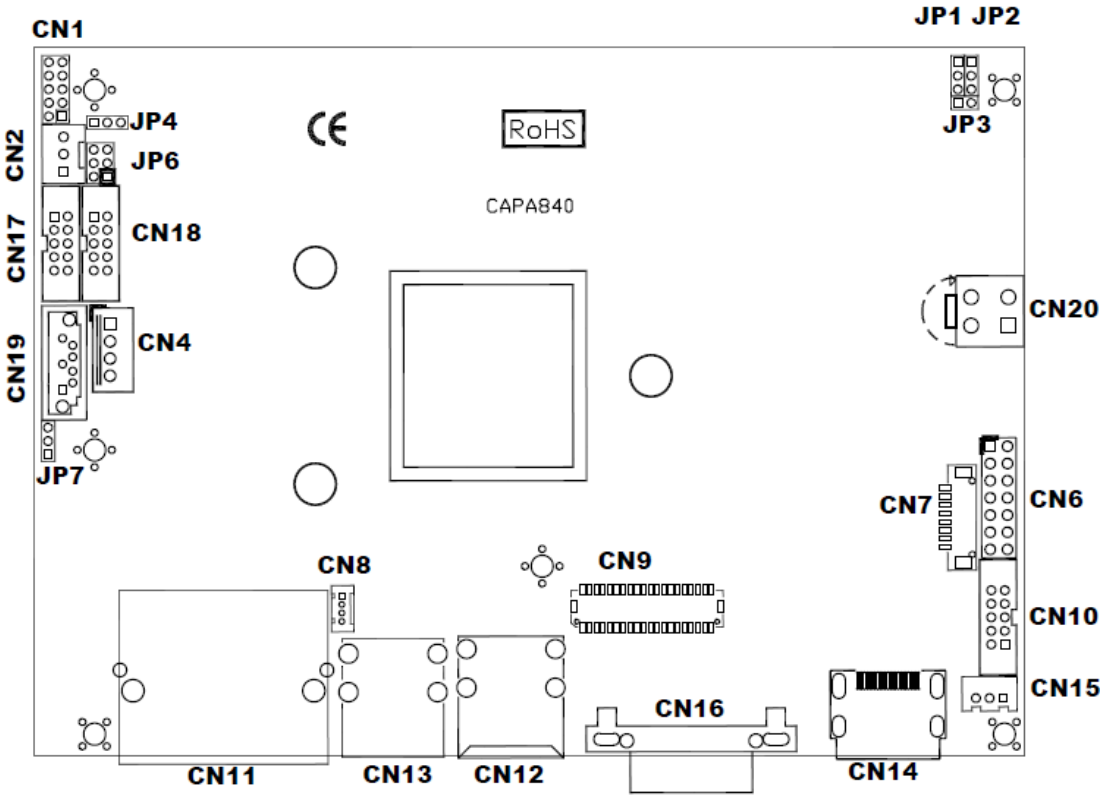


Bottom View

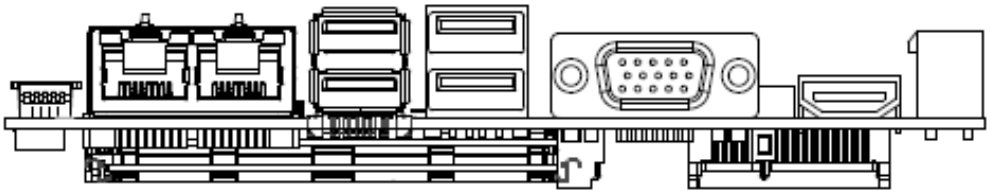


Side View

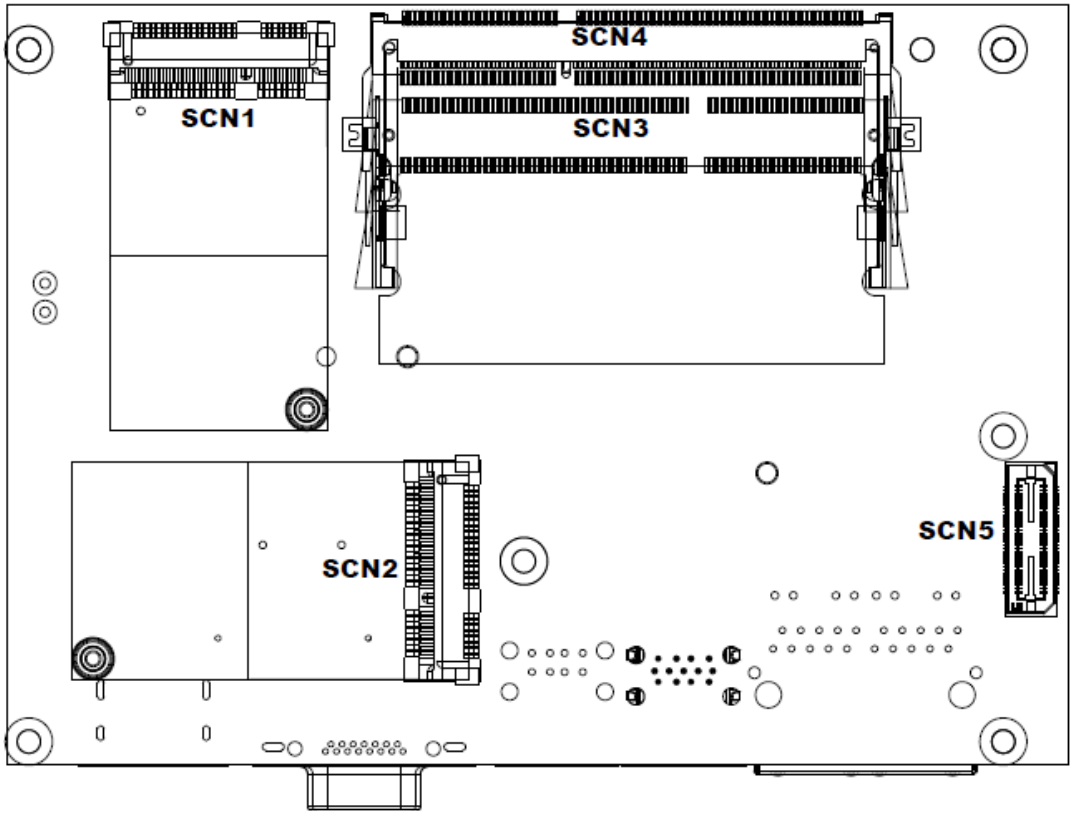
2.2 Board Layout



Top View



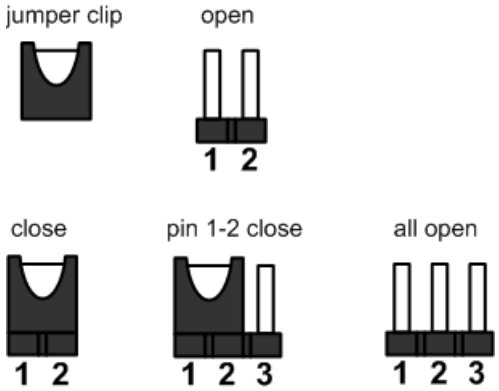
Side View



Bottom View

2.3 Jumper Settings

Jumper is a small component consisting of jumper clip and jumper pins. Install jumper clip on 2 jumper pins to close. And remove jumper clip from 2 jumper pins to open. Below illustration shows how to set up jumper.



Properly configure jumper settings on the CAPA840 to meet your application purpose. Below you can find a summary table of all jumpers and onboard default settings.

Note

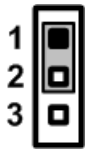
Once the default jumper setting needs to be changed, please do it under power-off condition.

Jumper	Description		Setting
JP1	LVDS Brightness Control Mode Setting Default: PWM Mode		1-2 Close
JP2	LVDS +3.3V/+5V Voltage Selection Default: +3.3V		1-2 Close
JP3	LVDS +12V Voltage Selection Default: None		None
JP4	Restore BIOS Optimal Defaults Default: Normal Operation		1-2 Close
JP6	COM1 Data/Power Selection Default: RS-232 Data	CN17 Pin 1: DCD	3-5 Close
		CN17 Pin 8: RI	4-6 Close
JP7	Auto Power On Default: Disable		1-2 Close

2.3.1 LVDS Brightness Control Mode Setting (JP1)

This jumper enables you to select PWM or voltage control mode for inverter connector (CN7). These two control modes are for adjusting the brightness of LVDS panel.

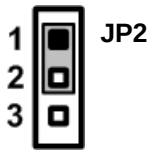
Function	Setting
PWM mode (Default)	1-2 close
Voltage mode	2-3 close



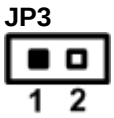
2.3.2 LVDS Voltage Selection (JP2 and JP3)

The board supports voltage selection for flat panel displays. Use these jumpers to set LVDS connector (CN9) pin 1~6 VCCM to +3.3V, +5V or +12V. To prevent hardware damage, before connecting please make sure that input voltage of the flat panel is correct.

Function	JP2 Setting
+3.3V level (Default)	1-2 close
+5V level	2-3 close



Function	JP3 Setting
+12V level	1-2 close
N/A	Open



2.3.3 Restore BIOS Optimal Defaults (JP4)

Put jumper clip to pin 2-3 for a few seconds then move it back to pin 1-2. Doing this procedure can restore BIOS optimal defaults.

Function	Setting
Normal (Default)	1-2 close
Restore BIOS optimal defaults	2-3 close

2.3.4 COM1 Data/Power Selection (JP6)

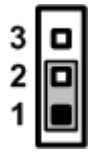
The COM1 port has +5V level power capability on DCD and +12V level on RI by setting this jumper. When this port is set to +5V or +12V level, please make sure its communication mode is RS-232. You can change the communication mode (RS-232/422/485) via BIOS setting, see section 4.4.

Function	Setting
Power: Set CN17 pin 1 to +5V level	1-3 close
Data: Set CN17 pin 1 to DCD (Default)	3-5 close
Power: Set CN17 pin 8 to +12V level	2-4 close
Data: Set CN17 pin 8 to RI (Default)	4-6 close

2.3.5 Auto Power On (JP7)

If JP7 is enabled for AC power input, the system will be automatically power on without pressing soft power button. If JP7 is disabled for AC power input, it is necessary to manually press soft power button to power on the system.

Function	Setting
Disable auto power on (Default)	1-2 close
Enable auto power on	2-3 close



2.4 Connectors

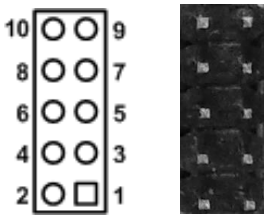
Signals go to other parts of the system through connectors. Loose or improper connection might cause problems, please make sure all connectors are properly and firmly connected. Here is a summary table of connectors on the hardware.

Connector	Description
CN1	Digital I/O Connector
CN2	CPU Fan Connector
CN4	SATA Power Connector
CN6	Front Panel Connector
CN7	Inverter Connector
CN8	Internal USB 2.0 Port 1
CN9	LVDS Connector
CN10	Audio Connector
CN11	Ethernet Port 1 and 2
CN12	USB 2.0 Port 6 and 7
CN13	USB 3.0 Port 0 and USB 2.0 Port 2
CN14	HDMI Connector
CN15	SMBus Connector
CN16	VGA Connector
CN17	COM1 Connector
CN18	COM2 Connector
CN19	SATA Connector
CN20	ATX Power Connector
SCN1	PCI-Express Mini Card (USB) and mSATA Connector
SCN2	PCI-Express Mini Card Connector
SCN3	Channel 0 DDR3L SO-DIMM Socket
SCN4	Channel 1 DDR3L SO-DIMM Socket
SCN5	ZIO Expansion Connector

2.4.1 Digital I/O Connector (CN1)

The board is equipped with an 8-channel (3 inputs and 5 outputs) digital I/O connector that meets requirements for a system customary automation control. The digital I/O can be configured to control cash drawers and sense warning signals from an Uninterrupted Power System (UPS), or perform store security control. You may use software programming to control these digital signals.

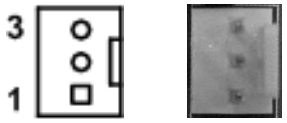
Pin	Signal	Pin	Signal
1	Digital Input 0	2	Digital Output 4
3	Digital Input 1	4	Digital Output 3
5	Digital Input 2	6	Digital Output 2
7	Digital Output 0	8	Digital Output 1
9	GND	10	+5V level



2.4.2 CPU Fan Connector (CN2)

This is a Molex 5045, 3-pin p=2.54mm wafer connector for fan interface. Fan is needed for cooling down CPU temperature. You can find fan speed within BIOS Setup Utility if fan is installed. For further information, see BIOS Setup Utility: Advanced\H/W Monitor\PC Health Status (see section 4.4).

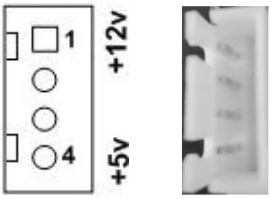
Pin	Signal
1	GND
2	+12V level
3	Fan speed feedback



2.4.3 SATA Power Connector (CN4)

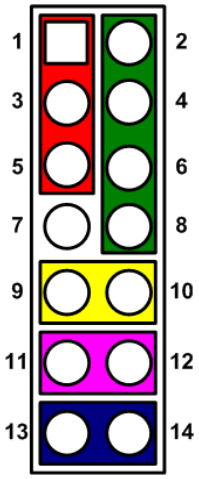
This is a JST B4B-XH-K-S, 4-pin p=2.5mm wafer connector for interfacing to SATA 2.5" HDD power supply.

Pin	Signal
1	+12V level
2	GND
3	GND
4	+5V level



2.4.4 Front Panel Connector (CN6)

Pin	Signal
1	PWRLED+
2	EXT SPK-
3	N.C.
4	Buzzer
5	PWRLED-
6	N.C.
7	N.C.
8	EXT SPK+
9	PWRSW-
10	PWRSW+
11	HW RST-
12	HW RST+
13	HDDLED-
14	HDDLED+



Power LED
Pin 1 connects anode(+) of LED and pin 5 connects cathode(-) of LED. The power LED lights up when the system is powered on.

External Speaker and Internal Buzzer
Pin 2, 4, 6 and 8 connect the case-mounted speaker unit or internal buzzer. While connecting the CPU board to an internal buzzer, please set pin 2 and 4 closed; while connecting to an external speaker, you need to set pins 2 and 4 opened and connect the speaker cable to pin 8(+) and pin 2(-).

Power On/Off Button
Pin 9 and 10 connect the power button on front panel to the CPU board, which allows users to turn on or off power supply.

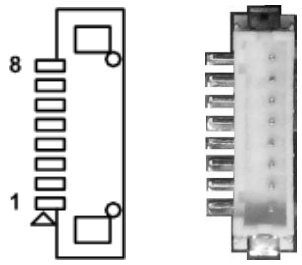
System Reset Switch
Pin 11 and 12 connect the case-mounted reset switch that reboots your computer without turning off the power switch. It is a better way to reboot your system for a longer life of system power supply.

HDD Activity LED
This connection is linked to hard drive activity LED on the control panel. LED flashes when HDD is being accessed. Pin 13 and 14 connect the hard disk drive to the front panel HDD LED, pin 13 is assigned as cathode(-) and pin 14 is assigned as anode(+).

2.4.5 Inverter Connector (CN7)

This is a DF13-8S-1.25C 8-pin connector for inverter. We strongly recommend you to use the matching DF13-8S-1.25C connector to avoid malfunction.

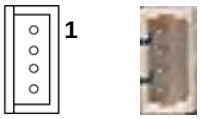
Pin	Signal
1	VBL1 (+12V level)
2	VBL1 (+12V level)
3	VBL2 (+5V level)
4	VBL_ENABLE
5	GND
6	GND
7	GND
8	VBL Brightness Control



2.4.6 Internal USB 2.0 Port (CN8)

This is a Molex 53047-0419, 4-pin p=1.25mm wafer connector for USB 2.0 port 1.

Pin	Signal
1	USB3_PWR23
2	D2+
3	D2-
4	GND

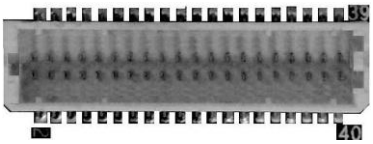


2.4.7 LVDS Connector (CN9)

This board has a 2x20-pin connector for LVDS LCD interface. It is strongly recommended to use the matching JST SHDR-40VS-B connector for LVDS interface. Pin 1~6 VCCM can be set to +3.3V, +5V or +12V by setting JP2 or JP3 (see section 2.3.2).

18-bit single channel

Pin	Signal	Pin	Signal
1	VCCM	2	VCCM
3	VCCM	4	VCCM
5	VCCM	6	VCCM
7	N.C.	8	N.C.
9	GND	10	GND
11	N.C.	12	N.C.
13	N.C.	14	N.C.
15	GND	16	GND
17	N.C.	18	N.C.
19	N.C.	20	N.C.
21	GND	22	GND
23	Channel A D0-	24	N.C.
25	Channel A D0+	26	N.C.
27	GND	28	GND
29	Channel A D1-	30	N.C.
31	Channel A D1+	32	N.C.
33	GND	34	GND
35	Channel A D2-	36	Channel A CLK-
37	Channel A D2+	38	Channel A CLK+
39	GND	40	GND



24-bit single channel

Pin	Signal	Pin	Signal
1	VCCM	2	VCCM
3	VCCM	4	VCCM
5	VCCM	6	VCCM
7	N.C.	8	N.C.
9	GND	10	GND
11	N.C.	12	N.C.
13	N.C.	14	N.C.
15	GND	16	GND
17	N.C.	18	N.C.
19	N.C.	20	N.C.
21	GND	22	GND
23	Channel A D0-	24	N.C.
25	Channel A D0+	26	N.C.
27	GND	28	GND
29	Channel A D1-	30	Channel A D3-
31	Channel A D1+	32	Channel A D3+
33	GND	34	GND
35	Channel A D2-	36	Channel A CLK-
37	Channel A D2+	38	Channel A CLK+
39	GND	40	GND

18-bit dual channel

Pin	Signal	Pin	Signal
1	VCCM	2	VCCM
3	VCCM	4	VCCM
5	VCCM	6	VCCM
7	N.C.	8	N.C.
9	GND	10	GND
11	N.C.	12	Channel B D0-
13	N.C.	14	Channel B D0+
15	GND	16	GND
17	Channel B CLK-	18	Channel B D1-
19	Channel B CLK+	20	Channel B D1+
21	GND	22	GND
23	Channel A D0-	24	Channel B D2-
25	Channel A D0+	26	Channel B D2+
27	GND	28	GND
29	Channel A D1-	30	N.C.
31	Channel A D1+	32	N.C.
33	GND	34	GND
35	Channel A D2-	36	Channel A CLK-
37	Channel A D2+	38	Channel A CLK+
39	GND	40	GND

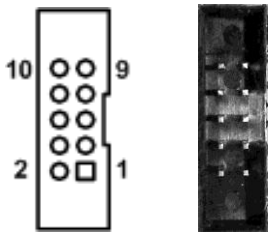
24-bit dual channel

Pin	Signal	Pin	Signal
1	VCCM	2	VCCM
3	VCCM	4	VCCM
5	VCCM	6	VCCM
7	N.C.	8	N.C.
9	GND	10	GND
11	Channel B D3-	12	Channel B D0-
13	Channel B D3+	14	Channel B D0+
15	GND	16	GND
17	Channel B CLK-	18	Channel B D1-
19	Channel B CLK+	20	Channel B D1+
21	GND	22	GND
23	Channel A D0-	24	Channel B D2-
25	Channel A D0+	26	Channel B D2+
27	GND	28	GND
29	Channel A D1-	30	Channel A D3-
31	Channel A D1+	32	Channel A D3+
33	GND	34	GND
35	Channel A D2-	36	Channel A CLK-
37	Channel A D2+	38	Channel A CLK+
39	GND	40	GND

2.4.8 Audio Connector (CN10)

This is a Molex 78046-102, 10-pin p=2.0mm box header for audio interface.

Pin	Signal	Pin	Signal
1	MIC_IN	2	GND
3	LINE_IN_L	4	GND
5	LINE_IN_R	6	GND
7	AUDIO_OUT_L	8	GND
9	AUDIO_OUT_R	10	GND

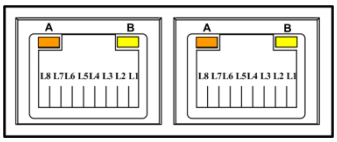


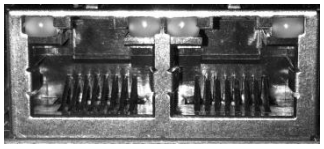
2.4.9 Ethernet Port (CN11)

The board has dual RJ-45 connector. Ethernet connection can be established by plugging one end of the Ethernet cable into this RJ-45 connector and the other end (phone jack) to a 1000/100/10-Base-T hub.

Pin	Signal	Pin	Signal
L1	MDI0+	L5	MDI2+
L2	MDI0-	L6	MDI2-
L3	MDI1+	L7	MDI3+
L4	MDI1-	L8	MDI3-
A	1000 LAN LED (Orange) / 100 LAN LED (Green)		
B	Active LED (Yellow)		

Ethernet 2 Ethernet 1



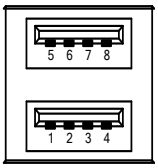


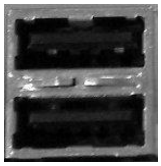
2.4.10 USB Ports (CN12 and CN13)

These are CN12 (for USB 2.0 port 6 and 7) and CN13 (for USB 3.0 port 0 and USB 2.0 port 2) connectors on the rear I/O. They are commonly used for installing USB peripherals such as keyboard, mouse, scanner, etc.

Pin	Signal	Pin	Signal
1	USB VCC (+5V level)	5	USB VCC (+5V level)
2	USB #4_D-	6	USB #5_D-
3	USB #4_D+	7	USB #5_D+
4	GND	8	GND

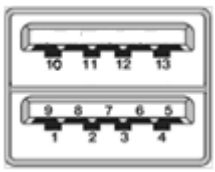
CN12

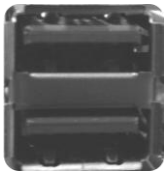




Pin	Signal	Pin	Signal
1	USB VCC (+5V level)	8	USB #0_RXN
2	USB #3_D-	9	USB #0_RXP
3	USB #3_D+	10	USB VCC (+5V level)
4	GND	11	USB #6_D-
5	USB #0_RXN	12	USB #6_D+
6	USB #0_RXP	13	GND
7	GND		

CN13

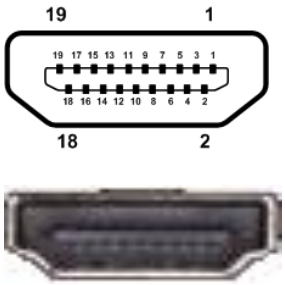




2.4.11 HDMI Connector (CN14)

The HDMI (High-Definition Multimedia Interface) is a compact digital interface which is capable of transmitting high-definition video and high-resolution audio over a single cable. Its interface is available through connector CN14.

Pin	Signal	Pin	Signal
1	HDMI DATA2+	2	GND
3	HDMI DATA2-	4	HDMI DATA1+
5	GND	6	HDMI DATA1-
7	HDMI DATA0+	8	GND
9	HDMI DATA0-	10	HDMI Clock+
11	GND	12	HDMI Clock-
13	N.C.	14	N.C.
15	HDMI SCL	16	HDMI SDA
17	GND	18	+5V
19	HDMI_HTPLG		



2.4.12 SMBus Connector (CN15)

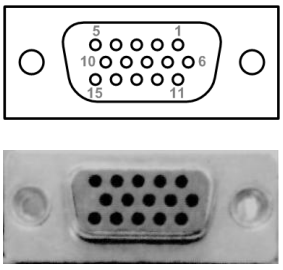
This connector is a JST B3B-PH-K-S, 3-pin p=2.0mm wafer connector for SMBus interface. The SMBus (System Management Bus) is a simple 2-wire bus for the purpose of lightweight communication.

Pin	Signal
1	CLK
2	DATA
3	GND

2.4.13 VGA Connector (CN16)

This is a 15-pin D-Sub connector which is commonly used for VGA display. This VGA interface configuration can be configured via software utility.

Pin	Signal	Pin	Signal
1	Red	2	Green
3	Blue	4	N.C.
5	GND	6	DETECT
7	GND	8	GND
9	VCC	10	GND
11	N.C.	12	DDC DATA
13	Horizontal Sync	14	Vertical Sync
15	DDC CLK		

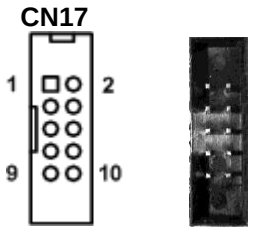


2.4.14 COM Connectors (CN17 and CN18)

These are Molex 78046-102, 10-pin p=2.0mm box headers for COM1 (CN17) and COM2 (CN18). Only COM1 is equipped with +5V level power capability on DCD and +12V level on RI by setting JP6 (see section 2.3.4). Also only COM1 supports RS-232/422/485 communication mode, see pin assignments given in table below. If you need COM1 to support RS-422 or RS-485, please refer to BIOS setting in section 4.4.

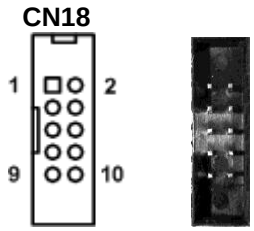
COM1 (RS-232/422/485):

Pin	RS-232	RS-422	RS-485
1	DCD	TX-	Data-
2	DSR	No use	No use
3	RXD	TX+	Data+
4	RTS	No use	No use
5	TXD	RX+	No use
6	CTS	No use	No use
7	DTR	RX-	No use
8	RI	No use	No use
9	GND	No use	No use
10	No use	No use	No use



COM2 (RS-232 only):

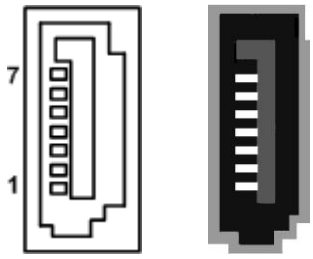
Pin	Signal	Pin	Signal
1	DCD	2	DSR
3	RXD	4	RTS
5	TXD	6	CTS
7	DTR	8	RI
9	GND	10	N.C.



2.4.15 SATA Connector (CN19)

This Serial Advanced Technology Attachment (Serial ATA or SATA) connector is for high-speed SATA interface. It is a computer bus interface for connecting to devices such as hard disk drive.

Pin	Signal
1	GND
2	SATA_TX+
3	SATA_TX-
4	GND
5	SATA_RX-
6	SATA_RX+
7	GND

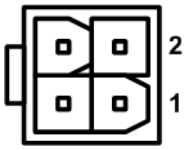


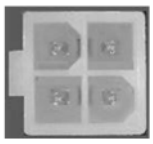
2.4.16 ATX Power Connector (CN20)

Steady and sufficient power can be supplied to all components on the board by connecting the power connector. Please make sure all components and devices are properly installed before connecting the power connector.

The CN20 is a 4-pin power supply interface. External power supply plug fits into CN20 in only one orientation. Properly press down power supply plug until it completely and firmly fits into this connector. Loose connection may cause system instability.

Pin	Signal
1	GND
2	GND
3	+12V~+24V
4	+12V~+24V

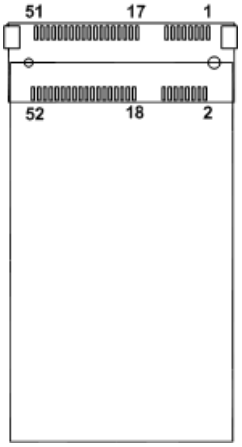


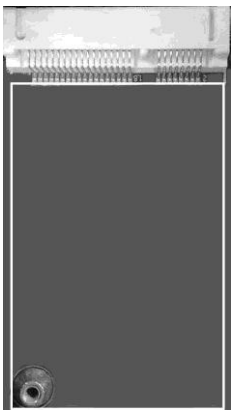


2.4.17 PCI-Express Mini Card (USB) and mSATA Connector (SCN1)

This is a PCI-Express Mini Card connector on the bottom side applying to only USB 2.0 and SATA (mSATA). It also complies with PCI-Express Mini Card Spec. V1.2.

Pin	Signal	Pin	Signal
1	WAKE#	2	+3.3VSB
3	No use	4	GND
5	No use	6	+1.5V
7	CLKREQ#	8	No use
9	GND	10	No use
11	REFCLK-	12	No use
13	REFCLK+	14	No use
15	GND	16	No use
17	No use	18	GND
19	No use	20	W_DISABLE#
21	GND	22	PERST#
23	SATA_RXP	24	+3.3VSB
25	SATA_RXN	26	GND
27	GND	28	+1.5V
29	GND	30	SMB_CLK
31	SATA_TXN	32	SMB_DATA
33	SATA_TXP	34	GND
35	GND	36	USB #4_D-
37	GND	38	USB #4_D+
39	+3.3VSB	40	GND
41	+3.3VSB	42	No use
43	GND	44	No use
45	No use	46	No use
47	No use	48	+1.5V
49	No use	50	GND
51	No use	52	+3.3VSB

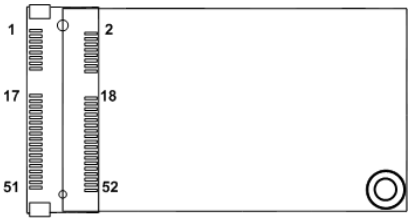




2.4.18 PCI-Express Mini Card Connector (SCN2)

This is a PCI-Express Mini Card connector on the bottom side applying to either PCI-Express or USB 2.0. It complies with PCI-Express Mini Card Spec. V1.2.

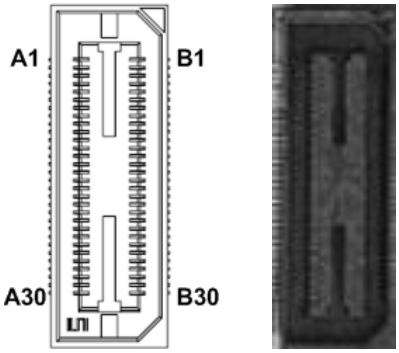
Pin	Signal	Pin	Signal
1	WAKE#	2	+3.3VSB
3	No use	4	GND
5	No use	6	+1.5V
7	CLKREQ#	8	No use
9	GND	10	No use
11	REFCLK-	12	No use
13	REFCLK+	14	No use
15	GND	16	No use
17	No use	18	GND
19	No use	20	W_DISABLE#
21	GND	22	PERST#
23	PE_RXN	24	+3.3VSB
25	PE_RXP	26	GND
27	GND	28	+1.5V
29	GND	30	SMB_CLK
31	PE_TXN	32	SMB_DATA
33	PE_TXP	34	GND
35	GND	36	USB #5_D-
37	GND	38	USB #5_D+
39	+3.3VSB	40	GND
41	+3.3VSB	42	No use
43	GND	44	No use
45	No use	46	No use
47	No use	48	+1.5V
49	No use	50	GND
51	No use	52	+3.3VSB



2.4.19 ZIO Expansion Connector (SCN5)

The board is equipped with SCN5 on the bottom side for connecting CPU board to a ZIO module.

Pin	Signal	Pin	Signal
A1	+12V	B1	GND
A2	+5VSB	B2	GND
A3	+5VSB	B3	GND
A4	+3.3VSB	B4	GND
A5	+3.3VSB	B5	RSVD
A6	RSVD	B6	RSVD
A7	PWROK	B7	RSVD
A8	SMB_CLK	B8	RSVD
A9	SMB_DATA	B9	GND
A10	GND	B10	PCI-E TXP4
A11	PCI-E RXP4	B11	PCI-E TXN4
A12	PCI-E RXN4	B12	WAKE_N
A13	USBOC_N	B13	PCI-E CLKP
A14	USB #7_D+	B14	PCI-E CLKN
A15	USB #7_D-	B15	GND
A16	No Use	B16	CLK_33M
A17	No Use	B17	SERIRQ
A18	GND	B18	LAD0
A19	No Use	B19	LAD1
A20	No Use	B20	LAD2
A21	PLTRST_N	B21	LAD3
A22	No Use	B22	L_FRAME
A23	No Use	B23	GND
A24	GND	B24	No Use
A25	No Use	B25	No Use
A26	No Use	B26	No Use
A27	No Use	B27	No Use
A28	No Use	B28	GND
A29	GND	B29	No Use
A30	No Use	B30	No Use



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Chapter 3
Hardware Description

3.1 Microprocessors

The CAPA840 supports Intel® Atom™ E3845/E3827 processors, which enable your system to operate under Windows® 7 and Windows® 8 environments. The system performance depends on the microprocessor. Make sure all correct settings are arranged for your installed microprocessor to prevent CPU from damages.

3.2 BIOS

The CAPA840 uses AMI Plug and Play BIOS with a single 64Mbit SPI Flash.

3.3 System Memory

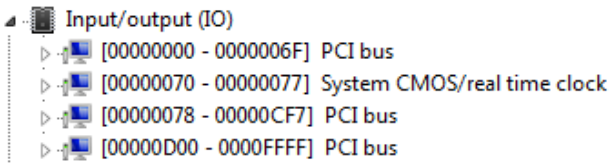
The CAPA840 supports two 204-pin DDR3L SO-DIMM sockets for maximum memory capacity up to 8GB DDR3L SDRAMs. The memory module comes in sizes of 1GB, 2GB, 4GB and 8GB.

Note

- ***The Intel® Atom™ E3845/E3827 processors support dual memory channel configuration. You must install memory modules of the same size, chip width, density and rank. Also it is a must to have SO-DIMM inserted in SCN3.***
- ***The Intel® Atom™ E3815 processor only supports single memory channel configuration. For single memory channel configuration, you must insert memory module in channel 0 DDR3L SO-DIMM socket (SCN3).***

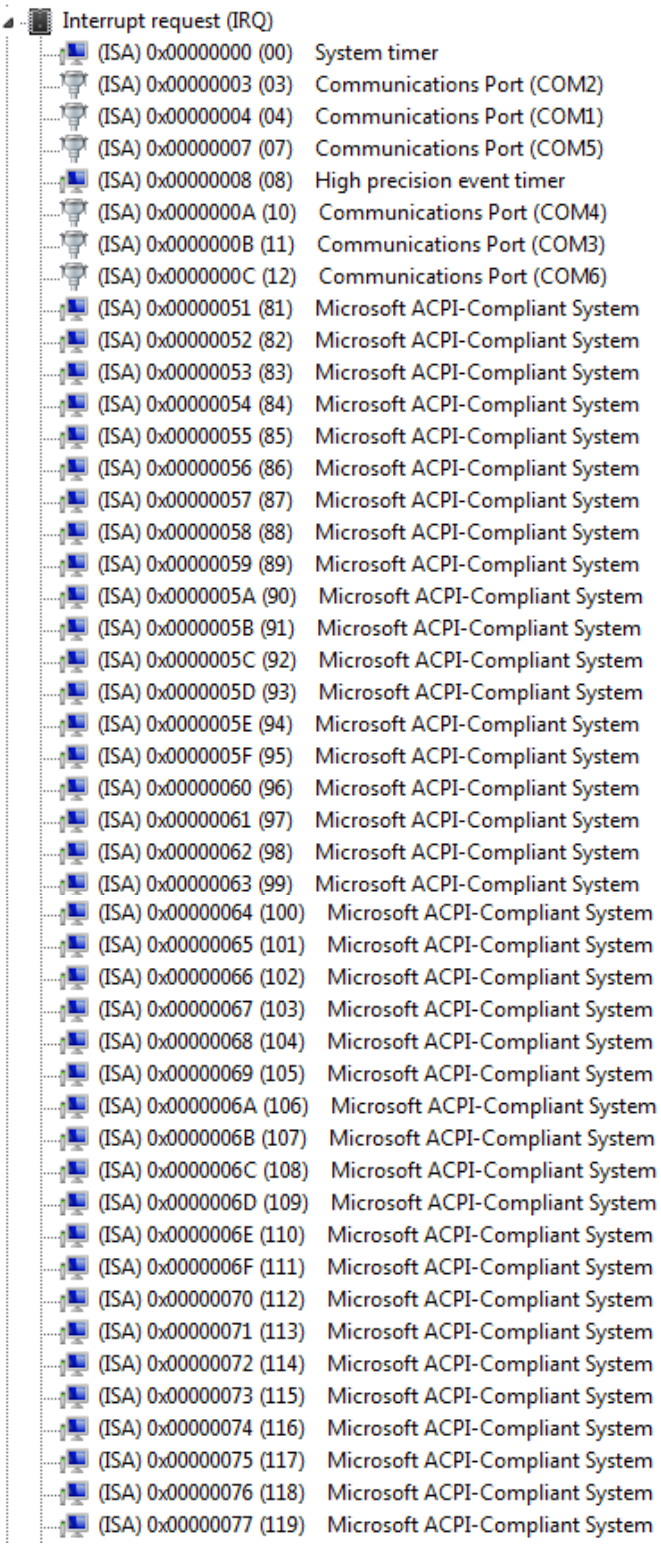
3.4 I/O Port Address Map

The Intel® Atom™ E3845/E3827 processors communicate via I/O ports.



3.5 Interrupt Controller (IRQ) Map

The interrupt controller (IRQ) mapping list is shown as follows:



(ISA) 0x00000078 (120) Microsoft ACPI-Compliant System
(ISA) 0x00000079 (121) Microsoft ACPI-Compliant System
(ISA) 0x0000007A (122) Microsoft ACPI-Compliant System
(ISA) 0x0000007B (123) Microsoft ACPI-Compliant System
(ISA) 0x0000007C (124) Microsoft ACPI-Compliant System
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(ISA) 0x0000007E (126) Microsoft ACPI-Compliant System
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(ISA) 0x00000080 (128) Microsoft ACPI-Compliant System
(ISA) 0x00000081 (129) Microsoft ACPI-Compliant System
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(ISA) 0x00000084 (132) Microsoft ACPI-Compliant System
(ISA) 0x00000085 (133) Microsoft ACPI-Compliant System
(ISA) 0x00000086 (134) Microsoft ACPI-Compliant System
(ISA) 0x00000087 (135) Microsoft ACPI-Compliant System
(ISA) 0x00000088 (136) Microsoft ACPI-Compliant System
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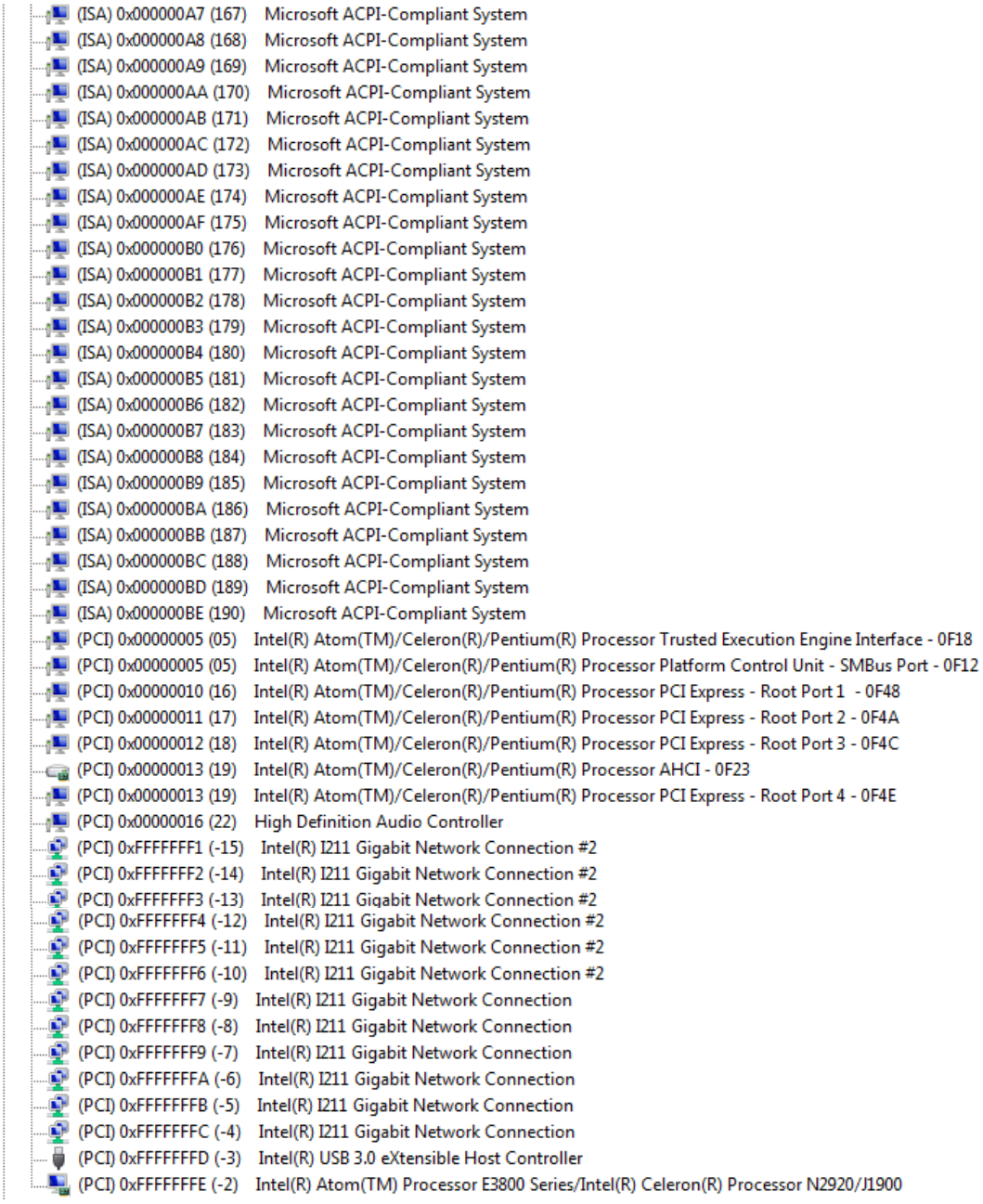
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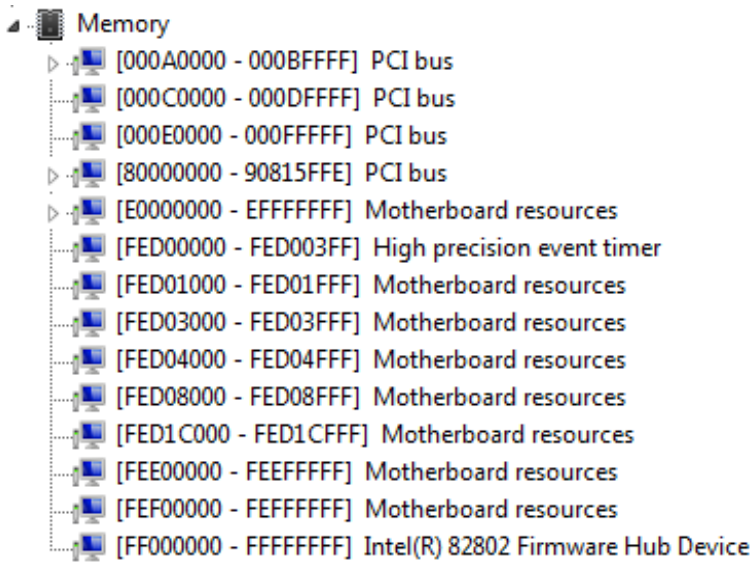
(ISA) 0x000000BA (186) Microsoft ACPI-Compliant System
(ISA) 0x000000BB (187) Microsoft ACPI-Compliant System
(ISA) 0x000000BC (188) Microsoft ACPI-Compliant System
(ISA) 0x000000BD (189) Microsoft ACPI-Compliant System
(ISA) 0x000000BE (190) Microsoft ACPI-Compliant System
(PCI) 0x00000005 (05) Intel(R) Atom(TM)/Celeron(R)/Pentium(R) Processor Trusted Execution Engine Interface - 0F18
(PCI) 0x00000005 (05) Intel(R) Atom(TM)/Celeron(R)/Pentium(R) Processor Platform Control Unit - SMBus Port - 0F12
(PCI) 0x00000010 (16) Intel(R) Atom(TM)/Celeron(R)/Pentium(R) Processor PCI Express - Root Port 1 - 0F48
(PCI) 0x00000011 (17) Intel(R) Atom(TM)/Celeron(R)/Pentium(R) Processor PCI Express - Root Port 2 - 0F4A
(PCI) 0x00000012 (18) Intel(R) Atom(TM)/Celeron(R)/Pentium(R) Processor PCI Express - Root Port 3 - 0F4C
(PCI) 0x00000013 (19) Intel(R) Atom(TM)/Celeron(R)/Pentium(R) Processor AHCI - 0F23
(PCI) 0x00000013 (19) Intel(R) Atom(TM)/Celeron(R)/Pentium(R) Processor PCI Express - Root Port 4 - 0F4E
(PCI) 0x00000016 (22) High Definition Audio Controller
(PCI) 0xFFFFFFF1 (-15) Intel(R) I211 Gigabit Network Connection #2
(PCI) 0xFFFFFFF2 (-14) Intel(R) I211 Gigabit Network Connection #2
(PCI) 0xFFFFFFF3 (-13) Intel(R) I211 Gigabit Network Connection #2
(PCI) 0xFFFFFFF4 (-12) Intel(R) I211 Gigabit Network Connection #2
(PCI) 0xFFFFFFF5 (-11) Intel(R) I211 Gigabit Network Connection #2
(PCI) 0xFFFFFFF6 (-10) Intel(R) I211 Gigabit Network Connection #2
(PCI) 0xFFFFFFF7 (-9) Intel(R) I211 Gigabit Network Connection
(PCI) 0xFFFFFFF8 (-8) Intel(R) I211 Gigabit Network Connection
(PCI) 0xFFFFFFF9 (-7) Intel(R) I211 Gigabit Network Connection
(PCI) 0xFFFFFFFA (-6) Intel(R) I211 Gigabit Network Connection
(PCI) 0xFFFFFFFB (-5) Intel(R) I211 Gigabit Network Connection
(PCI) 0xFFFFFFFC (-4) Intel(R) I211 Gigabit Network Connection
(PCI) 0xFFFFFFFD (-3) Intel(R) USB 3.0 eXtensible Host Controller
(PCI) 0xFFFFFFFE (-2) Intel(R) Atom(TM) Processor E3800 Series/Intel(R) Celeron(R) Processor N2920/J1900

3.6 Memory Map

The memory mapping list is shown as follows:



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Chapter 4
AMI BIOS Setup Utility

The AMI UEFI BIOS provides users with a built-in setup program to modify basic system configuration. All configured parameters are stored in a flash chip to save the setup information whenever the power is turned off. This chapter provides users with detailed description about how to set up basic system configuration through the AMI BIOS setup utility.

4.1 Starting

To enter the setup screens, follow the steps below:

1. Turn on the computer and press the <Del> key immediately.
2. After you press the <Del> key, the main BIOS setup menu displays. You can access the other setup screens from the main BIOS setup menu, such as the Advanced and Chipset menus.

Note

If your computer cannot boot after making and saving system changes with BIOS setup, you can restore BIOS optimal defaults by setting JP4 (see section 2.3.3).

It is strongly recommended that you should avoid changing the chipset's defaults. Both AMI and your system manufacturer have carefully set up these defaults that provide the best performance and reliability.

4.2 Navigation Keys

The BIOS setup/utility uses a key-based navigation system called hot keys. Most of the BIOS setup utility hot keys can be used at any time during the setup navigation process. These keys include <F1>, <F2>, <Enter>, <ESC>, <Arrow> keys, and so on.

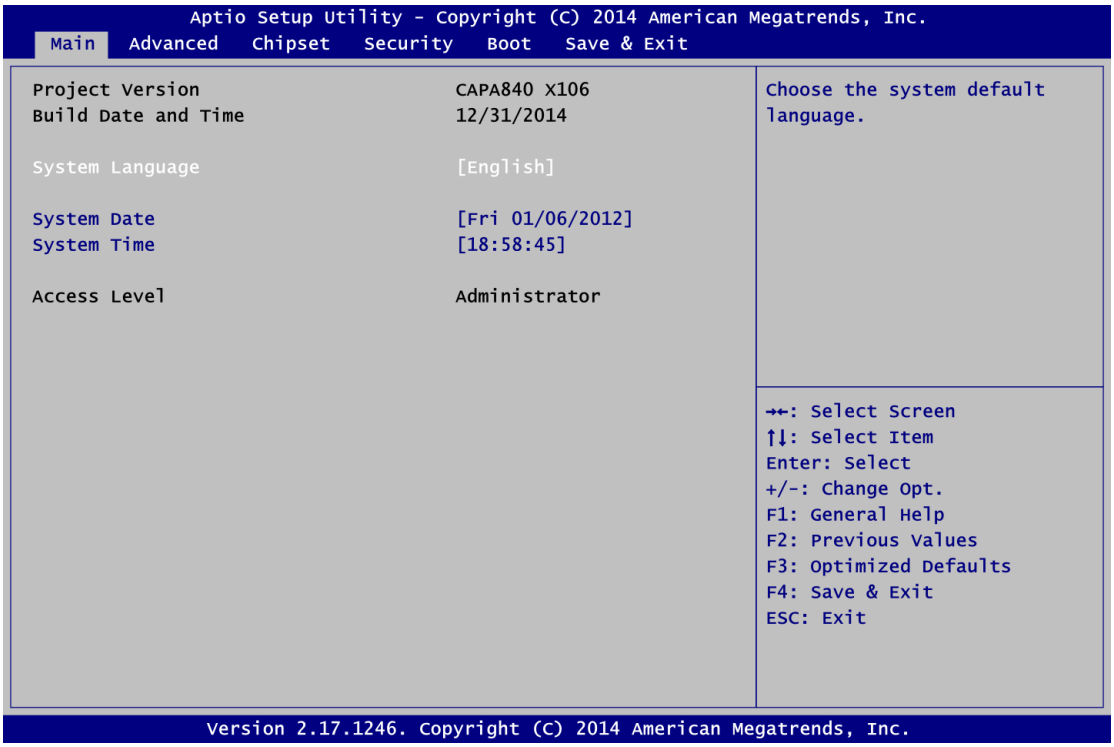
Note

Some of the navigation keys differ from one screen to another.

Hot Keys	Description
→← Left/Right	The Left and Right <Arrow> keys allow you to select a setup screen.
↑↓ Up/Down	The Up and Down <Arrow> keys allow you to select a setup screen or sub-screen.
+– Plus/Minus	The Plus and Minus <Arrow> keys allow you to change the field value of a particular setup item.
Tab	The <Tab> key allows you to select setup fields.
F1	The <F1> key allows you to display the General Help screen.
F2	The <F2> key allows you to Load Previous Values.
F3	The <F3> key allows you to Load Optimized Defaults.
F4	The <F4> key allows you to save any changes you have made and exit Setup. Press the <F4> key to save your changes.
Esc	The <Esc> key allows you to discard any changes you have made and exit the Setup. Press the <Esc> key to exit the setup without saving your changes.
Enter	The <Enter> key allows you to display or change the setup option listed for a particular setup item. The <Enter> key can also allow you to display the setup sub- screens.

4.3 Main Menu

When you first enter the setup utility, you will enter the Main setup screen. You can always return to the Main setup screen by selecting the Main tab. System Time/Date can be set up as described below. The Main BIOS setup screen is shown below.



- **BIOS Information**
  Display the auto-detected BIOS information.

- **System Language**
  Choose the system default language.

- **System Date/Time**
  Use this option to change the system time and date. Highlight System Time or System Date using the <Arrow> keys. Enter new values through the keyboard. Press the <Tab> key or the <Arrow> keys to move between fields. The date must be entered in MM/DD/YY format. The time is entered in HH:MM:SS format.

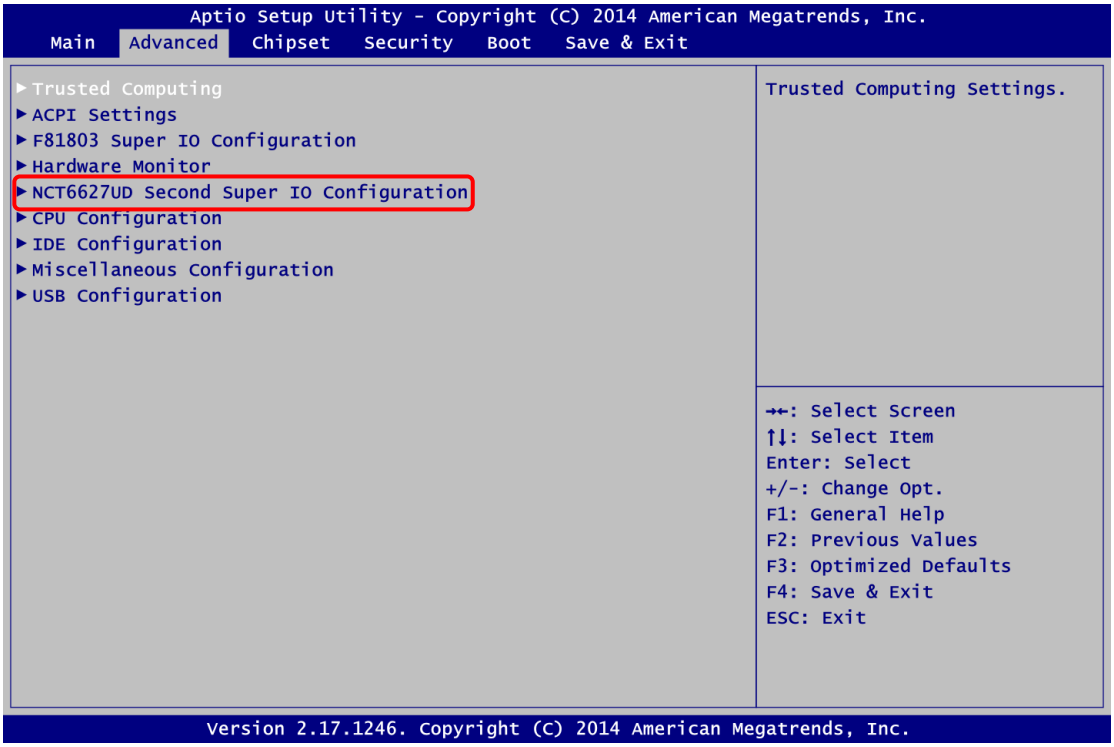
- **Access Level**
  Display the access level of current user.

4.4 Advanced Menu

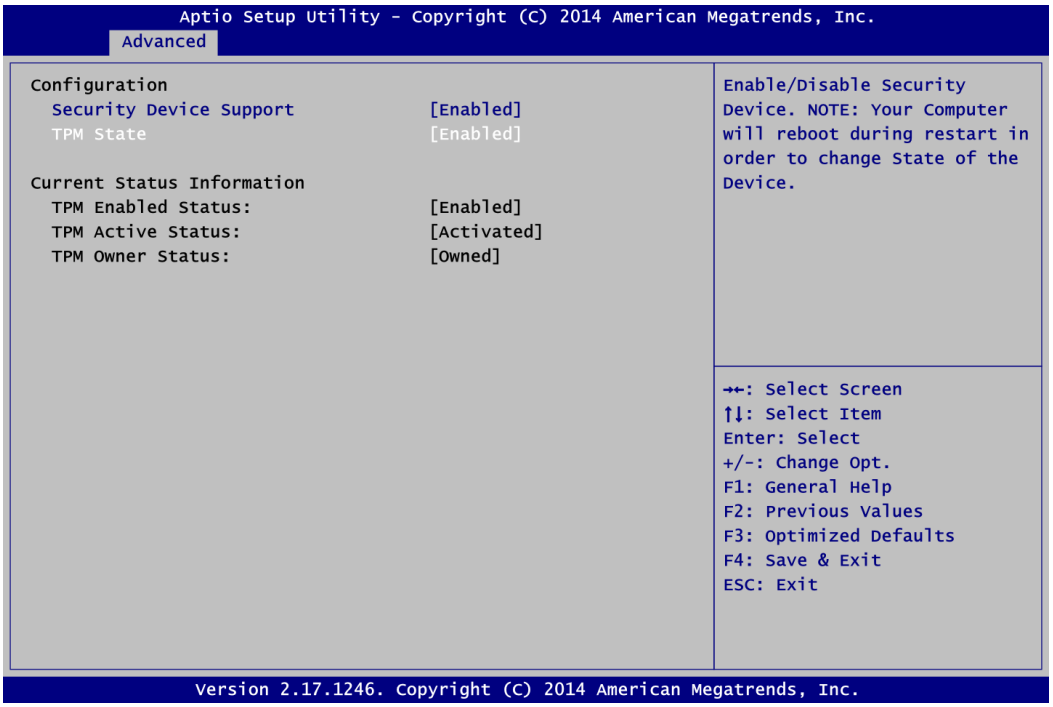
The Advanced menu also allows users to set configuration of the CPU and other system devices. You can select any of the items in the left frame of the screen to go to the sub menus:

- ▶ Trusted Computing
- ▶ ACPI Settings
- ▶ F81803 Super IO Configuration
- ▶ Hardware Monitor
- ▶ NCT6627UD Second Super IO Configuration (This option appears only if a ZIO module with serial ports is connected)
- ▶ CPU Configuration
- ▶ IDE Configuration
- ▶ Miscellaneous Configuration
- ▶ USB Configuration

For items marked with "▶", please press <Enter> for more options.



- **Trusted Computing**
  This screen provides function for specifying the TPM (Trusted Platform Module) settings.

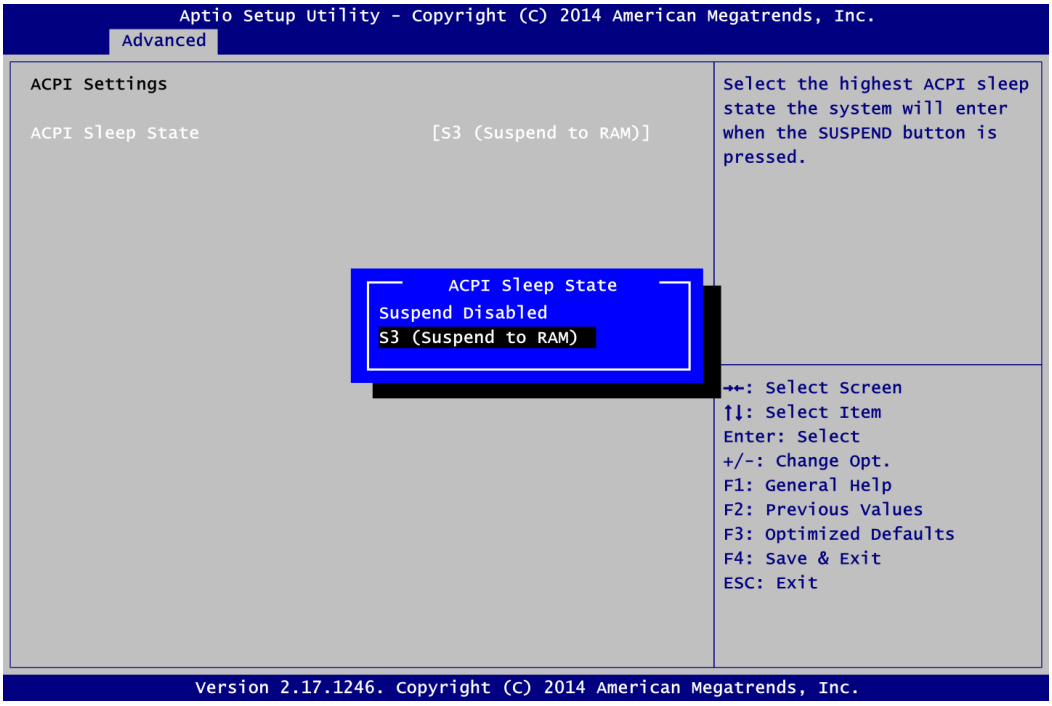


Security Device Support
Enable or disable BIOS support for security device. The default setting is Disabled.

TPM State
Once the Security Device Support is Enabled, TPM can be used by the operating system.

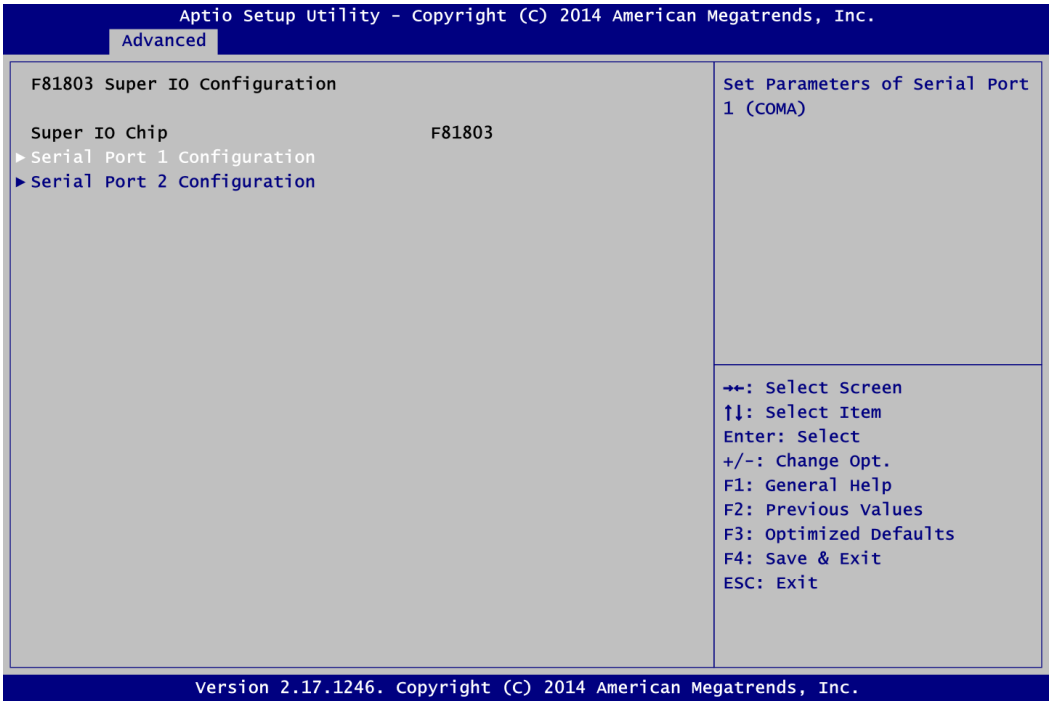
Current Status Information
Display current TPM status information.

- **ACPI Settings**
  You can use this screen to select options for the ACPI configuration, and change the value of the selected option. A description of the selected item appears on the right side of the screen.



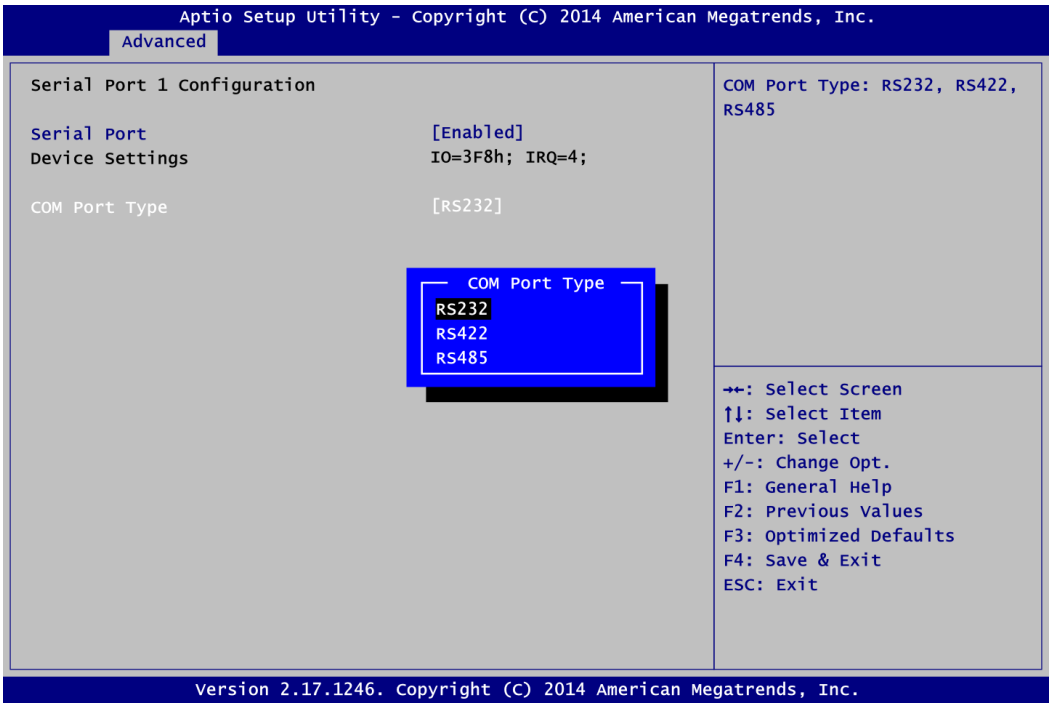
ACPI Sleep State
Select the ACPI (Advanced Configuration and Power Interface) sleep state. Configuration options are Suspend Disabled and S3 (Suspend to RAM). The default setting is S3 (Suspend to RAM); this option selects ACPI sleep state the system will enter when suspend button is pressed.

- **F81803 Super IO Configuration**
  You can use this screen to select options for the Super IO Configuration, and change the value of the selected option. A description of the selected item appears on the right side of the screen. For items marked with "▶", please press <Enter> for more options.



Serial Port 1~2 Configuration
Set parameters related to serial port 1~2.

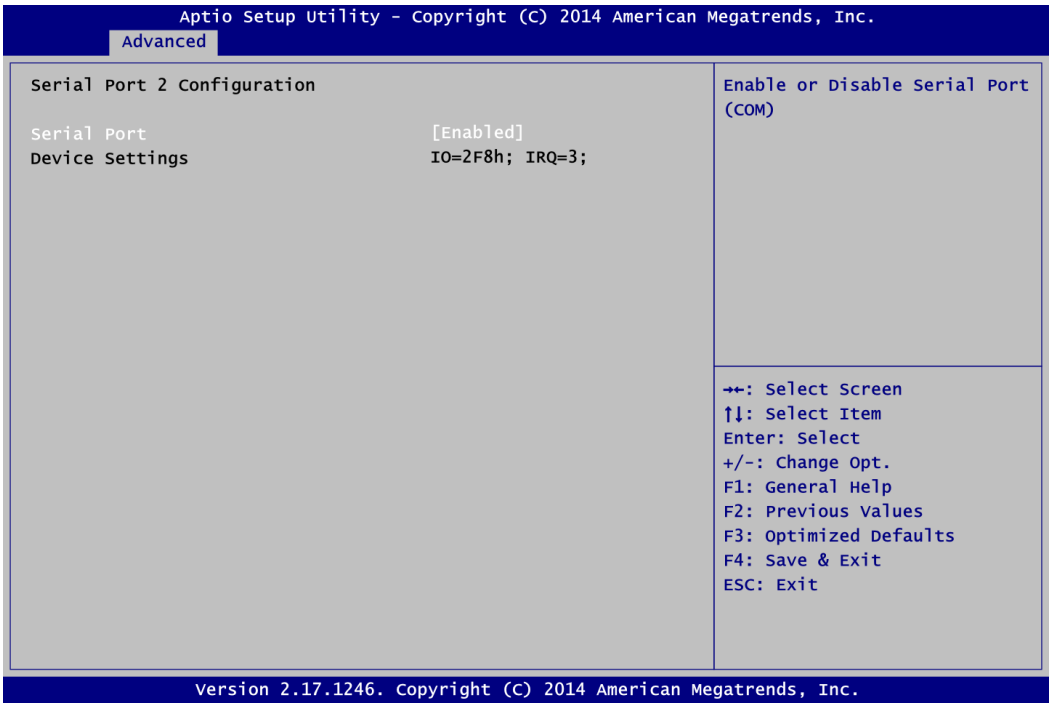
- **Serial Port 1 Configuration**



Serial Port
Enable or disable serial port 1. The optimal setting for base I/O address is 3F8h and for interrupt request address is IRQ4.

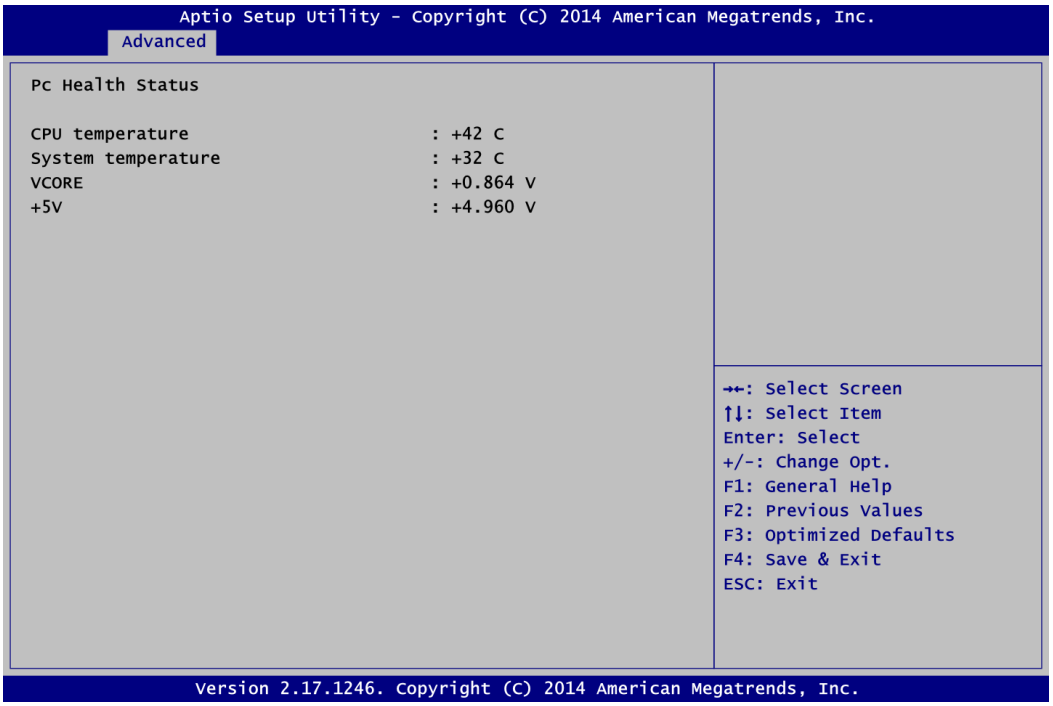
COM Port Type
Use this option to set RS-232/422/485 communication mode.

- **Serial Port 2 Configuration**



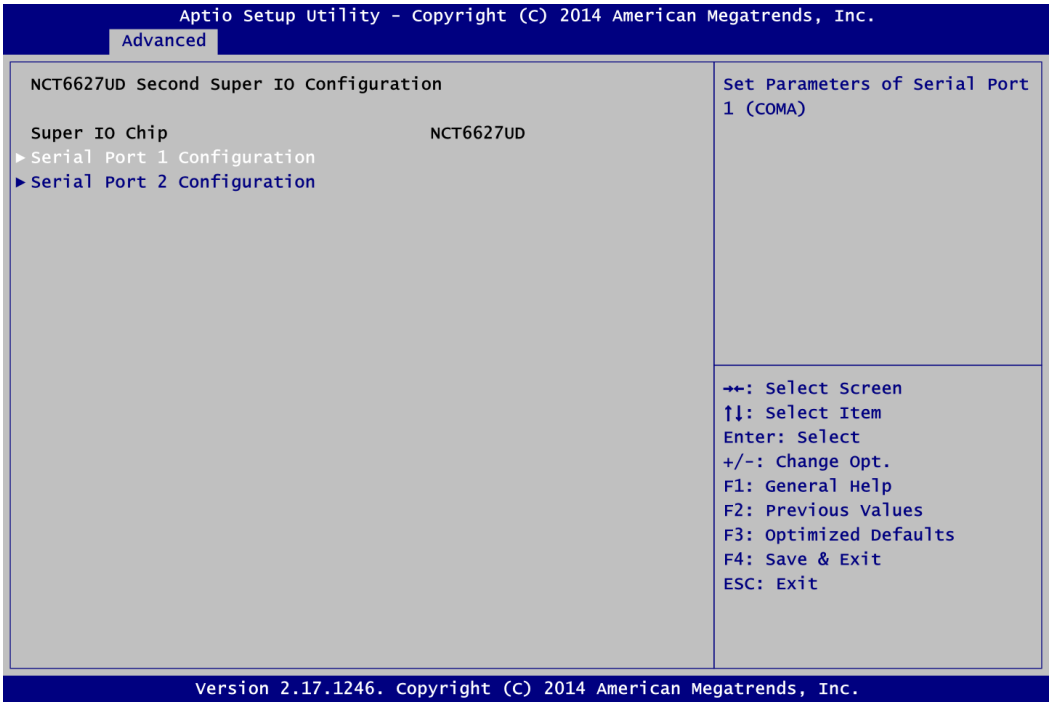
Serial Port
Enable or disable serial port 2. The optimal setting for base I/O address is 2F8h and for interrupt request address is IRQ3.

- **Hardware Monitor**
This screen monitors hardware health status.



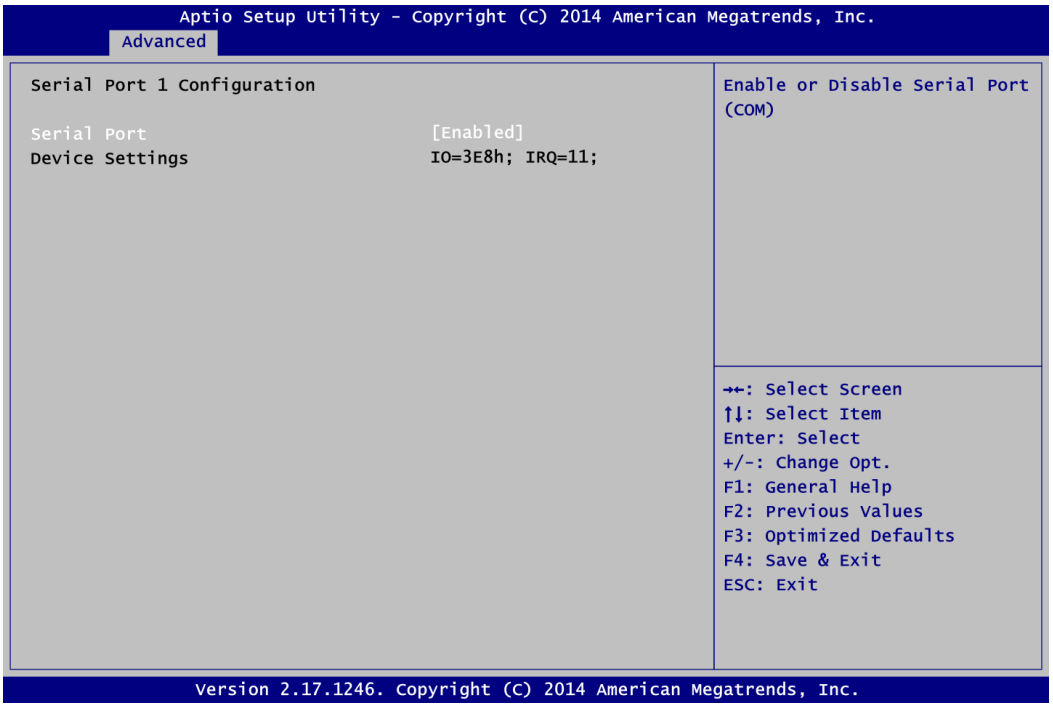
This screen displays the temperature of system and CPU, system voltages (VCORE and +5V).

- **NCT6627UD Second Super IO Configuration**
  This screen is available only if a ZIO module with serial ports is connected. You can use this screen to select options for the Second Super IO Configuration, and change the value of the selected option. A description of the selected item appears on the right side of the screen. For items marked with "▶", please press <Enter> for more options.



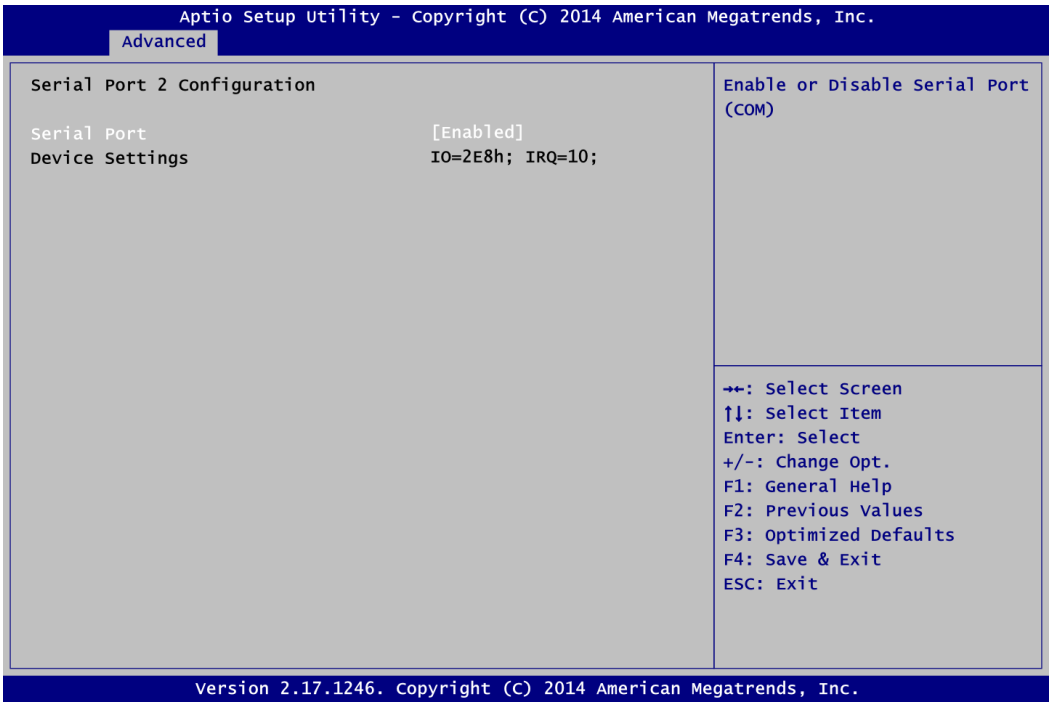
Serial Port 1~2 Configuration
Set parameters related to serial port 1~2 on I/O board.

- **Serial Port 1 Configuration**



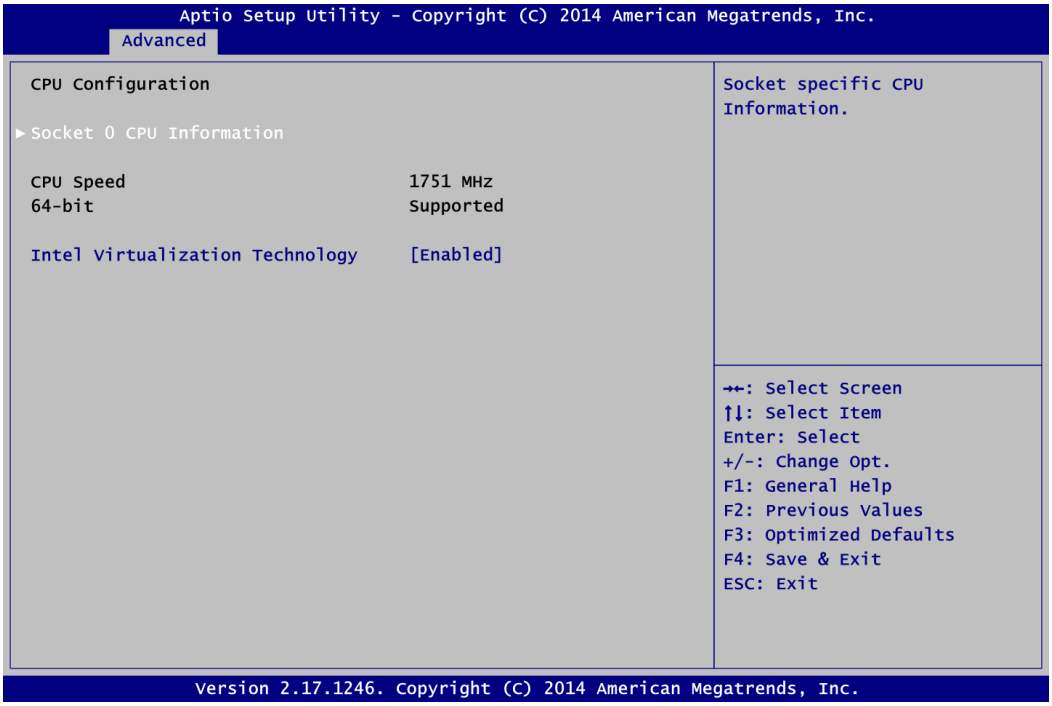
Serial Port
Enable or disable serial port 1 on I/O board. The optimal setting for base I/O address is 3E8h and for interrupt request address is IRQ11.

- **Serial Port 2 Configuration**



Serial Port
Enable or disable serial port 2 on I/O board. The optimal setting for base I/O address is 2E8h and for interrupt request address is IRQ10.

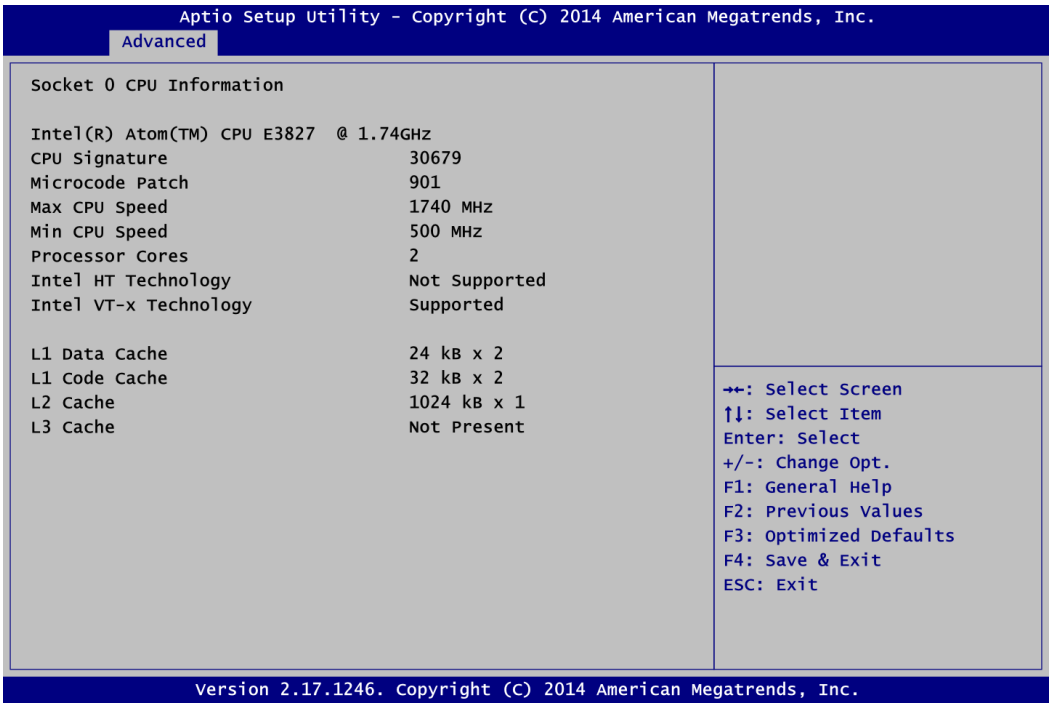
- **CPU Configuration**
  This screen shows the CPU Configuration, and you can change the value of the selected option.



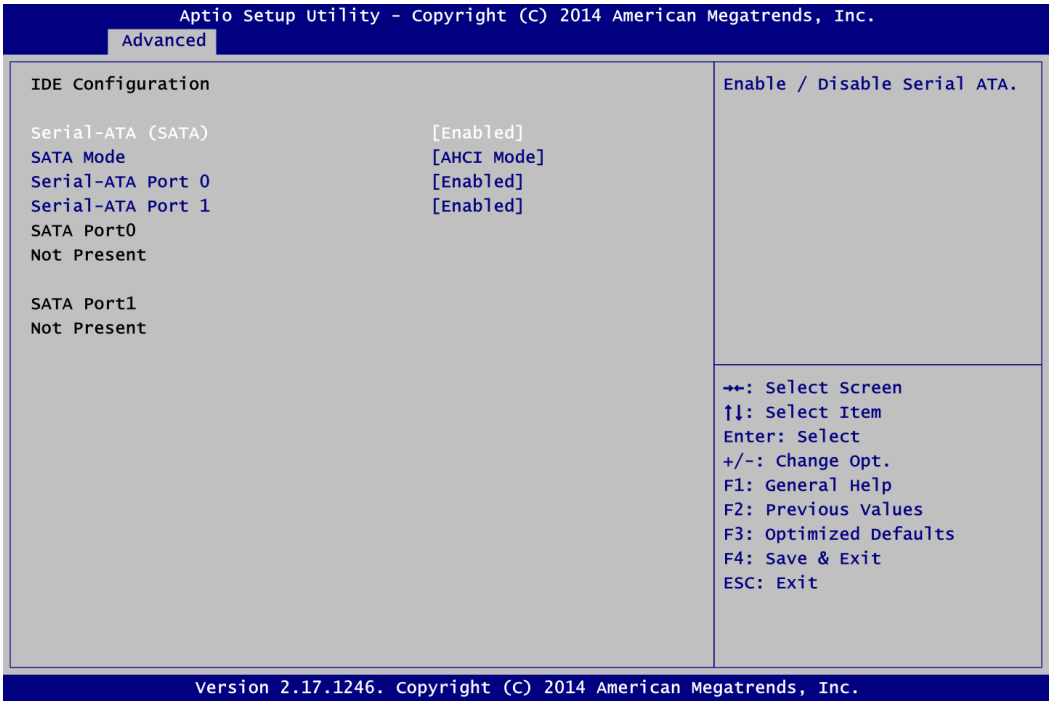
Socket 0 CPU Information
This item is for socket specific CPU information.

Intel Virtualization Technology
Enable or disable Intel Virtualization Technology. When enabled, a VMM (Virtual Machine Mode) can utilize the additional hardware capabilities. It allows a platform to run multiple operating systems and applications independently, hence enabling a computer system to work as several virtual systems.

- **Socket 0 CPU Information**
  This screen shows CPU Information.

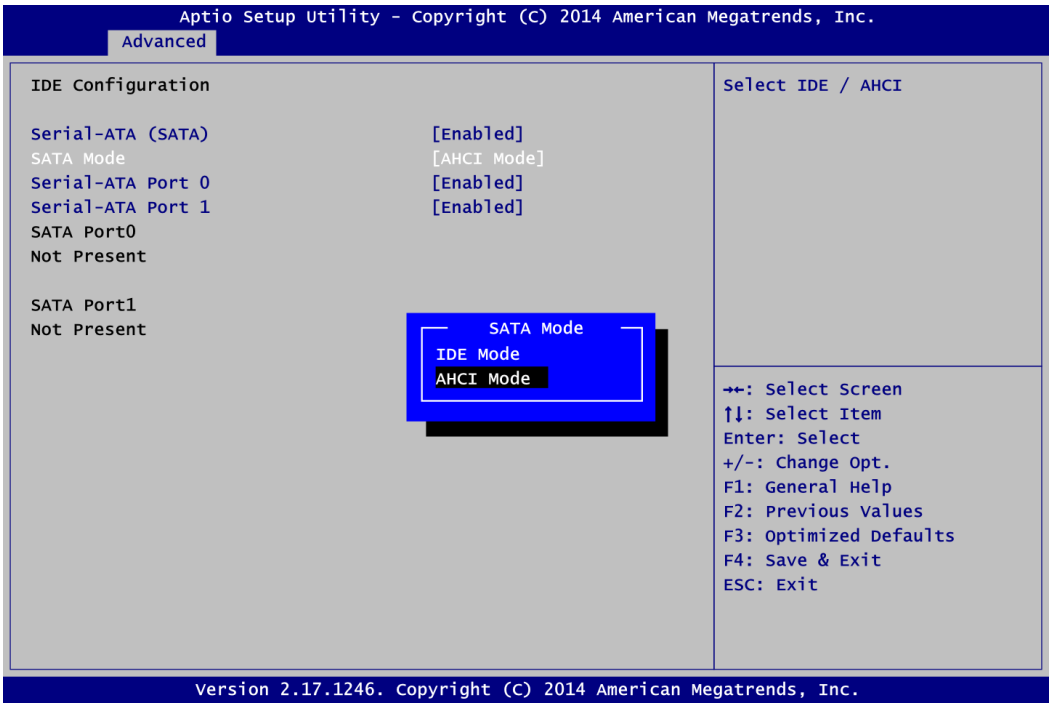


- **IDE Configuration**
  In the IDE Configuration menu, you can see the currently installed hardware in the SATA ports. During system boot up, the BIOS automatically detects the presence of SATA devices.



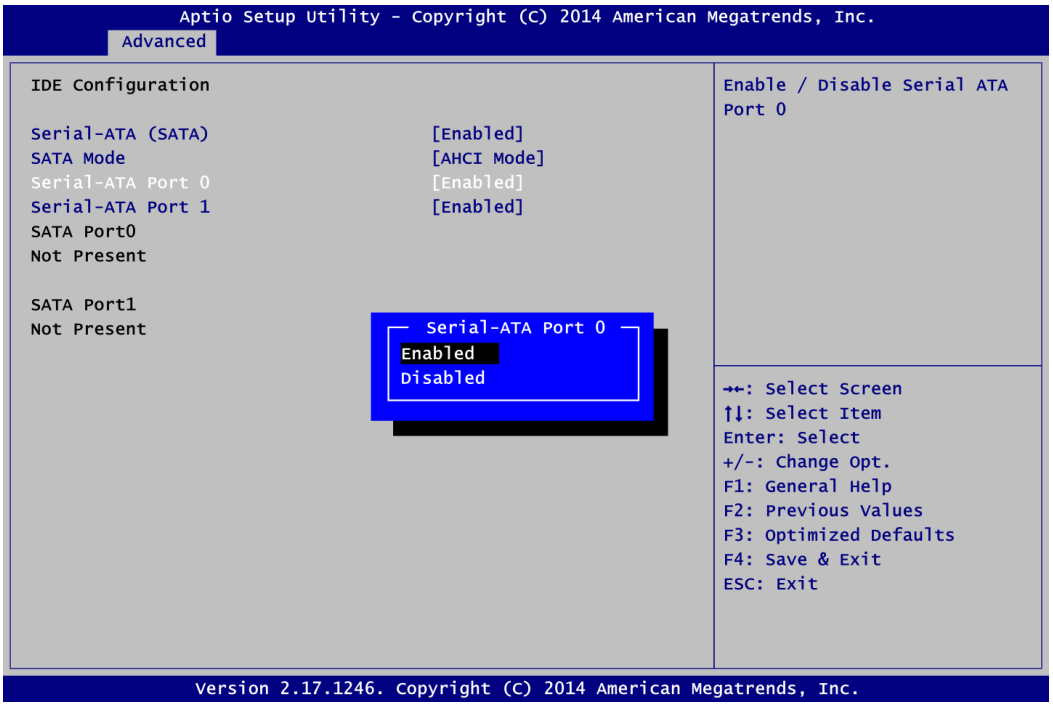
Serial-ATA (SATA)
Enable or disable the SATA Controller feature. The default is Enabled.

- **SATA Mode**



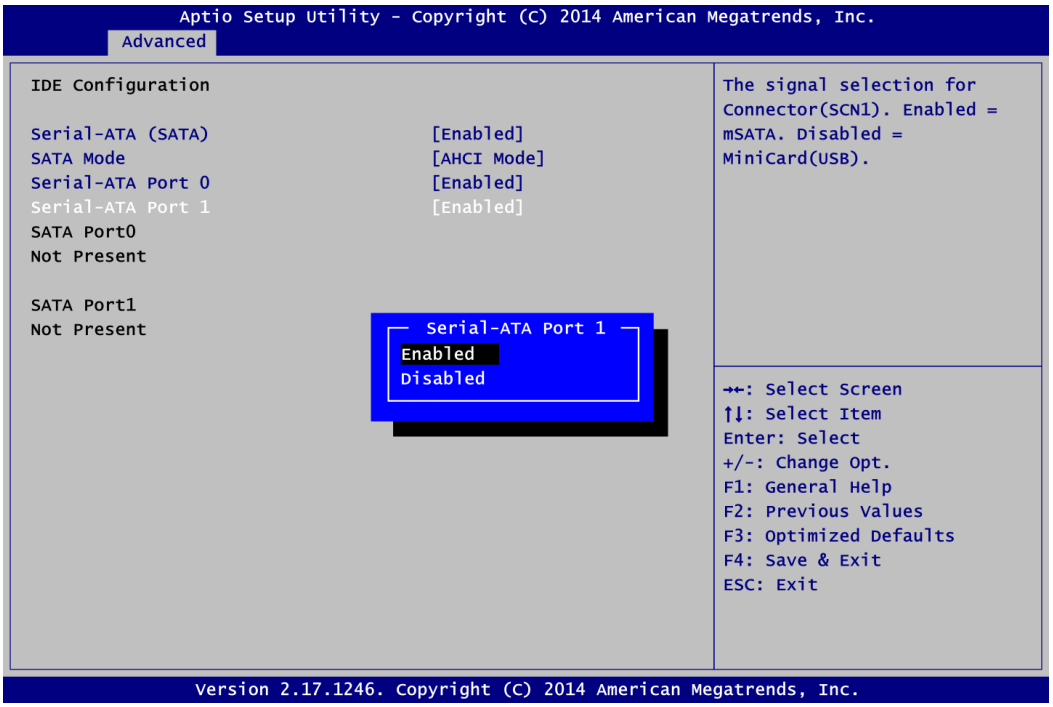
SATA Mode
Determine how SATA controller(s) operate. Operation mode options are IDE Mode and AHCI (Advanced Host Controller Interface) Mode. The default is AHCI Mode.

- **Serial ATA Port 0**



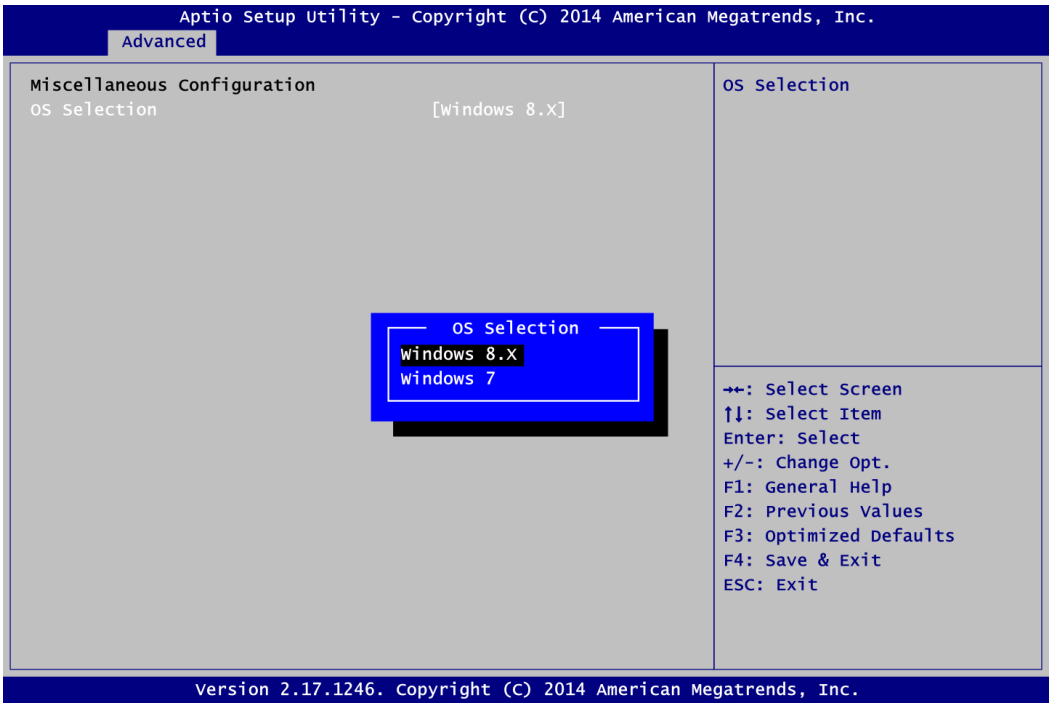
Serial-ATA Port 0
Enable or disable the onboard SATA port 0 which is CN19 (see section 2.4.15).

- **Serial ATA Port 1**



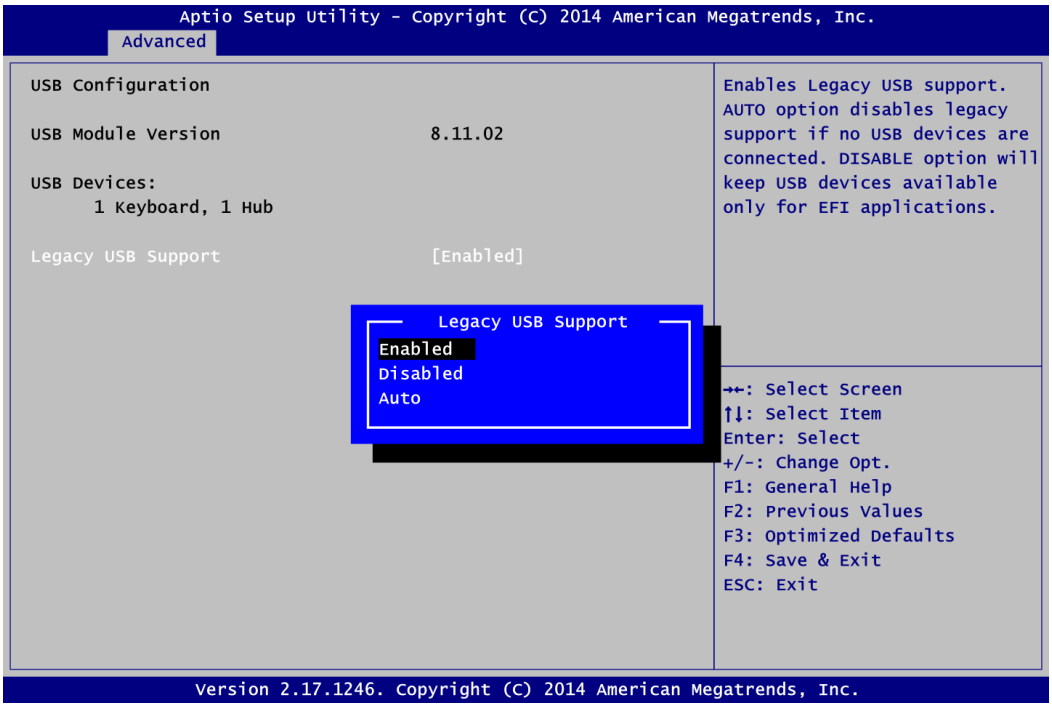
Serial-ATA Port 1
Enable or disable the onboard SATA port 1 which is SCN1 (see section 2.4.17).

- **Miscellaneous Configuration**



OS Selection
Use this item to select Windows® 8.x or Windows® 7 operating system. The default is Windows® 8.x.

- **USB Configuration**



USB Devices
Display all detected USB devices.

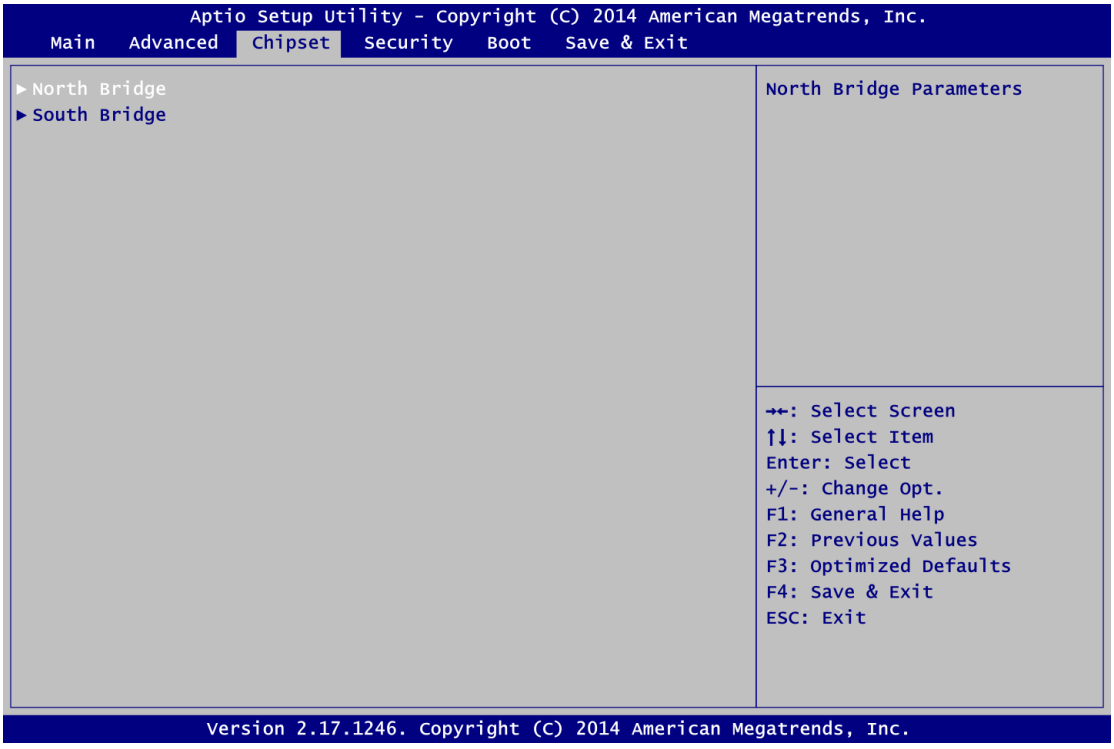
Legacy USB Support
Use this item to enable or disable support for USB device on legacy operating system. The default setting is Enabled. Auto option disables legacy support if no USB devices are connected. Disable option will keep USB devices available only for EFI applications.

4.5 Chipset Menu

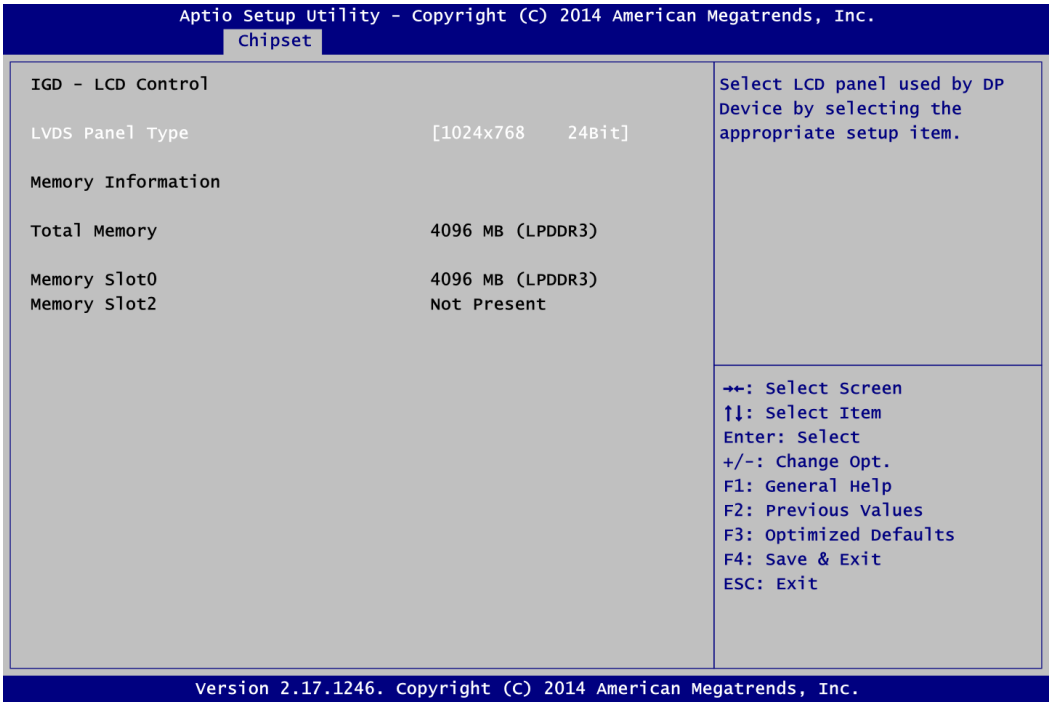
The Chipset menu allows users to change the advanced chipset settings. You can select any of the items in the left frame of the screen to go to the sub menus:

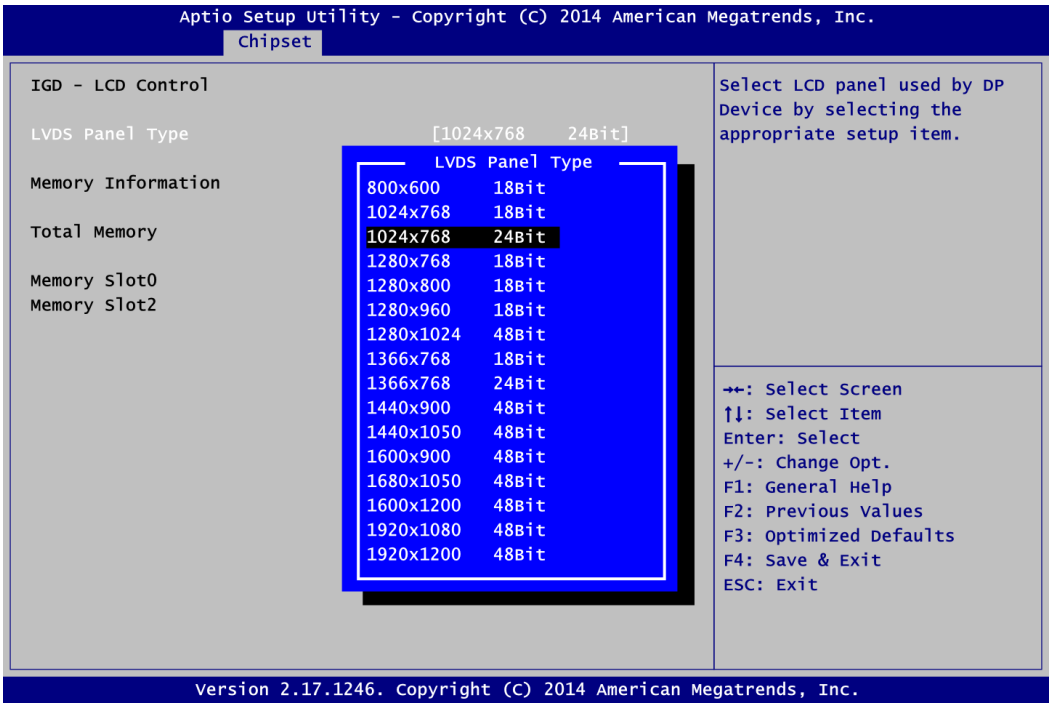
- ► North Bridge
- ► South Bridge

For items marked with "►", please press <Enter> for more options.



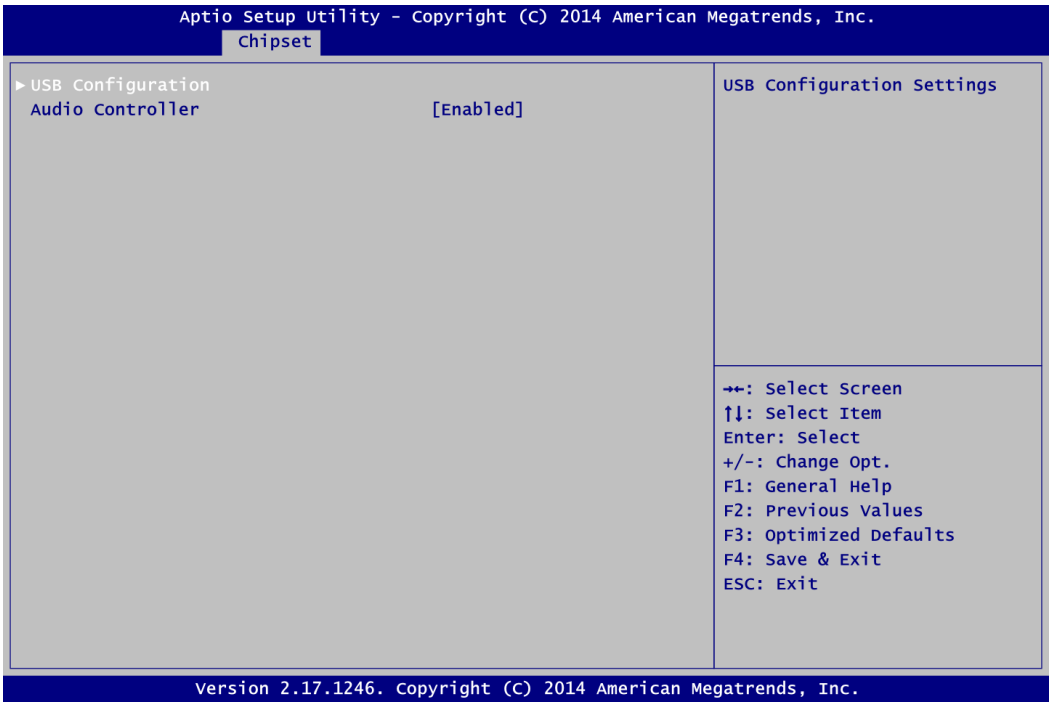
- **North Bridge**
  This screen shows system memory information and allows users to configure parameters of North Bridge chipset.





LVDS Panel Type
Select LVDS panel resolution.

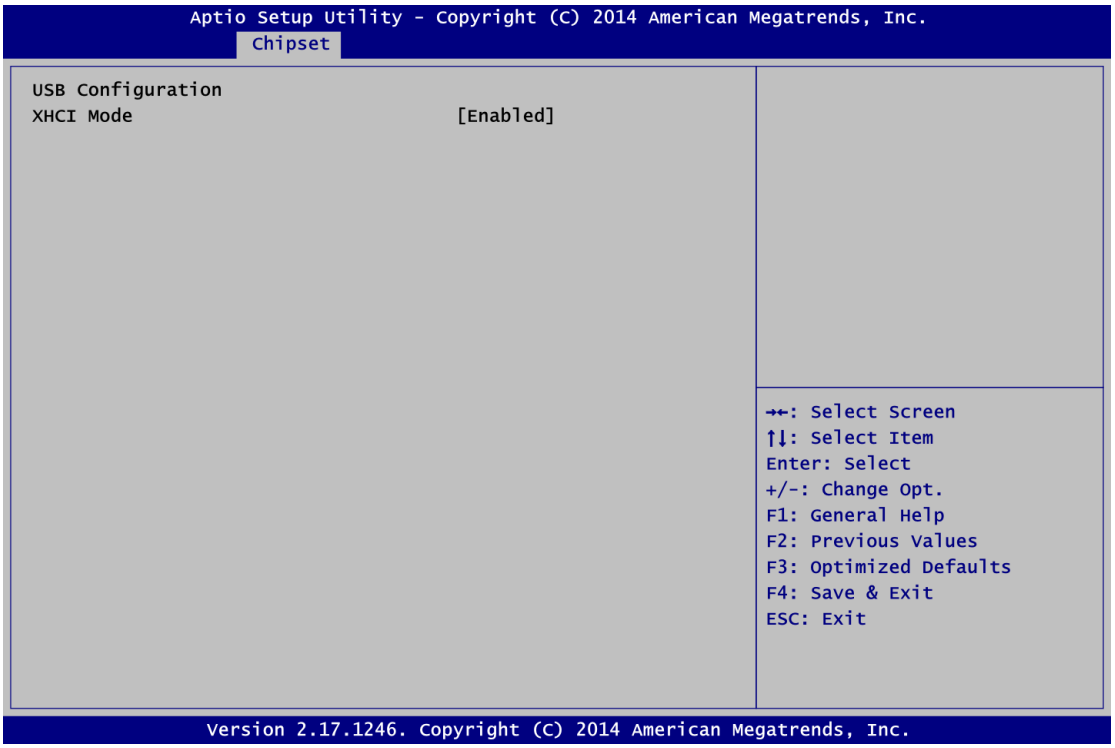
- **South Bridge**
  This screen allows users to configure parameters of South Bridge chipset.



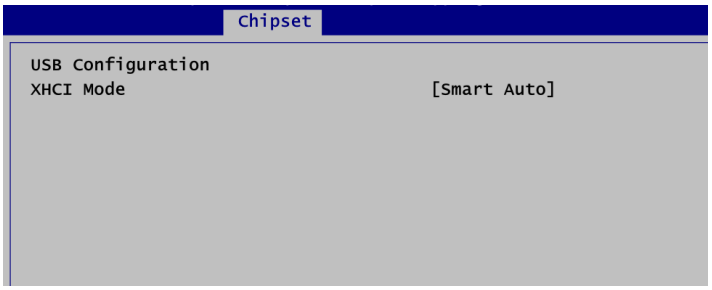
USB Configuration
This item is for USB configuration settings.

Audio Controller
Control detection of the audio device.

- **South Bridge – USB Configuration**

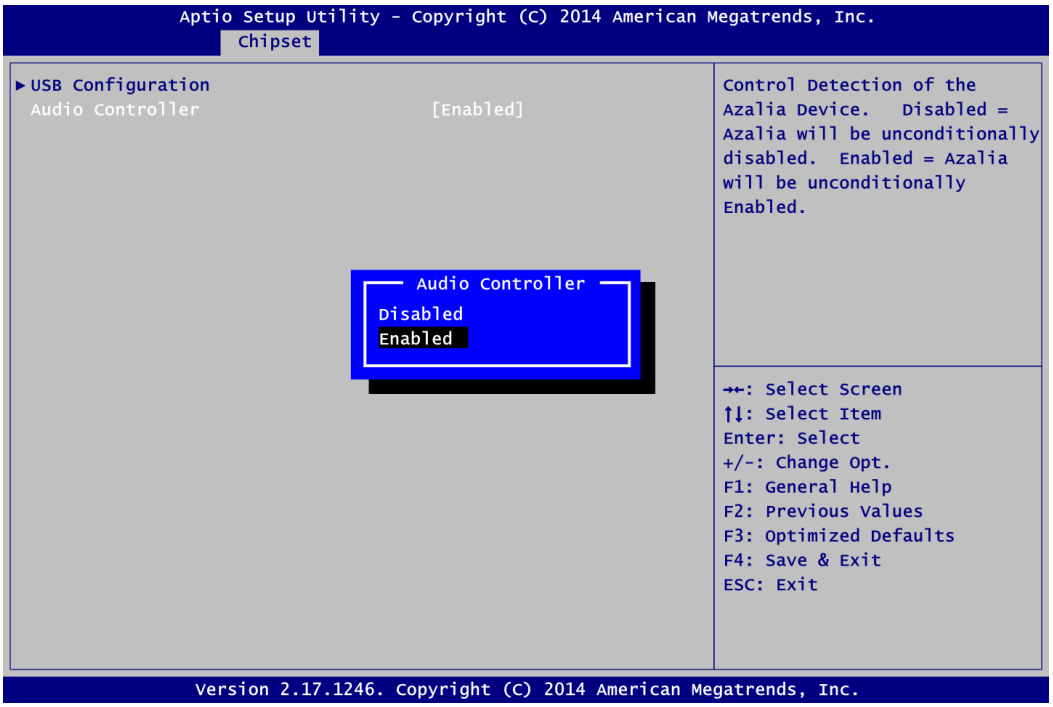


XHCI Mode
When Advanced\Miscellaneous Configuration\OS Selection is set to Windows® 8.x, XHCI mode is Enabled.



Meanwhile, when Advanced\Miscellaneous Configuration\OS Selection is set to Windows® 7, XHCI mode is Smart Auto.

- **Audio Controller**



Audio Controller
Control detection of the audio device.
- Disabled: Audio device will be unconditionally disabled.
- Enabled: Audio device will be unconditionally enabled.

4.6 Security Menu

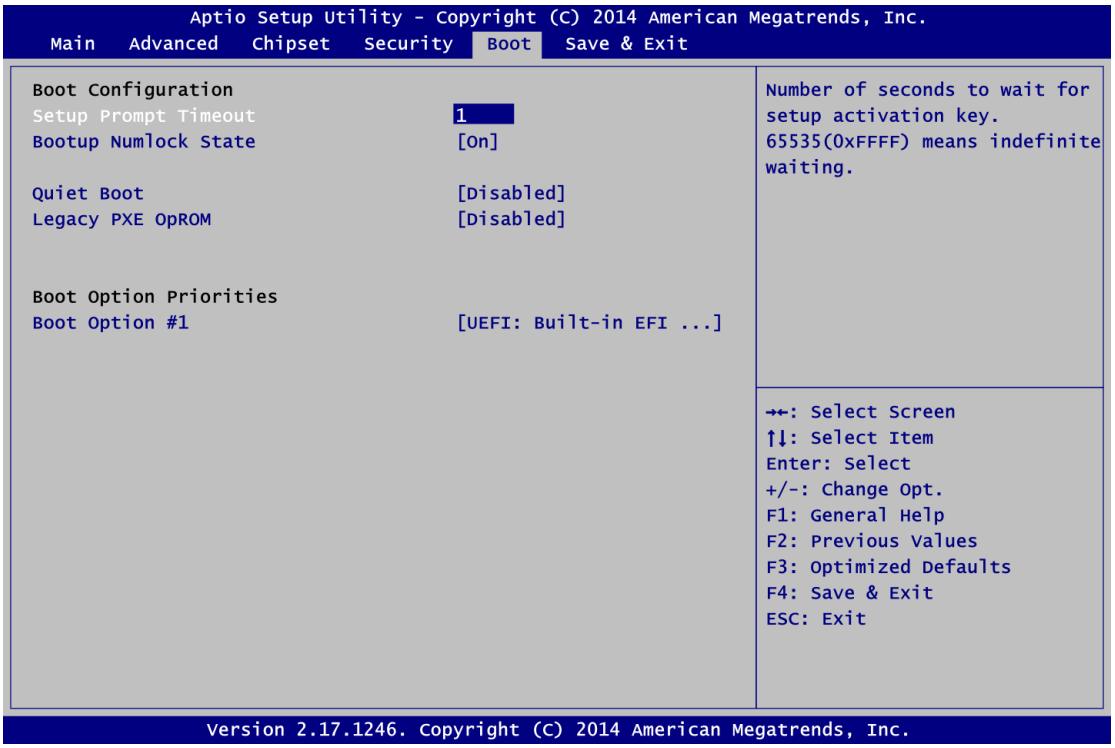
The Security menu allows users to change the security settings for the system.

- **Administrator Password**
  Set administrator password.

- **User Password**
  Set user password.

4.7 Boot Menu

The Boot menu allows users to change boot options of the system.



- **Setup Prompt Timeout**
  Number of seconds to wait for setup activation key. 65535(0xFFFF) means indefinite waiting.

- **Bootup NumLock State**
  Use this item to select the power-on state for the keyboard NumLock.

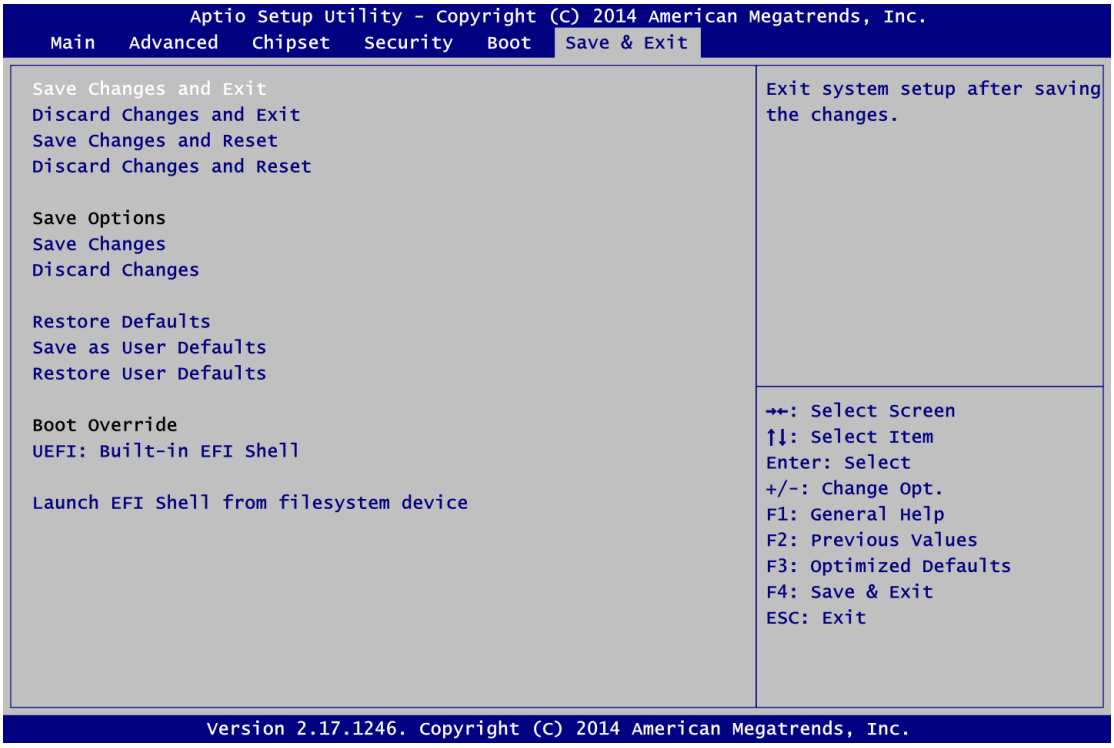
- **Quiet Boot**
  Select to display either POST output messages or a splash screen during boot-up.

- **Legacy PXE OpROM**
  Use this item to enable or disable the boot ROM function of the onboard LAN chip when the system boots up.

- **Boot Option Priorities**
  These are settings for boot priority. Specify the boot device priority sequence from the available devices.

4.8 Save & Exit Menu

The Save & Exit menu allows users to load your system configuration with optimal or fail-safe default values.



- **Save Changes and Exit**
  When you have completed the system configuration changes, select this option to leave Setup and return to Main Menu. Select Save Changes and Exit from the Save & Exit menu and press <Enter>. Select Yes to save changes and exit.

- **Discard Changes and Exit**
  Select this option to quit Setup without making any permanent changes to the system configuration and return to Main Menu. Select Discard Changes and Exit from the Save & Exit menu and press <Enter>. Select Yes to discard changes and exit.

- **Save Changes and Reset**
  When you have completed the system configuration changes, select this option to leave Setup and reboot the computer so the new system configuration parameters can take effect. Select Save Changes and Reset from the Save & Exit menu and press <Enter>. Select Yes to save changes and reset.

- **Discard Changes and Reset**
  Select this option to quit Setup without making any permanent changes to the system configuration and reboot the computer. Select Discard Changes and Reset from the Save & Exit menu and press <Enter>. Select Yes to discard changes and reset.

- **Save Changes**
  When you have completed the system configuration changes, select this option to save changes. Select Save Changes from the Save & Exit menu and press <Enter>. Select Yes to save changes.

- **Discard Changes**
  Select this option to quit Setup without making any permanent changes to the system configuration. Select Discard Changes from the Save & Exit menu and press <Enter>. Select Yes to discard changes.

- **Restore Defaults**
  It automatically sets all Setup options to a complete set of default settings when you select this option. Select Restore Defaults from the Save & Exit menu and press <Enter>.

- **Save as User Defaults**
  Select this option to save system configuration changes done so far as User Defaults. Select Save as User Defaults from the Save & Exit menu and press <Enter>.

- **Restore User Defaults**
  It automatically sets all Setup options to a complete set of User Defaults when you select this option. Select Restore User Defaults from the Save & Exit menu and press <Enter>.

- **Boot Override**
  Select a drive to immediately boot that device regardless of the current boot order.

- **Launch EFI Shell from filesystem device**
  Attempt to launch EFI Shell application (Shellx64.efi) from one of the available filesystem devices.

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Appendix A
Watchdog Timer

A.1 About Watchdog Timer

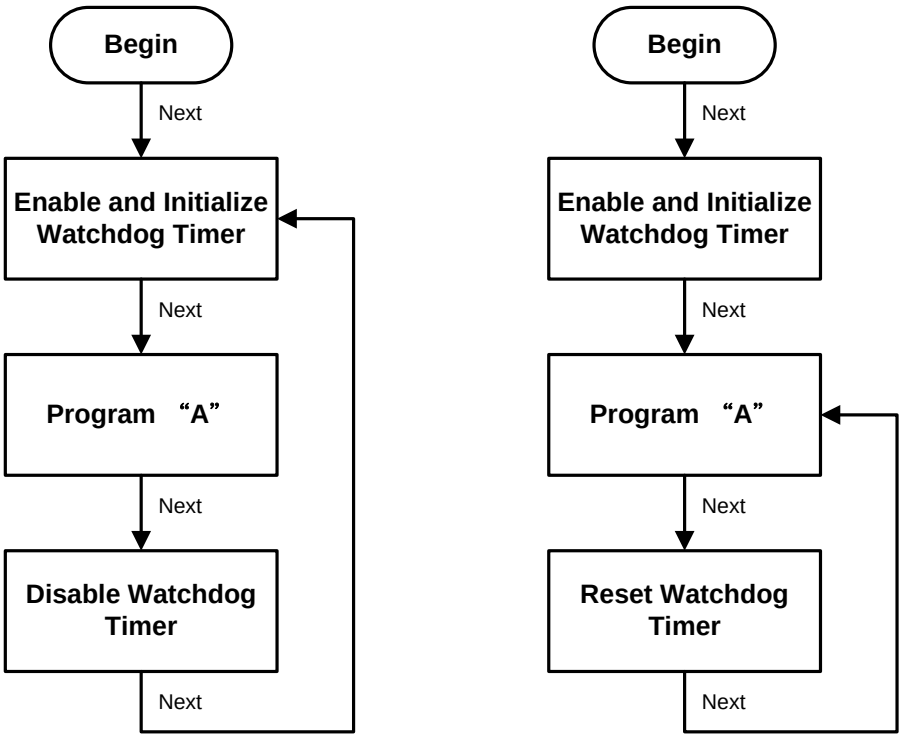
Software stability is major issue in most application. Some embedded systems are not watched by operator for 24 hours. It is usually too slow to wait for someone to reboot when computer hangs. The systems need to be able to reset automatically when things go wrong. The watchdog timer gives us solution.

The watchdog timer is a counter that triggers a system reset when it counts down to zero from a preset value. The software starts counter with an initial value and must reset it periodically. If the counter ever reaches zero which means the software has crashed, the system will reboot.

A.2 How to Use Watchdog Timer

The I/O port base addresses of watchdog timer are 2E (hex) and 2F (hex). The 2E (hex) and 2F (hex) are address and data port respectively.

Assume that program A is put in a loop that must execute at least once every 10ms. Initialize watchdog timer with a value bigger than 10ms. If the software has no problems; watchdog timer will never expire because software will always restart the counter before it reaches zero.



A.3 Sample Program

Assembly sample code :

```
;Enable WDT:
mov     dx,2Eh
mov     al,87            ;Un-lock super I/O
out     dx,al
out     dx,al

;Select Logic device:
mov     dx,2Eh
mov     al,07h
out     dx,al
mov     dx,2Fh
mov     al,07h
out     dx,al

;Enable WDT base address:
mov     dx,2Eh
mov     al,30h
out     dx,al
mov     dx,2Fh
mov     al,01h
out     dx,al

;Activate WDT:
mov     dx,2Eh
mov     al,0F0h
out     dx,al
mov     dx,2Fh
mov     al,80h
out     dx,al

;Set base timer :
mov     dx,2Eh
mov     al,0F6h
out     dx,al
mov     dx,2Fh
mov     al,Mh            ;M=00h,01h,...FFh (hex),Value=0 to 255
out     dx,al            ;(see Note below)

;Set Second or Minute :
mov     dx,2Eh
mov     al,0F5h
out     dx,al
mov     dx,2Fh
mov     al,Nh            ;N=71h or 79h(see Note below)
out     dx,al
```

Note:

*If **N**=71h, the time base is set to second.*
***M** = time value*
00: Time-out disable
01: Time-out occurs after 1 second
02: Time-out occurs after 2 seconds
03: Time-out occurs after 3 seconds
.
.
FFh: Time-out occurs after 255 seconds

*If **N**=79h, the time base is set to minute.*
***M** = time value*
00: Time-out disable
01: Time-out occurs after 1 minute
02: Time-out occurs after 2 minutes
03: Time-out occurs after 3 minutes
.
.
FFh: Time-out occurs after 255 minutes

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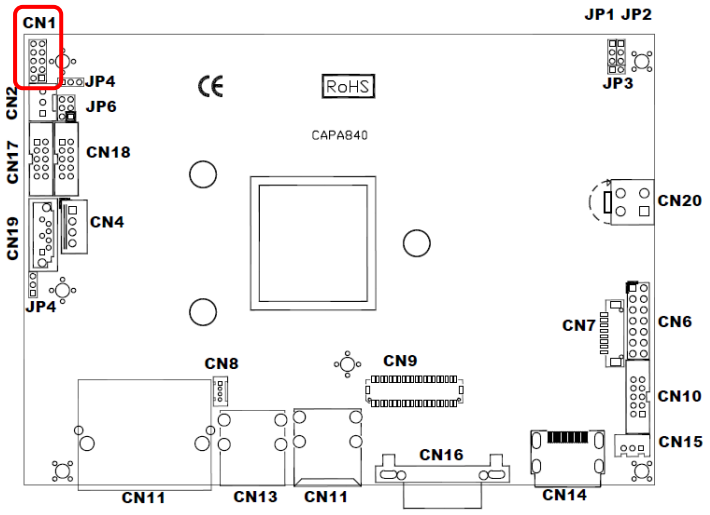
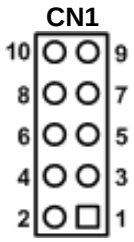
Appendix B
Digital I/O

B.1 About Digital I/O

The digital I/O on CPU board has 8 bits. Each bit can be set to function as input or output by software programming. In default, all pins are pulled high with +5V level (according to main power). The BIOS default settings are 3 inputs and 5 outputs where all of these pins are set to 1.





Pin	Signal	Pin	Signal
1	DI0	2	DO4
3	DI1	4	DO3
5	DI2	6	DO2
7	DO0	8	DO1
9	GND	10	+5V level

B.2 Digital I/O Programming

- I^2C to GPIO PCA9554PW GPIO.
- I^2C address: 01001000.

Command byte

Command	Protocol	Function
0	Read byte	Input port register
1	Read/write byte	Output port register
2	Read/write byte	Polarity inversion register
3	Read/write byte	Configuration register

The command byte is the first byte to follow the address byte during a write transmission. It is used as a pointer to determine which of the following registers will be written or read.

Register 0: Input port register.
This register is a read-only port. It reflects the incoming logic levels of the pins, regardless of whether the pin is defined as an input or an output by Register 3. Writes to this register have no effect.

The default "X" is determined by the externally applied logic level, normally "1" when no external signal externally applied because of the internal pull-up resistors.

Register 0 – Input port register bit description

Bit	Symbol	Access	Value	Description
7	I7	Read only	X	Determined by externally applied logic level.
6	I6	Read only	X	
5	I5	Read only	X	
4	I4	Read only	X	
3	I3	Read only	X	
2	I2	Read only	X	
1	I1	Read only	X	
0	I0	Read only	X	

Register 1: Output port register.
This register reflects the outgoing logic levels of the pins defined as outputs by Register 3. Bit values in this register have no effect on pins defined as inputs. Reads from this register return the value that is in the flip-flop controlling the output selection, not the actual pin value.

Register 1 – Output port register bit description

Bit	Symbol	Access	Default Value	Description
7	O7	R	1	Reflects outgoing logic levels of pins defined as outputs by Register 3.
6	O6	R	1	
5	O5	R	1	
4	O4	R	1	
3	O3	R	1	
2	O2	R	1	
1	O1	R	1	
0	O0	R	1	

Register 2: Polarity Inversion register.
This register allows the user to invert the polarity of the Input port register data. If a bit in this register is set (written with "1"), the corresponding Input port data is inverted. If a bit in this register is cleared (written with "0"), the Input port data polarity is retained.

Register 2 – Polarity inversion register bit description

Bit	Symbol	Access	Default Value	Description
7	N7	R/W	0	Inverts polarity of Input port register data. 0 = Input port register data retained (default value). 1 = Input port register data inverted.
6	N6	R/W	0	
5	N5	R/W	0	
4	N4	R/W	0	
3	N3	R/W	0	
2	N2	R/W	0	
1	N1	R/W	0	
0	N0	R/W	0	

Register 3: Configuration register.
This register configures the directions of the I/O pins. If a bit in this register is set, the corresponding port pin is enabled as an input with high-impedance output driver. If a bit in this register is cleared, the corresponding port pin is enabled as an output. At reset, the I/Os are configured as inputs with a weak pull-up to V_{DD}.

Register 3 – Configuration register bit description

Bit	Symbol	Access	Default Value	Description
7	C7	R/W	1	Configures the directions of the I/O pins. 0 = Corresponding port pin enabled as an output. 1 = Corresponding port pin configured as input (default value).
6	C6	R/W	1	
5	C5	R/W	1	
4	C4	R/W	1	
3	C3	R/W	1	
2	C2	R/W	1	
1	C1	R/W	1	
0	C0	R/W	1	

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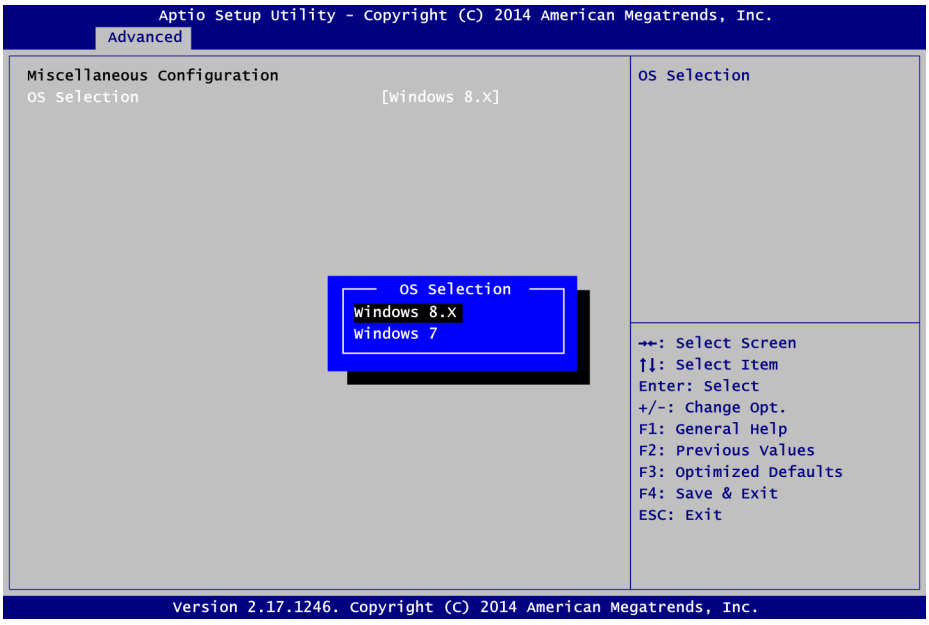
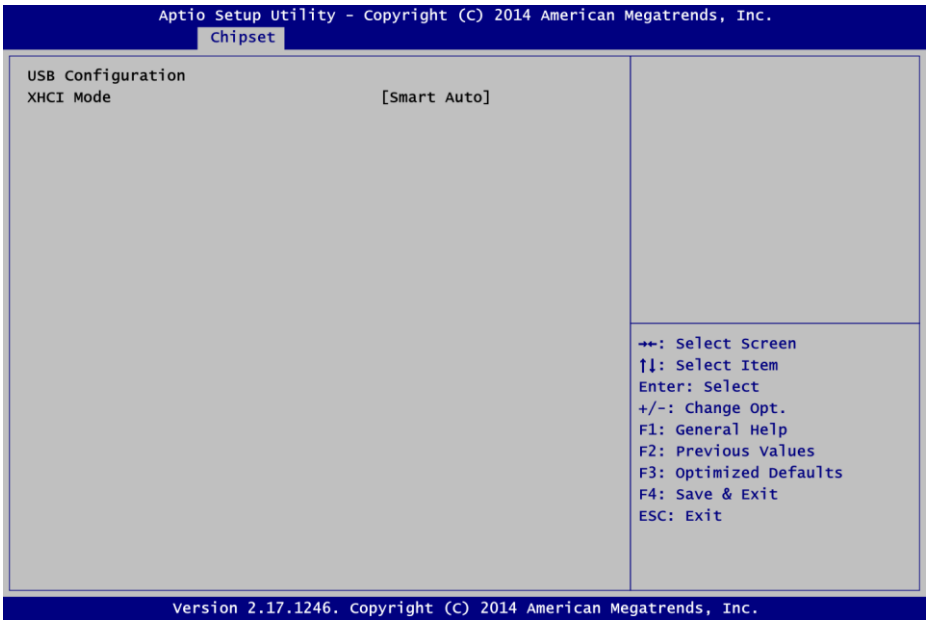
Appendix C
Window® 7 Installation Guide

Before you install Windows® 7, please follow the instructions below:

1. Enter BIOS setup utility, and ensure that Advanced\Miscellaneous Configuration\OS Selection option is set to Windows® 7 (see section 4.4).



2. After that, go to Chipset\South Bridge to verify that XHCI Mode is Smart Auto.



3. Save changes and exit BIOS utility.

4. Reboot and you may begin to install Windows® 7 on your computer. But please note that during installation, only USB ports at CN13 can be used.

5. After Windows® 7 installation is complete, install XHCI driver (Intel_USB_3.0_xHC_Driver_3.0.4.65_MR4_PV) from the product information CD. After installing driver, all USB ports can work properly.