

# USER'S MANUAL

## **CAPA520**

**8<sup>th</sup>/9<sup>th</sup> Generation Intel® Core™  
Processor Family 3.5" Board**

**User's Manual**

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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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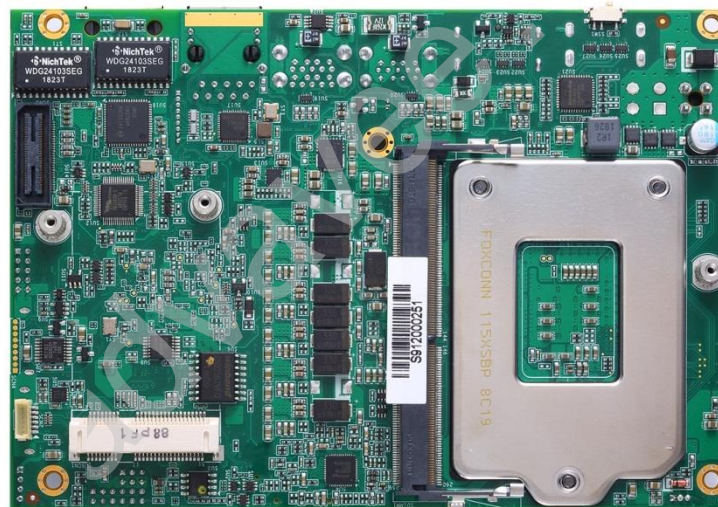
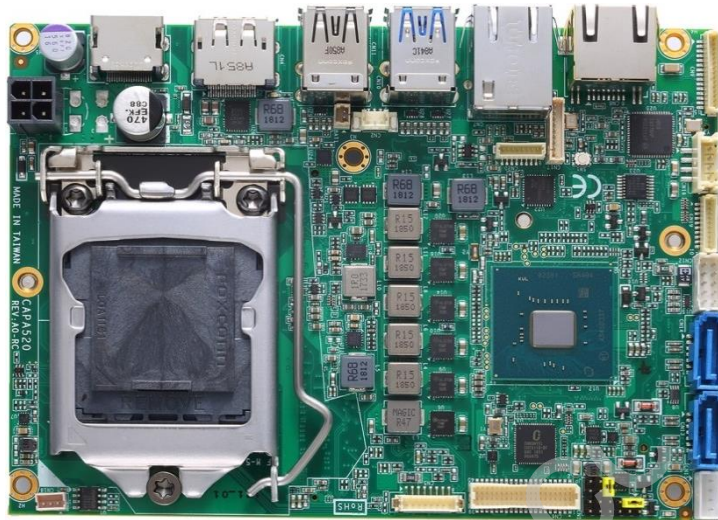
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# Chapter 1

## Introduction



The CAPA520, a high performance 3.5" board, supports LGA1151 socket for 8<sup>th</sup>/ 9<sup>th</sup> Generation Intel® Core™ i7/ i5/ i3 processors with H310 (Q370 optional) chipsets. The board delivers outstanding system performance through high-bandwidth interfaces, multiple I/O functions for interactive applications and various embedded computing solutions.

There is one 260-pin unbuffered SO-DIMM socket for single channel DDR4 2666MHz memory supporting up to 32GB memory capacity. It also features three Gigabit/Fast Ethernet ports, two SATA port with transfer rate up to 6Gb/s, three USB 3.0 and three 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 one serial port (RS-232/422/485) and 3.5" form factor that applies an extensive array of PC peripherals.

## 1.1 Features

- LGA1151 socket for 8<sup>th</sup>/ 9<sup>th</sup> Generation Intel® Core™ i7/ i5/ i3/ Celeron® with TDP 35W processors
- H310 (Q370 optional) chipset
- 1 DDR4 SO-DIMM supports up to 32GB memory capacity
- 3 USB 3.0 and 3 USB 2.0 ports (USB 3.1 Gen2 for Q370 chipset)
- 1 COM port with RS232/422/485 supported
- 1 PCI-Express Mini Card
- +12V only DC-in supported

## 1.2 Specifications

- **CPU**
  - LGA1151 Socket.

### Suggested CPU

- Intel® Core™ i7-8700T 6 core 2.4GHz / i7-9700TE 8 core 1.8GHz.
- Intel® Core™ i5-8500T 6 core 2.1GHz / i5-9500TE 6 core 2.2GHz.
- Intel® Core™ i3-8100T quad core 3.1GHz / i3-9100TE quad 2.2GHz.
- Intel® Celeron® processor G4900T dual core 2.9GHz.



*SpeedStep might be functioned to minimize power draw and heat generation.*

### Note

- **Chipset**
  - Intel® H310 chipset.
  - Intel® Q370 chipset (optional).
- **Thermal Solution**
  - Active.
- **Operating Temperature**
  - -20°C~60°C.
- **BIOS**
  - American Megatrends Inc. UEFI (Unified Extensible Firmware Interface) BIOS.
  - 256Mbit SPI Flash, DMI, Plug and Play.
  - PXE Ethernet Boot ROM.
- **System Memory**
  - One 260-pin unbuffered DDR4 SO-DIMM socket.
  - Maximum up to 32GB DDR4 2666MHz memory capacity.
- **Onboard Multi I/O**
  - Controller: Fintek F81803U.
  - Serial Port: One port for RS-232/422/485.
- **Serial ATA**
  - Two SATA-600 connector.
  - mSATA supported (BOM optional).



- **USB Interface**
  - Four USB ports on the rear I/O:
    - H310 chipset: Three for USB 3.0 and one for USB 2.0.
    - Q370 chipset (optional): Three for USB 3.1 Gen2 and one for USB 2.0.
  - Two USB 2.0 ports in 2x5-pin internal wafer connector.
  
- **Display**
  - One DisplayPort. Max. resolution is 4096x2160 @60Hz.
  - 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. Max. resolution is 4096x2160 @30Hz.
  
- **Watchdog Timer**
  - 1~255 seconds or minutes; up to 255 levels.
  
- **Ethernet**
  - LAN1: Intel® i219LM supports 1000/100/10Mbps Gigabit/Fast Ethernet with Wake-on-LAN and PXE Boot ROM.
  - LAN2: Intel® i211AT supports 1000/100/10Mbps Gigabit/Fast Ethernet with Wake-on-LAN and PXE Boot ROM.
  - LAN3: Intel® i211AT supports 1000/100/10Mbps Gigabit/Fast Ethernet with Wake-on-LAN and PXE Boot ROM.
  
- **Audio**
  - HD audio link without codec.
  - 1x8-pin 1.0mm wafer HDA signal to support expansion audio board AX93A22.
  
- **Expansion Interface**
  - One full-size PCI-Express Mini Card socket complies with PCI-Express Mini Card Spec. V1.2.
  
- **ZIO Connector**
  - 60-pin high speed connector; containing one PCI-Express x1, one USB 2.0, one USB 3.1 Gen1, one LPC and one SMBus.
  
- **Power Input**
  - One 2x2-pin connector.
  - +12V only 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

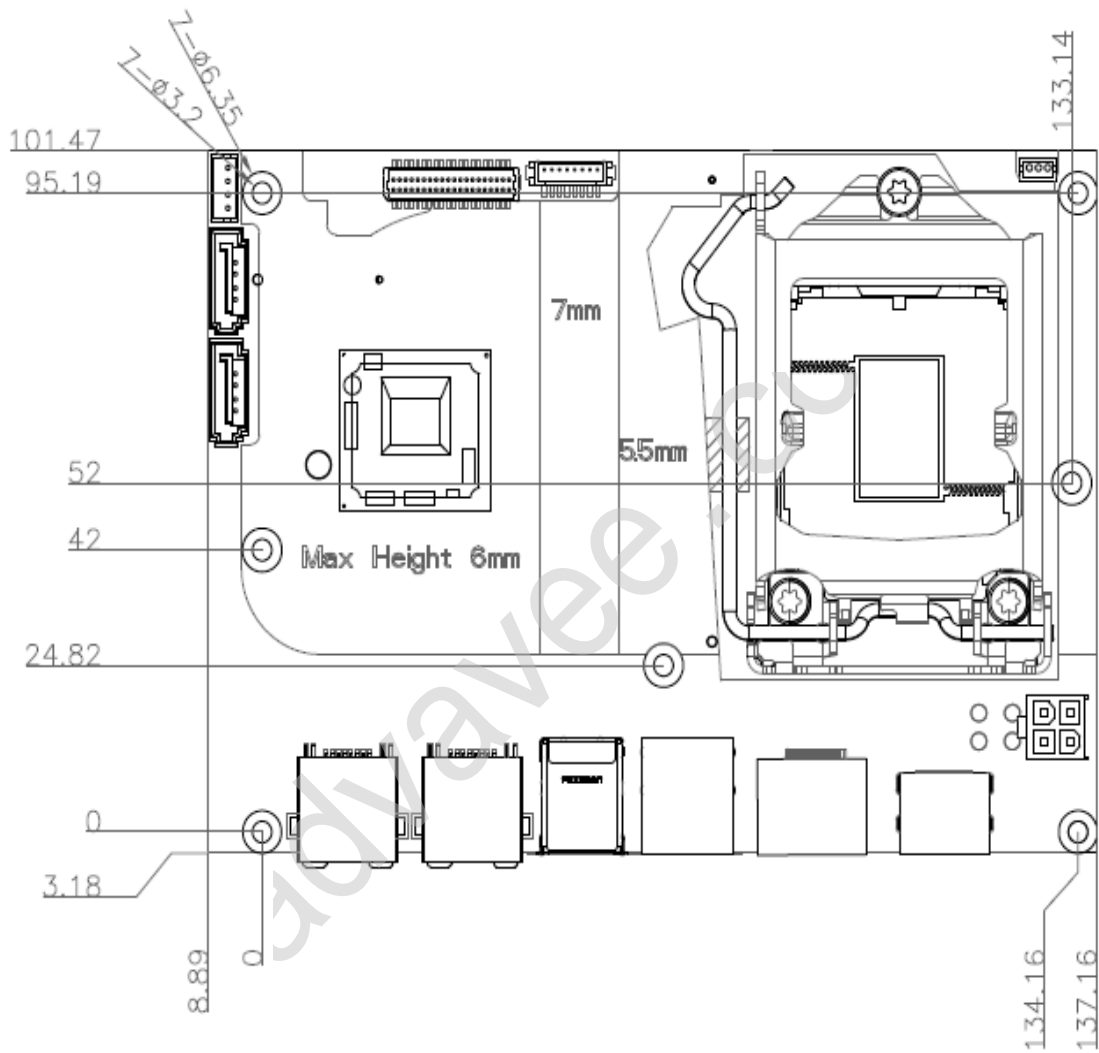
- Chipset and graphics driver
- Ethernet driver (Intel® i211AT and i219LM)
- Audio driver (optional for AX93A22)

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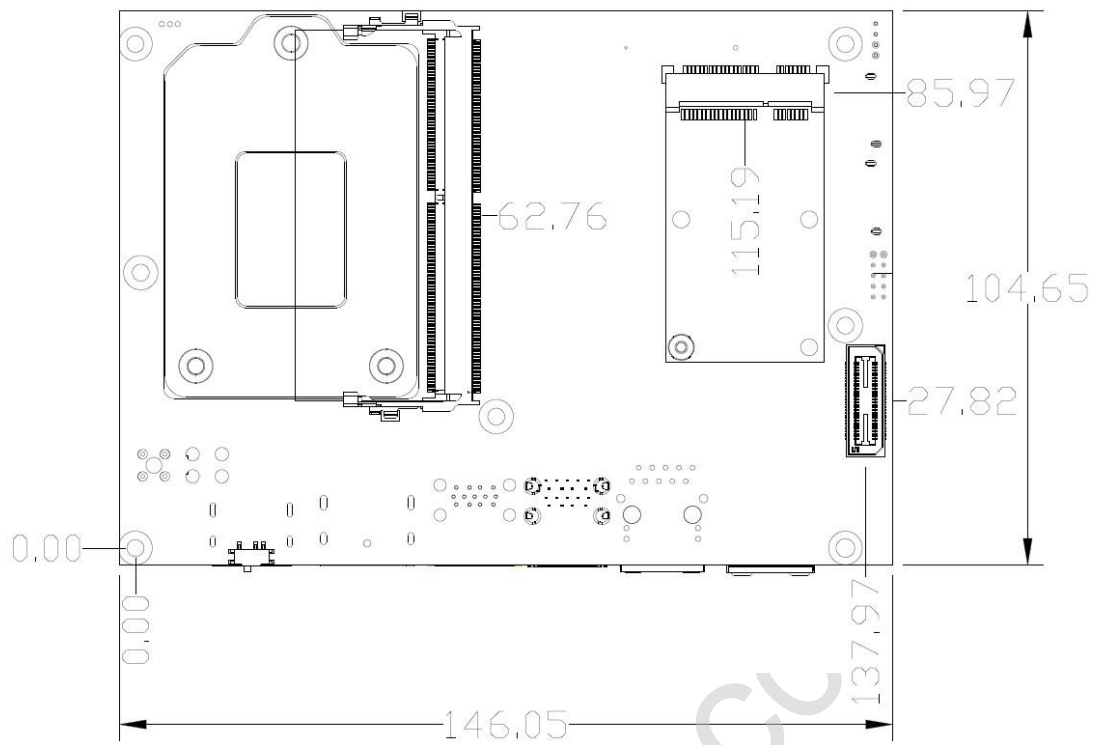
# Chapter 2

## Board and Pin Assignments

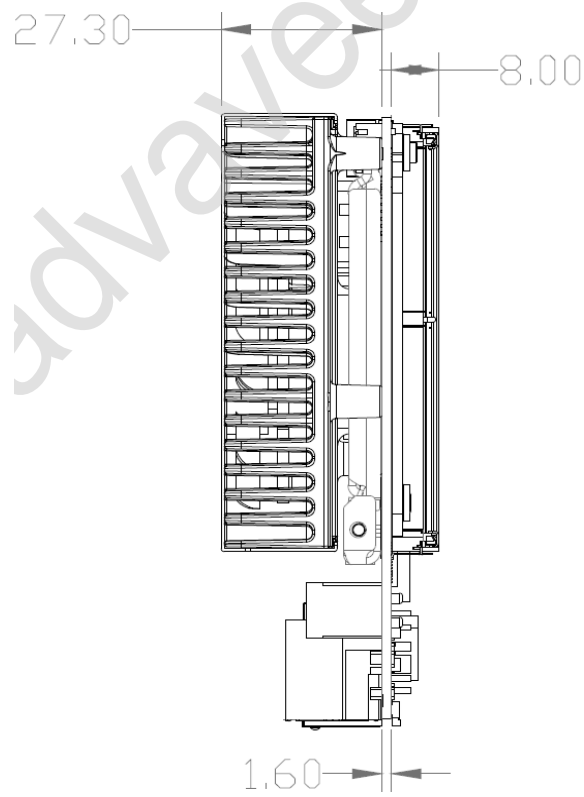
### 2.1 Board Dimensions and Fixing Holes



Top View

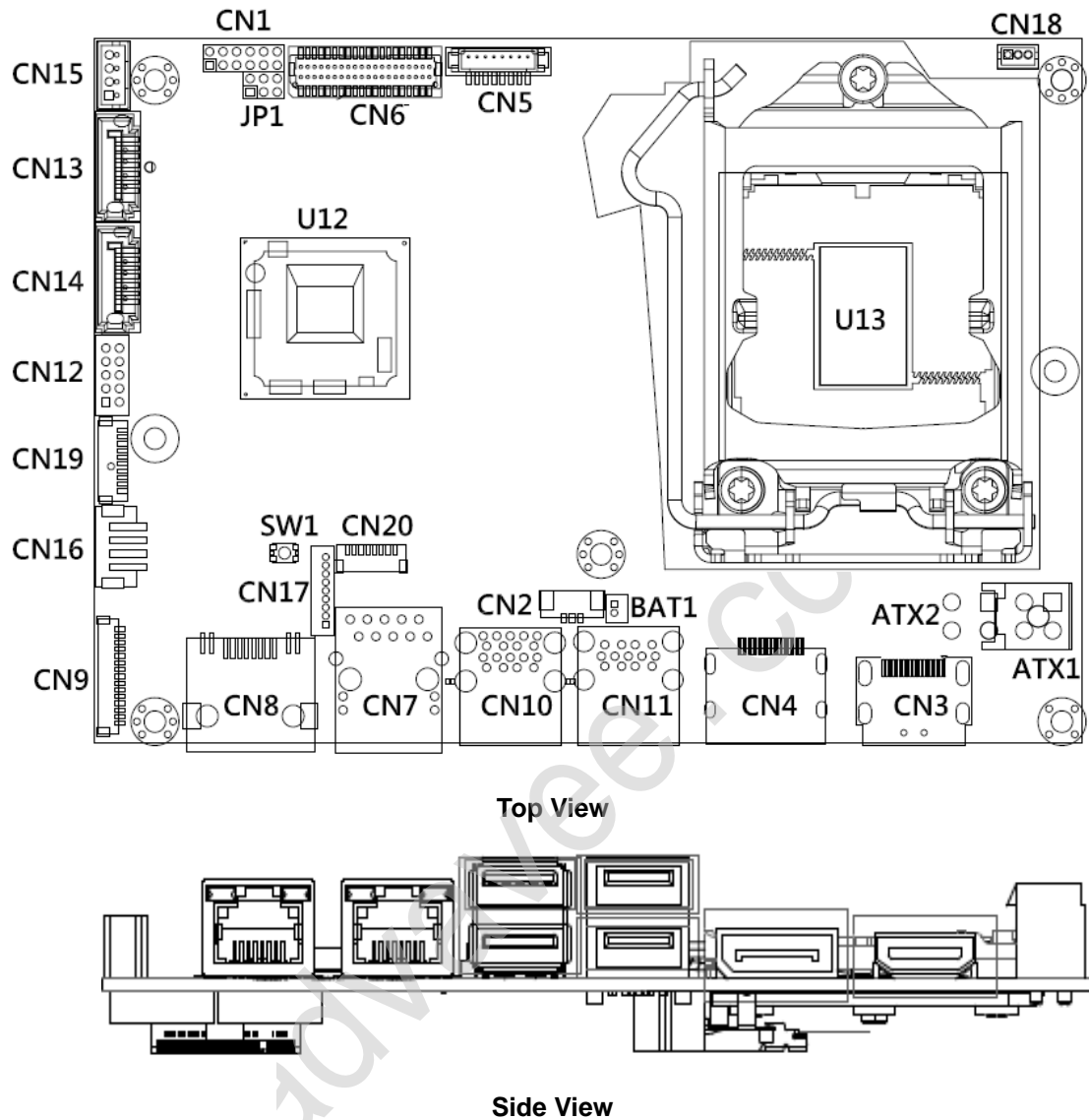


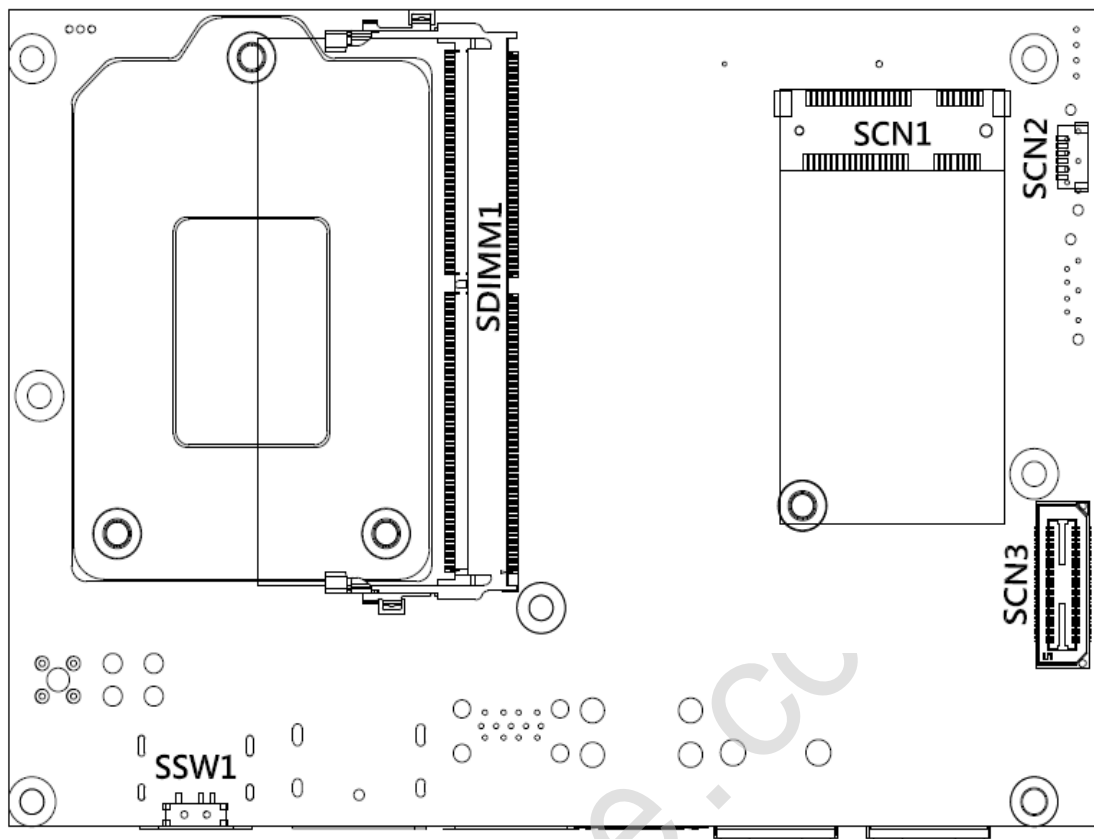
Bottom View



Side View

## 2.2 Board Layout



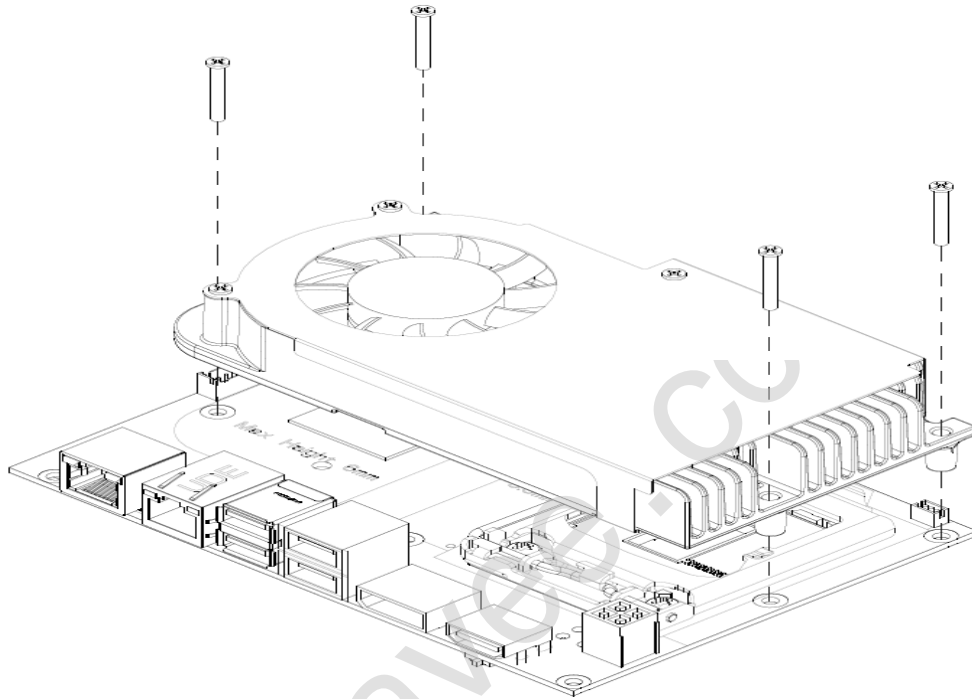


Bottom View

## 2.3 Installing Fan

The processor needs specially designed heatsink and fan assembly to cool down and ensure sufficient air flow inside your system.

After applying thermal grease on the processor and installing it on the socket, please place heatsink and fan assembly on top of the processor. Match the four screws to the fixing holes on the board. Then screw tightly the heatsink and CPU fan assembly onto the board.



Note

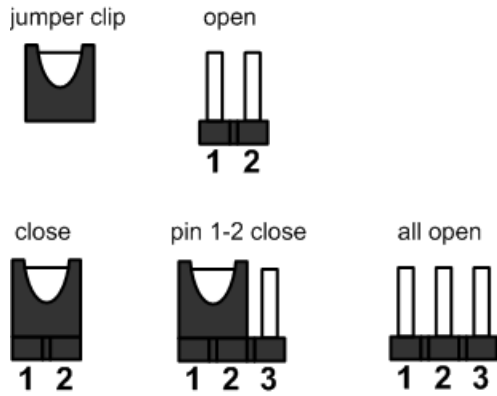
**Be careful not to over tighten the screws as it can damage the processor or the CPU board.**

Also make sure the fan cable is plugged to fan connector (see section 2.5.15) as indicated in image below.



## 2.4 Jumper and Switch 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 and switch settings on the CAPA520 to meet your application purpose. Below you can find a summary table of jumper, switch and onboard default settings.



**Note**

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

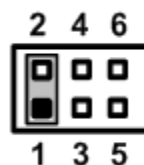
Jumper and Switch	Description	Setting
JP1	LVDS +3.3V/+5V/+12V Voltage Selection Default: +3.3V Level	1-2 Close
SW1	Restore BIOS Optimal Defaults Default: Normal Operation	Release
SSW1	Auto Power On Default: Disable	1-2 Close



### 2.4.1 LVDS +3.3V/+5V/+12V Voltage Selection (JP1)

This is a 2x3-pin (pitch=2.0mm) jumper. The board supports voltage selection for flat panel displays. Use JP1 to set LVDS connector (see section 2.5.6) 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.

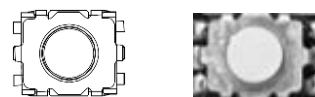
Function	Setting
+12V level	5-6 close
+5V level	2-4 close
+3.3V level (Default)	1-2 close



### 2.4.2 Restore BIOS Optimal Defaults (SW1)

Use SW1 to clear CMOS. Press the tact switch for at least 3 seconds to restore BIOS optimal defaults.

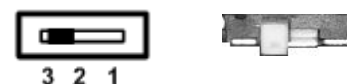
Function	Setting
Normal (Default)	Release
Restore BIOS optimal defaults	Press



### 2.4.3 Auto Power On (SSW1)

If SSW1 is enabled for power input, the system will be automatically power on without pressing soft power button. If SSW1 is disabled for 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



## 2.5 Connectors

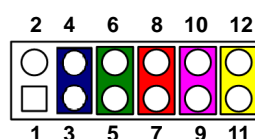
Signals go to other parts of the system through connectors. Loose or improper connection might cause problems, please make sure all connectors are properly and firmly connected. Here is a summary table of connectors on the hardware.

Connector	Description
CN1	Front Panel Connector
CN2	SMBus Connector
CN3	HDMI Connector
CN4	DisplayPort Connector
CN5	Inverter Connector
CN6	LVDS Connector
CN7, CN8	Ethernet Port 1 and 2
CN9	Ethernet Port 3 Wafer Connector
CN10	USB 3.0 Port
CN11	USB 3.0/USB2.0 Port
CN12	USB 2.0 Wafer Connector
CN13, CN14	SATA 0 and 1 Ports
CN15, CN16	SATA 0 and 1 Power Connectors
CN17	COM1 Wafer Connector
CN18	Fan Connector
CN19	Digital I/O Connector
CN20	Audio HDA Wafer Connector
ATX1	ATX Power Connector
BAT1	CMOS Battery Connector
SCN1	Full-size PCI-Express Mini Card Connector
SCN2	SIM Card Wafer Connector
SCN3	ZIO Expansion Connector
SDIMM1	DDR4 SO-DIMM Connector

## 2.5.1 Front Panel Connector (CN1)

This is a 2x6-pin header (pitch=2.0mm) for front panel interface.

Pin	Signal	Pin	Signal
1	BUZZER-	2	BUZZER+
3	GND	4	PWR_PSON
5	PWRLED-	6	PWRLED+
7	PWRSW-	8	PWRSW+
9	HW RST-	10	HW RST+
11	HDDLED-	12	HDDLED+



### Internal Buzzer

Pin 1(-) and 2(+) connect the internal buzzer cable.

### Power Status (PS-ON)

Pin 4 and pin 3 are PS-ON signal which are connected to know the power status of this board.

### Power LED

Pin 6 connects anode (+) of LED and pin 5 connects cathode(-) of LED. The power LED lights up when the system is powered on.

### Power On/Off Button

Pin 7 and 8 connect the power button on front panel to CPU board, which allows users to turn on or off power.

### System Reset Switch

Pin 9 and 10 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.

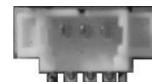
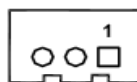
### HDD Activity LED

This connection is linked to hard drive activity LED on the control panel. LED flashes when HDD is being accessed. Pin 11 and 12 connect the hard disk drive to the front panel HDD LED, pin 9 is assigned as cathode(-) and pin 10 is assigned as anode(+).

### 2.5.2 SMBus Connector (CN2)

This is a 1x3-pin (pitch=1.25mm) wafer connector fully compliant with JST B3B-PH-K-S for SMBus interface. The SMBus (System Management Bus) is a simple bus for the purpose of lightweight communication.

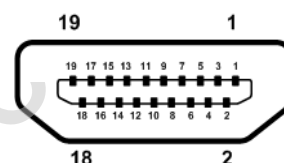
Pin	Signal
1	CLK
2	DATA
3	GND



### 2.5.3 HDMI Connector (CN3)

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.

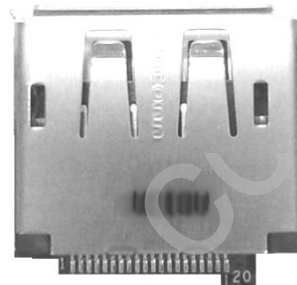
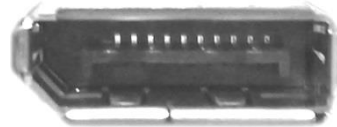
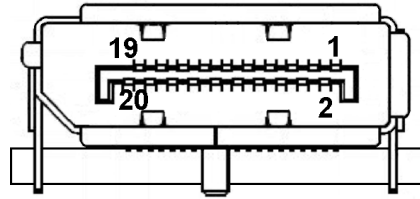
Pin	Signal	Pin	Signal
1	HDMI OUT_DATA2+	2	GND
3	HDMI OUT_DATA2-	4	HDMI OUT_DATA1+
5	GND	6	HDMI OUT_DATA1-
7	HDMI OUT_DATA0+	8	GND
9	HDMI OUT_DATA0-	10	HDMI OUT_Clock+
11	GND	12	HDMI OUT_Clock-
13	N.C.	14	N.C.
15	HDMI OUT_SCL	16	HDMI OUT_SDA
17	GND	18	+5V
19	HDMI_HTPLG		



### 2.5.4 DisplayPort Connector (CN4)

The DisplayPort interface is available through connector CN4.

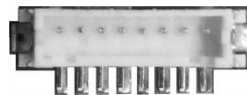
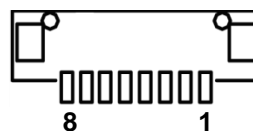
Pin	Signal
1	DPB_LANE0
2	GND
3	DPB_LANE0#
4	DPB_LANE1
5	GND
6	DPB_LANE1#
7	DPB_LANE2
8	GND
9	DPB_LANE2#
10	DPB_LANE3
11	GND
12	DPB_LANE3#
13	Detect Pin
14	GND
15	DPB_AUX
16	GND
17	DPB_AUX#
18	DPB_HPD
19	GND
20	+3.3V



### 2.5.5 Inverter Connector (CN5)

This is an 8-pin (pitch=1.25mm) connector fully compliant with Hirose DF13-8P-1.25V for inverter. We strongly recommend you to use the matching connector, DF13-8S-1.25C, 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

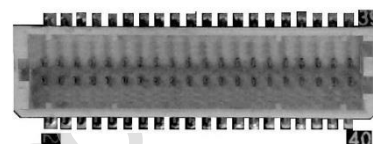
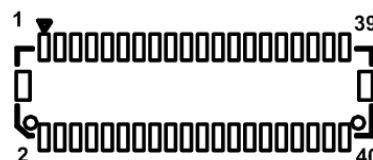


### 2.5.6 LVDS Connector (CN6)

This board has one 2x20-pin (pitch=1.0mm) connector for LVDS LCD. It is strongly recommended to use the matching connector, JST SHDR-40VS-B, for LVDS interface. Pin 1~6 VCCM can be set to +3.3V, +5V or +12V using JP1 (see section 2.4.1). **Please note that when making LVDS cable, the pin 2 of JST SHDR-40VS-B connector should match the pin 1 of CN1.**

#### 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	LVDS_HPD	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	LVDS_HPD	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	LVDS_HPD	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

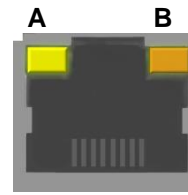
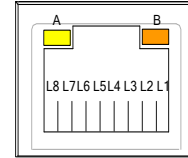
**24-bit dual channel**

Pin	Signal	Pin	Signal
1	VCCM	2	VCCM
3	VCCM	4	VCCM
5	VCCM	6	VCCM
7	N.C	8	N.C
9	LVDS_HPD	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

### 2.5.7 Ethernet Ports (CN7 and CN8)

The board has two RJ-45 Ethernet connectors; CN7 for LAN1 with Intel® i219LM and CN8 for LAN2 with Intel® i211AT. Ethernet connection can be established by plugging one end of the Ethernet cable into this connector and the other end (phone jack) to a 1000/100/10-Base-T hub.

Pin	1000 Base-T	100/10 Base-T	Description
L1	BI_DA+	TX+	Bidirectional or Transmit Data+
L2	BI_DA-	TX-	Bidirectional or Transmit Data-
L3	BI_DB+	RX+	Bidirectional or Receive Data+
L4	BI_DC+	N.C.	Bidirectional or Not Connected
L5	BI_DC-	N.C.	Bidirectional or Not Connected
L6	BI_DB-	RX-	Bidirectional or Receive Data-
L7	BI_DD+	N.C.	Bidirectional or Not Connected
L8	BI_DD-	N.C.	Bidirectional or Not Connected
A	Active Link LED (Yellow) Off: No link Blinking: Data activity detected		
B	Speed LED 1000: Orange 100/10: Green/OFF		

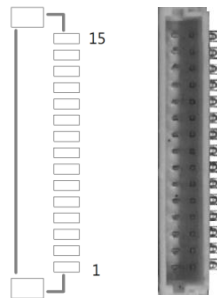


### 2.5.8 Ethernet Wafer Connector (CN9)

This is a wafer connector fully compliant with JST BM15B-SRSS-TB 15-pin (pitch=1.0mm) for LAN3 Ethernet port interface.

It is suggested to connect AX93287 IO board to have RJ-45 connector for Ethernet connection.

Pin	Signal
1	GND
2	LAN_LINK_ACT
3	LAN_VDD33
4	GND
5	MDI0+
6	MDI0-
7	MDI1+
8	MDI2+
9	MDI2-
10	MDI1-
11	MDI3+
12	MDI3-
13	GND
14	LAN_100_LED
15	LAN_1000_LED

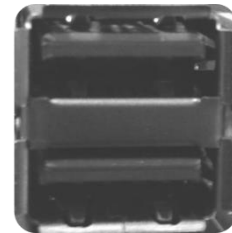
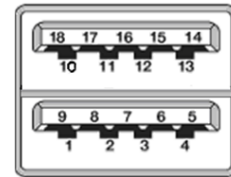




### 2.5.9 USB 3.0 Port (CN10)

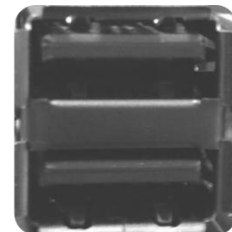
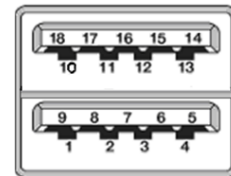
This is a Universal Serial Bus (compliant with USB 3.0) connector on the rear I/O for installing USB peripherals such as keyboard, mouse, scanner, etc.

Pin	Signal	Pin	Signal
1	USB_VCC (+5V power)	10	USB_VCC (+5V power)
2	USB_Data1-	11	USB_Data2-
3	USB_Data1+	12	USB_Data2+
4	GND	13	GND
5	SSRX1-	14	SSRX2-
6	SSRX1+	15	SSRX2+
7	GND	16	GND
8	SSTX1-	17	SSTX2-
9	SSTX1+	18	SSTX2+



### 2.5.10 USB 3.0/2.0 Port (CN11)

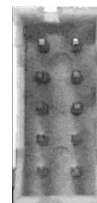
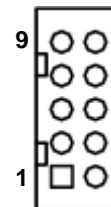
Pin	Signal	Pin	Signal
1	USB VCC (+5V level)	8	SSTX3-
2	USB_Data3-	9	SSTX3+
3	USB_Data3+	10	USB VCC (+5V level)
4	GND	11	USB_Data4-
5	SSRX3-	12	USB_Data4+
6	SSRX3+	13	GND
7	GND		



### 2.5.11 USB 2.0 Wafer Connector (CN12)

This is a 2x5-pin (pitch=2.0mm) wafer connector fully compliant with Hirose DF11-XDP-2DSA for installing versatile USB 2.0 compliant interface peripherals.

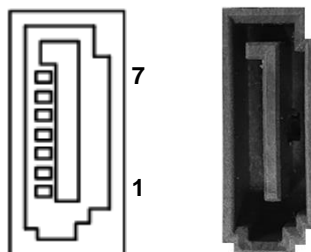
Pin	Signal	Pin	Signal
1	USB VCC (+5V level)	2	USB VCC (+5V level)
3	USB_Data6-	4	USB_Data5-
5	USB_Data6+	6	USB_Data5+
7	GND	8	GND
9	GND	10	GND



### 2.5.12 SATA Connectors (CN13 and CN14)

These Serial Advanced Technology Attachment (Serial ATA or SATA) connectors are for high-speed SATA interfaces. They are computer bus interfaces for connecting to devices such as hard disk drive(s).

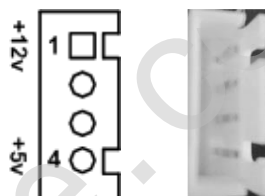
Pin	Signal
1	GND
2	SATA_TX+
3	SATA_TX-
4	GND
5	SATA_RX-
6	SATA_RX+
7	GND



### 2.5.13 SATA Power Connector (CN15)

The CN15 is a 1x4-pin (pitch=2.0mm) wafer and fully compliant with JST B4B-PH-K-S.

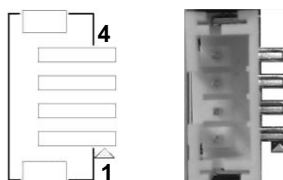
Pin	Signal
1	+12V level
2	GND
3	GND
4	+5V level



### 2.5.14 SATA Power Connector (CN16)

The CN16 is a 1x4-pin (pitch=2.0mm) wafer connector fully compliant with JST B4B-PH-K-S.

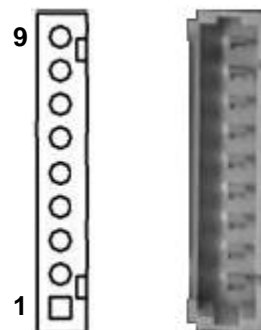
Pin	Signal
1	+12V level
2	GND
3	GND
4	+5V level



### 2.5.15 COM1 Wafer Connector (CN17)

This is a 1x9-pin (pitch=1.25mm) wafer fully compliant with MOLEX 53047 for serial port interface. The pin assignments of RS-232/422/485 are listed in table below. If you need COM1 to support RS-422 or RS-485, please refer to BIOS setting in section 4.4.

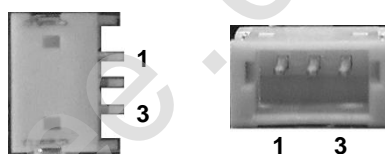
Pin	RS-232	RS-422	RS-485
1	DCD	TX-	Data-
2	DSR	No use	No use
3	RXD	TX+	Data+
4	RTS	No use	No use
5	TXD	RX+	No use
6	CTS	No use	No use
7	DTR	RX-	No use
8	RI	No use	No use
9	GND	No use	No use



### 2.5.16 Fan Connector (CN18)

This is a 1x3-pin (pitch=1.5mm) connector for fan interface. You can find fan speed option within BIOS Setup Utility if fan is installed. For further information, see BIOS Setup Utility: AdvancedH/W Monitor/PC Health Status (see section 4.4).

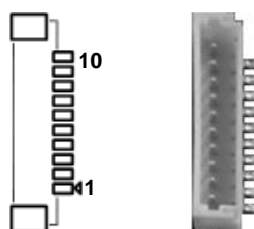
Pin	Signal
1	GND
2	+12V level
3	Fan speed feedback



### 2.5.17 Digital I/O Connector (CN19)

This is a 1x10-pin (pitch=1.0mm) wafer connector fully compliant with JST BM10B-SRSS-TB. This 8-channel digital I/O 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, please refer to Appendix B.

Pin	Signal	Pin	Signal
1	DIO 0	2	DIO 7
3	DIO 1	4	DIO 6
5	DIO 2	6	DIO 5
7	DIO 3	8	DIO 4
9	+5V	10	GND



### 2.5.18 Audio Wafer Connector (CN20)

This is an 8-pin (pitch=1.0mm) wafer connector fully compliant with JST BM08B-SRSS-TB for HD audio interface.

It is suggested to connect AX93A22 audio I/O board to have Mic in/Line in and Line out.

Pin	Signal
1	+5V_SBY
2	AZ_BIT_CLK
3	AZ_SDATA_IN
4	AZ_SDATA_OUT
5	AZ_SYNC
6	AZ_RST#
7	SLP_S3#
8	GND



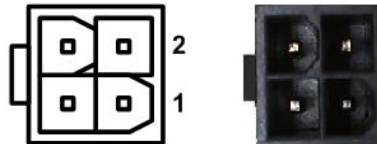
### 2.5.19 ATX Power Connector (ATX1)

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 ATX1 is a 2x2-pin power input interface. Follow the connector orientation to plug the external power supply. Properly press down power supply plug until it completely and firmly fits into this connector. Loose connection may cause system instability.

Note that ATX1 is co-layout with 2x2-pin right angle connector (ATX2).

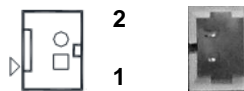
Pin	Signal
1	GND
2	GND
3	+12V
4	+12V



### 2.5.20 CMOS Battery Connector (BAT1)

This connector is for CMOS battery interface.

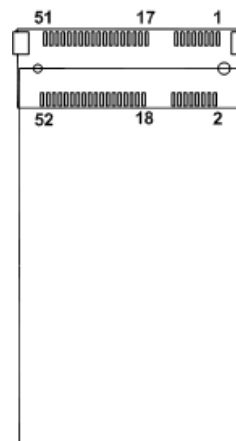
Pin	Signal
1	+3V
2	GND



### 2.5.21 Full-size PCI-Express Mini Card Connector (SCN1)

This is a full-size PCI-Express Mini Card connector complying with PCI-Express Mini Card Spec. V1.2. It supports either PCI-Express, USB 2.0 or SATA (mSATA).

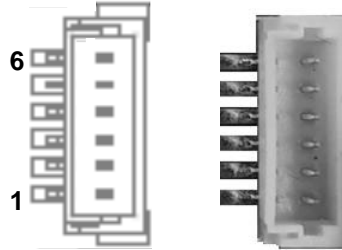
Pin	Signal	Pin	Signal
1	WAKE#	2	+3.3VSB
3	No use	4	GND
5	No use	6	+1.5V
7	CLKREQ#	8	No use
9	GND	10	No use
11	REFCLK-	12	No use
13	REFCLK+	14	No use
15	GND	16	No use
17	No use	18	GND
19	No use	20	W_DISABLE#
21	GND	22	PERST#
23	PCIE5_RX_DP0/ SATA2_RXN	24	+3.3VSB
25	PCIE5_RX_DN0/ SATA2_RXP	26	GND
27	GND	28	+1.5V
29	GND	30	SMB_CLK
31	PCIE5_TX_DN0/ SATA2_TXN	32	SMB_DATA
33	PCIE5_TX_DP0/ SATA2_TXP	34	GND
35	GND	36	USB_Data8-
37	GND	38	USB_Data8+
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



### 2.5.22 SIM Card Wafer Connector (SCN2)

The SCN2 is a 6-pin (pitch=1.0mm) wafer connector fully compliant with JST B6B-PH-K-S for SIM Card interface. AX93A19 SIM I/O board is suggested to use for SCN2 to have SIM card slot.

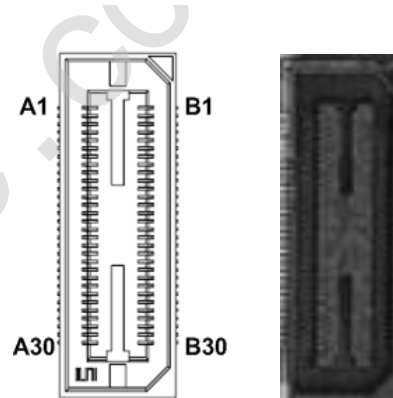
Pin	Signal
1	PWR
2	RST
3	CLK
4	I/O
5	VPP
6	GND



### 2.5.23 ZIO Expansion Connector (SCN3)

The board is equipped with SCN3 for connecting CPU board to a ZIO module. Ex.AX93262, AX93285,AX93291, AX93295 and AX93A20

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 TXP11
A11	PCI-E RXP11	B11	PCI-E TXN11
A12	PCI-E RXN11	B12	WAKE_N
A13	USBOC_N	B13	PCI-E CLKP
A14	USB_Data6+	B14	PCI-E CLKN
A15	USB_Data6-	B15	GND
A16	USB_Data7+	B16	CLK_24M
A17	USB_Data7-	B17	SERIRQ
A18	GND	B18	LAD0
A19	SSTX4+	B19	LAD1
A20	SSTX4-	B20	LAD2
A21	PLTRST_N	B21	LAD3
A22	SSRX4+	B22	L_FRAME
A23	SSRX4-	B23	GND
A24	GND	B24	DDI2_0P
A25	DDI2_1P	B25	DDI2_0N
A26	DDI2_1N	B26	DDI2_2P
A27	DDI2_3P	B27	DDI2_2N
A28	DDI2_3N	B28	GND
A29	GND	B29	DDI2_AUXP
A30	DDPC_HPD	B30	DDI2_AUXN



# Chapter 3

## Hardware Description

### 3.1 Microprocessors

The CAPA520 supports Intel® Core™ i7/ i5/ i3/ Celeron® processors, which enable your system to operate under 64-bit Windows® 10 environments. The system performance depends on the microprocessor. Make sure all correct settings are arranged for your installed microprocessor to prevent the CPU from damages.























































### 3.2 BIOS

The CAPA520 uses AMI Plug and Play BIOS with a single 256Mbit SPI Flash.

### 3.3 System Memory

The CAPA520 supports one 260-pin DDR4 SO-DIMM socket for maximum memory capacity up to 32GB DDR4 SDRAMs. The memory module comes in sizes of 1GB, 2GB, 4GB , 8GB , 16GB, and 32GB.
























### 3.4 I/O Port Address Map

▼	 Input/output (IO)
	[0000000000000000 - 000000000000CF7] PCI Express Root Complex
	[0000000000000020 - 0000000000000021] Programmable interrupt controller
	[0000000000000024 - 0000000000000025] Programmable interrupt controller
	[0000000000000028 - 0000000000000029] Programmable interrupt controller
	[000000000000002C - 000000000000002D] Programmable interrupt controller
	[000000000000002E - 000000000000002F] Motherboard resources
	[0000000000000030 - 0000000000000031] Programmable interrupt controller
	[0000000000000034 - 0000000000000035] Programmable interrupt controller
	[0000000000000038 - 0000000000000039] Programmable interrupt controller
	[000000000000003C - 000000000000003D] Programmable interrupt controller
	[0000000000000040 - 0000000000000043] System timer
	[000000000000004E - 000000000000004F] Motherboard resources
	[0000000000000050 - 0000000000000053] System timer
	[0000000000000061 - 0000000000000061] Motherboard resources
	[0000000000000063 - 0000000000000063] Motherboard resources
	[0000000000000065 - 0000000000000065] Motherboard resources
	[0000000000000067 - 0000000000000067] Motherboard resources
	[0000000000000070 - 0000000000000070] Motherboard resources
	[0000000000000080 - 0000000000000080] Motherboard resources
	[0000000000000092 - 0000000000000092] Motherboard resources
	[00000000000000A0 - 00000000000000A1] Programmable interrupt controller
	[00000000000000A4 - 00000000000000A5] Programmable interrupt controller
	[00000000000000A8 - 00000000000000A9] Programmable interrupt controller
	[00000000000000AC - 00000000000000AD] Programmable interrupt controller
	[00000000000000B0 - 00000000000000B1] Programmable interrupt controller
	[00000000000000B2 - 00000000000000B3] Motherboard resources
	[00000000000000B4 - 00000000000000B5] Programmable interrupt controller
	[00000000000000B8 - 00000000000000B9] Programmable interrupt controller
	[00000000000000BC - 00000000000000BD] Programmable interrupt controller
	[00000000000000F0 - 00000000000000F0] Numeric data processor
	[0000000000000240 - 0000000000000247] Communications Port (COM2)
	[0000000000000248 - 000000000000024F] Communications Port (COM3)
	[0000000000000250 - 0000000000000257] Communications Port (COM4)
	[0000000000000258 - 000000000000025F] Communications Port (COM5)
	[00000000000003F8 - 00000000000003FF] Communications Port (COM1)
	[00000000000004D0 - 00000000000004D1] Programmable interrupt controller
	[0000000000000680 - 000000000000069F] Motherboard resources
	[0000000000000A00 - 0000000000000A0F] Motherboard resources
	[0000000000000A10 - 0000000000000A1F] Motherboard resources
	[0000000000000A20 - 0000000000000A2F] Motherboard resources
	[0000000000000D00 - 0000000000000FFF] PCI Express Root Complex
	[000000000000164E - 000000000000164F] Motherboard resources
	[0000000000001800 - 00000000000018FE] Motherboard resources
	[0000000000001854 - 0000000000001857] Motherboard resources
	[0000000000002000 - 00000000000020FE] Motherboard resources
	[0000000000003000 - 0000000000003FFF] Intel(R) PCI Express Root Port #7 - A33E
	[0000000000004000 - 0000000000004FFF] Intel(R) PCI Express Root Port #6 - A33D
	[0000000000005000 - 000000000000503F] Intel(R) UHD Graphics 630
	[0000000000005060 - 000000000000507F] Standard SATA AHCI Controller
	[0000000000005080 - 0000000000005083] Standard SATA AHCI Controller
	[0000000000005090 - 0000000000005097] Standard SATA AHCI Controller
	[000000000000EFA0 - 000000000000EFBF] Intel(R) SMBus - A323
	[000000000000FFF8 - 000000000000FFFF] Intel(R) Active Management Technology - SOL (COM6)



### 3.5 Interrupt Controller (IRQ) Map

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







































































































- ▼  Interrupt request (IRQ)
  -  (ISA) 0x00000000 (00) System timer
  -  (ISA) 0x00000004 (04) Communications Port (COM1)
  -  (ISA) 0x0000000A (10) Communications Port (COM2)
  -  (ISA) 0x0000000A (10) Communications Port (COM3)
  -  (ISA) 0x0000000A (10) Communications Port (COM4)
  -  (ISA) 0x0000000A (10) Communications Port (COM5)
  -  (ISA) 0x0000000D (13) Numeric data processor
  -  (ISA) 0x0000000E (14) Intel(R) Serial IO GPIO Host Controller - INT3450
  -  (ISA) 0x00000037 (55) Microsoft ACPI-Compliant System
  -  (ISA) 0x00000038 (56) Microsoft ACPI-Compliant System
  -  (ISA) 0x00000039 (57) Microsoft ACPI-Compliant System
  -  (ISA) 0x0000003A (58) Microsoft ACPI-Compliant System
  -  (ISA) 0x0000003B (59) Microsoft ACPI-Compliant System
  -  (ISA) 0x0000003C (60) Microsoft ACPI-Compliant System
  -  (ISA) 0x0000003D (61) Microsoft ACPI-Compliant System
  -  (ISA) 0x0000003E (62) Microsoft ACPI-Compliant System
  -  (ISA) 0x0000003F (63) Microsoft ACPI-Compliant System
  -  (ISA) 0x00000040 (64) Microsoft ACPI-Compliant System
  -  (ISA) 0x00000041 (65) Microsoft ACPI-Compliant System
  -  (ISA) 0x00000042 (66) Microsoft ACPI-Compliant System
  -  (ISA) 0x00000043 (67) Microsoft ACPI-Compliant System
  -  (ISA) 0x00000044 (68) Microsoft ACPI-Compliant System

















 (ISA) 0x000001AA (426)	Microsoft ACPI-Compliant System	 (ISA) 0x000001DD (477)	Microsoft ACPI-Compliant System
 (ISA) 0x000001AB (427)	Microsoft ACPI-Compliant System	 (ISA) 0x000001DE (478)	Microsoft ACPI-Compliant System
 (ISA) 0x000001AC (428)	Microsoft ACPI-Compliant System	 (ISA) 0x000001DF (479)	Microsoft ACPI-Compliant System
 (ISA) 0x000001AD (429)	Microsoft ACPI-Compliant System	 (ISA) 0x000001E0 (480)	Microsoft ACPI-Compliant System
 (ISA) 0x000001AE (430)	Microsoft ACPI-Compliant System	 (ISA) 0x000001E1 (481)	Microsoft ACPI-Compliant System
 (ISA) 0x000001AF (431)	Microsoft ACPI-Compliant System	 (ISA) 0x000001E2 (482)	Microsoft ACPI-Compliant System
 (ISA) 0x000001B0 (432)	Microsoft ACPI-Compliant System	 (ISA) 0x000001E3 (483)	Microsoft ACPI-Compliant System
 (ISA) 0x000001B1 (433)	Microsoft ACPI-Compliant System	 (ISA) 0x000001E4 (484)	Microsoft ACPI-Compliant System
 (ISA) 0x000001B2 (434)	Microsoft ACPI-Compliant System	 (ISA) 0x000001E5 (485)	Microsoft ACPI-Compliant System
 (ISA) 0x000001B3 (435)	Microsoft ACPI-Compliant System	 (ISA) 0x000001E6 (486)	Microsoft ACPI-Compliant System
 (ISA) 0x000001B4 (436)	Microsoft ACPI-Compliant System	 (ISA) 0x000001E7 (487)	Microsoft ACPI-Compliant System
 (ISA) 0x000001B5 (437)	Microsoft ACPI-Compliant System	 (ISA) 0x000001E8 (488)	Microsoft ACPI-Compliant System
 (ISA) 0x000001B6 (438)	Microsoft ACPI-Compliant System	 (ISA) 0x000001E9 (489)	Microsoft ACPI-Compliant System
 (ISA) 0x000001B7 (439)	Microsoft ACPI-Compliant System	 (ISA) 0x000001EA (490)	Microsoft ACPI-Compliant System
 (ISA) 0x000001B8 (440)	Microsoft ACPI-Compliant System	 (ISA) 0x000001EB (491)	Microsoft ACPI-Compliant System
 (ISA) 0x000001B9 (441)	Microsoft ACPI-Compliant System	 (ISA) 0x000001EC (492)	Microsoft ACPI-Compliant System
 (ISA) 0x000001BA (442)	Microsoft ACPI-Compliant System	 (ISA) 0x000001ED (493)	Microsoft ACPI-Compliant System
 (ISA) 0x000001BB (443)	Microsoft ACPI-Compliant System	 (ISA) 0x000001EE (494)	Microsoft ACPI-Compliant System
 (ISA) 0x000001BC (444)	Microsoft ACPI-Compliant System	 (ISA) 0x000001EF (495)	Microsoft ACPI-Compliant System
 (ISA) 0x000001BD (445)	Microsoft ACPI-Compliant System	 (ISA) 0x000001F0 (496)	Microsoft ACPI-Compliant System
 (ISA) 0x000001BE (446)	Microsoft ACPI-Compliant System	 (ISA) 0x000001F1 (497)	Microsoft ACPI-Compliant System
 (ISA) 0x000001BF (447)	Microsoft ACPI-Compliant System	 (ISA) 0x000001F2 (498)	Microsoft ACPI-Compliant System
 (ISA) 0x000001C0 (448)	Microsoft ACPI-Compliant System	 (ISA) 0x000001F3 (499)	Microsoft ACPI-Compliant System
 (ISA) 0x000001C1 (449)	Microsoft ACPI-Compliant System	 (ISA) 0x000001F4 (500)	Microsoft ACPI-Compliant System
 (ISA) 0x000001C2 (450)	Microsoft ACPI-Compliant System	 (ISA) 0x000001F5 (501)	Microsoft ACPI-Compliant System
 (ISA) 0x000001C3 (451)	Microsoft ACPI-Compliant System	 (ISA) 0x000001F6 (502)	Microsoft ACPI-Compliant System
 (ISA) 0x000001C4 (452)	Microsoft ACPI-Compliant System	 (ISA) 0x000001F7 (503)	Microsoft ACPI-Compliant System
 (ISA) 0x000001C5 (453)	Microsoft ACPI-Compliant System	 (ISA) 0x000001F8 (504)	Microsoft ACPI-Compliant System
 (ISA) 0x000001C6 (454)	Microsoft ACPI-Compliant System	 (ISA) 0x000001F9 (505)	Microsoft ACPI-Compliant System
 (ISA) 0x000001C7 (455)	Microsoft ACPI-Compliant System	 (ISA) 0x000001FA (506)	Microsoft ACPI-Compliant System
 (ISA) 0x000001C8 (456)	Microsoft ACPI-Compliant System	 (ISA) 0x000001FB (507)	Microsoft ACPI-Compliant System
 (ISA) 0x000001C9 (457)	Microsoft ACPI-Compliant System	 (ISA) 0x000001FC (508)	Microsoft ACPI-Compliant System
 (ISA) 0x000001CA (458)	Microsoft ACPI-Compliant System	 (ISA) 0x000001FD (509)	Microsoft ACPI-Compliant System
 (ISA) 0x000001CB (459)	Microsoft ACPI-Compliant System	 (ISA) 0x000001FE (510)	Microsoft ACPI-Compliant System
 (ISA) 0x000001CC (460)	Microsoft ACPI-Compliant System	 (ISA) 0x000001FF (511)	Microsoft ACPI-Compliant System
 (ISA) 0x000001CD (461)	Microsoft ACPI-Compliant System	 (PCI) 0x00000010 (16)	High Definition Audio Controller
 (ISA) 0x000001CE (462)	Microsoft ACPI-Compliant System	 (PCI) 0x00000010 (16)	Intel(R) Serial IO I2C Host Controller - A368
 (ISA) 0x000001CF (463)	Microsoft ACPI-Compliant System	 (PCI) 0x00000011 (17)	Intel(R) Serial IO I2C Host Controller - A369
 (ISA) 0x000001D0 (464)	Microsoft ACPI-Compliant System	 (PCI) 0x00000013 (19)	Intel(R) Active Management Technology - SOL (COM6)
 (ISA) 0x000001D1 (465)	Microsoft ACPI-Compliant System	 (PCI) 0xFFFFFEEB (-21)	Intel(R) Management Engine Interface
 (ISA) 0x000001D2 (466)	Microsoft ACPI-Compliant System	 (PCI) 0xFFFFFEFC (-20)	Intel(R) I211 Gigabit Network Connection
 (ISA) 0x000001D3 (467)	Microsoft ACPI-Compliant System	 (PCI) 0xFFFFFEFD (-19)	Intel(R) I211 Gigabit Network Connection
 (ISA) 0x000001D4 (468)	Microsoft ACPI-Compliant System	 (PCI) 0xFFFFFEFE (-18)	Intel(R) I211 Gigabit Network Connection
 (ISA) 0x000001D5 (469)	Microsoft ACPI-Compliant System	 (PCI) 0xFFFFFEFF (-17)	Intel(R) I211 Gigabit Network Connection
 (ISA) 0x000001D6 (470)	Microsoft ACPI-Compliant System	 (PCI) 0xFFFFFFF0 (-16)	Intel(R) I211 Gigabit Network Connection
 (ISA) 0x000001D7 (471)	Microsoft ACPI-Compliant System	 (PCI) 0xFFFFFFF1 (-15)	Intel(R) I211 Gigabit Network Connection
 (ISA) 0x000001D8 (472)	Microsoft ACPI-Compliant System	 (PCI) 0xFFFFFFF2 (-14)	Intel(R) I211 Gigabit Network Connection #2
 (ISA) 0x000001D9 (473)	Microsoft ACPI-Compliant System	 (PCI) 0xFFFFFFF3 (-13)	Intel(R) I211 Gigabit Network Connection #2
 (ISA) 0x000001DA (474)	Microsoft ACPI-Compliant System	 (PCI) 0xFFFFFFF4 (-12)	Intel(R) I211 Gigabit Network Connection #2
 (ISA) 0x000001DB (475)	Microsoft ACPI-Compliant System	 (PCI) 0xFFFFFFF5 (-11)	Intel(R) I211 Gigabit Network Connection #2
 (ISA) 0x000001DC (476)	Microsoft ACPI-Compliant System	 (PCI) 0xFFFFFFF6 (-10)	Intel(R) I211 Gigabit Network Connection #2

-  (PCI) 0xFFFFFFFF7 (-9) Intel(R) Management Engine Interface
-  (PCI) 0xFFFFFFFF8 (-8) Intel(R) UHD Graphics 630
-  (PCI) 0xFFFFFFFF9 (-7) Intel(R) USB 3.1 eXtensible Host Controller - 1.10 (Microsoft)
-  (PCI) 0xFFFFFFFFFA (-6) Standard SATA AHCI Controller
-  (PCI) 0xFFFFFFFFFB (-5) Intel(R) PCI Express Root Port #8 - A33F
-  (PCI) 0xFFFFFFFFFC (-4) Intel(R) PCIe Controller (x16) - 1901
-  (PCI) 0xFFFFFFFFFD (-3) Intel(R) PCI Express Root Port #6 - A33D
-  (PCI) 0xFFFFFFFFFE (-2) Intel(R) PCI Express Root Port #7 - A33E

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## 3.6 Memory Map

The memory mapping list is shown as follows:

Address Range	Device Name
[0000000000A0000 - 0000000000BFFFF]	PCI Express Root Complex
[0000000000E0000 - 0000000000E3FFF]	PCI Express Root Complex
[0000000000E4000 - 0000000000E7FFF]	PCI Express Root Complex
[0000000000E8000 - 0000000000EBFFF]	PCI Express Root Complex
[0000000000EC000 - 0000000000EFFFF]	PCI Express Root Complex
[0000000000F0000 - 0000000000FFFFFF]	PCI Express Root Complex
[0000000040000000 - 00000000403FFFF]	Motherboard resources
[0000000090000000 - 000000009FFFFFF]	Intel(R) UHD Graphics 630
[0000000090000000 - 00000000DFFFFFF]	PCI Express Root Complex
[00000000A0000000 - 00000000A0FFFFFF]	Intel(R) UHD Graphics 630
[00000000A1100000 - 00000000A11FFFF]	Intel(R) PCI Express Root Port #7 - A33E
[00000000A11DC000 - 00000000A11DFFFF]	Intel(R) I211 Gigabit Network Connection #2
[00000000A11E0000 - 00000000A11FFFF]	Intel(R) I211 Gigabit Network Connection #2
[00000000A1200000 - 00000000A12FFFF]	Intel(R) PCI Express Root Port #6 - A33D
[00000000A12DC000 - 00000000A12DFFFF]	Intel(R) I211 Gigabit Network Connection
[00000000A12E0000 - 00000000A12FFFF]	Intel(R) I211 Gigabit Network Connection
[00000000A1300000 - 00000000A131FFFF]	Intel(R) Ethernet Connection (7) I219-LM
[00000000A1320000 - 00000000A132FFFF]	Intel(R) USB 3.1 eXtensible Host Controller - 1.10 (Microsoft)
[00000000A1334000 - 00000000A1335FFF]	Standard SATA AHCI Controller
[00000000A1338000 - 00000000A13380FF]	Intel(R) SMBus - A323
[00000000A133A000 - 00000000A133A7FF]	Standard SATA AHCI Controller
[00000000A133B000 - 00000000A133B0FF]	Standard SATA AHCI Controller
[00000000A1341000 - 00000000A1341FFF]	Intel(R) Thermal Subsystem - A379
[00000000E0000000 - 00000000EFFFFFF]	Motherboard resources
[00000000FC800000 - 00000000FE7FFFF]	PCI Express Root Complex
[00000000FD000000 - 00000000FD69FFF]	Motherboard resources
[00000000FD6A0000 - 00000000FD6AFFFF]	Intel(R) Serial IO GPIO Host Controller - INT3450
[00000000FD6B0000 - 00000000FD6BFFFF]	Intel(R) Serial IO GPIO Host Controller - INT3450
[00000000FD6C0000 - 00000000FD6CFFFF]	Motherboard resources
[00000000FD6D0000 - 00000000FD6DFFFF]	Intel(R) Serial IO GPIO Host Controller - INT3450
[00000000FD6E0000 - 00000000FD6EFFFF]	Intel(R) Serial IO GPIO Host Controller - INT3450
[00000000FD6F0000 - 00000000FD6FFFF]	Motherboard resources
[00000000FE000000 - 00000000FE01FFF]	Motherboard resources
[00000000FE010000 - 00000000FE010FFF]	Intel(R) SPI (flash) Controller - A324
[00000000A1320000 - 00000000A132FFFF]	Intel(R) USB 3.1 eXtensible Host Controller - 1.10 (Microsoft)
[00000000A1334000 - 00000000A1335FFF]	Standard SATA AHCI Controller
[00000000A1338000 - 00000000A13380FF]	Intel(R) SMBus - A323
[00000000A133A000 - 00000000A133A7FF]	Standard SATA AHCI Controller
[00000000A133B000 - 00000000A133B0FF]	Standard SATA AHCI Controller
[00000000A1341000 - 00000000A1341FFF]	Intel(R) Thermal Subsystem - A379
[00000000E0000000 - 00000000EFFFFFF]	Motherboard resources
[00000000FC800000 - 00000000FE7FFFF]	PCI Express Root Complex
[00000000FD000000 - 00000000FD69FFF]	Motherboard resources
[00000000FD6A0000 - 00000000FD6AFFFF]	Intel(R) Serial IO GPIO Host Controller - INT3450
[00000000FD6B0000 - 00000000FD6BFFFF]	Intel(R) Serial IO GPIO Host Controller - INT3450
[00000000FD6C0000 - 00000000FD6CFFFF]	Motherboard resources
[00000000FD6D0000 - 00000000FD6DFFFF]	Intel(R) Serial IO GPIO Host Controller - INT3450
[00000000FD6E0000 - 00000000FD6EFFFF]	Intel(R) Serial IO GPIO Host Controller - INT3450
[00000000FD6F0000 - 00000000FD6FFFF]	Motherboard resources
[00000000FE000000 - 00000000FE01FFF]	Motherboard resources
[00000000FE010000 - 00000000FE010FFF]	Intel(R) SPI (flash) Controller - A324
[00000000FE0F8000 - 00000000FE0F8FFF]	Intel(R) Active Management Technology - SOL (COM6)
[00000000FE0F9000 - 00000000FE0F9FFF]	Intel(R) Management Engine Interface
[00000000FE0FA000 - 00000000FE0FAFFF]	Intel(R) Serial IO I2C Host Controller - A369
[00000000FE0FB000 - 00000000FE0FBFFF]	Intel(R) Serial IO I2C Host Controller - A368
[00000000FE0FC000 - 00000000FE0FFFF]	High Definition Audio Controller
[00000000FE100000 - 00000000FE11FFF]	High Definition Audio Controller
[00000000FE200000 - 00000000FE7FFFF]	Motherboard resources
[00000000FED00000 - 00000000FED003FF]	High precision event timer
[00000000FED10000 - 00000000FED17FFF]	Motherboard resources
[00000000FED18000 - 00000000FED18FFF]	Motherboard resources
[00000000FED19000 - 00000000FED19FFF]	Motherboard resources
[00000000FED20000 - 00000000FED33FFF]	Motherboard resources
[00000000FED40000 - 00000000FED44FFF]	Trusted Platform Module 2.0
[00000000FED45000 - 00000000FED8FFFF]	Motherboard resources
[00000000FED90000 - 00000000FED93FFF]	Motherboard resources
[00000000FEE00000 - 00000000FEFFFFFF]	Motherboard resources
[00000000FF000000 - 00000000FFFFFFFFF]	Motherboard resources

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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 SW1 (see section 2.4.2).*

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.



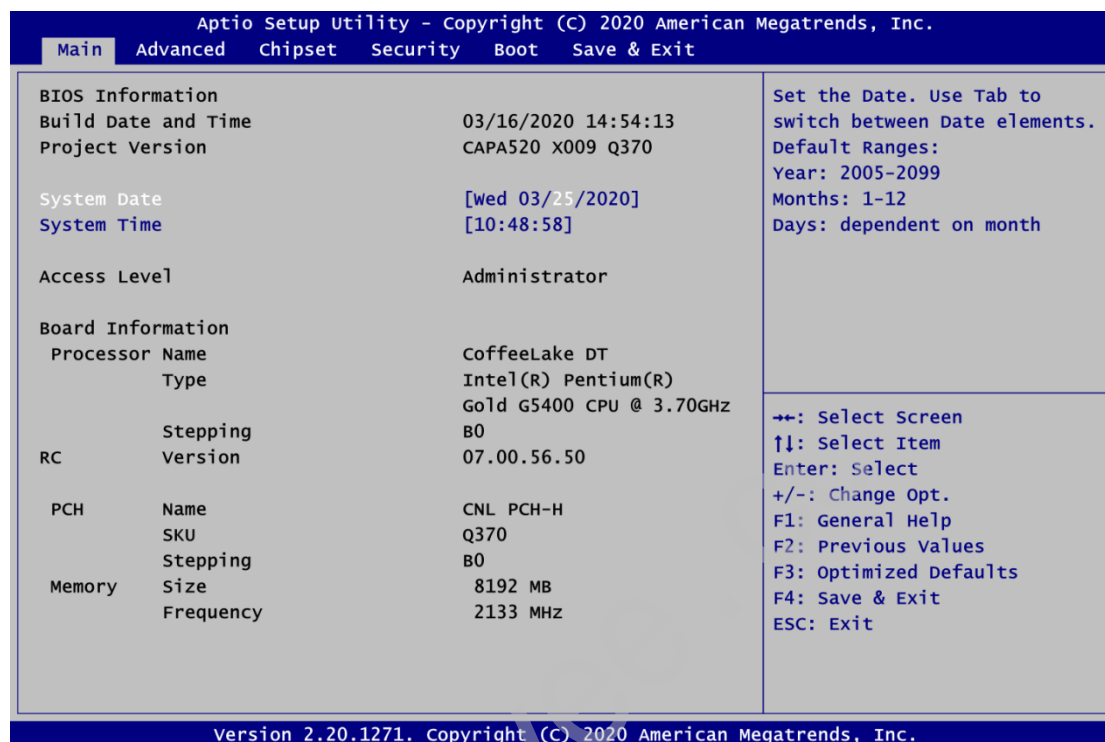
**Note**

*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.



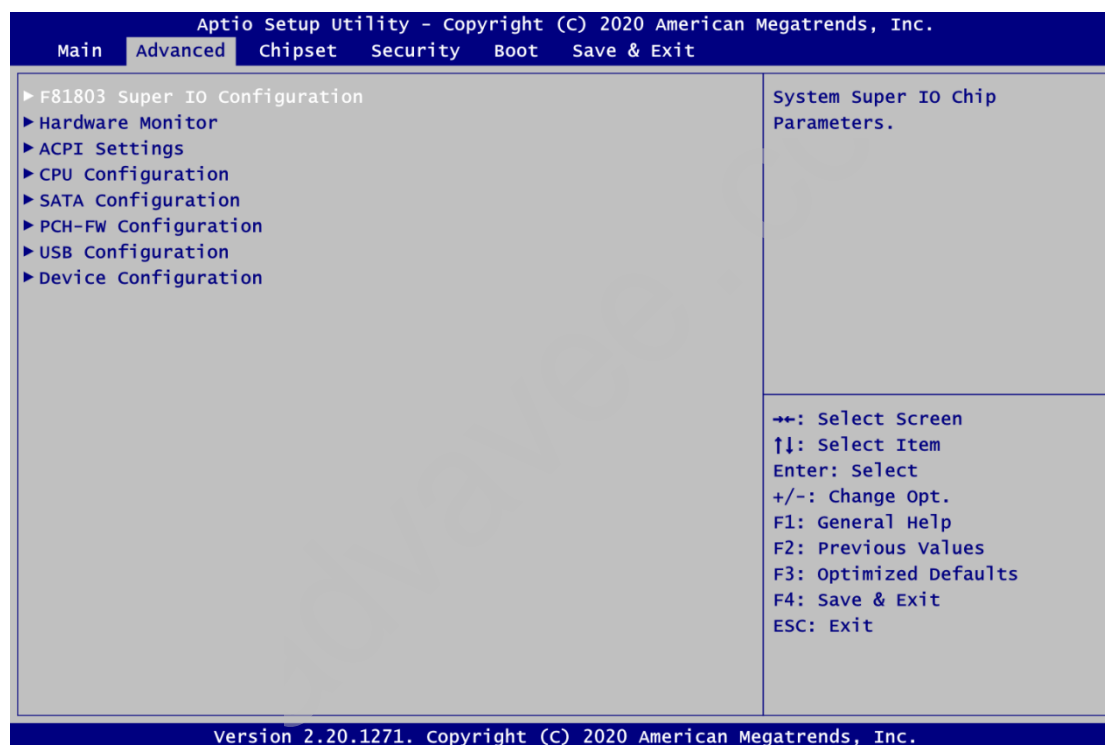
- BIOS Information**  
 Display BIOS information.
- System Date/Time**  
 Use this option to change the system time and date. Highlight System Time or System Date using the <Arrow> keys. Enter new values through the keyboard. Press the <Tab> key or the <Arrow> keys to move between fields. The date must 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:

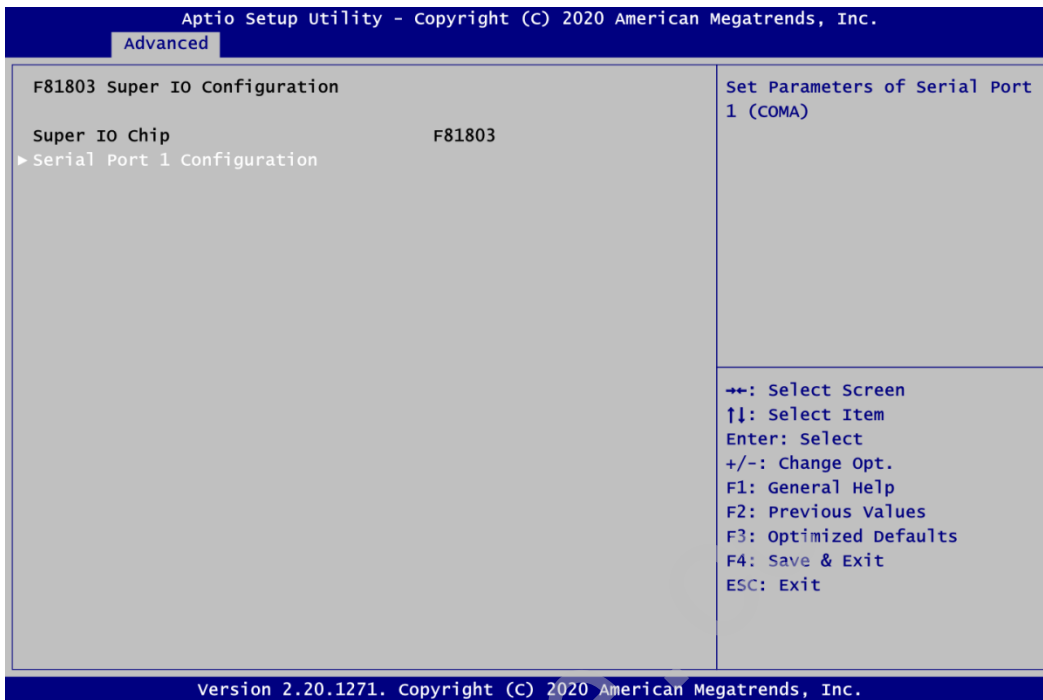
- ▶ F81803 Super IO Configuration
- ▶ Hardware Monitor
- ▶ ACPI Settings
- ▶ CPU Configuration
- ▶ SATA Configuration
- ▶ PCH-FW Configuration
- ▶ USB Configuration
- ▶ Device Configuration

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



- **F81803 Super IO Configuration**

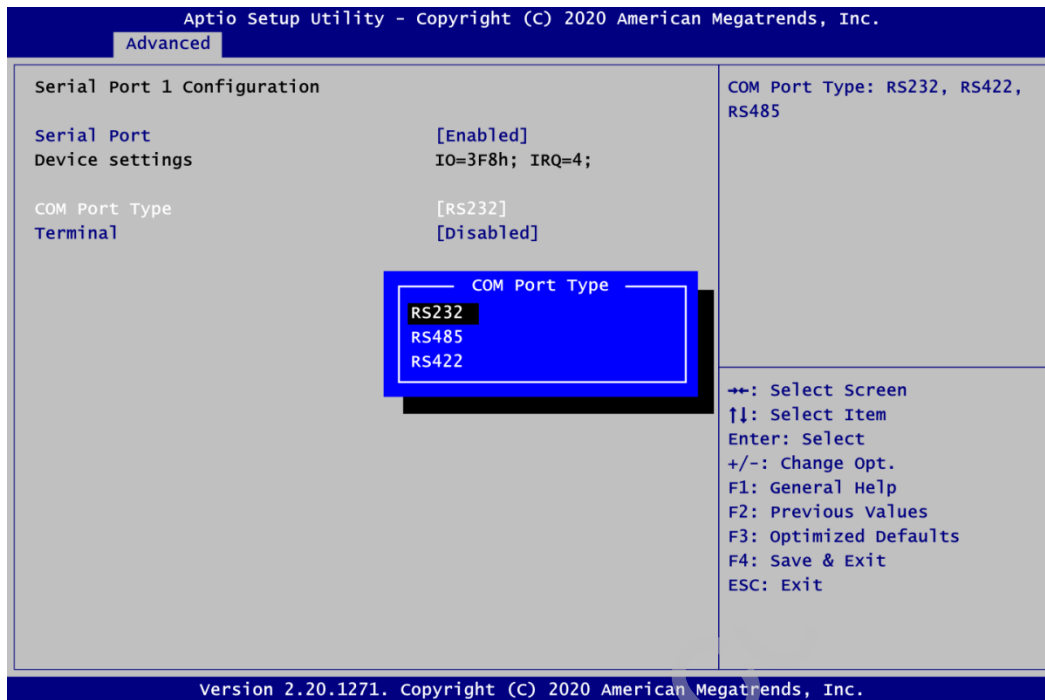
You can use this screen to select options for F81803 Super IO configuration, and change the value of the selected option. A description of the selected item appears on the right side of the screen. For items marked with "►", please press <Enter> for more options.



#### **Serial Port 1 Configuration**

Use this item to set parameters related to serial port 1 (see section 2.5.14) on CAPA520.

- **Serial Port 1 Configuration**



**Serial Port**

Enable or disable serial port 1 on CAPA520. The optimal setting for onboard F81803 SIO address is 3F8h and for interrupt request address is IRQ4.

**COM Port Type**

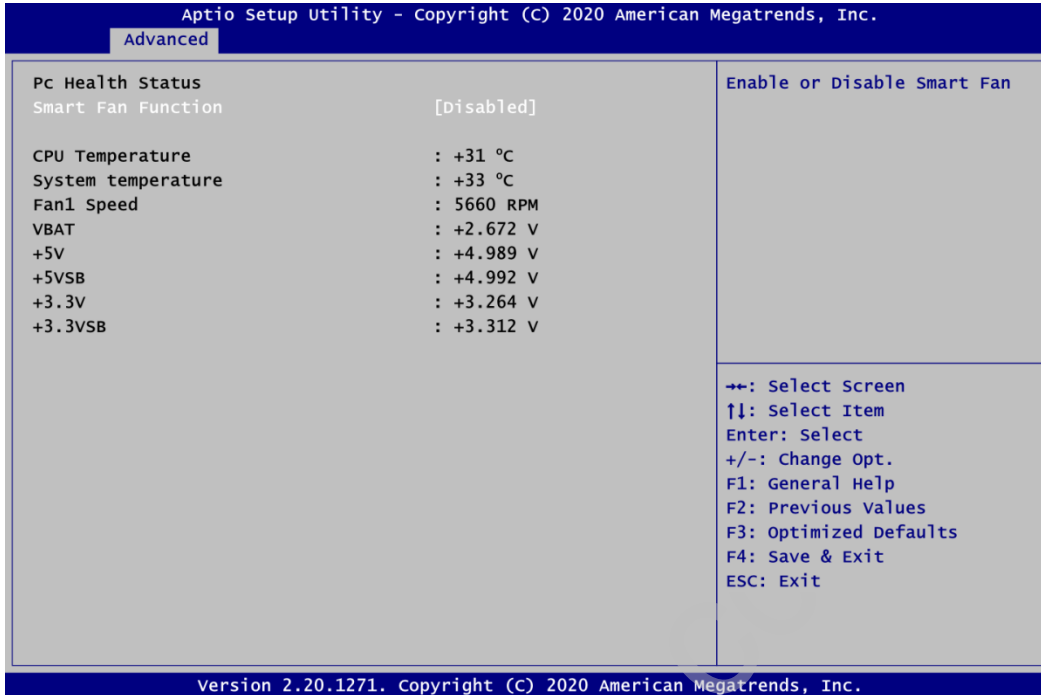
Use this item to set RS-232/422/485 communication mode.

**Terminal Mode**

Enable the RS-422/485 termination resistor to enhance the signal.

● **Hardware Monitor**

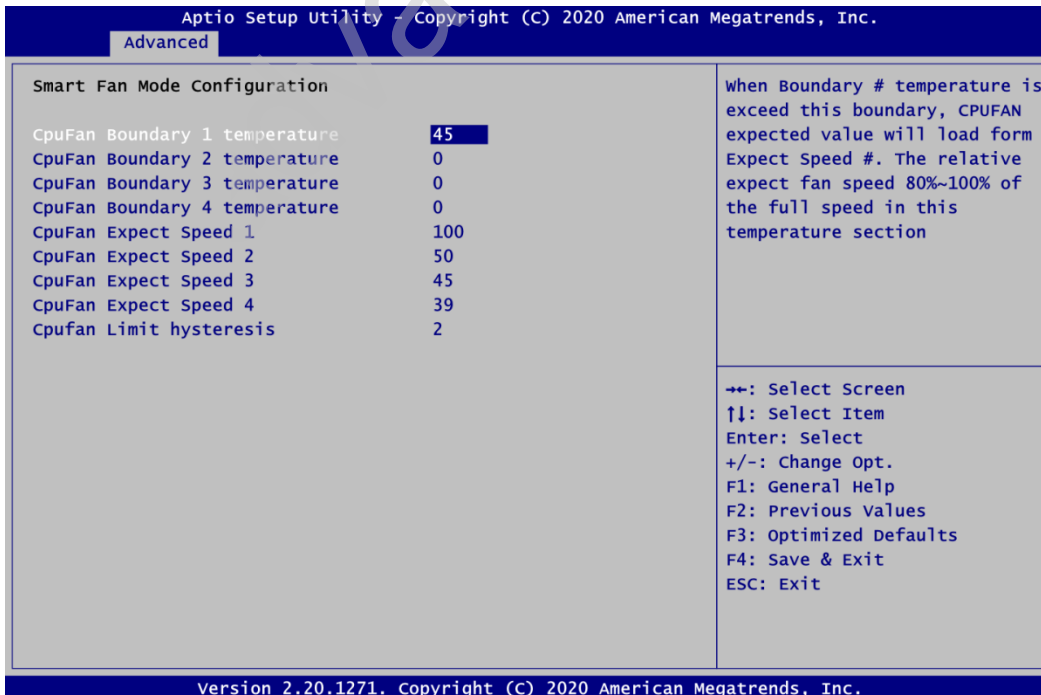
This screen monitors hardware health status.



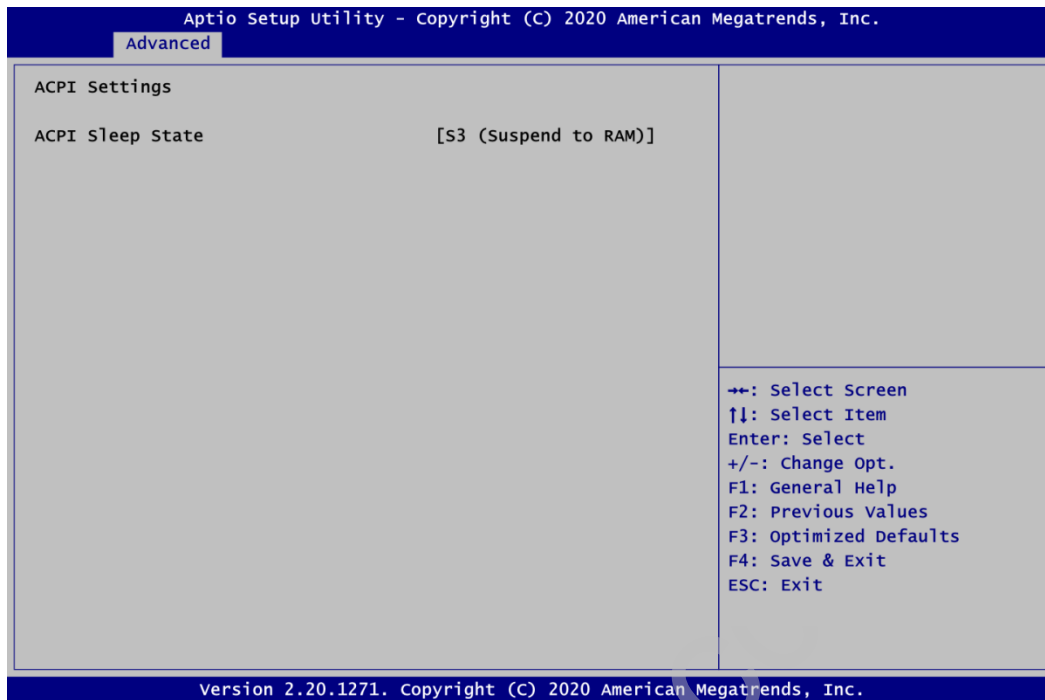
This screen displays the temperature of system and CPU, fan speed in RPM and system voltages (+3.3VSB/+5VSB and +3.3V/+5V).

**Smart Fan Function**

Enable or disable Smart Fan control function. Once enabled, you will be able to go further for Smart Fan Mode Configuration, see image below.



- **ACPI Settings**



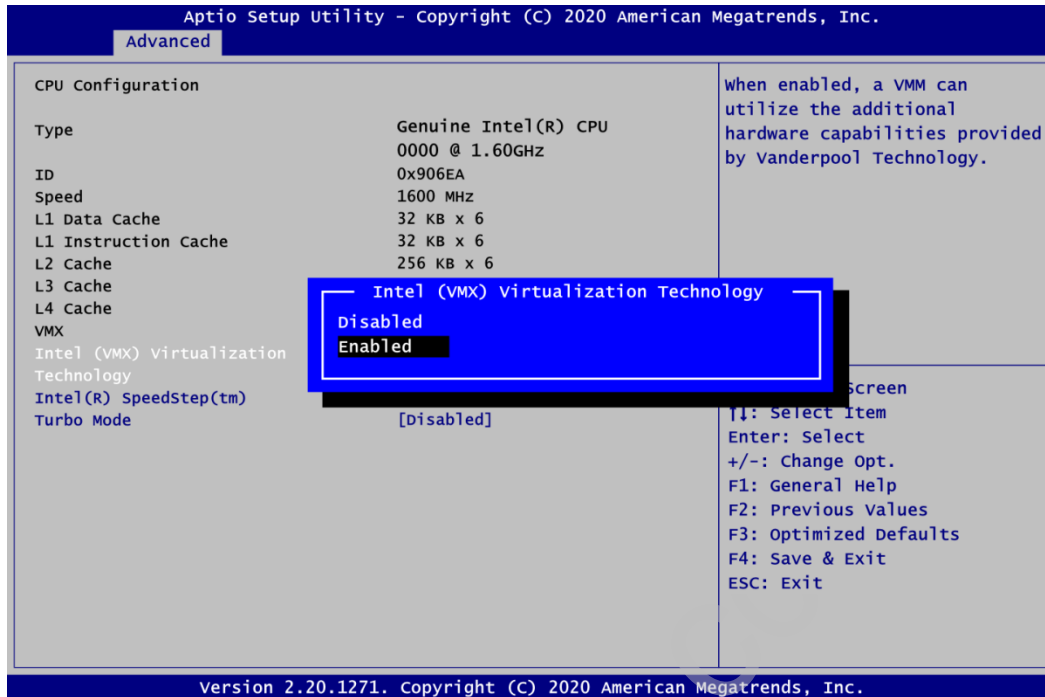
**ACPI Sleep State**

Select S3 (Suspend to RAM) as ACPI sleep state the system will enter when suspend button is pressed.



- **CPU Configuration**

This screen shows the CPU Configuration.



#### Intel (VMX) 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 single computer system to work as several virtual systems.

#### Intel® SpeedStep™

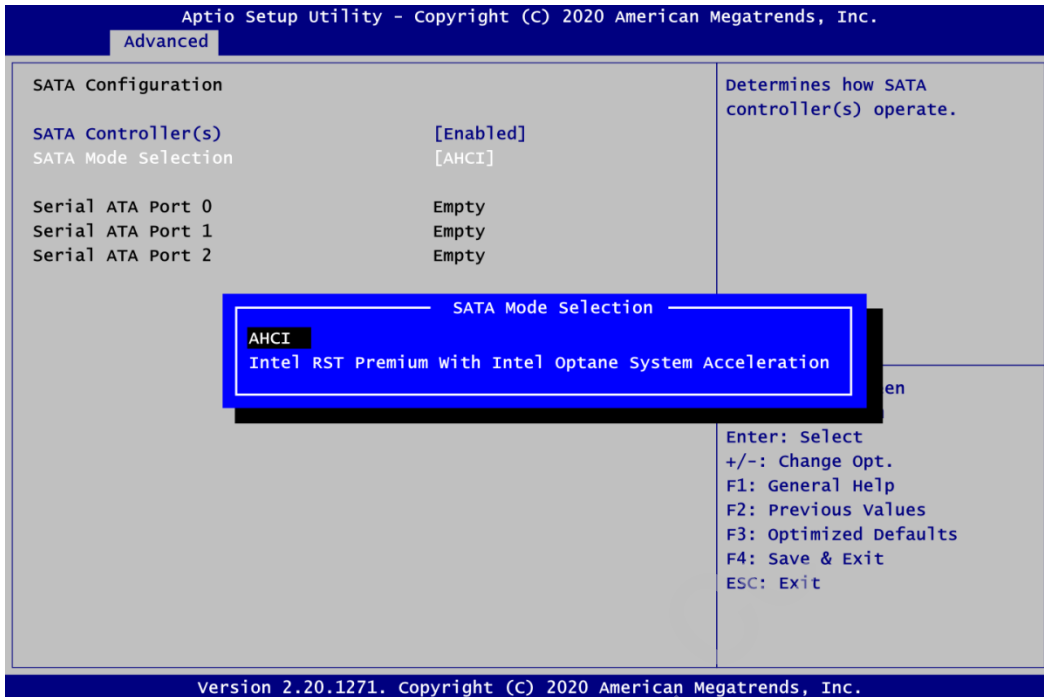
The processor will control the frequency dynamically.

#### Turbo Mode

Enable or disable processor Turbo Mode. The processor can run up to maximum turbo frequency when the system loading becomes higher.

- **SATA Configuration**

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



**SATA Controller(s)**

Enable or disable the SATA Controller feature. The default is Enabled.

**SATA Mode Selection**

Determine how SATA controller(s) operate. Operation mode options are AHCI (Advanced Host Controller Interface) and Intel RST Premium with Intel Optane system Acceleration.

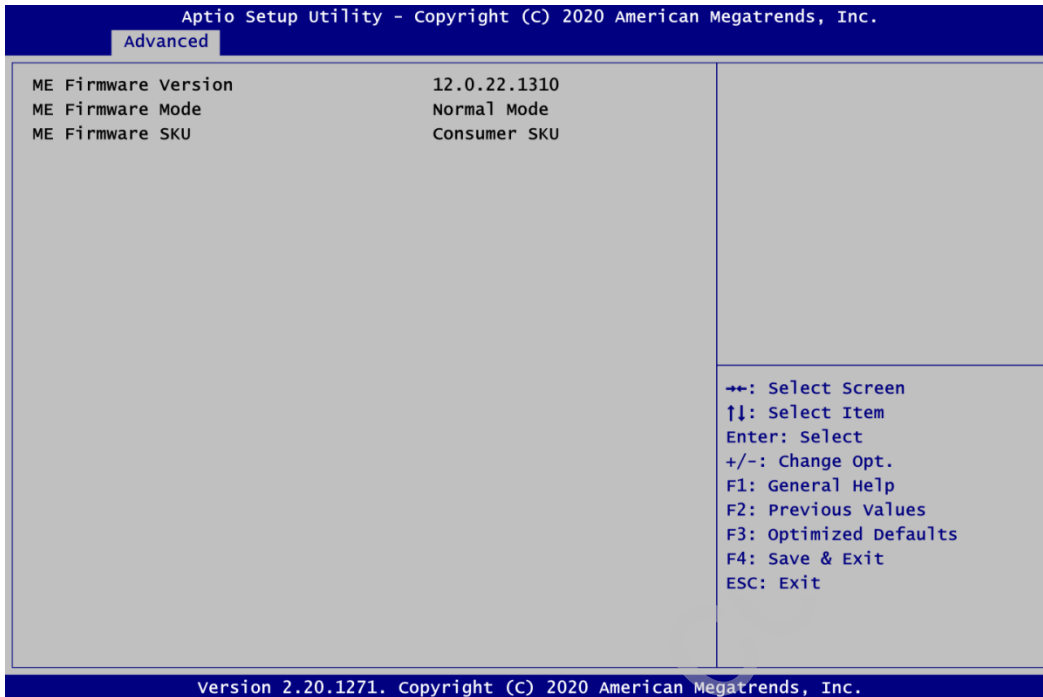


Note

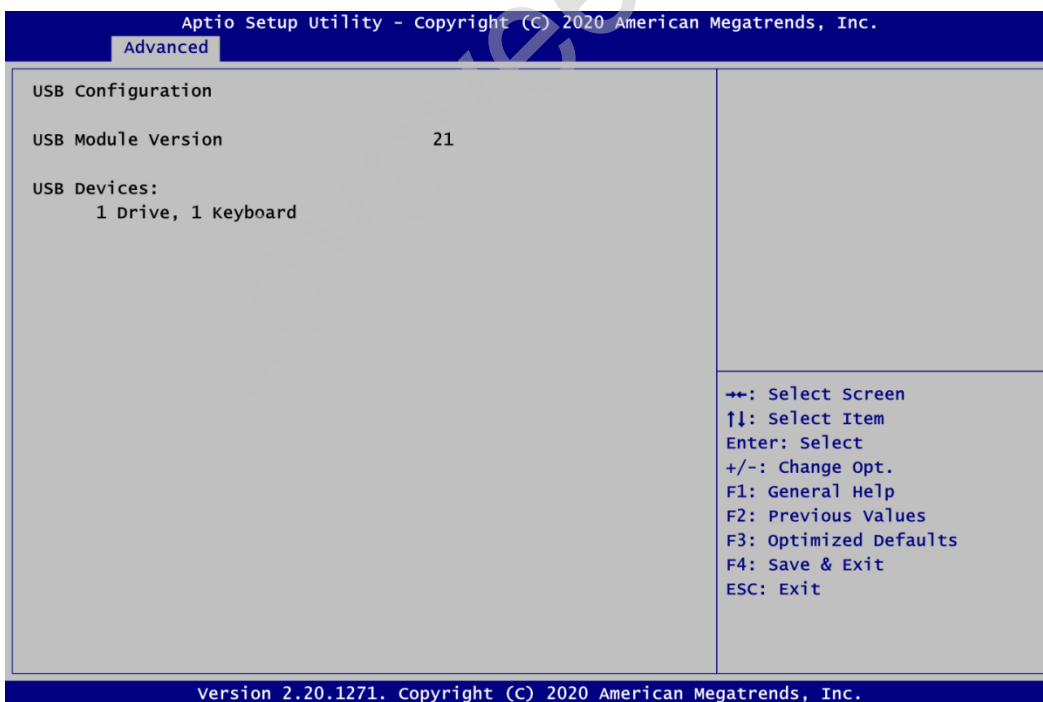
*Only Q370 chipset can support Intel RST Premium with Intel Optane system Acceleration.*

- **PCH-FW Configuration**

This screen displays ME Firmware information.



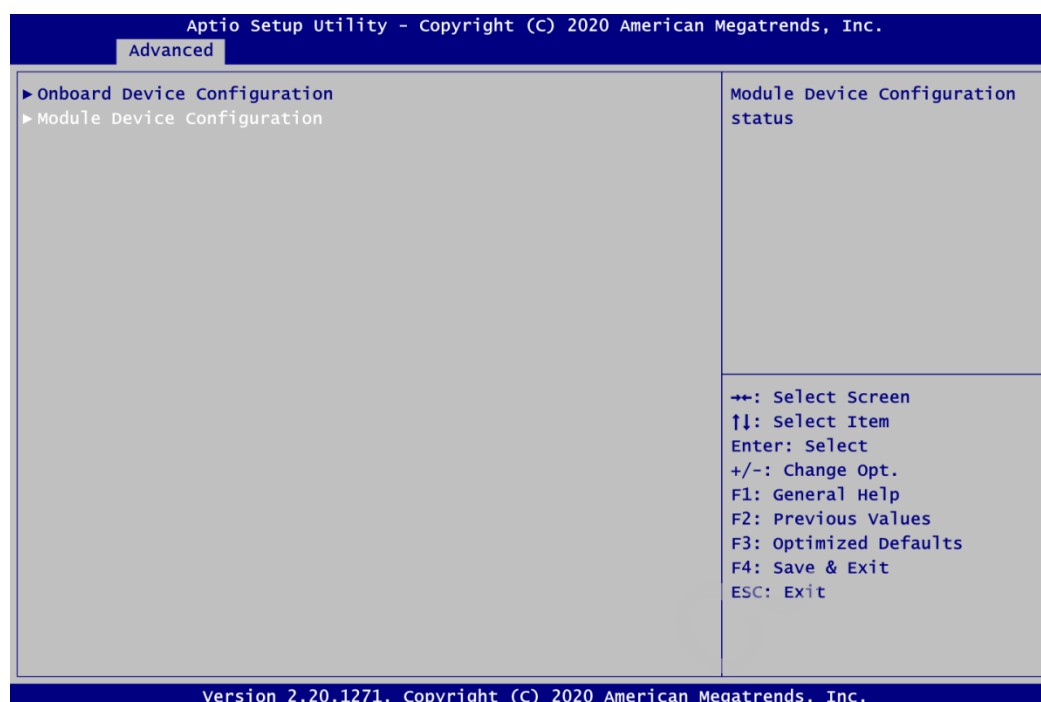
- **USB Configuration**

**USB Devices**

Display all detected USB devices.

- **Device Configuration**

A description of the selected item appears on the right side of the screen. For items marked with "▶", please press <Enter> for more options.



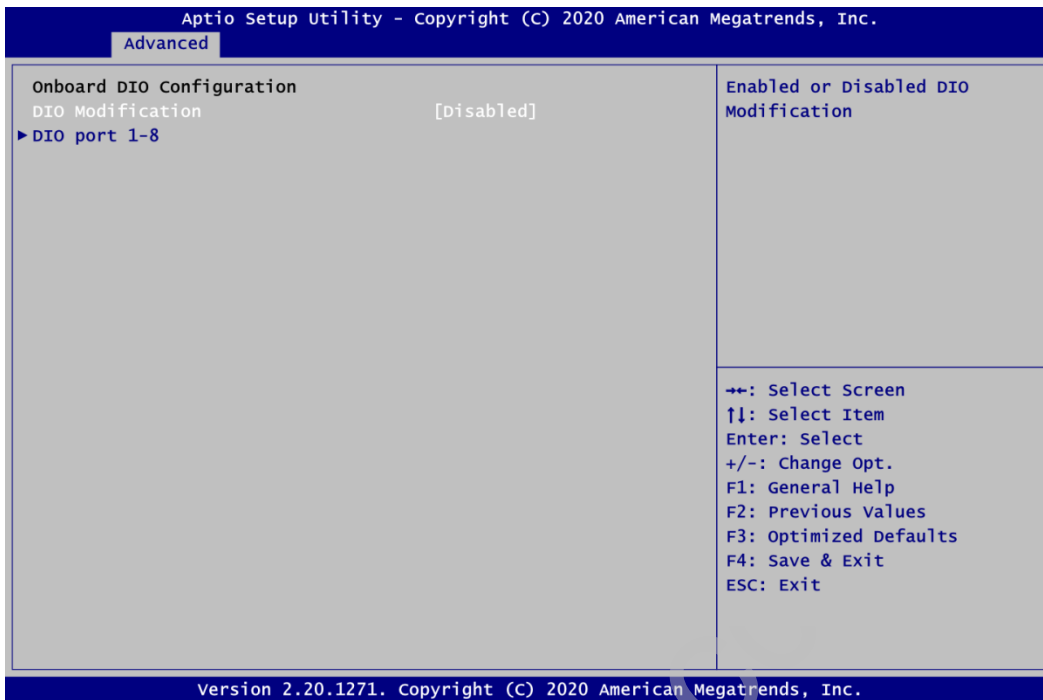
**Onboard Device Configuration**

Use this option to configure onboard device (e.g., Digital I/O setting).

**Module Device Configuration**

This option appears only if a ZIO module is installed. BIOS will auto-detect all supported functions and you can use it to change settings on the ZIO module. The CAPA520 supports the following ZIO expansion modules: AX93262, AX93285, AX93291, AX93295 and AX93A20.

- Onboard Device Configuration\Onboard DIO Configuration



#### DIO Modification

Enable or disable digital I/O modification. The default is Disabled. Once it is enabled, you can load manufacture default and access to the DIO status sub screen to set output or input.

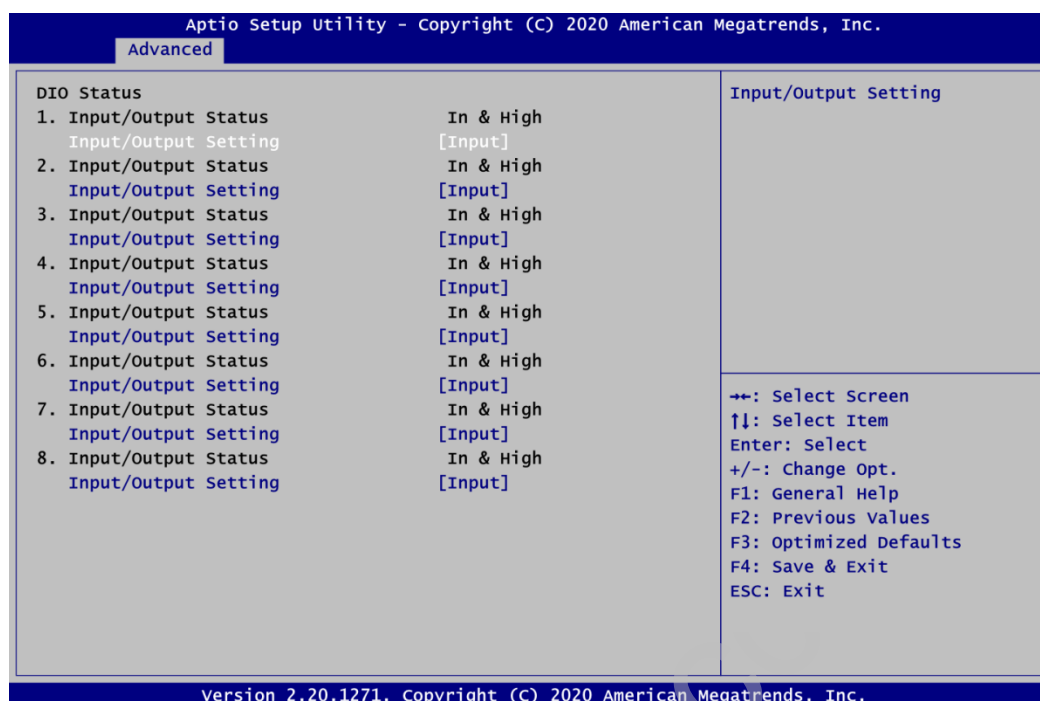
#### Load Manufacture Default

Use this option to load default settings.

#### DIO port 1-8

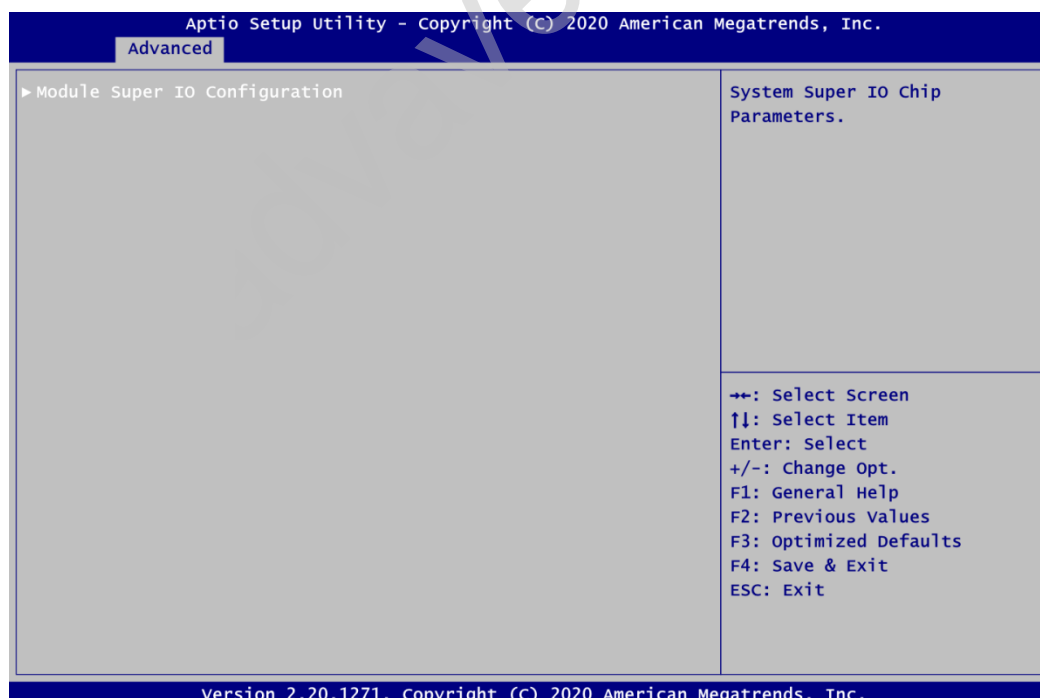
Select this option to open DIO status sub-screen to set output or input for each port.

- **DIO port 1-8**



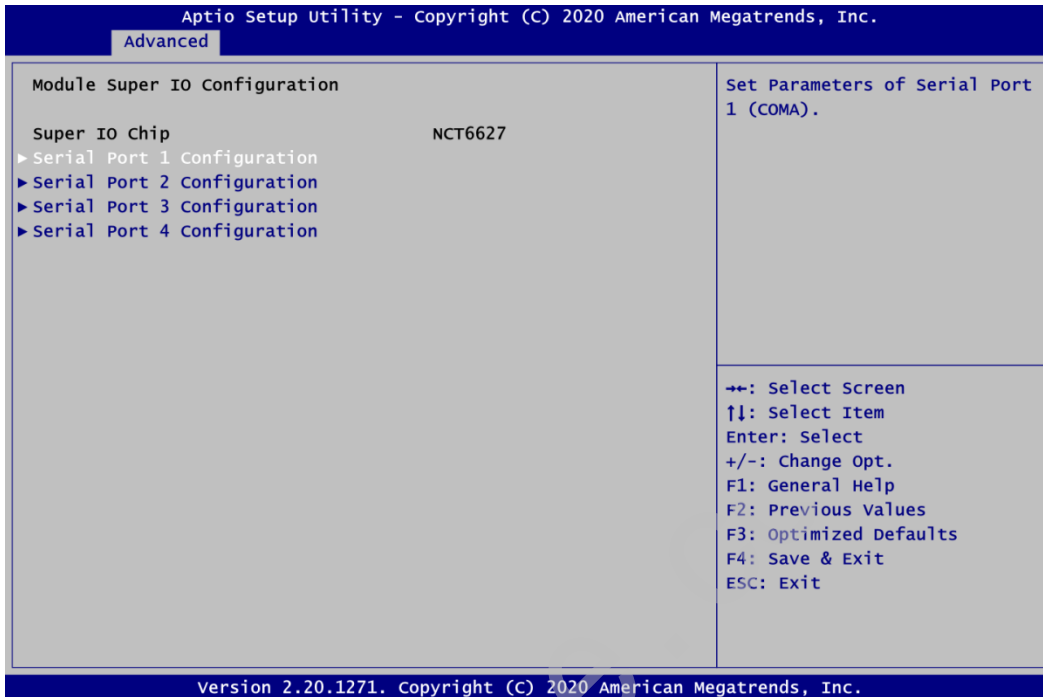
- **Module Device Configuration\Module Super IO Configuration**

This screen is available only if a ZIO module with serial ports is connected. For items marked with "▶", please press <Enter> for more options.



- **Module Super IO Configuration**

You can use this screen to select options for NCT6627 Super IO Configuration, and change the value of the selected option. A description of selected item appears on the right side of the screen. For items marked with "▶", please press <Enter> for more options.



#### Serial Port 1~4 Configuration

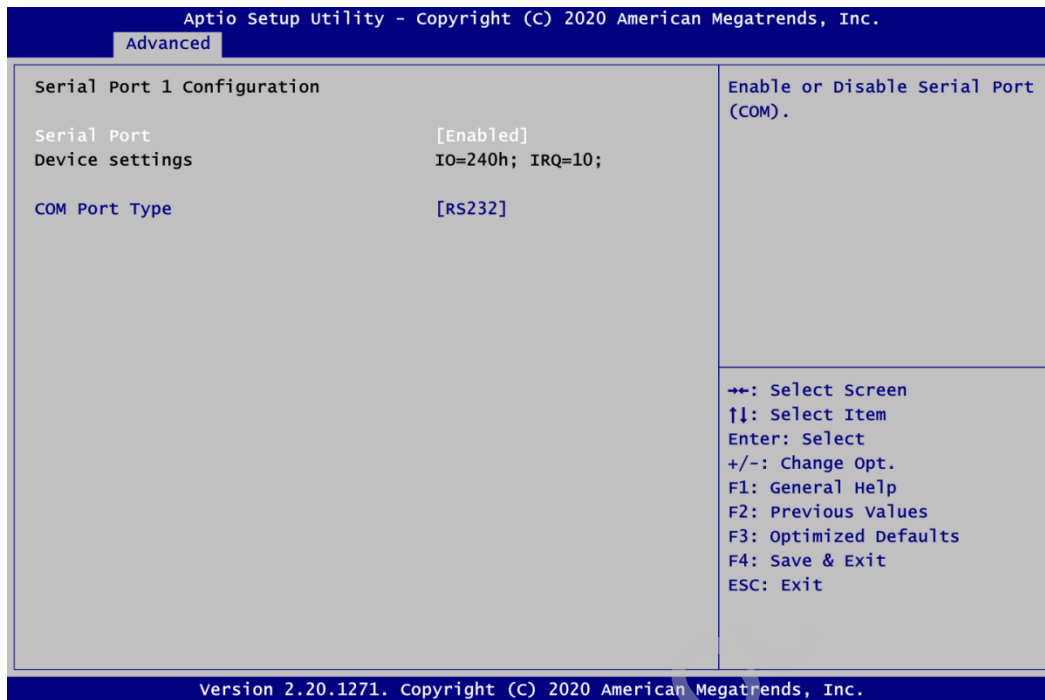
Set parameters related to serial port 1~4 on ZIO module.



**Note**

*The numbers of serial ports depends on which ZIO module is connected. Once the Module Device Configuration is selected, this screen will show the numbers of serial ports on that selected ZIO module.*

- **Serial Port 1 Configuration**



**Serial Port**

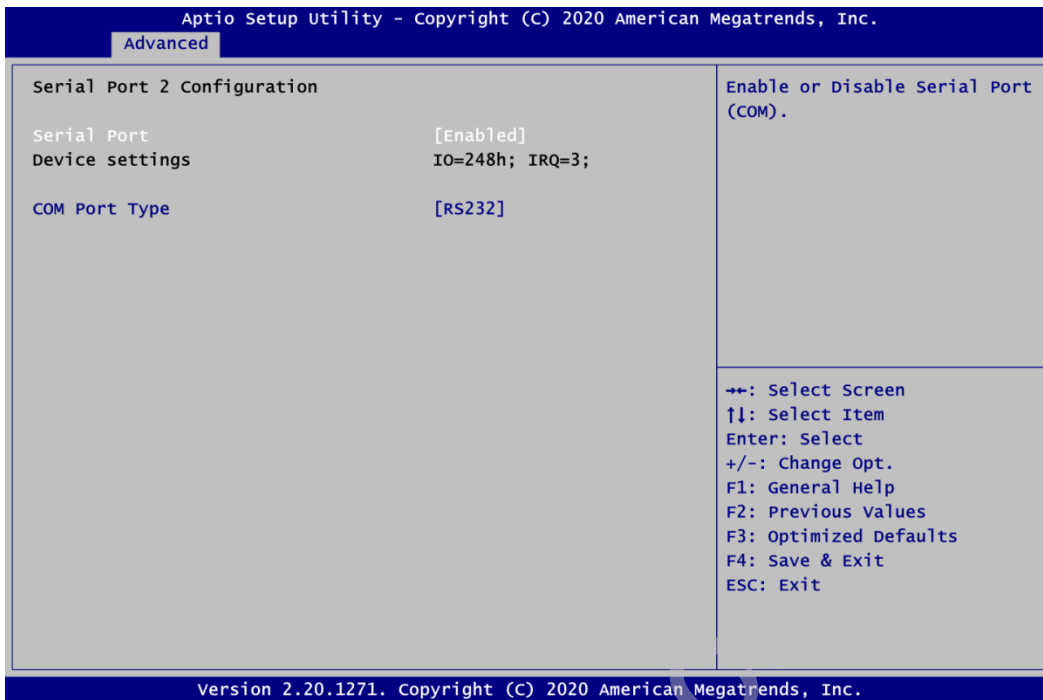
Enable or disable serial port 1 on ZIO module. The optimal setting for base I/O address is 240h and for interrupt request address is IRQ10.

**COM Port Type**

Use this item to set RS-232/422/485 communication mode.



- Serial Port 2 Configuration

**Serial Port**

Enable or disable serial port 2 on ZIO module. The optimal setting for base I/O address is 248h and for interrupt request address is IRQ3.

**COM Port Type**

Use this item to set RS-232/422/485 communication mode.

- **Serial Port 3 Configuration**



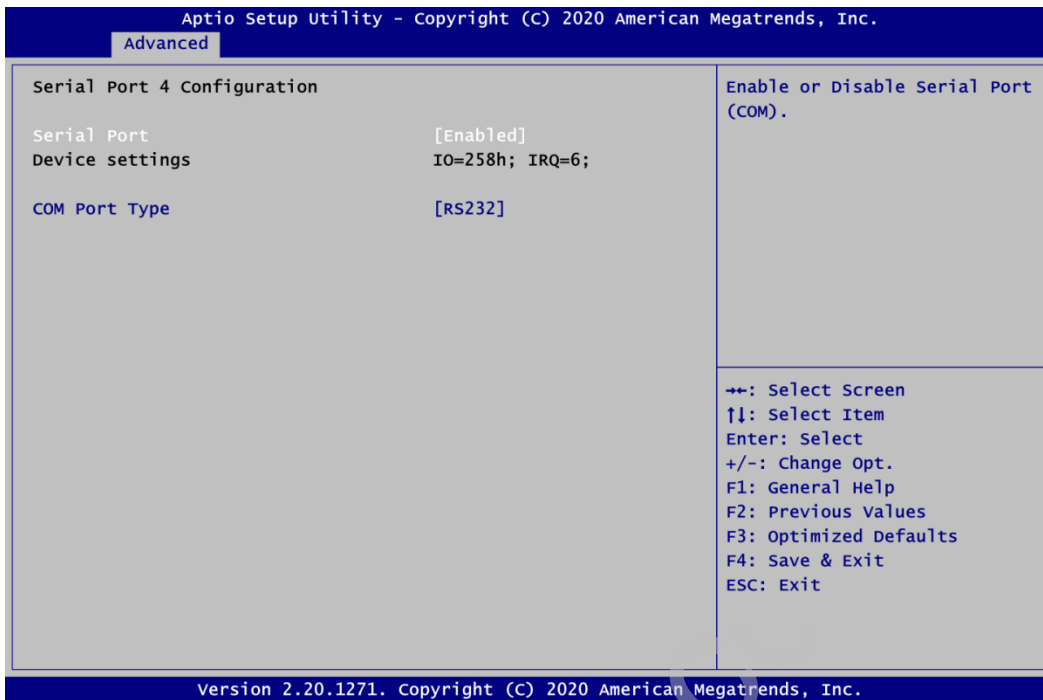
**Serial Port**

Enable or disable serial port 3 on ZIO module. The optimal setting for base I/O address is 250h and for interrupt request address is IRQ5.

**COM Port Type**

Use this item to set RS-232/422/485 communication mode.

- Serial Port 4 Configuration

**Serial Port**

Enable or disable serial port 4 on ZIO module. The optimal setting for base I/O address is 258h and for interrupt request address is IRQ6.

**COM Port Type**

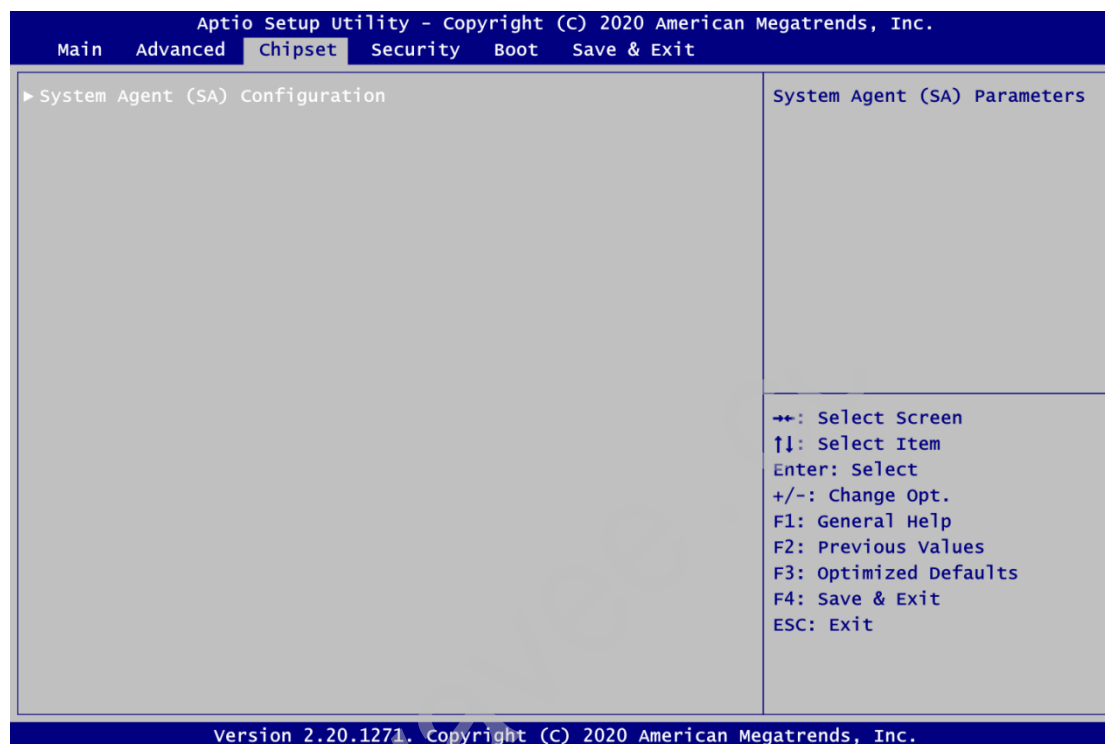
Use this item to set RS-232/422/485 communication mode.

## 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:

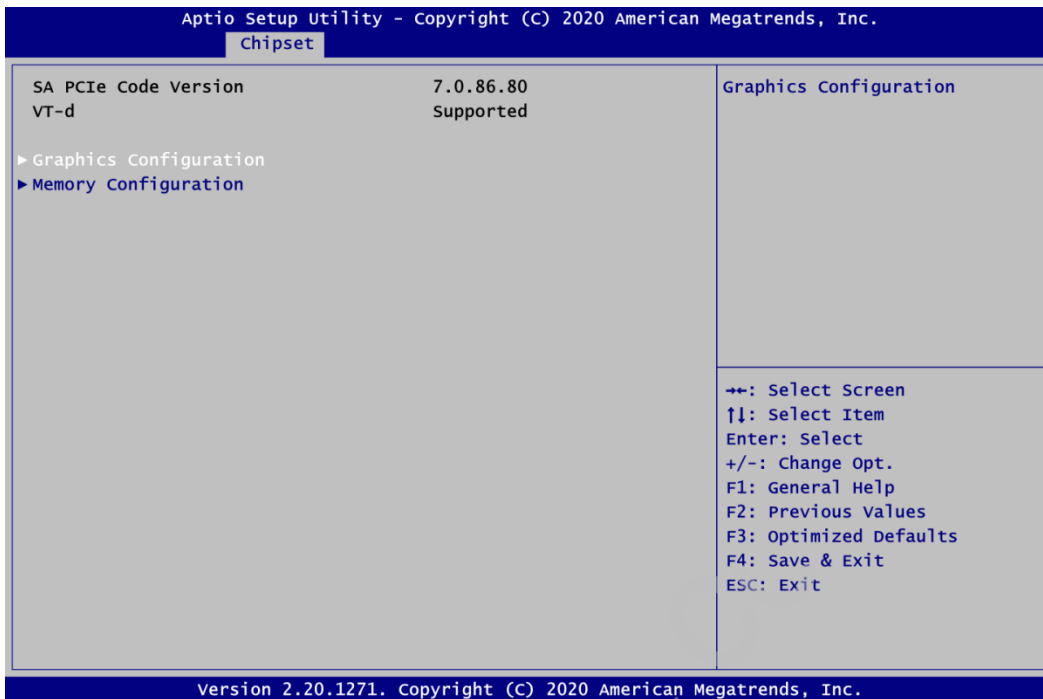
- ▶ System Agent (SA) Configuration

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



- **System Agent (SA) Configuration**

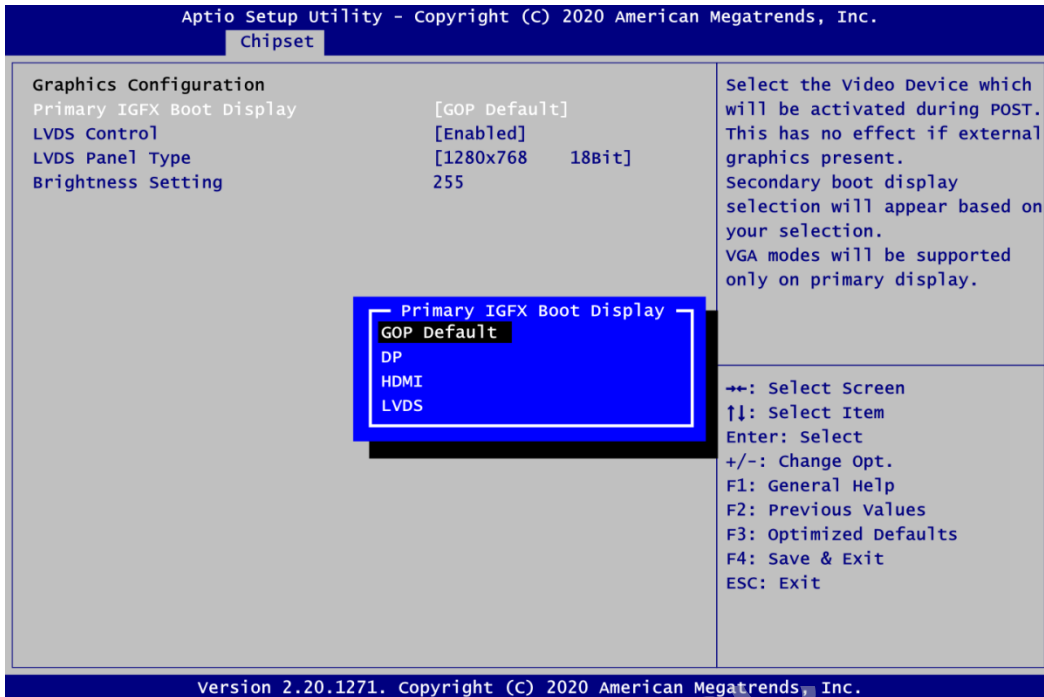
This screen shows System Agent version information and provides function for specifying related parameters.

**Graphics Configuration**

Use this item to open graphics configuration sub screen.

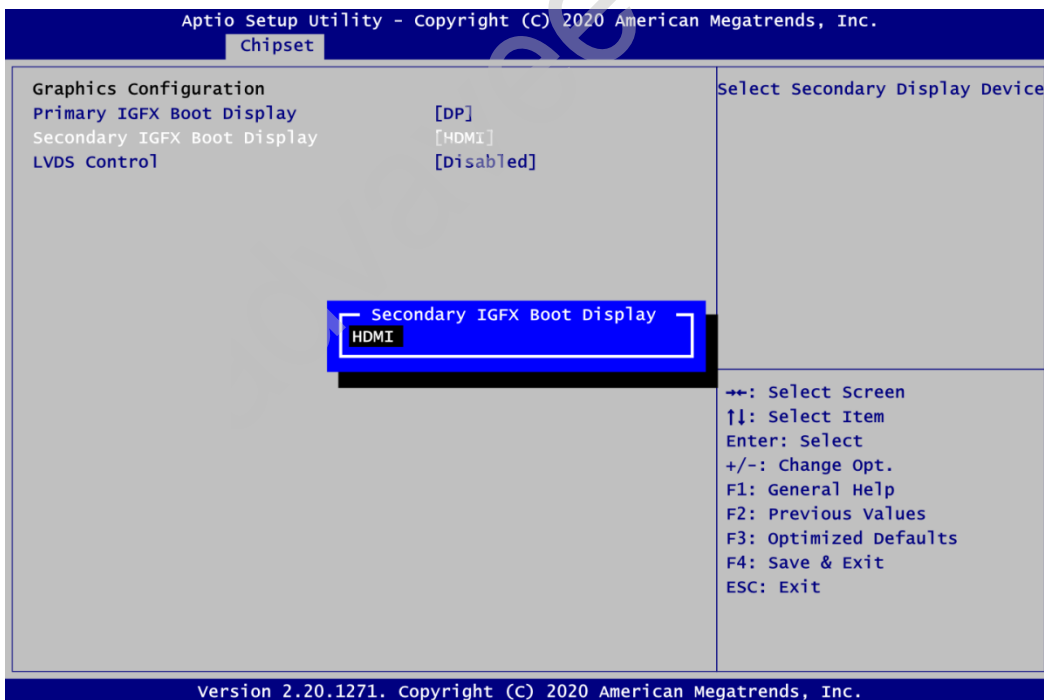
**Memory Configuration**

Use this item to refer to information related to system memory.



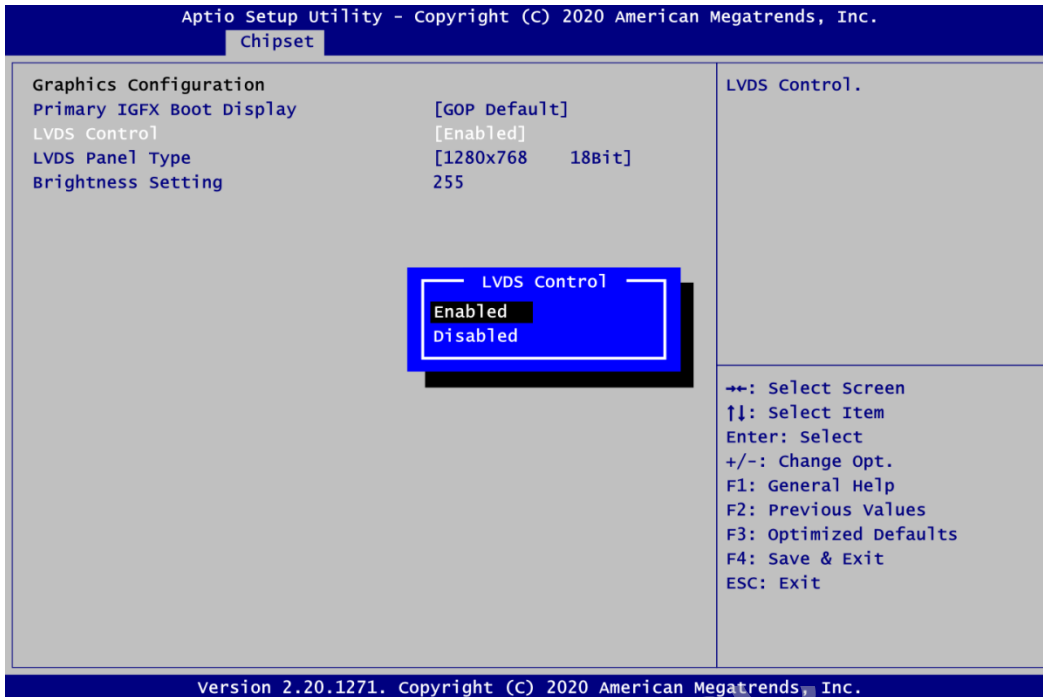
### Primary IGFX Boot Display

Select the video device which will be activated during POST (Power-On Self Test). The default is GOP Default.



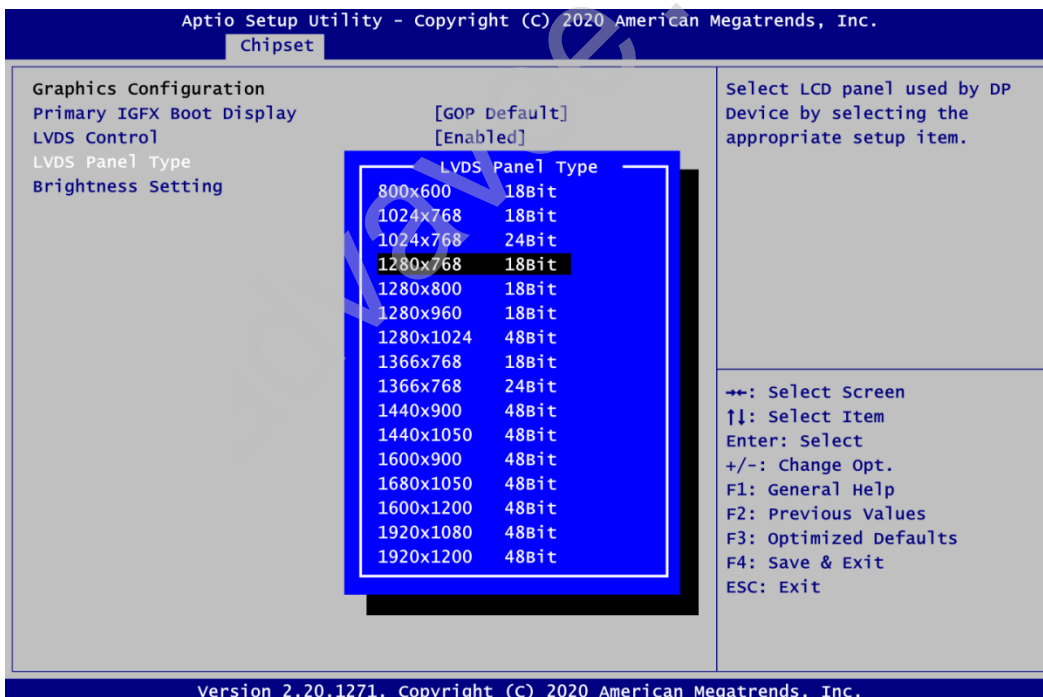
### Secondary IGFX Boot Display

When the Primary IGFX Boot Display is set a specific display, instead of GOP Default, Secondary IGFX Boot Display will be showed for selection.



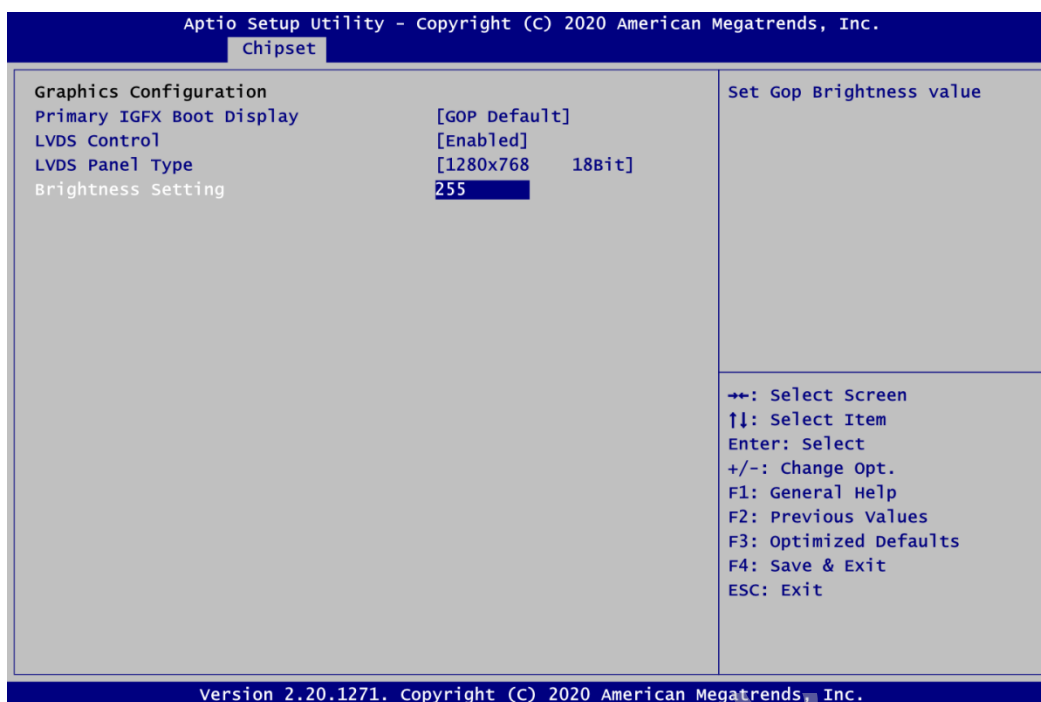
### LVDS Control

Enable or disable LVDS Control.



### LVDS Panel Type

After LVDS control is enabled, the LVDS Panel Type is showed for selection. Select the appropriate LVDS panel resolution by options in image above.



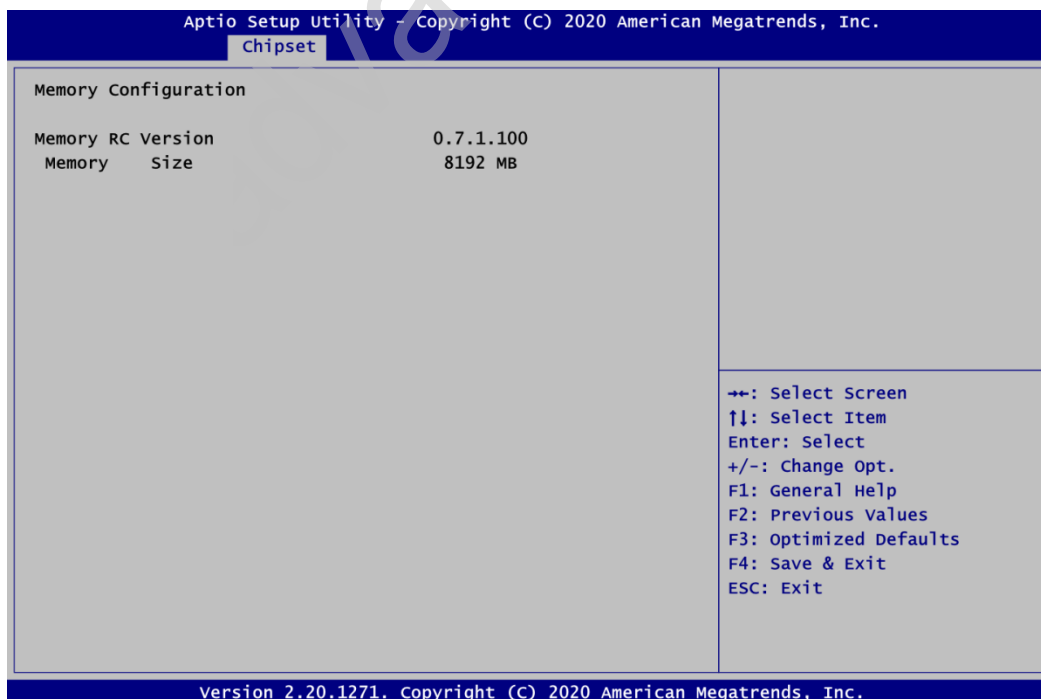
### Brightness Setting

After LVDS control is enabled, the Brightness Setting is showed for selection. It allows user to adjust the brightness level of the LVDS panel.

- Range: 0~255
- Default: 255

- **Memory Configuration**

This screen shows the system memory information.





## 4.6 Security Menu

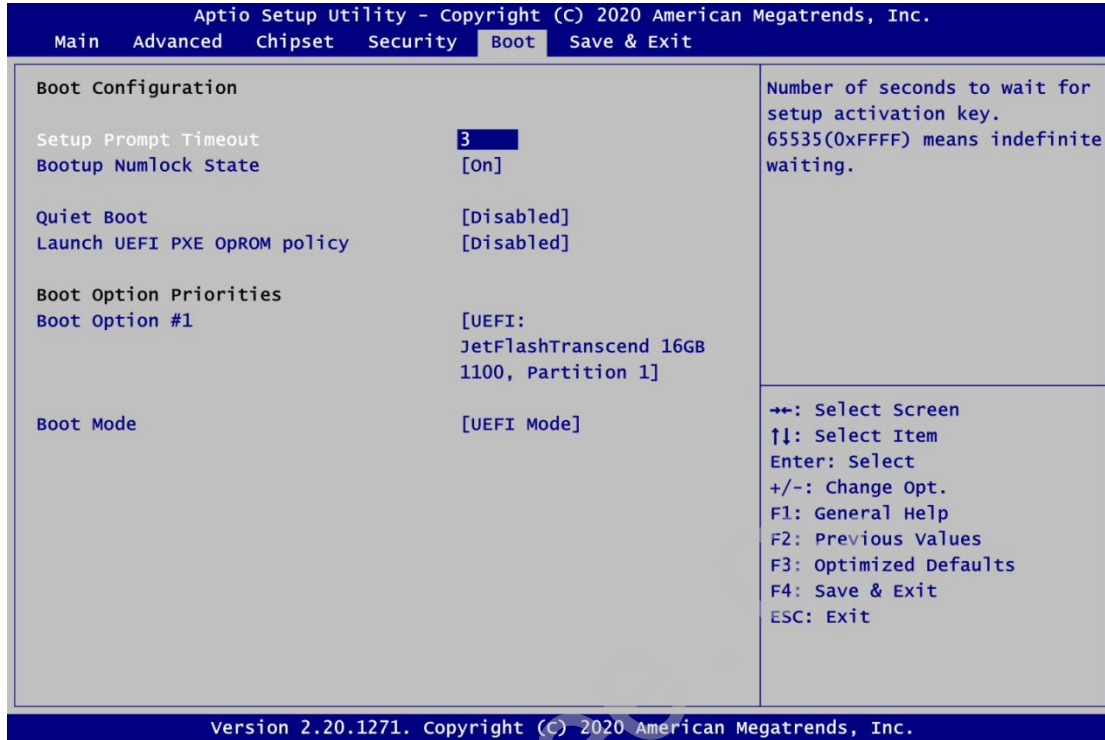
The Security menu allows users to change the security settings for the system.



- **Administrator Password.**  
Set administrator password.
- **User Password**  
Set user password.

## 4.7 Boot Menu

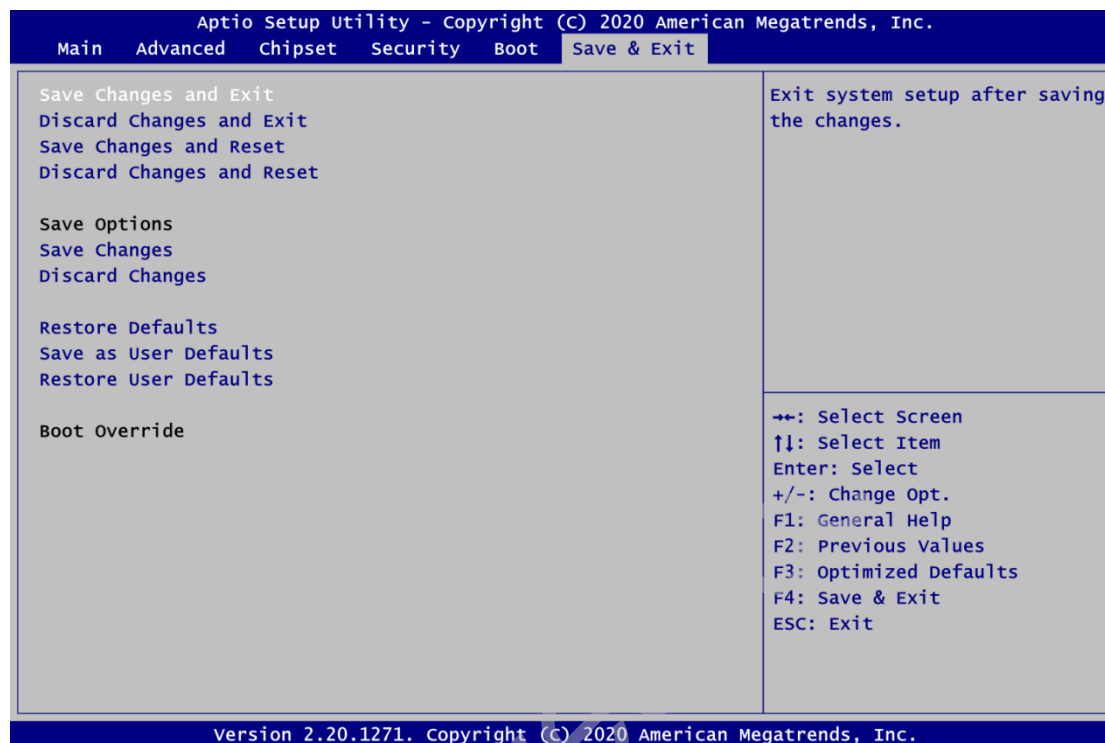
The Boot menu allows users to change boot options of the system.



- 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.
- Launch UEFI PXE OpROM policy**  
 Use this item to enable or disable the boot ROM function of the onboard LAN chip when the system boots up.
- Boot Option Priorities [Boot Option #1, ...]**  
 These are settings for boot priority. Specify the boot device priority sequence from the available devices.
- Boot Mode**  
 Use this option for boot mode settings.
  - UEFI Boot: Select support to boot any UEFI-capable OS.
  - Legacy Boot: Select support to boot non UEFI-capable OS that expects a legacy BIOS interface.

## 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.

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# Appendix A

## Watchdog Timer

### A.1 About Watchdog Timer

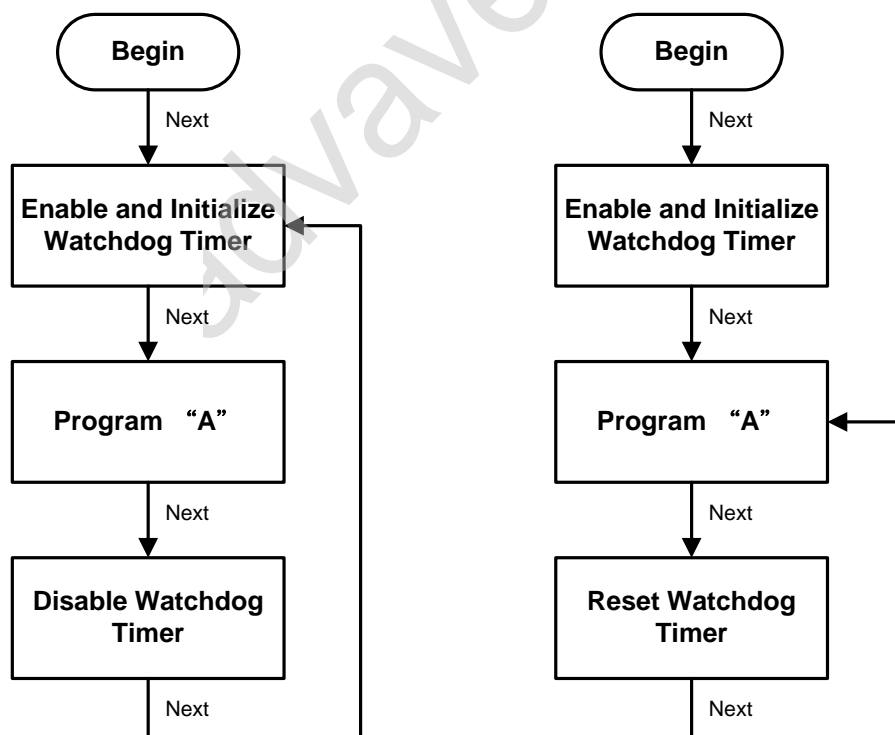
Software stability is major issue in most application. Some embedded systems are not watched by operator for 24 hours. It is usually too slow to wait for someone to reboot when computer hangs. The systems need to be able to reset automatically when things go wrong. The watchdog timer gives us solution.

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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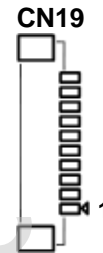
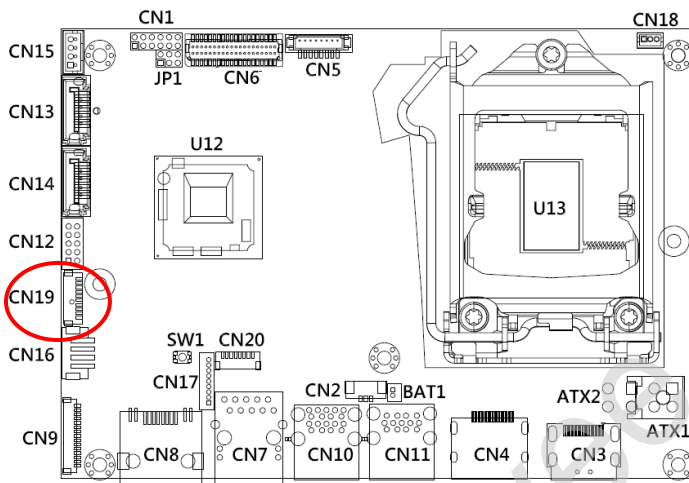


# Appendix B

## 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 8 inputs where all of these pins are set to 1.



Pin	Signal	Pin	Signal
1	DIO 0	2	DIO 7
3	DIO 1	4	DIO 6
5	DIO 2	6	DIO 5
7	DIO 3	8	DIO 4
9	+5V	10	GND



Note

The maximum current @5V is up to 85mA. Each DO can be up to 10mA at least.

### B.2 Digital I/O Programming

- I<sup>2</sup>C to GPIO PCA9554PW GPIO.
- I<sup>2</sup>C address: 01000100.

#### 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	