MMB501

Intel® Socket 1151 Core™ i7/ i5/ i3 Processors Micro MICRO ATX Industrial Motherboard

User's Manual

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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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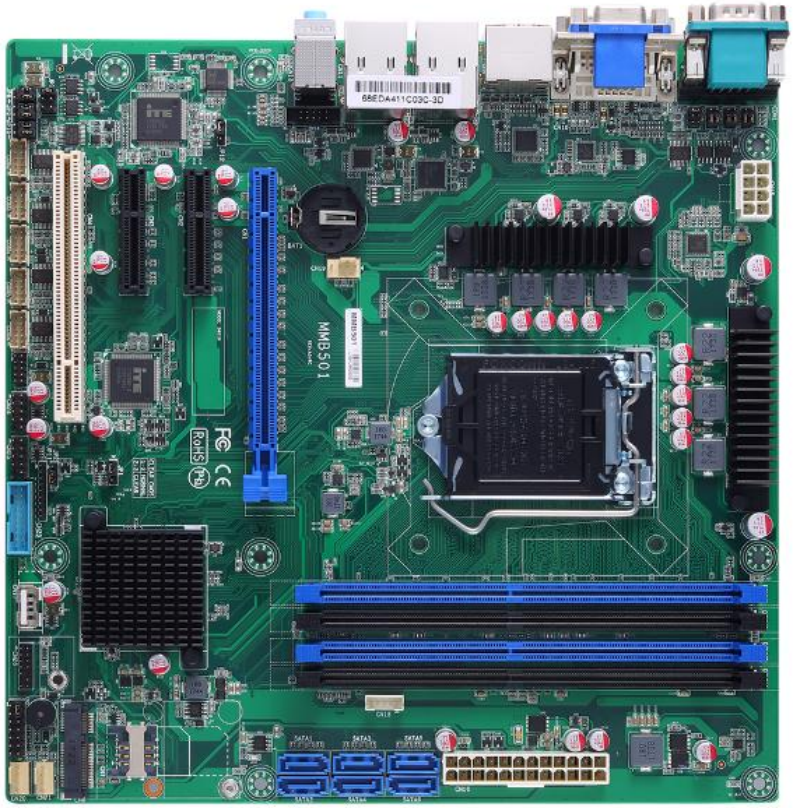
Chapter 1
Introduction



The MMB501 is an advanced micro ATX industrial motherboard based on the 7th / 6th Generation Intel® Core™ i7/ i5/ i3/ Pentium® and Celeron® processors (Kabylake-S / Skylake-S) in LGA1151 Socket with Intel® Q170. The optimized MMB501 is specially designed for better computing and visual performance; ideally used in every major industry for tasks ranging from financial modeling to designing complex buildings and vehicles. With its built-in Intel® HD Graphics 530/510, this industrial grade motherboard delivers great 3D visual performance with triple display capability through DP, DVI-D, HDMI and VGA ports demanded by professional-grade CAD and media/entertainment fields.

In addition, the MMB501 supports Intel® Turbo Boost 2.0 technology, Intel® Hyper-Threading technology, Intel® HD Graphics with DX11 support, 3-D Tri-Gate transistors, 64GB DDR4 2133/2400MHz memory, and PCI-Express 3.0 x16 slot. It also features Intel® Active Management Technology 9.0 (iAMT), SATA RAID, as well as PCI-Express x4 expansion making it ideal for applications with added security features.

1.1 Features

- LGA1151 Socket 7th/6th Generation Intel® Core™ i7/i5/i3, Pentium® and Celeron® processors (Kabylake-S/Skylake-S) up to 65W
- 4 DDR4 2133/2400MHz DIMM with maximum capacity up to 64GB (max. 16GB per slot)
- DP, DVI-D, HDMI, and VGA with triple view supported
- 6 SATA 6Gb/s RAID 0/1/5/10
- 6 USB 3.0 and 5 USB 2.0 ports
- PCI-Express Mini Card

1.2 Specifications

- **CPU**
  - LGA1151 Socket 6th Generation Intel® Core™ i7/ i5/ i3, Pentium® and Celeron® processors.

- **Chipset**
  - Intel® Q170.

- **BIOS**
  - AMI BIOS.

- **System Memory**
  - Four 288-pin DIMM sockets.
  - Maximum up to 64GB DDR4 memory (max. 16GB per slot).
  - Support 2133/2400MHz.

- **Onboard Multi I/O**
  - One PS/2 keyboard and mouse.
  - Six serial ports:
    - Four RS-232 (internal box headers).
    - Two RS-232/422/485 (one in rear I/O, and the other in internal box header).

- **USB Interface**
  - Six USB 3.0 ports (four in rear I/O, and the others in internal header)
  - Five USB 2.0 ports (internal box headers)

- **Ethernet**
  - LAN1: 1000/100/10Mbps Gigabit/Fast Ethernet supports Wake-on-LAN, PXE Boot ROM, iAMT with Intel® i219LM.
  - LAN2: 1000/100/10Mbps Gigabit/Fast Ethernet supports Wake-on-LAN, PXE Boot ROM with Intel® i211AT.

- **Serial ATA**
  - Six SATA 6Gb/s with RAID 0/1/5/10.

- **Audio**
  - Realtek ALC662 2 channel HDA Codec.
  - Support MIC-in/line-in/line-out.

- **Display**
  - One 15-pin D-Sub as VGA connector. Resolution max. up to 1920x1200 @60Hz.
  - One HDMI 1.4b with resolution max. up to 4096x2160 @24Hz.
  - One DVI-D with resolution max. up to 1920×1200 @60Hz.
  - One DP with resolution max. up to 5120x2880@60Hz

- **Expansion Interface**
  - One PCI-Express x16 slot.
  - Two PCI-Express x4 slots.
  - One PCI slots.
  - One PCI Express Mini Card(full size, for wifi/3G/4G w/SIM slot)

- **Power Input**
  - One ATX power input connector.
  - One 12V ATX power input connector for CPU Power.

- **Operating Temperature**
  - 0°C ~ 60°C.

- **Storage Temperature**
  - -20°C ~ 75°C.

- **Form Factor**
  - 244 x 244mm.

Note

All specifications and images are subject to change without notice.

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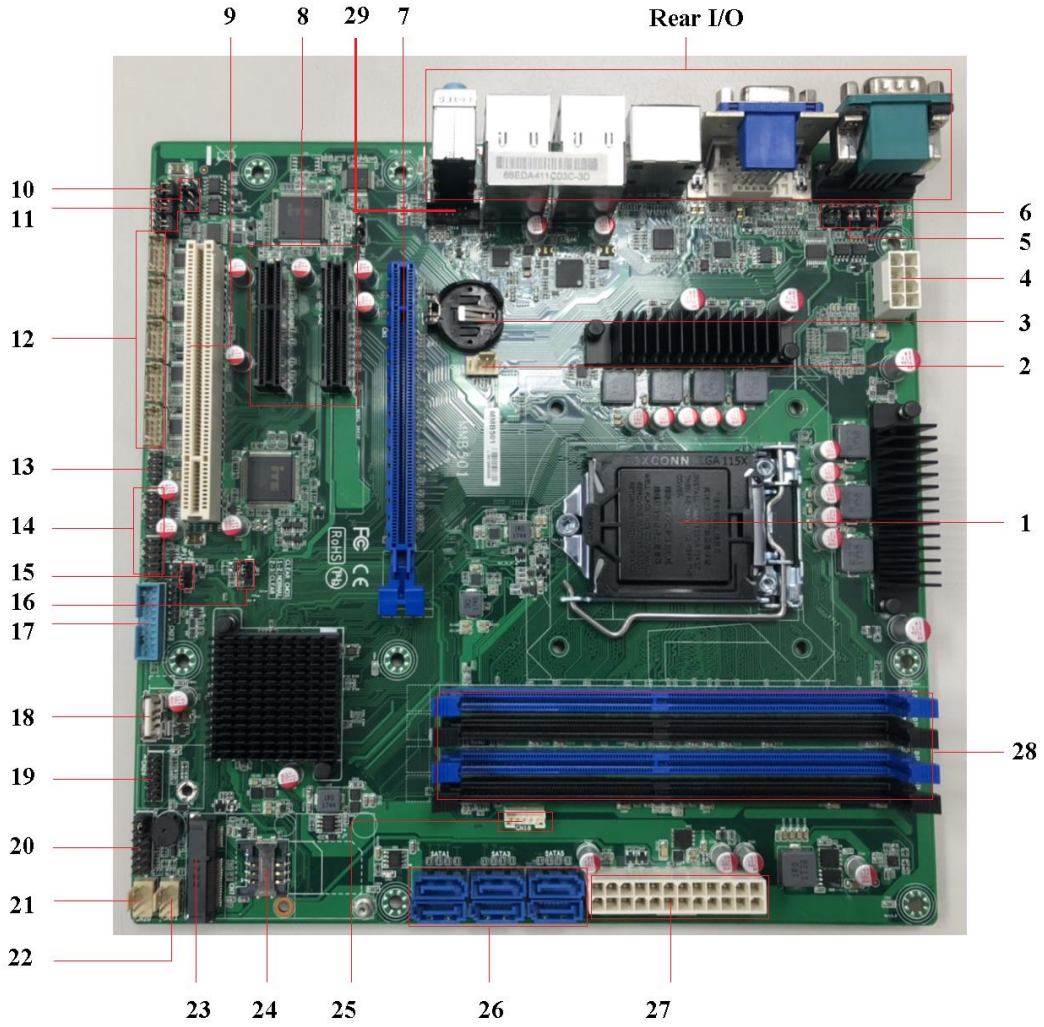
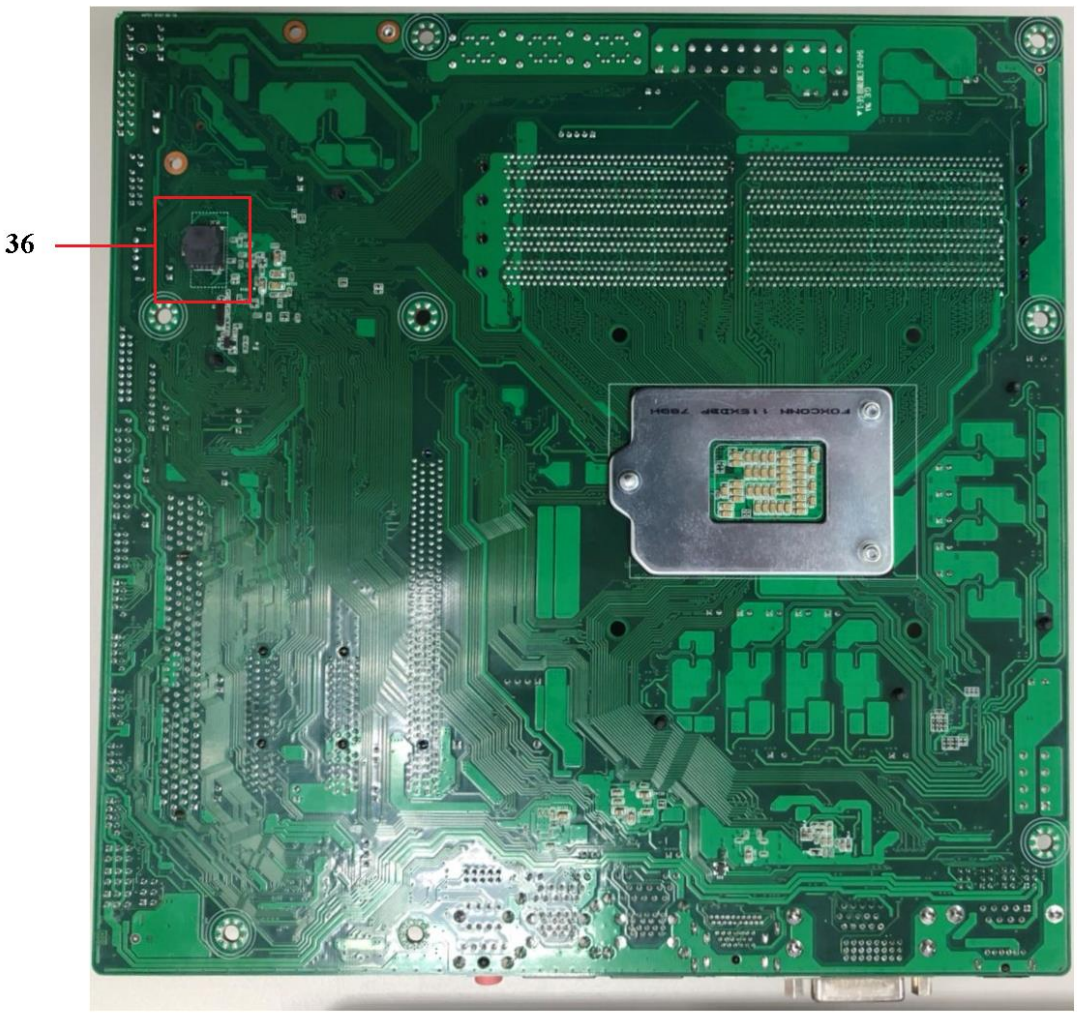
Chapter 2
Board and Pin Assignments

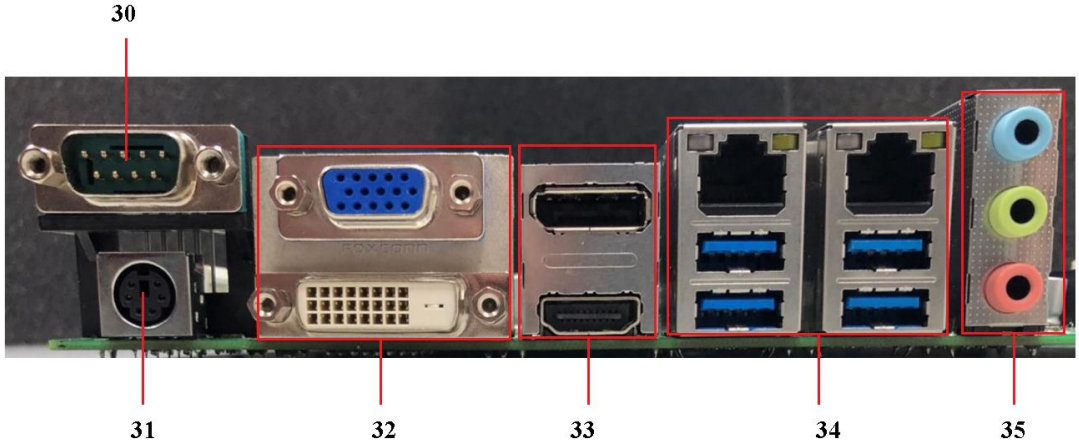
2.1 Board Layout



Board Layout (BOTTOM)



2.2 Rear I/O



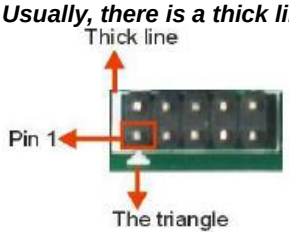
Note ***A direct contact CPU cooler back plate is not available for MMB501.***

Jumpers/Headers/Connectors			
1	CPU Socket for LGA1151(J1)	20	Front Panel Header (CN5)
2	CPU Fan Connector (CN19)	21	System Fan Connector (CN20)
3	Coin battery Socket for RC2032 (BAT1)	22	System Fan Connector (CN21)
4	ATX2 CPU Power Input Connector (CN15)	23	Mini PCIE Slot (CN6)
5	COM1 Mode Select (JP3. JP5. JP6)	24	SIM Card Slot (CN7)
6	COM1 Data/Power Select (JP4)	25	SMBus Header (CN18)
7	PCI-Express x16 Slot (CN1)	26	SATA 3.0 Connector (SATA1~SATA6)
8	PCI-Express x4 Slots (CN2. CN3)	27	ATX1 24-pin Power Input Connector (CN16)
9	PCI Slots (CN4)	28	DDR4 Slots (DIMM1~4)
10	COM2 Data/Power Select (JP8)	29	Front Audio Header (CN14)
11	COM2 Mode Select (JP7, JP9, JP10)	30	COM1 Connector (COM1)
12	COM Headers (COM2~COM6)	31	PS/2 Connector (CN8)
13	GPIO Header (CN22)	32	DVI-D & VGA Connector (CN10)
14	Internal USB Headers (CN24. CN25)	33	HDMI & DP Connector (CN9)
15	AT/ATX Mode Select (JP2)	34	LAN and USB 3.0 Connectors (CN11. CN12)
16	Clear CMOS (JP1)	35	Audio Jack (CN13)
17	Internal USB 3.0 Connector (CN23)	36	SPI Flash Socket (BIOS2)
18	USB 2.0 Type-A 180D Connector (CN17)		
19	SPI interface for TPM module (CN26)		

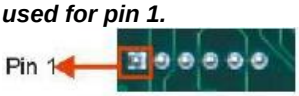
Note

To identify the first pin of a header or jumper, please refer to the following information:

- ***Usually, there is a thick line or a triangle near the header or jumper pin 1.***

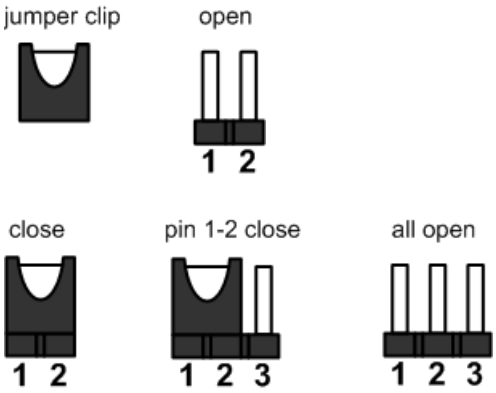


- ***Square pad, which you can find on the back of the motherboard, is usually used for pin 1.***



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. The following illustration shows how to set up jumper.



Before applying power to MMB501 Series, please make sure all of the jumpers are in factory default position. 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	Clear CMOS Default: Normal Operation	1-2 Close
JP2	AT/ATX Power Mode Select Default: ATX Mode	1-2 Close
JP3	COM1/2 RS-232/422/485 Mode Select Default: RS-232	1-2 Close
JP5		3-5, 4-6 Close
JP6		3-5, 4-6 Close
JP4/8	COM1/2 Data/Power Select Default: RS-232 Data	3-5 Close
		4-6 Close

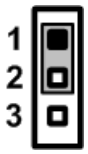
2.3.1 Clear CMOS (JP1)

This jumper (3x1-pin p=2.54mm) allows you to clear the Real Time Clock (RTC) RAM in CMOS. You can clear the CMOS memory of date, time, and system setup parameters by erasing the CMOS RTC RAM data. The onboard button cell battery powers the RAM data in CMOS, which includes system setup information such as system passwords.

To erase the RTC RAM:

1. Turn OFF the computer and unplug the power cord.
2. Remove the onboard battery.
3. Move the jumper clip from pins 1-2 (default) to pins 2-3. Keep the clip on pins 2-3 for about 5~10 seconds, then move the clip back to pins 1-2.
4. Re-install the battery.
5. Plug the power cord and turn ON the computer.
6. Hold down the <Del> key during the boot process and enter BIOS setup to re-enter data.

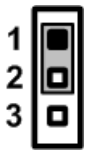
Function	Setting
Normal operation (Default)	1-2 close
Clear CMOS	2-3 close



2.3.2 AT/ATX Mode Select (JP2)

This 3x1-pin p=2.00mm jumper allows you to select AT or ATX power mode.

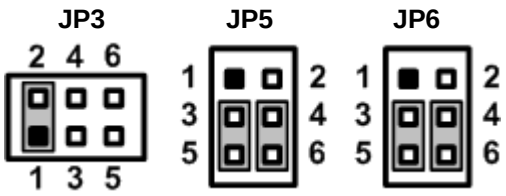
Function	Setting
ATX mode (Default)	1-2 close
AT mode	2-3 close



2.3.3 COM1 Mode Select (JP3, JP5, JP6)

Use these jumpers (3x2-pin p=2.54mm) to set COM1 port to operate in RS-232, RS-422 or RS-485 communication mode.

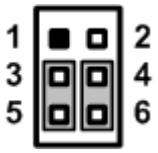
Function	Setting
RS-232 mode (Default)	JP3 1-2 close JP5 3-5, 4-6 close JP6 3-5, 4-6 close
RS-422 mode	JP3 3-4 close JP5 1-3, 2-4 close JP6 1-3, 2-4 close
RS-485 mode	JP3 5-6 close JP5 1-3, 2-4 close JP6 1-3, 2-4 clos



2.3.4 COM1 Data/Power Select (JP4)

The COM1 port has +5V power capability on DCD# and +12V on RI# by setting this jumper (3x2-pin p=2.54mm).

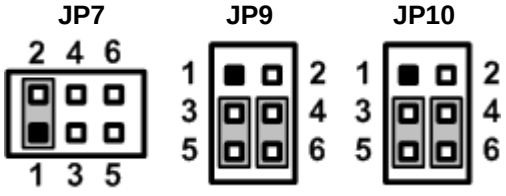
Function	Setting
Power: Set COM1 pin 1 to +5V	1-3 close
Data: Set COM1 pin 1 to DCD# (Default)	3-5 close
Power: Set COM1 pin 9 to +12V	2-4 close
Data: Set COM1 pin 9 to RI# (Default)	4-6 close



2.3.5 COM2 Mode Select (JP7, JP9, JP10)

Use these jumpers (3x2-pin p=2.54mm) to set COM1 port to operate in RS-232, RS-422 or RS-485 communication mode.

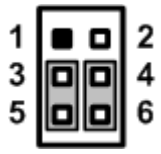
Function	Setting
RS-232 mode (Default)	JP7 1-2 close JP9 3-5, 4-6 close JP10 3-5, 4-6 close
RS-422 mode	JP7 3-4 close JP9 1-3, 2-4 close JP19 1-3, 2-4 close
RS-485 mode	JP7 5-6 close JP9 1-3, 2-4 close JP10 1-3, 2-4 clos



2.3.6 COM2 Data/Power Select (JP8)

The COM2 port has +5V power capability on DCD# and +12V on RI# by setting this jumper (3x2-pin p=2.54mm).

Function	Setting
Power: Set COM2 pin 1 to +5V	1-3 close
Data: Set COM2 pin 1 to DCD# (Default)	3-5 close
Power: Set COM2 pin 8 to +12V	2-4 close
Data: Set COM2 pin 8 to RI# (Default)	4-6 close



2.4 Connectors

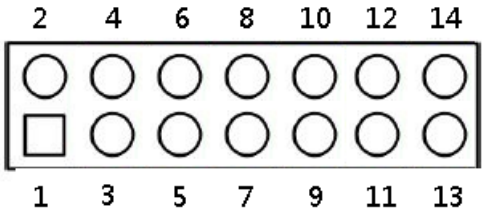
Signals go to other parts of the system through connectors. Loose or improper connection might cause problems, please make sure all connectors are properly and firmly connected. Here is a summary table showing connectors on the hardware.

Connector	Description
CN1	PCI-Express x16 Slot
CN2~CN3	PCI-Express x4 Slots
CN4	PCI Slots
CN5	Front Panel Header
CN6~ CN7	Mini PCIE Slot & SIM Card Slot
CN8	PS/2
CN9	HDMI & DP Connector
CN10	DVI-D & VGA Connector
CN11, CN12	LAN and USB 3.0 Connectors
CN13	Audio Jack
CN14	Front Audio Header
CN15	ATX2 CPU Power Input Connector
CN16	ATX1 24-pin Power Input Connector
CN17	USB 2.0 Type-A 180D Connector
CN18	SMBus Header
CN19	CPU Fan Connector
CN20~CN21	System Fan Connectors
CN22	GPIO Header
CN23	Internal USB 3.0 Connector
CN24~CN25	Internal USB Headers
CN26	SPI interface for TPM module
BAT1	Coin battery Socket for RC2032
COM1	COM1 Connector
COM2~COM6	COM Headers
DIMM1~DIMM4	DDR4 Slots
SATA1~SATA6	SATA 3.0 Connector
J1	CPU Socket for LGA1151
BIOS2	SPI Flash Socket

2.4.1 Front Panel Header (CN5)

This is front panel header (5x2-pin p=2.54mm).

Pin	Signal
1	PWR LED-
2	SPK-
3	GND
4	BUZZER-
5	PWRLED+
6	NC
7	NC
8	VCC5
9	PWRSW-
10	PWRSW+
11	HW RST-
12	HW RST+
13	HDD LED-
14	HDD LED+



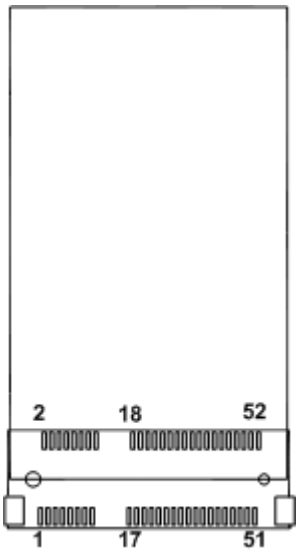
Note

[*]: The buzzer on motherboard will be active when pin 2 and pin 4 is connected; the external speaker on chassis will be active when pin 2 and pin 4 is open.

2.4.2 Mini PCIE Slot with SIM Card Slot (CN6 & CN7)

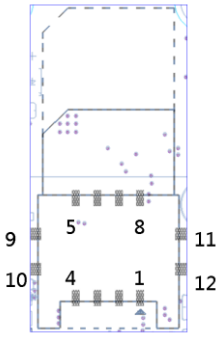
Mini PCIE Slot (CN6)

Pin	Signal	Pin	Signal
1	PCH_WAKE_N	2	VCC3_DUAL
3	NC	4	GND
5	NC	6	VCC1P5
7	NC	8	UIM_PWR
9	GND	10	UIM_DAT
11	CLKOUT_PCIE_N	12	UIM_CLK
13	CLKOUT_PCIE_P	14	UIM_REST
15	GND	16	UIM_VPP
17	NC	18	GND
19	NC	20	RF_KILL#_WIFI
21	GND	22	BUF_PLT_RST_N
23	PCIE_RX_DN	24	VCC3_DUAL
25	PCIE_RX_DP	26	GND
27	GND	28	VCC1P5
29	GND	30	SMB_CLK_RESUME
31	PCIE_TX_DN	32	SMB_DATA_RESUME
33	PCIE_TX_DP	34	GND
35	GND	36	USB-
37	GND	38	USB+
39	VCC3_DUAL	40	GND
41	VCC3_DUAL	42	NC
43	GND	44	NC
45	CL_CLK	46	NC
47	CL_DATA	48	VCC1P5
49	CL_RST_N	50	GND
51	NC	52	VCC3_DUAL
53	GND	54	GND
55	NC	56	NC



SIM Card Slot (CN7)

Pin	Signal	Pin	Signal
1	UIM_PWR	2	UIM_REST
3	UIM_CLK	4	NC
5	NC	6	UIM_DAT
7	UIM_VPP	8	GND
9	GND	10	GND
11	GND	12	GND

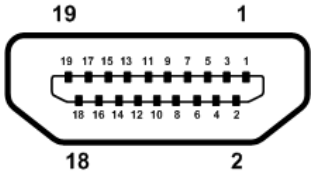


The CN6 is a half-size PCI-Express Mini Card connector. It supports the PCI-Express Mini Cards which are applied to either PCI-Express x1 or USB.

2.4.3 HDMI & DP Connector (CN9)

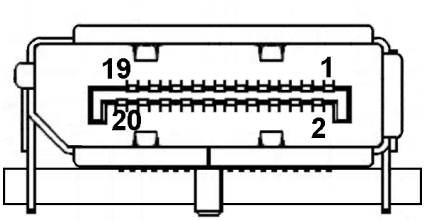
The HDMI (High-Definition Multimedia Interface) is a compact digital interface which is capable of transmitting high-definition video and high-resolution audio over a single cable.

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



The DisplayPort interface is available through CN9.

Pin	Signal	Pin	Signal
1	DP_TX0+	2	GND
3	DP_TX0-	4	DP_TX1+
5	GND	6	DP_TX1-
7	DP_TX2+	8	GND
9	DP_TX2-	10	DP_TX3+
11	GND	12	DP_TX3-
13	GND	14	GND
15	DP_AUX+	16	GND
17	DP_AUX-	18	DP_HPD
19	GND	20	+3.3V

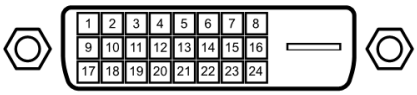


2.4.4 VGA and DVI-D Connector (CN10)

CN10 is a double-deck connector comprising a lower connector for VGA port and the upper connector for DVI-D port.

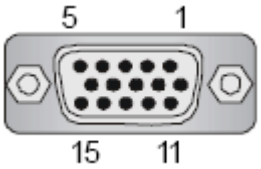
This is a high rise DVI-D connector provides transmission of fast and high quality video signal between source device (graphic card) and display device (monitor).

Pin	Signal	Pin	Signal
1	TX2-	2	TX2+
3	Ground	4	NC
5	NC	6	DVI_SPD_CLK
7	DVI_SPD DATA	8	CRT-VSYNC
9	TX1-	10	TX1+
11	Ground	12	NC
13	NC	14	VGAVCC
15	Ground	16	FPDETECT
17	TX0-	18	TX0+
19	Ground	20	NC
21	NC	22	Ground
23	TXC+	24	TXC-



The 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	NC
5	GND	6	DETECT
7	GND	8	GND
9	VCC	10	GND
11	NC	12	DDC DATA
13	Horizontal Sync	14	Vertical Sync
15	DDC CLK		

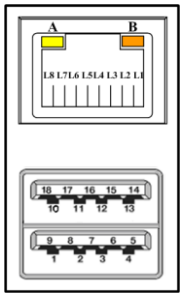


2.4.5 LAN and USB 3.0 Connectors (CN11 and CN12)

The motherboard comes with two high performance plug and play Ethernet interfaces (RJ-45) which are fully compliant with the IEEE 802.3 standard. Connection can be established by plugging one end of the Ethernet cable into this RJ-45 connector and the other end to a 1000/100/10 Base-T hub.

The Universal Serial Bus (compliant with USB 3.0) connectors on the rear I/O are for installing USB peripherals such as keyboard, mouse, scanner, etc.

Pin	LAN Signal	Pin	LAN Signal
L1	Tx+ (Data transmission positive)	L2	Tx- (Data transmission negative)
L3	Rx+ (Data reception positive)	L4	RJ-1 (For 1000 Base-T only)
L5	RJ-1 (For 1000 Base-T only)	L6	Rx- (Data reception negative)
L7	RJ-1 (For 1000 Base-T only)	L8	RJ-1 (For 1000 Base-T only)
A	Active LED	B	Speed LED



LAN

USB

Note

- ***Speed LED turns orange for 1000Mbps or green for 100Mbps. The light is off for 10Mbps.***
- ***CN11 supports AMT when chipset is customized into Intel® Q170. Both CN11 and CN12 support Wake-on-LAN.***

Pin	USB Signal	Pin	USB Signal
1	+5 V_DUAL	2	USB -
3	USB +	4	GND
5	USB3_SSRX	6	USB3_SSRX+
7	GND	8	USB3_SSTX
9	USB3_SSTX+		

2.4.6 Audio Jack (CN13)

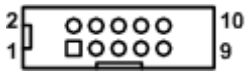
Install audio driver, and then attach audio devices to CN13.

Pin Color	Signal
Blue	Line-in
Green	Line-out
Pink	MIC-in

2.4.7 Front Audio Header (CN14)

This is front audio header (5x2-pin p=2.00mm) for convenient connection and control of audio devices.

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



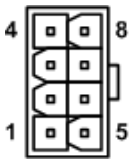
2.4.8 Power Input Connectors (CN15 and CN16)

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

External power supply plug fits into this connector 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.

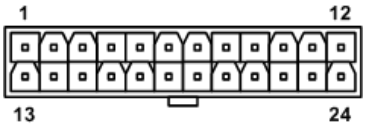
ATX2 CPU power input connector (CN15):

Pin	CN33 Signal	Pin	CN33 Signal
1	GND	5	+12V
2	GND	6	+12V
3	GND	7	+12V
4	GND	8	+12V



ATX1 24-pin power input connector (CN16):

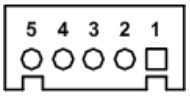
Pin	CN34 Signal	Pin	CN34 Signal
1	3.3V	13	3.3V
2	3.3V	14	-12V
3	GND	15	GND
4	+5V	16	PS_ON
5	GND	17	GND
6	+5V	18	GND
7	GND	19	GND
8	PWR OK	20	-5V
9	5VSB	21	+5V
10	+12V	22	+5V
11	+12V	23	+5V
12	3.3V	24	GND



2.4.9 SMBus Header (CN18)

The CN18 (5x1-pin p=2.00mm) is for SMBus (System Management Bus) interface.

Pin	Signal	Pin	Signal
1	SMB_SCL	2	N/C
3	GND	4	SMB_SDA
5	+5V		



2.4.10 Fan Connectors (CN19~CN21)

This motherboard has three fan connectors. Find fan speed option(s) at BIOS Setup Utility: Advanced\HW Monitor\PC Health Status.

The CN19 (4x1-pin p=2.54mm) is for CPU fan connector.

Pin	Signal
1	GND
2	+12V
3	FAN Speed Detection
4	FAN Speed Control

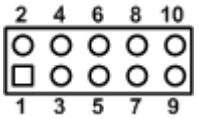
The CN20 and CN21 (4x1-pin p=2.54mm) are for system fan connectors.

Pin	Signal
1	GND
2	+12V
3	FAN Speed Detection
4	FAN Speed Control

2.4.11 GPIO Header (CN22)

This header (5x2-pin p=2.00mm) is for digital I/O interface.

Pin	Signal	Pin	Signal
1	SIO_GPO70 (0xA06 Bit0, H)	2	SIO_GPO77 (0xA06 Bit7, H)
3	SIO_GPO71 (0xA06 Bit1, H)	4	SIO_GPO76 (0xA06 Bit6, H)
5	SIO_GPO72 (0xA06 Bit2, H)	6	SIO_GPO75 (0xA06 Bit5, H)
7	SIO_GPO73 (0xA06 Bit3, H)	8	SIO_GPO74 (0xA06 Bit4, H) [*]
9	VCC5	10	GND



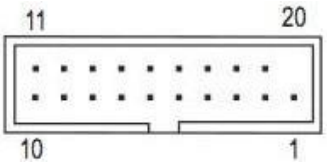
Note

[*]: "H" or "L" means the default voltage is High or Low level, and GPIO output is 5V. The GPI or GPO and High or Low level can be selected with BIOS setting.

2.4.12 Internal USB 3.0 Connector (CN23)

The CN23 is a 19-pin internal connector for installing versatile USB 3.0 compliant peripherals.

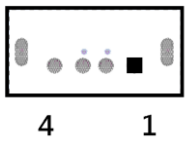
Pin	Signal	Pin	Signal
1	+5 V_DUAL		
2	SSRX-	19	+5 V_DUAL
3	SSRX+	18	SSRX-
4	GND	17	SSRX+
5	SSTX-	16	GND
6	SSTX+	15	SSTX-
7	GND	14	SSTX+
8	USB-	13	GND
9	USB+	12	USB-
10	ID	11	USB+



2.4.13 Internal USB Headers (CN17 and CN24~CN25)

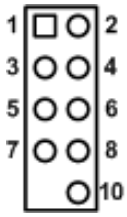
The CN17 is Type-A 180D Connector for USB2.0 signal.

Pin	Signal
1	+5 V_DUAL
2	USB-
3	USB+
4	GND



These are 5x2-pin p=2.54mm headers, support two USB 2.0 signal for CN24~CN25.

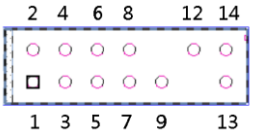
Pin	Signal	Pin	Signal
1	+5 V_DUAL	2	+5 V_DUAL
3	USB-	4	USB-
5	USB+	6	USB+
7	GND	8	GND
		10	N/C



2.4.14 SPI interface for TPM module (CN26)

These are 7x2-pin p=2.0mm headers for SPI interface with AX93515 TPM module.

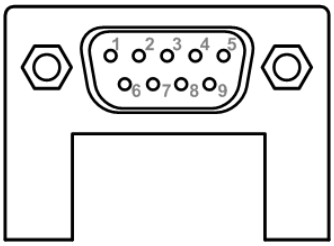
Pin	Signal	Pin	Signal
1	VCC3P3	2	GND
3	MOSI	4	MISO
5	CLK	6	CS2
7	RST	8	PIRQ
9	PP		
		12	NC
13	NC	14	MC



2.4.15 COM1 Connector (COM1)

This is a high rise 9-pin D-Sub connector for COM1 serial port interface. The pin assignments of RS-232/422/485 are listed in table below.

Pin	RS-232 [*]	RS-422 [*]	RS-485 [*]
1	DCD# [**]	TX-	485-
2	RXD	TX+	485+
3	TXD	RX+	N/C
4	DTR#	RX-	N/C
5	GND	GND	GND
6	DSR#	N/C	N/C
7	RTS#	N/C	N/C
8	CTS#	N/C	N/C
9	RI# [**]	N/C	N/C



Note

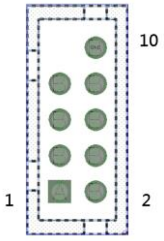
[*]: Signals of COM1 can be RS-232/422/485 by selecting JP3, JP5 and JP6 (see section 2.3.3).
[**]: Pin 1 of COM1 can be DCD/+5V and pin 9 of COM1 can be RI/+12V by selecting JP4 (see section 2.3.4).

2.4.16 COM Headers (COM2~COM6)

The motherboard comes with 5x2-pin p=2.0mm Box headers for COM2~COM6 serial port interfaces.

COM3~COM6:

Pin	Signal	Pin	Signal
1	DSR#	2	DCD#[**]
3	RTS#	4	RXD#
5	CTS#	6	TXD#
7	RI#[**]	8	DTR#
		10	GND



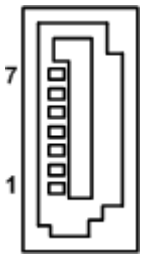
Note

[*]: Signals of COM2 can be RS-232/422/485 by selecting JP7, JP9 and JP10 (see section 2.3.5).
[**]: Pin 2 of COM2 can be DCD/+5V and pin7 of COM2 can be RI/+12V by selecting JP8 (see section 2.3.6).

2.4.17 SATA 3.0 Connectors (SATA1~SATA6)

These Serial Advanced Technology Attachment (Serial ATA or SATA) connectors are for SATA 3.0 interface allowing up to 6.0Gb/s data transfer rate. 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



Chapter 3
Hardware Description

3.1 Microprocessors

The MMB501 Series supports Intel® Core™ i7/ i5/ i3, Pentium® and Celeron® processors, which enable your system to operate under Windows® 7 32/64-bit, Windows® 8.1, Windows® 10 and Linux 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 MMB501 Series uses AMI Plug and Play BIOS.

3.3 System Memory

The MMB501 supports four 288-pin DDR4 DIMM sockets for maximum memory capacity up to 64GB DDR4 SDRAMs. The memory module comes in sizes of 2GB, 4GB, 8GB and 16GB.

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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 <Del> during the Power On Self Test (POST) to enter BIOS setup, otherwise, POST will continue with its test routines.
2. Once you enter the BIOS, 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 JP1 (see section 2.3.1).

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.

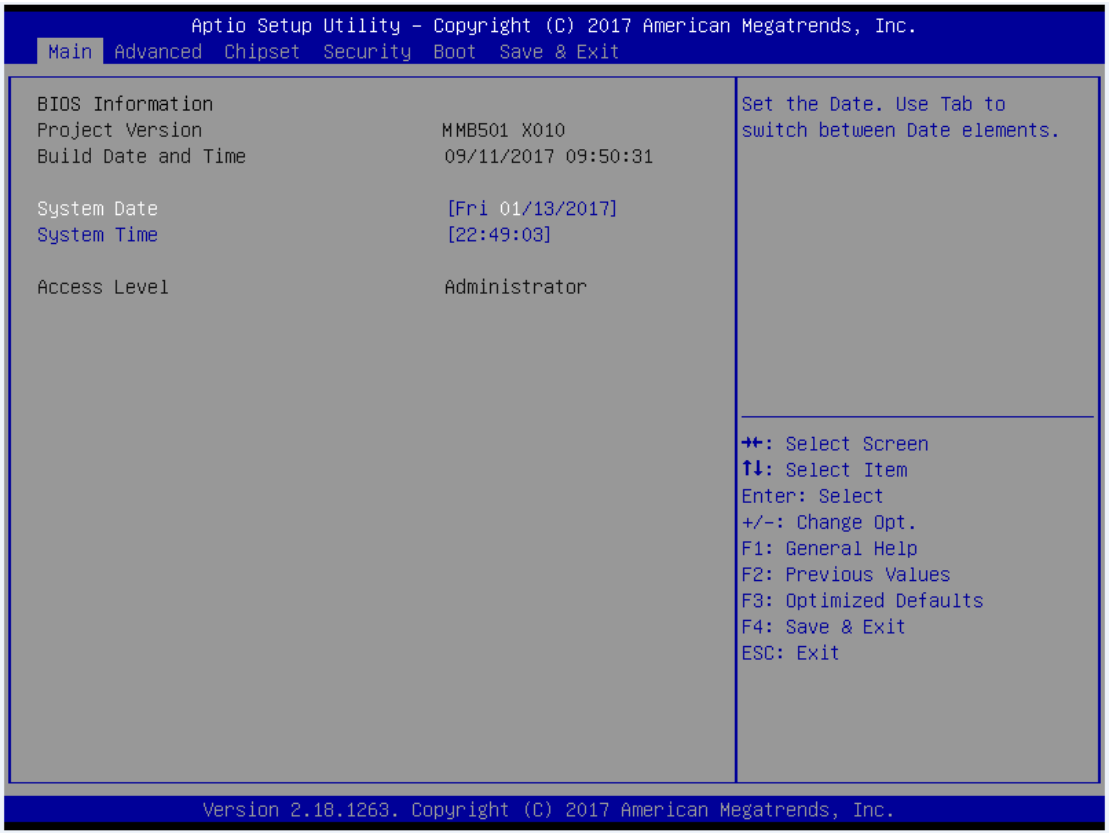
Note

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.
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.
+– Plus/Minus	The Plus and Minus <Arrow> keys allow you to change the field value of a particular setup item.
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.

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 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.

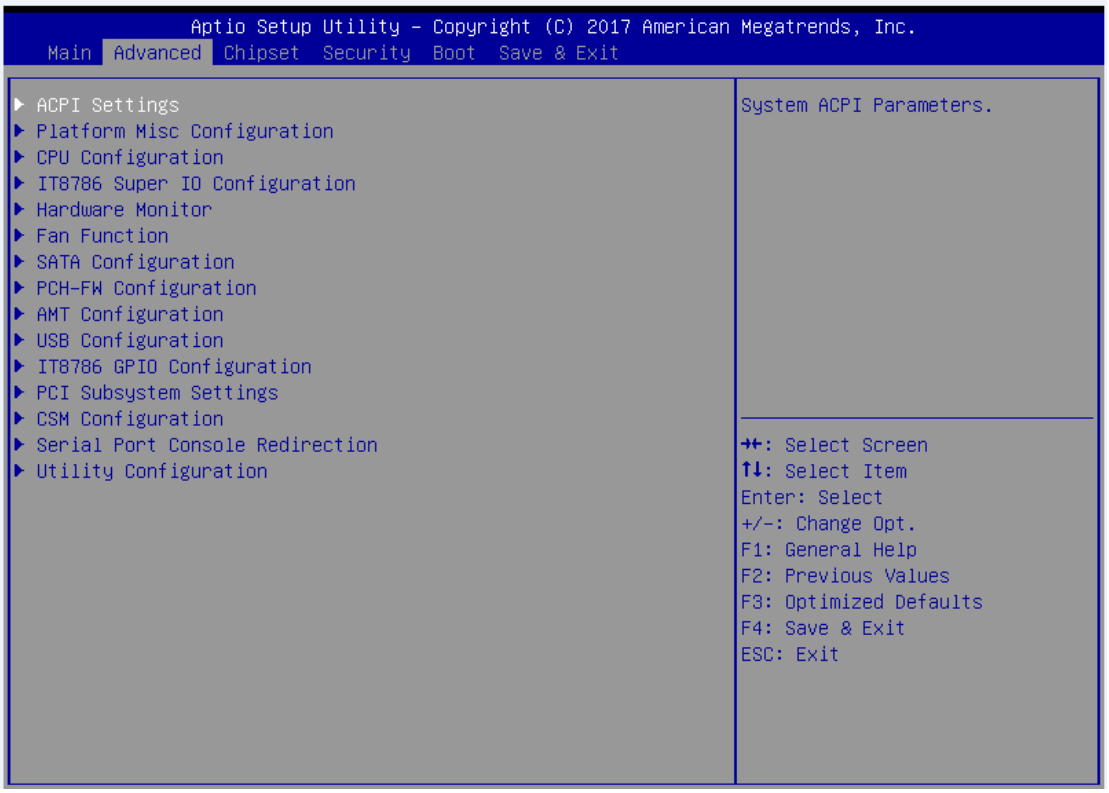
Access Level
Display the access level of current user.

4.4 Advanced Menu

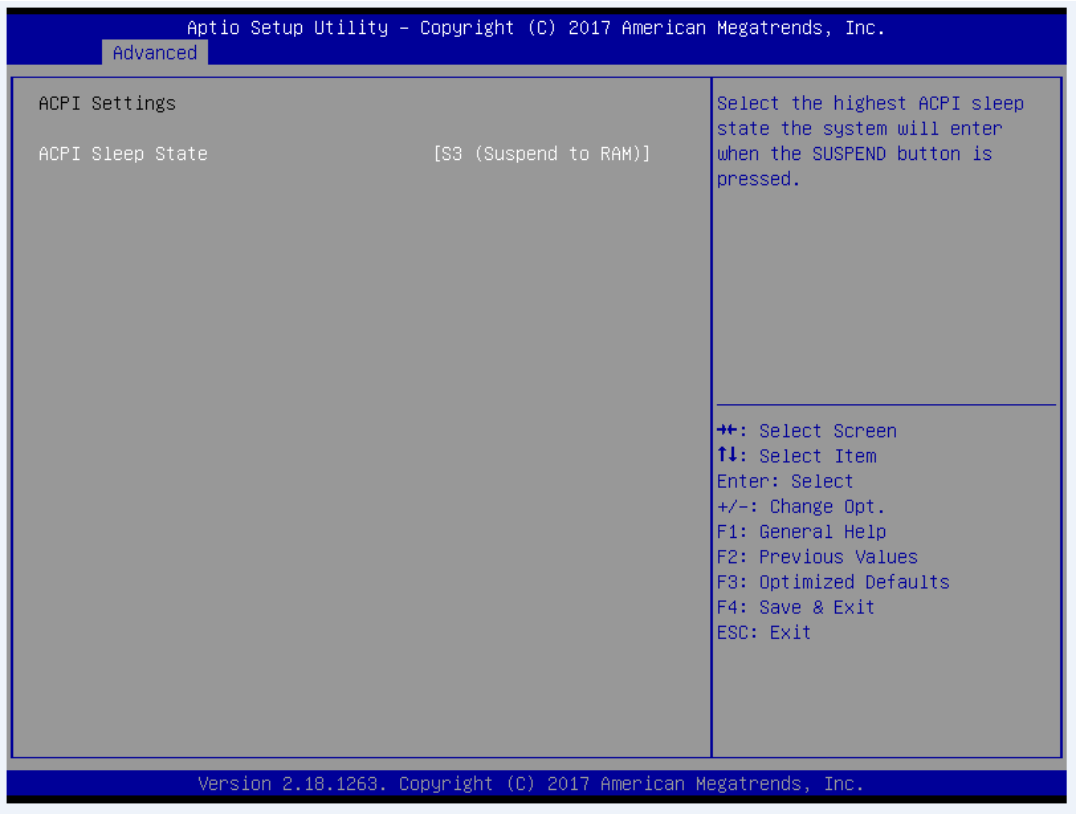
The Advanced menu also allows users to set configuration of the CPU and other system devices. You can select any of the items in the left frame of the screen to go to the sub menus:

- ACPI Settings
- AMT configuration
- CPU Configuration
- CSM Configuration
- FAN Function
- Hardware Monitor
- IT8786 GPIO Configuration
- IT8786 Super IO Configuration
- PCH-FW configuration
- PCI Subsystem Settings
- Platform Misc Configuration
- Sata Configuration
- Serial Port Configuration
- USB Configuration
- Utility Configuration

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



- **ACPI Settings**

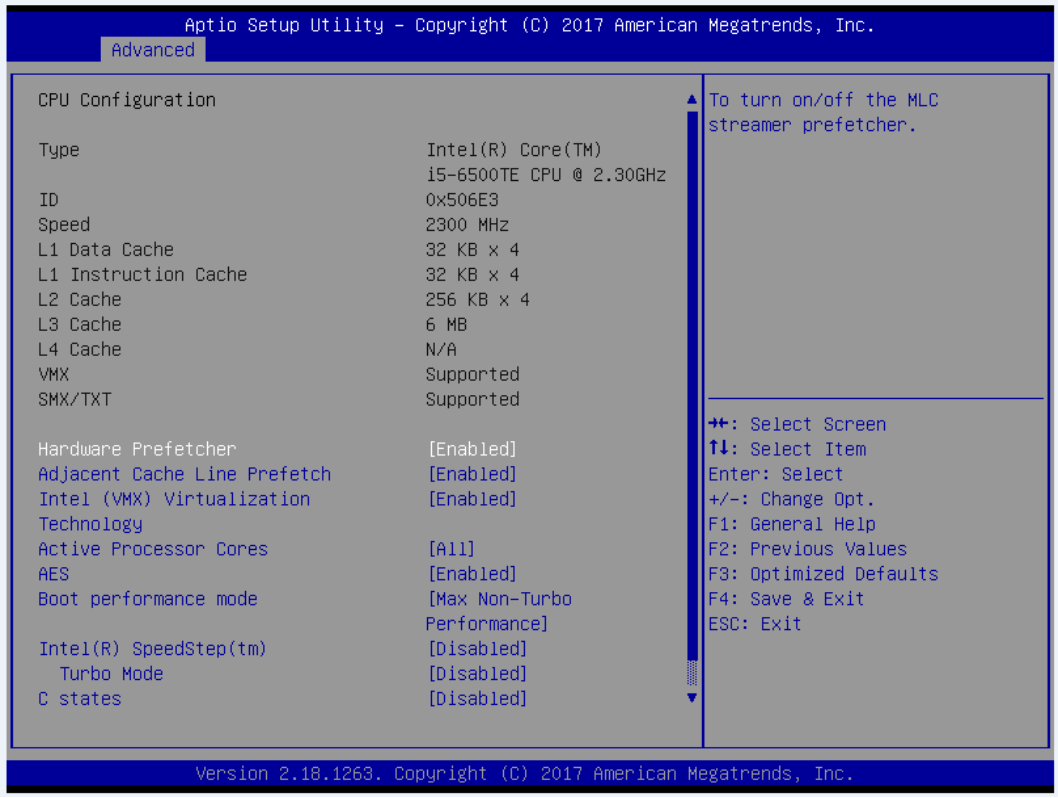


ACPI Sleep State
Select the ACPI (Advanced Configuration and Power Interface) sleep state. Configuration options are Suspend Disabled and S3 (Suspend to RAM). The default is S3 (Suspend to RAM); this option selects ACPI sleep state the system will enter when suspend button is pressed.

- **AMT Configuration**
  Use this screen to configure AMT parameters.

AMT BIOS Features
Enable or disable Active Management Technology BIOS features. The default is Enabled.

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



Hyper-threading
Enable or disable Hyper-threading Technology, which allows a single physical processor to multitask as multiple logical processors. When disabled, only one thread per enabled core is enabled.

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 single computer system to work as several virtual systems.

Hardware Prefetcher
To turn on/off the MLC streamer prefetcher.

Adjacent Cache Line Prefetch
To turn on/off prefetching of adjacent cache lines.

Active Processor Cores
Number of cores to enable in each processor package.

AES
Enabled / Disable AES (Advanced Encryption Standard)

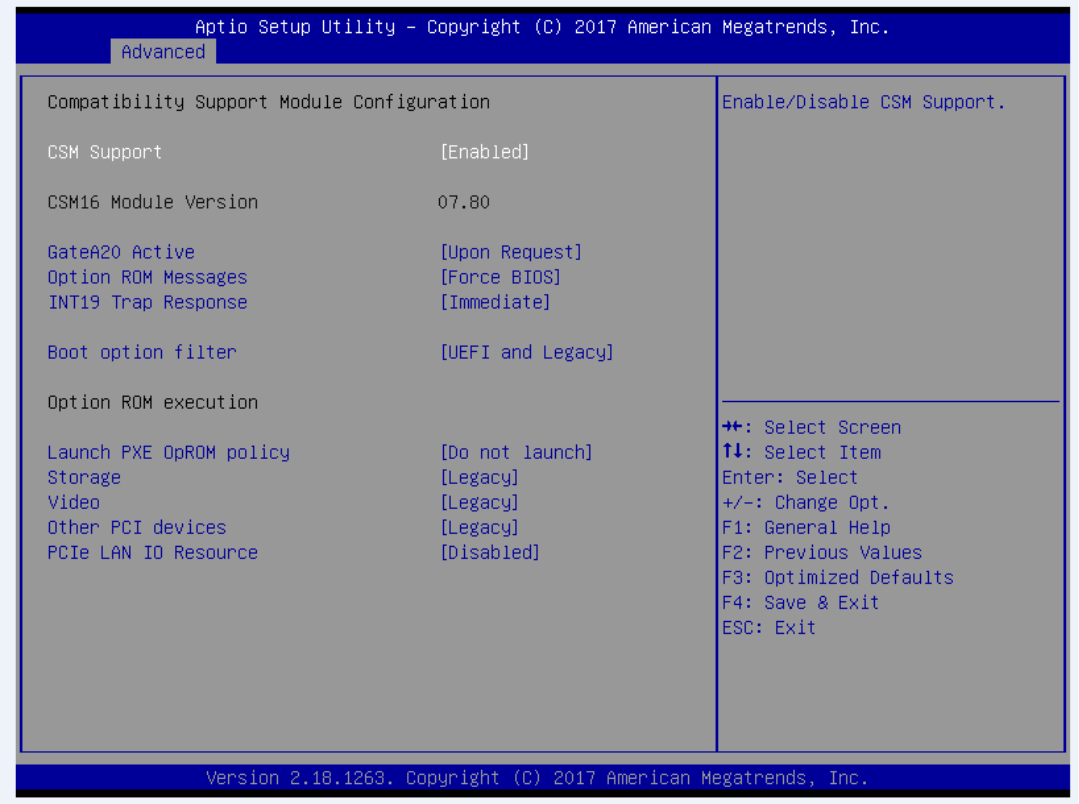
Boot performance mode
Select the performance state that the BIOS will set starting from reset vector.

Intel (R) SpeedStep(tm)
Allows more than two frequency ranges to be supported.

Turbo Mode
Enable/Disable processor Turbo Mode (requires EMTTM enabled too). AUTO means enabled, unless max turbo ratio is bigger than 16 - SKL A0 W/A.

C states
Enable/Disable CPU Power Management. Allows CPU to go to C states when it's not 100% utilized.

- **CSM Configuration**
  This screen displays CSM information.



CSM Support
Enabled / Disable CSM Support.

GateA20 Active
UPON REQUEST - GA20 can be disabled using BIOS services. ALWAYS - do not allow disabling GA20; this option is useful when any RT code is executed above 1MB.

Option ROM Messages
Set display mode for Option ROM.

INT19 Trap Response
BIOS reaction on INT19 trapping by Option ROM: IMMEDIATE - execute the trap right away; POSTPONED - execute the trap during legacy boot.

Boot option filter
This option controls Legacy/UEFI ROMs priority.

Storage
Controls the execution of UEFI and Legacy Storage OpROM

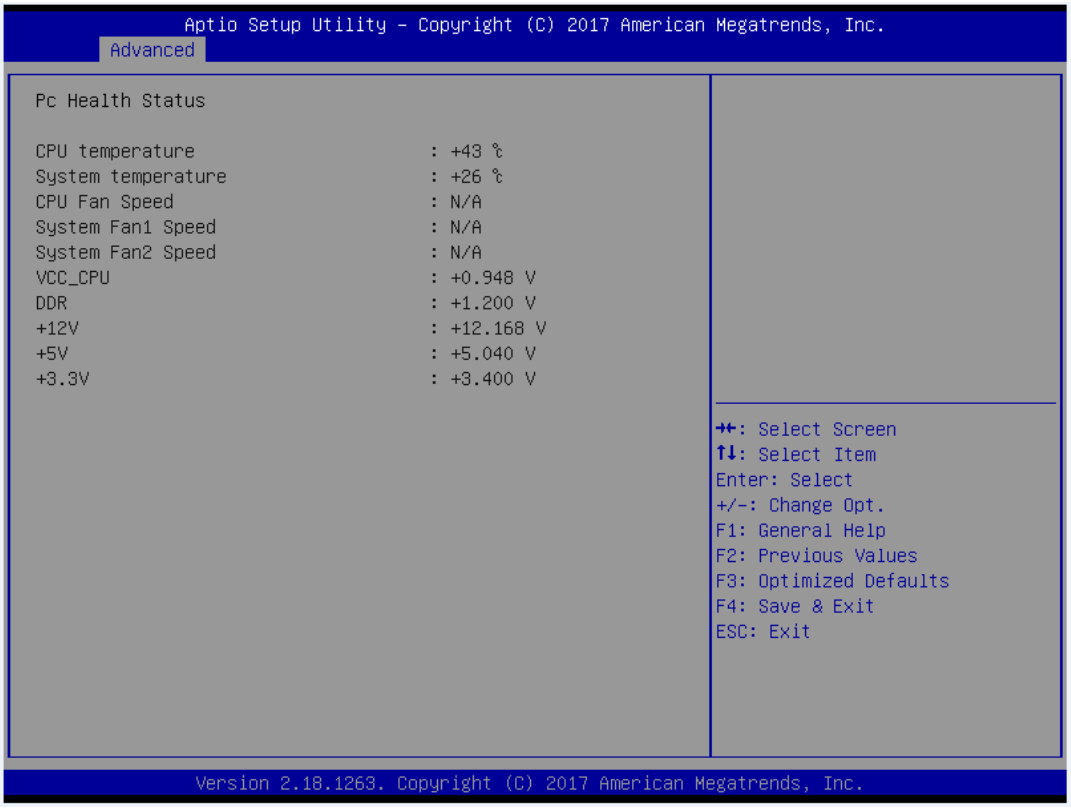
Video
Controls the execution of UEFI and Legacy Video OpROM.

Other PCI devices
Determines OpROM execution policy for devices other than Network, Storage, or Video.

- **Fan Function**
  This screen allows you to select CPU and system fan mode.

CPU_Fan1/Smart Fan 2/Smart Fan 3 Mode
These items allow you to select CPU and system fans mode, which can be set to Full on, Manual and Automatic Mode.

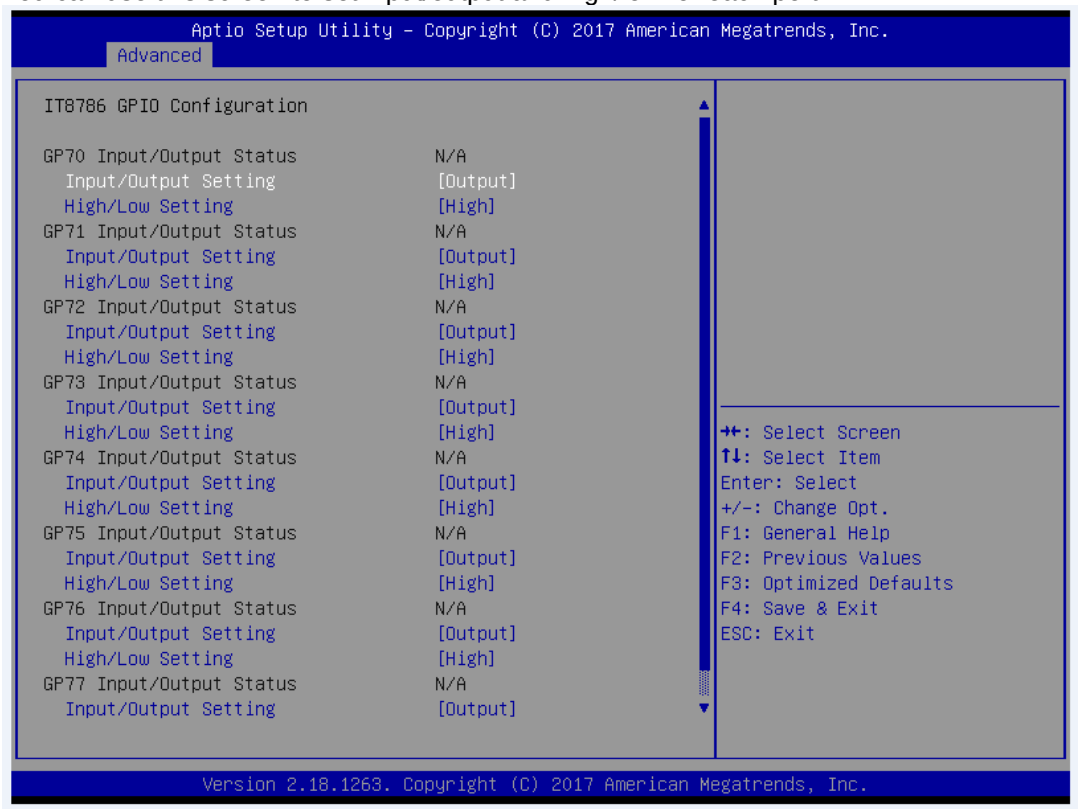
- **Hardware Monitor**
  This screen monitors hardware health status.



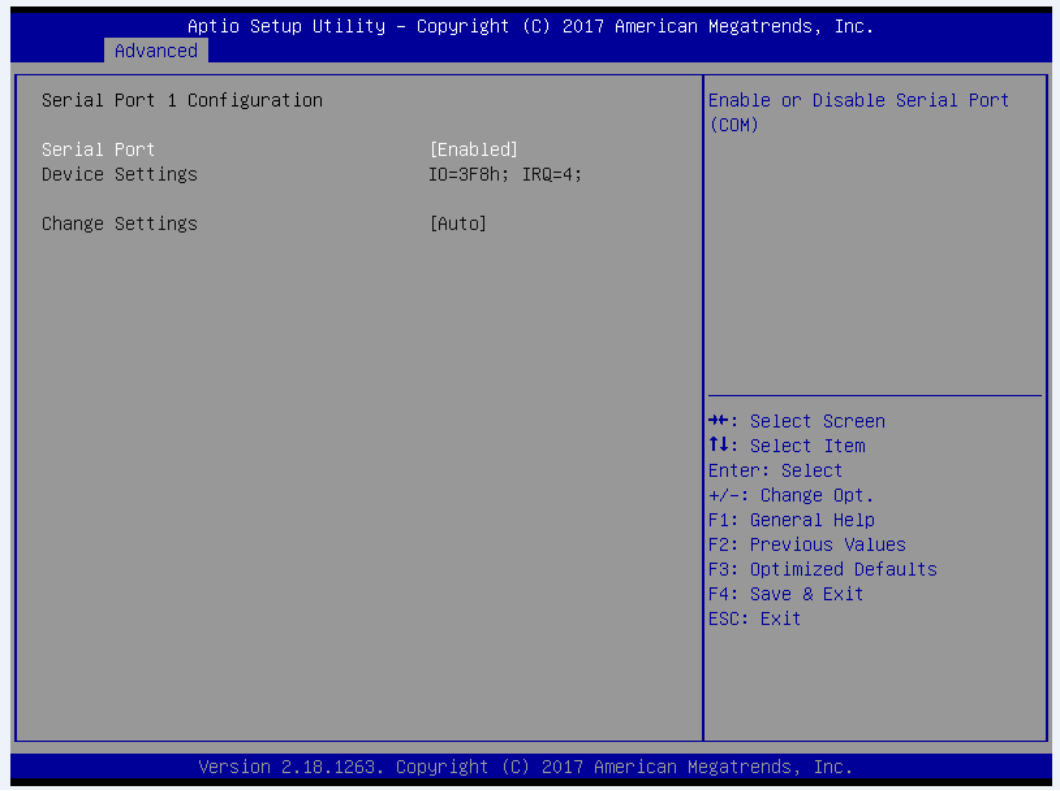
This screen displays the temperature of system and CPU, cooling fans speed in RPM and system voltages (VCC_CPU, DDR, +12V, +5V and +3.3V).

- **IT8786 GPIO Configuration**

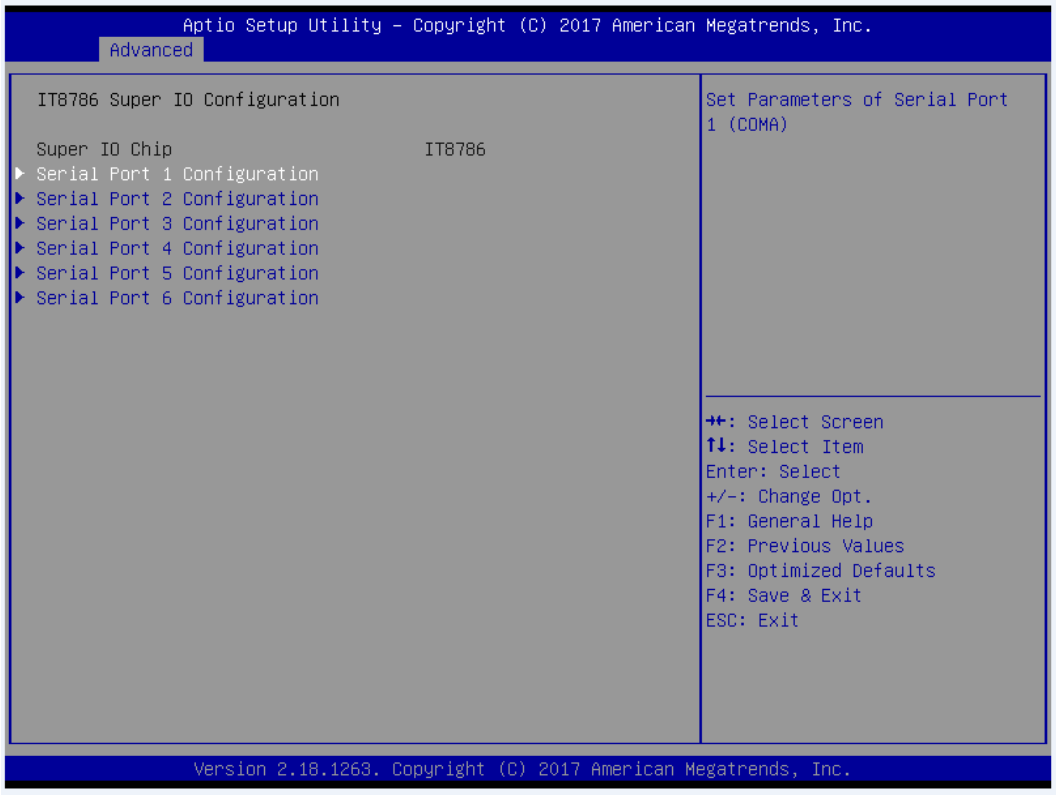
  You can use this screen to set input/output and high/low for each port.



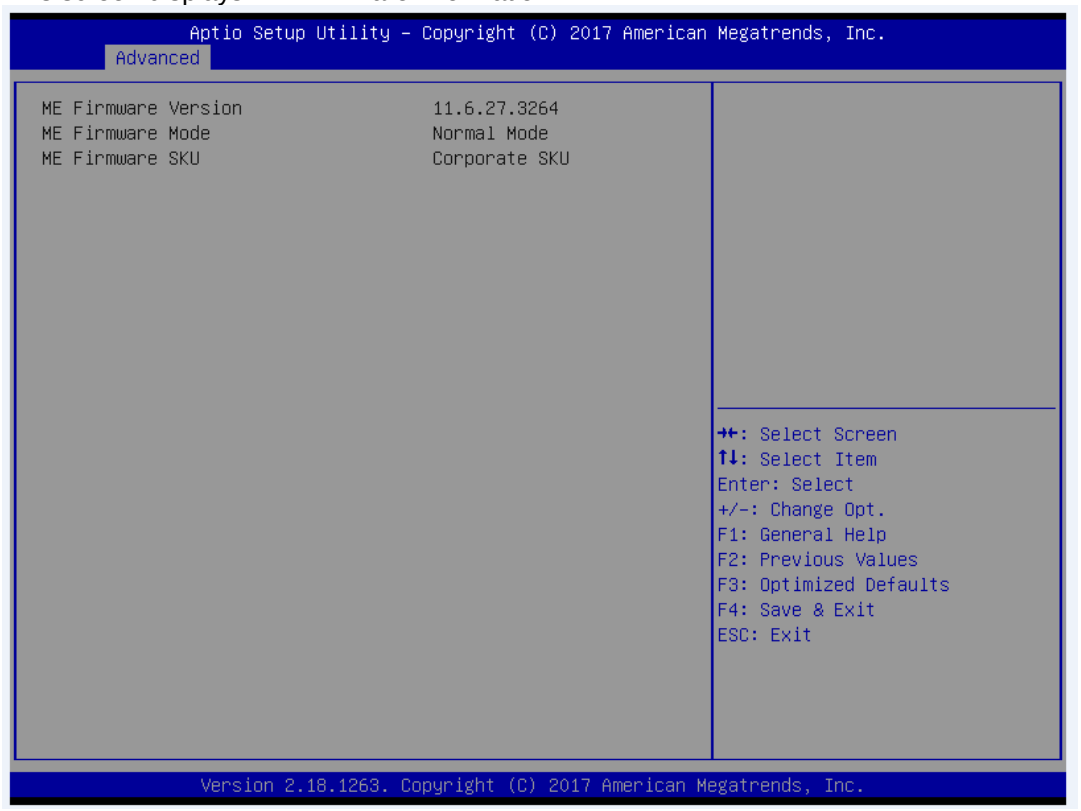
- **IT8786 Super IO Configuration**
  You can use this screen to select options for the Super IO Configuration, and change the value of the selected option. A description of the selected item appears on the right side of the screen. For items marked with "▶", please press <Enter> for more options.



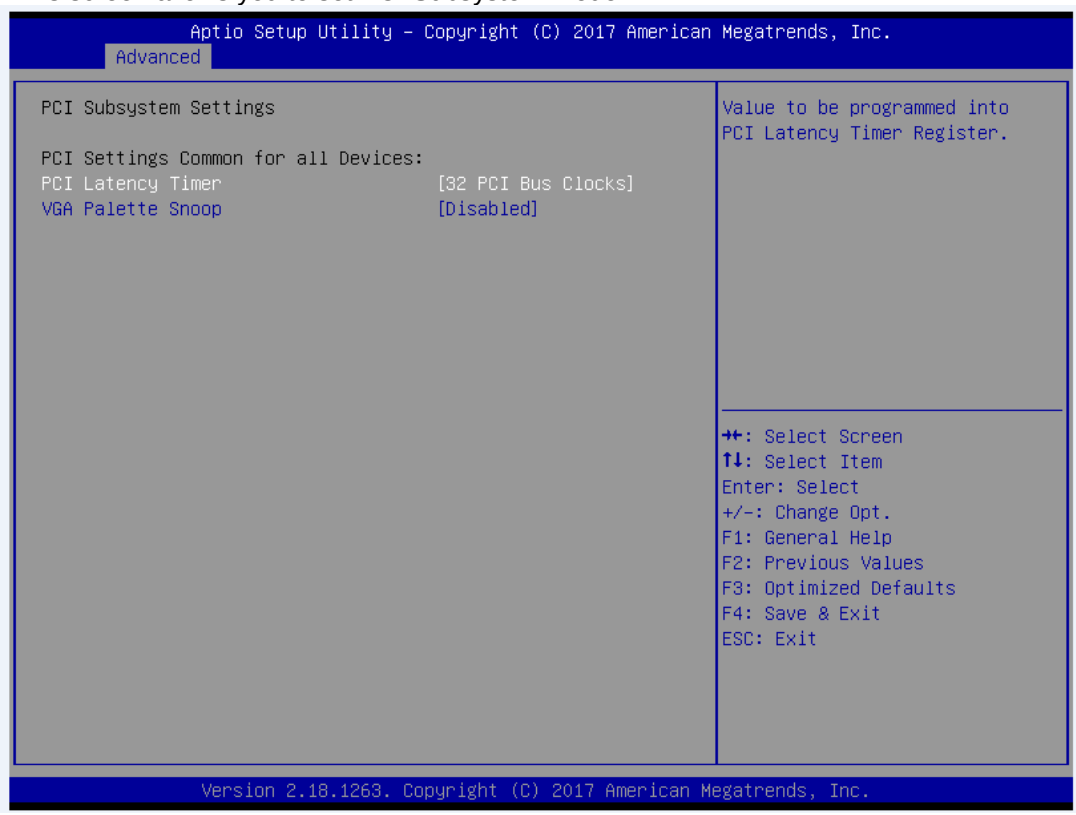
Serial Port 1~6 Configuration
Use these items to set parameters related to serial port 1~6.



- **PCH-FW Configuration**
  This screen displays ME Firmware information.



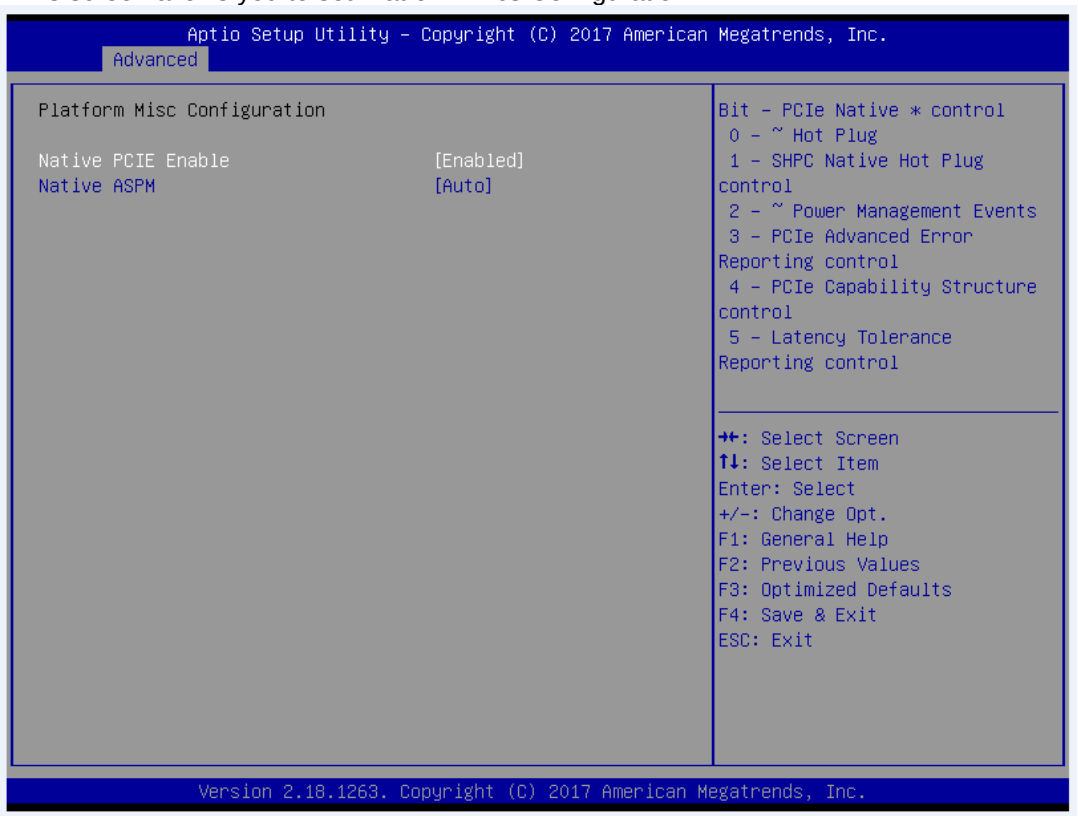
- **PCI Subsystem settings**
  This screen allows you to set PCI Subsystem mode.



PCI Latency Timer
Value to be programmed into PCI Latency Timer Register.

VGA Palette Snoop
Enables or Disables VGA Palette Registers Snooping.

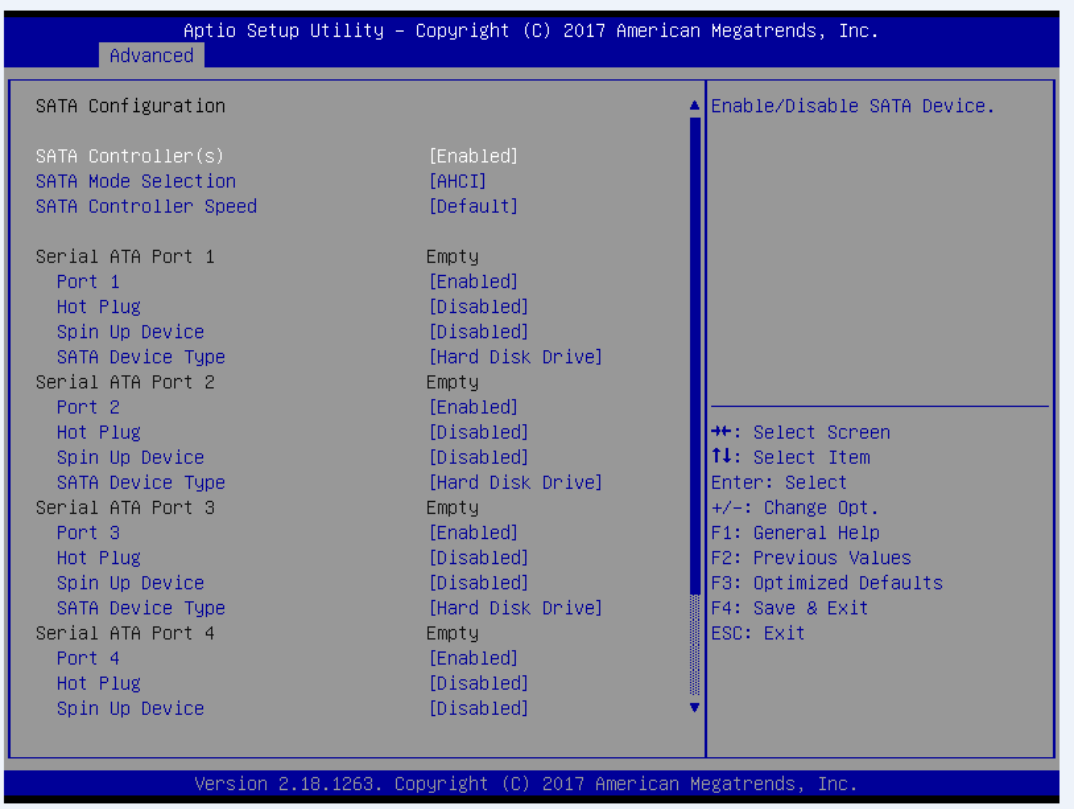
- **Platform Mics Configuration**
  This screen allows you to set Platform Mics Configuration.



Native PCIE Enable
Bit - PCIe Native * control\n 0 - ~ Hot Plug\n 1 - SHPC Native Hot Plug control\n 2 - ~ Power Management Events\n 3 - PCIe Advanced Error Reporting control\n 4 - PCIe Capability Structure control\n 5 - Latency Tolerance Reporting control.

Native ASPM
Enabled - OS Controlled ASPM, Disabled - BIOS Controlled ASPM.

- **SATA Configuration**
  During system boot up, the BIOS automatically detects the presence of SATA devices. In the SATA Configuration menu, you can see the currently installed hardware in the 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 RAID and AHCI (Advanced Host Controller Interface) Mode. The default is AHCI Mode.

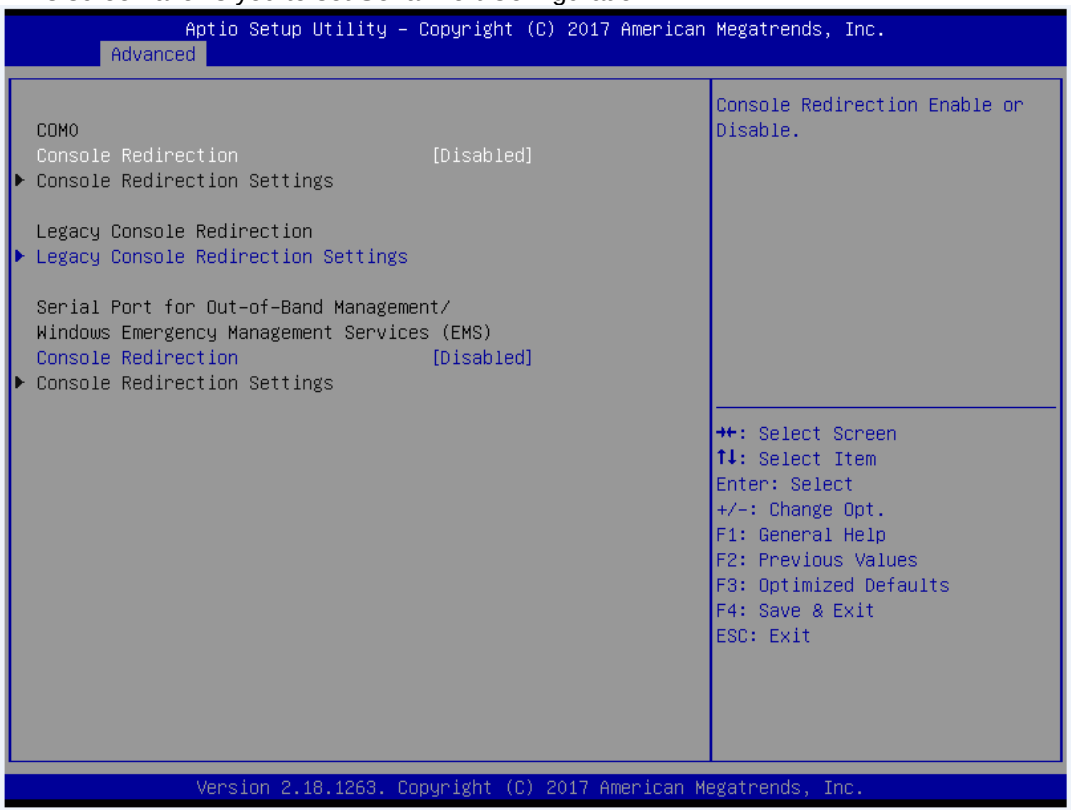
SATA Controller Speed
Indicates the maximum speed the SATA controller can support.

Hot Plug
Designates this port as Hot Pluggable.

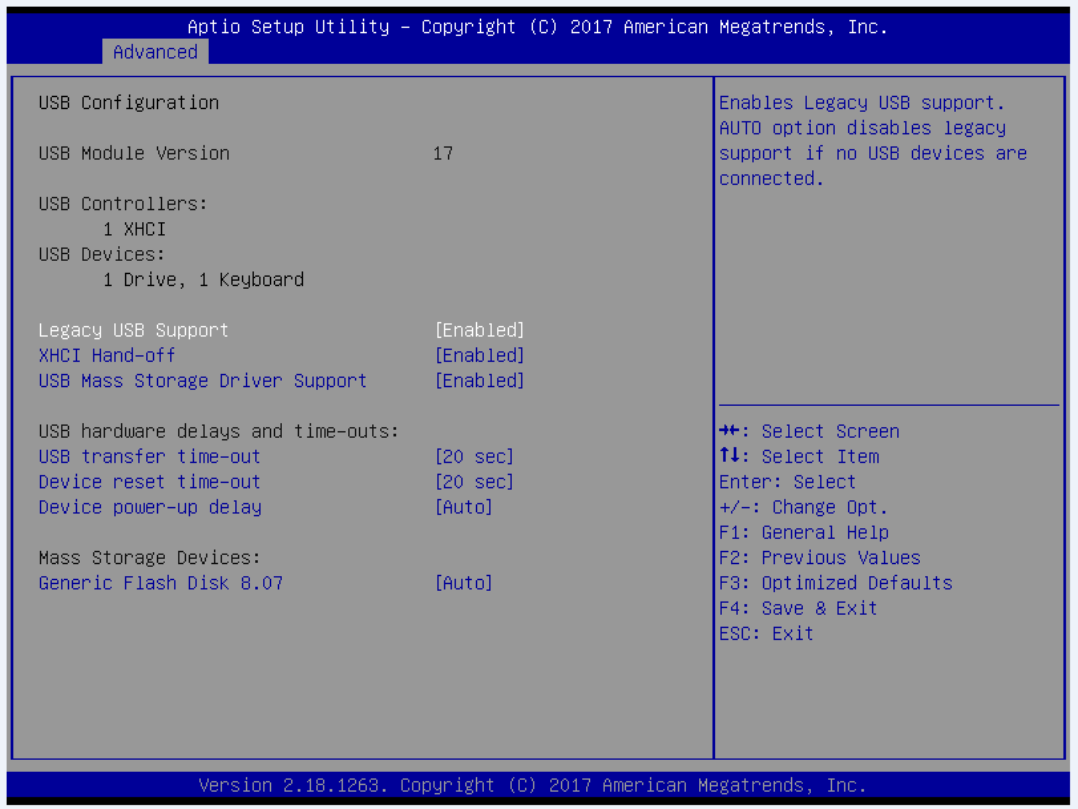
Spin Up Device
If enabled for any of ports Staggerred Spin Up will be performed and only the drives which have this option enabled will spin up at boot. Otherwise all drives spin up at boot..

SATA Device Type
Identify the SATA port is connected to Solid State Drive or Hard Disk Drive

- **Serial Port Configuration**
  This screen allows you to set Serial Port Configuration.



- **USB Configuration**



USB Devices
Display all detected USB devices.

Legacy USB Support
Enables Legacy USB support. AUTO option disables legacy support if no USB devices are connected.

XHCI Hand-off
This is a workaround for OSes without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.

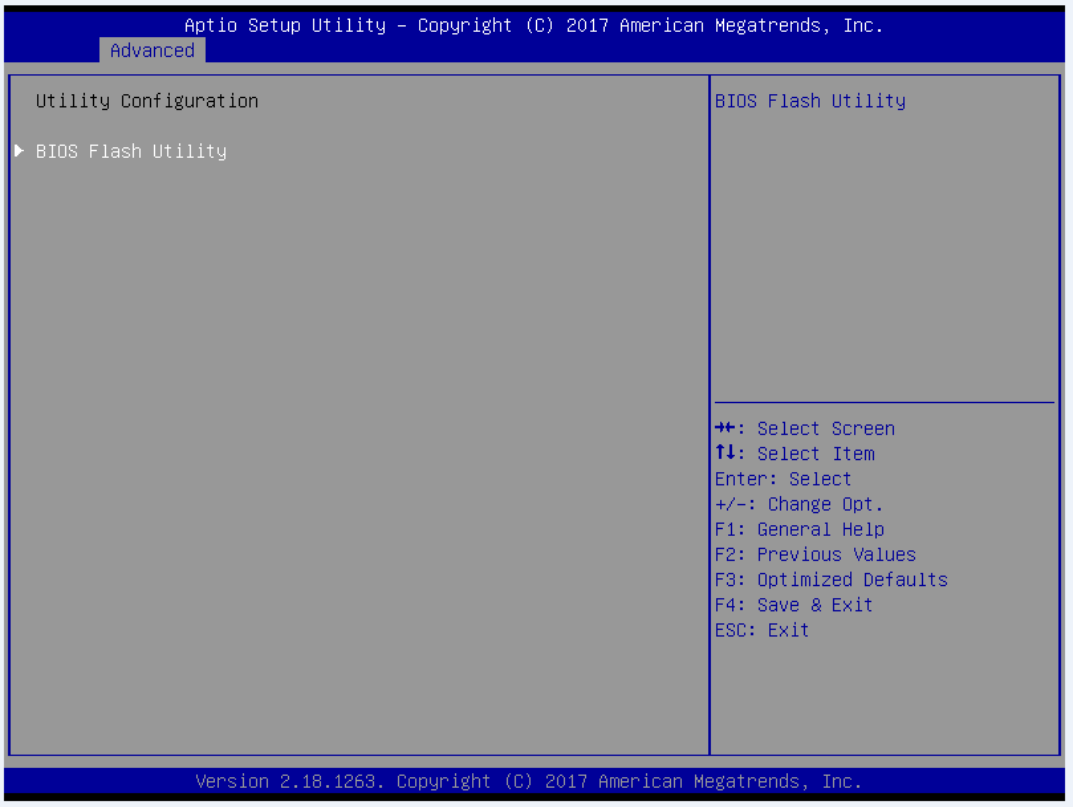
USB Mass Storage Driver Support
Enable/Disable USB Mass Storage Driver Support.

USB transfer time-out
The time-out value for Control, Bulk, and Interrupt transfers.

Device reset time-out
USB mass storage device Start Unit command time-out.

Device power-up delay
Maximum time the device will take before it properly reports itself to the Host Controller. 'Auto' uses default value: for a Root port it is 100 ms, for a Hub port the delay is taken from Hub descriptor.

- **Utility Configuration**



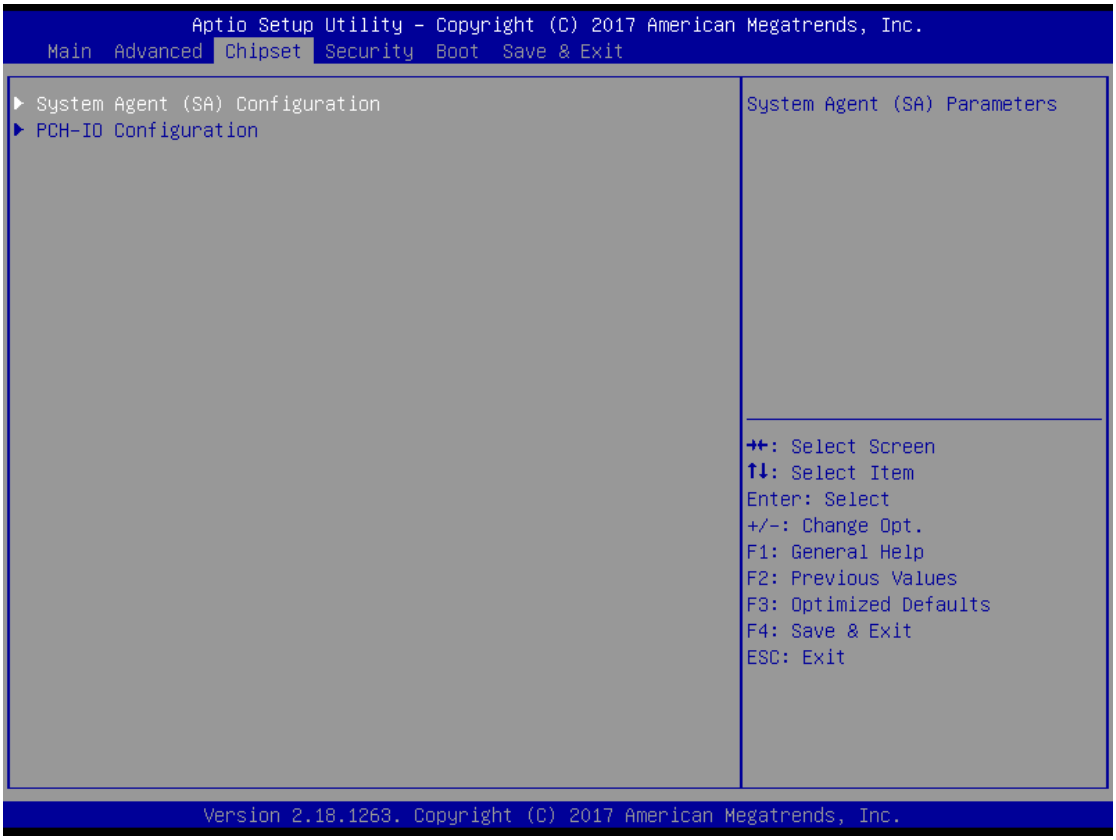
BIOS Flash Utility
BIOS flash utility configuration. For more detailed information, please refer to Appendix B.

4.5 Chipset Menu

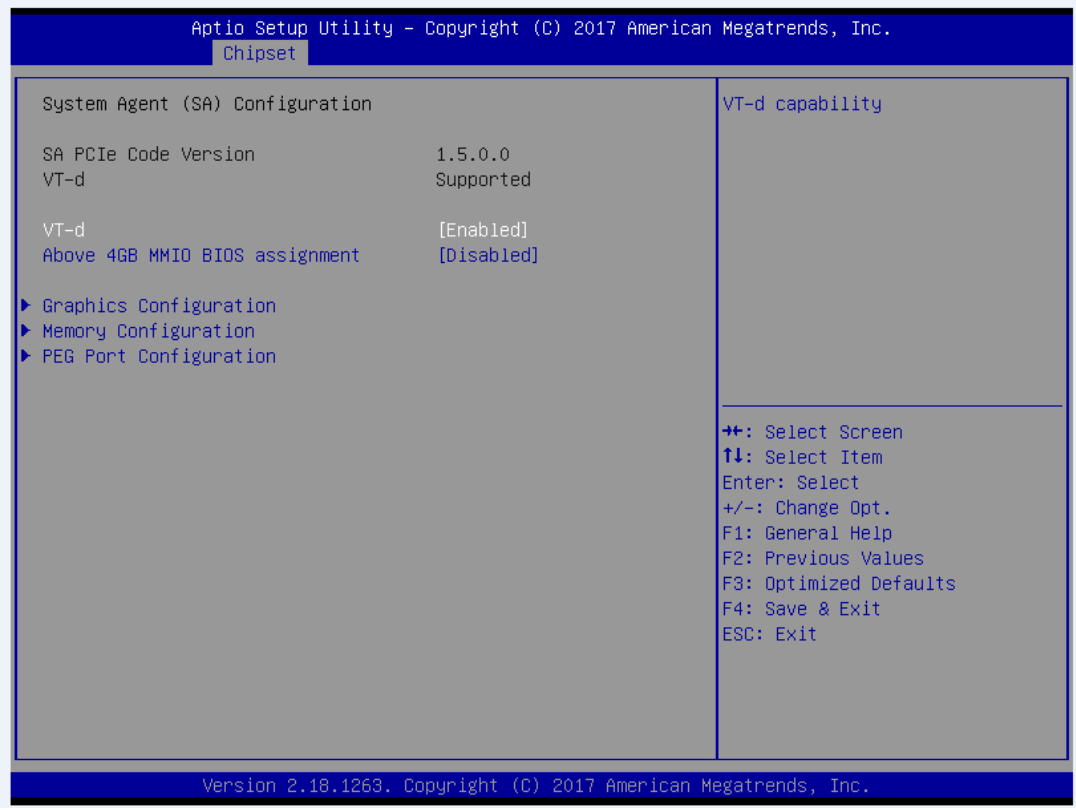
The Chipset menu allows users to change the advanced chipset settings. You can select any of the items in the left frame of the screen to go to the sub menus:

- ► System Agent (SA) Configuration
- ► PCH-IO Configuration

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



- **System Agent (SA) Configuration**
  This screen allows users to configure System Agent (SA) parameters. For items marked with "►", please press <Enter> for more options.



Graphics Configuration
Open sub menu for parameters related to graphics configuration.

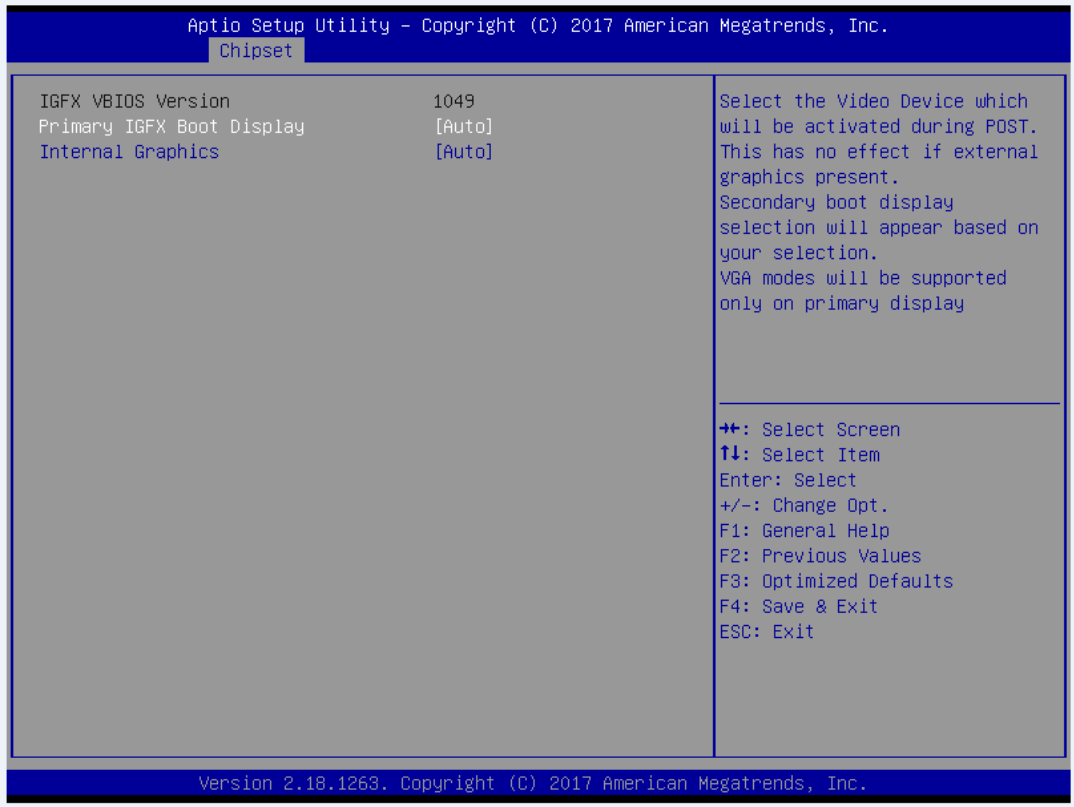
Memory Configuration
Open sub menu for information related to system memory.

PEG Port Configuration
Open sub menu for parameters related to graphics configuration.

VT-d
VT-d capability.

Above 4GB MMIO BIOS assignment
Enable/Disable above 4GB Memory MappedIO BIOS assignment\n\nThis is enabled automatically when Aperture Size is set to 2048MB.

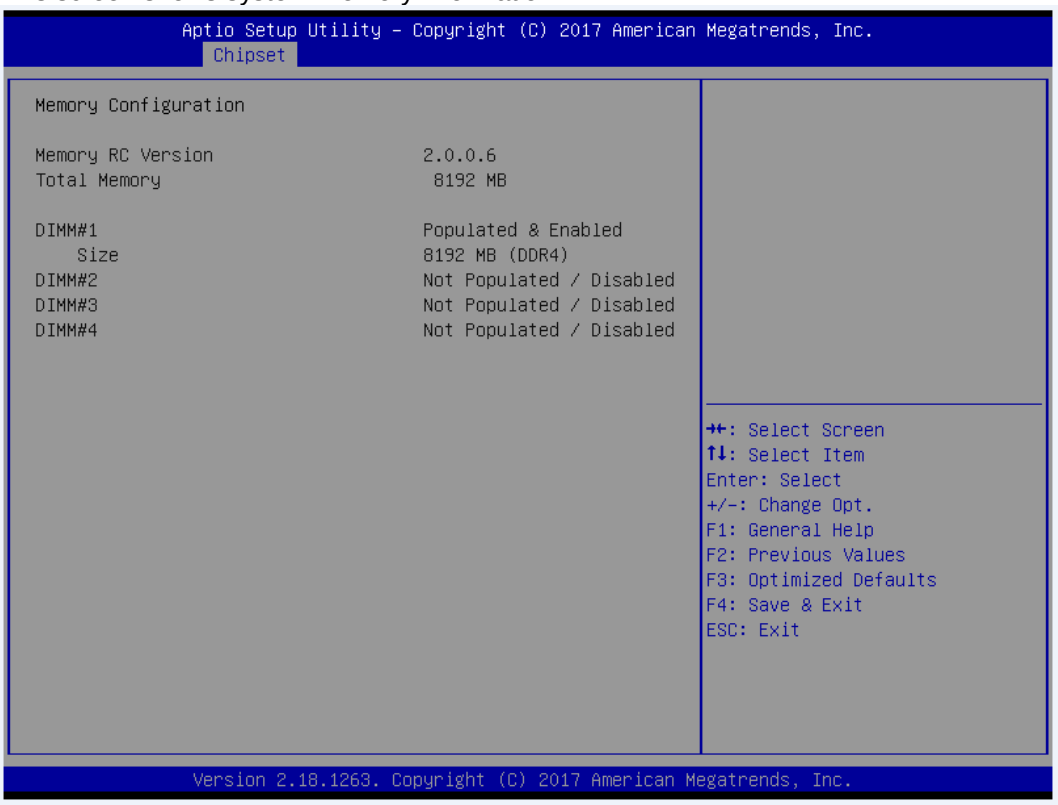
- **Graphics Configuration**



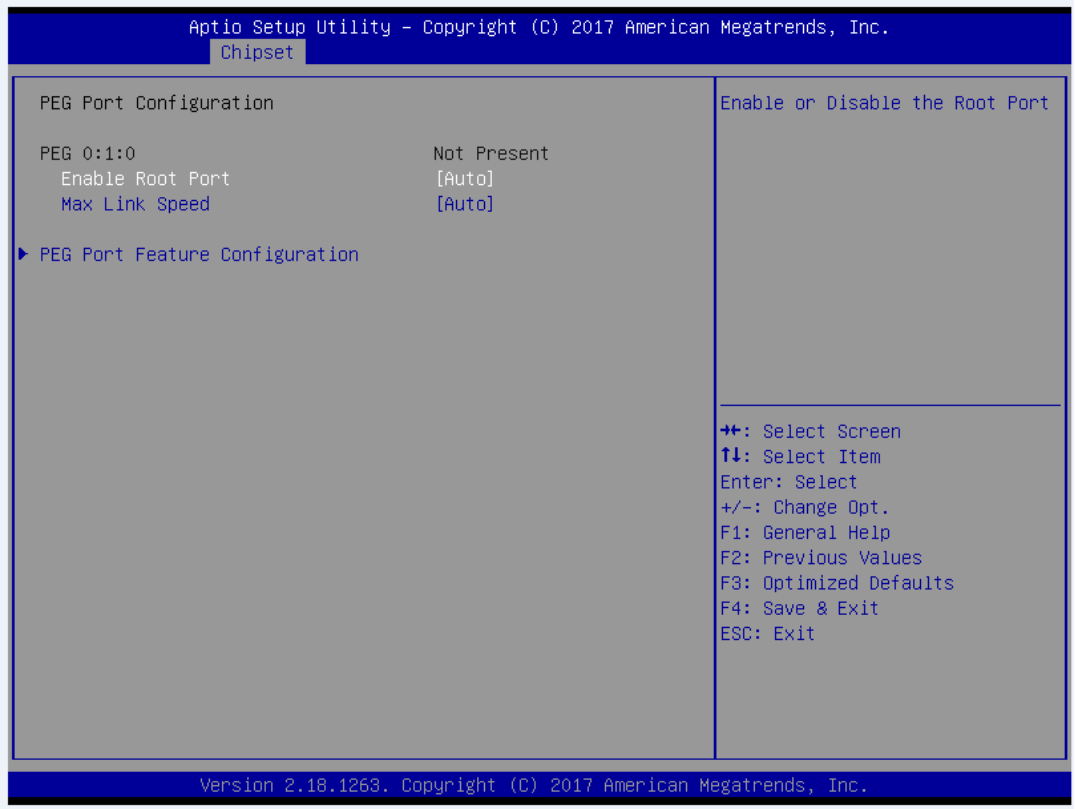
Primary IGFX Boot Display
Select the video device which will be activated during POST (Power-On Self Test). The default is Auto.

Internal Graphics
Keep IGFX enabled based on the setup options.

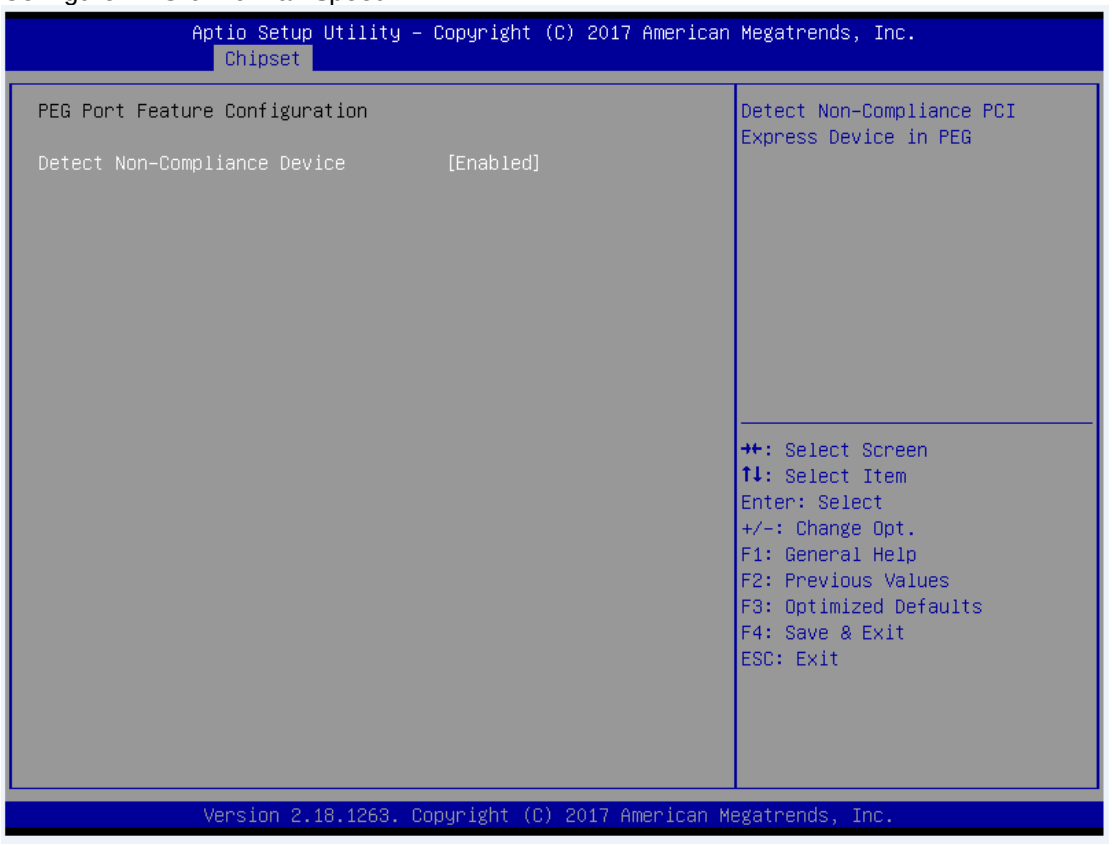
- **Memory Configuration**
  This screen shows system memory information.



- **PEG Port Configuration**
  This screen shows PEG Port/POE Port feature information.

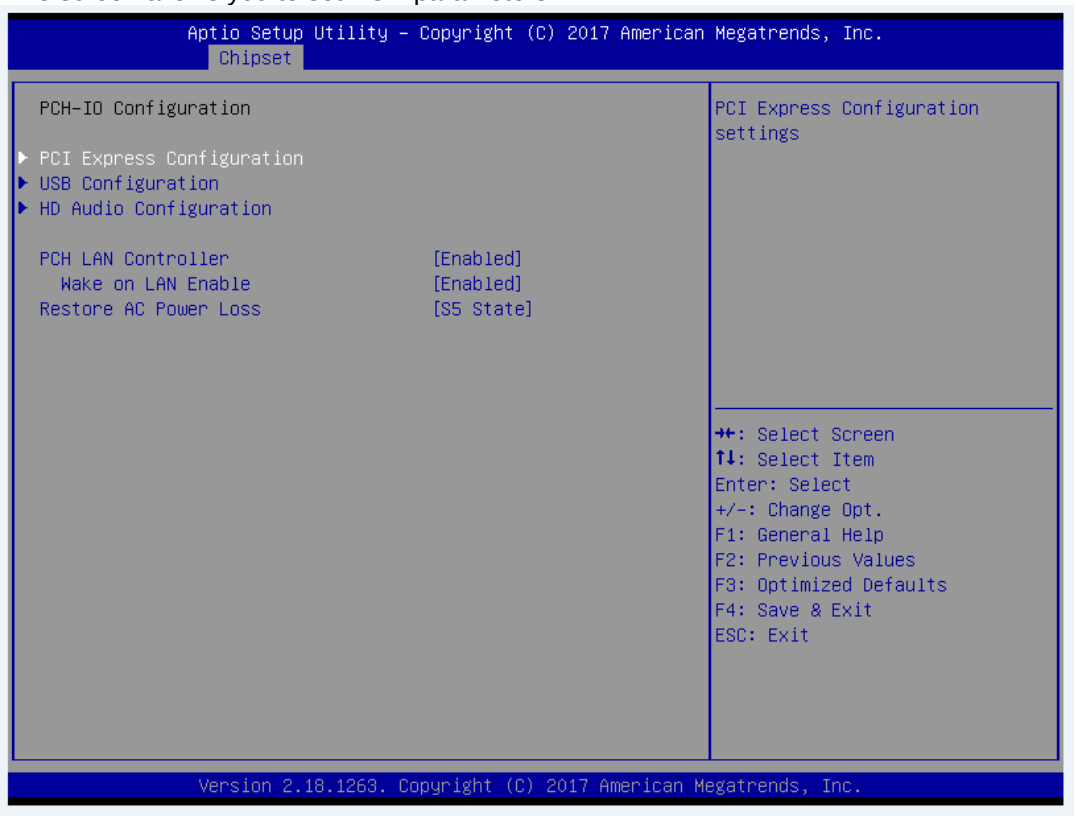


Max Link Speed
Configure PEG 0:1:0 Max Speed.



Detect Non-Compliance Device
Detect Non-Compliance PCI Express Device in PEG.

- **PCH-IO Configuration**
  This screen allows you to set PCH parameters.

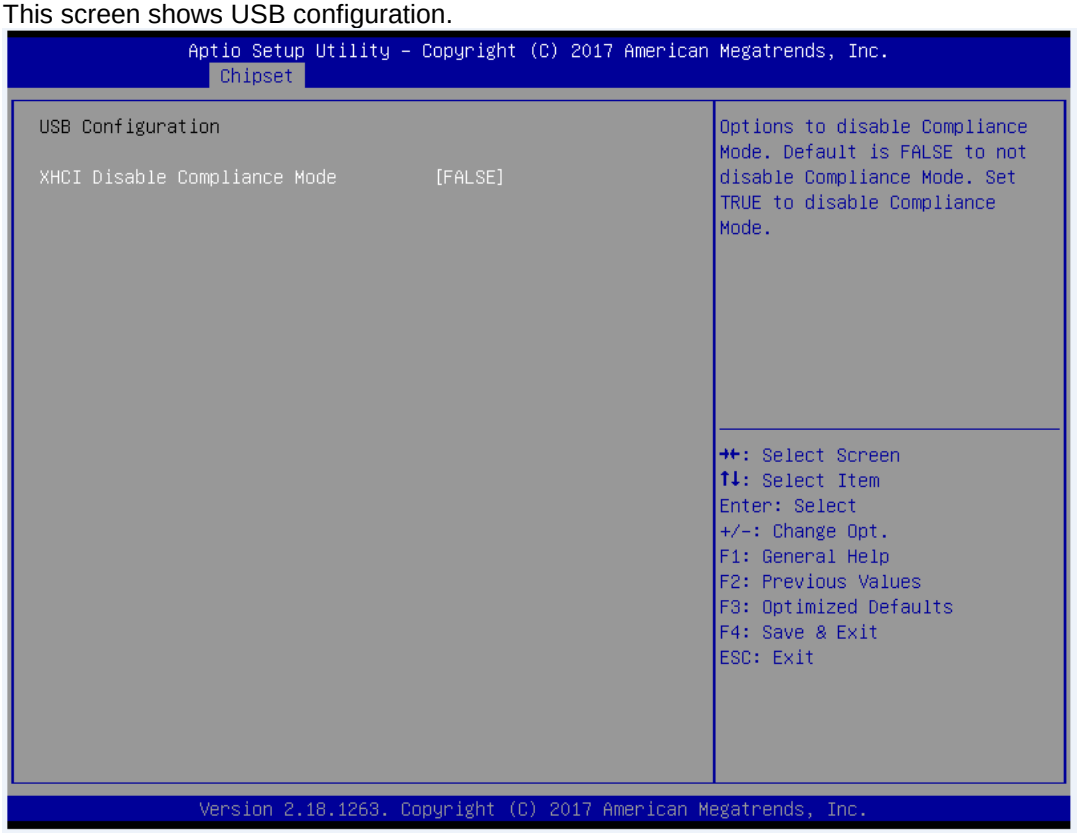


PCH LAN Controller
Enable or disable onboard PCH LAN controller.

Wake on LAN Enable
Enable or disable integrated LAN to wake the system.

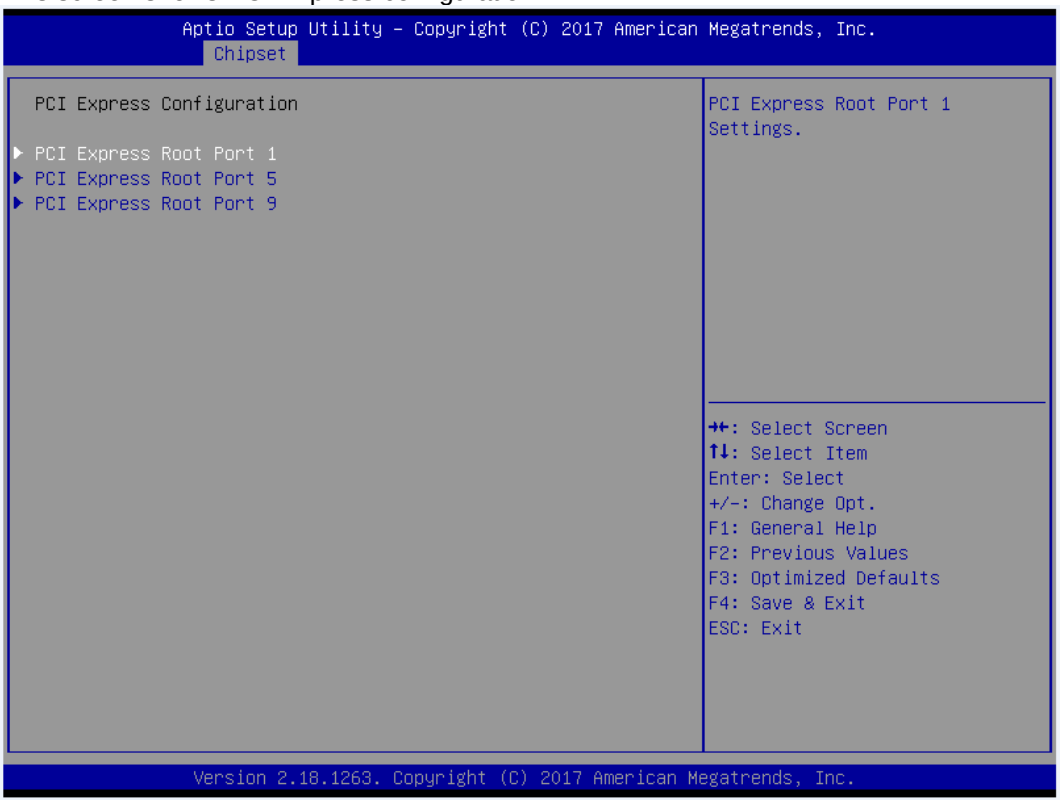
Restore AC Power Loss
Specify what state to go to when power is re-applied after a power failure (G3 state).

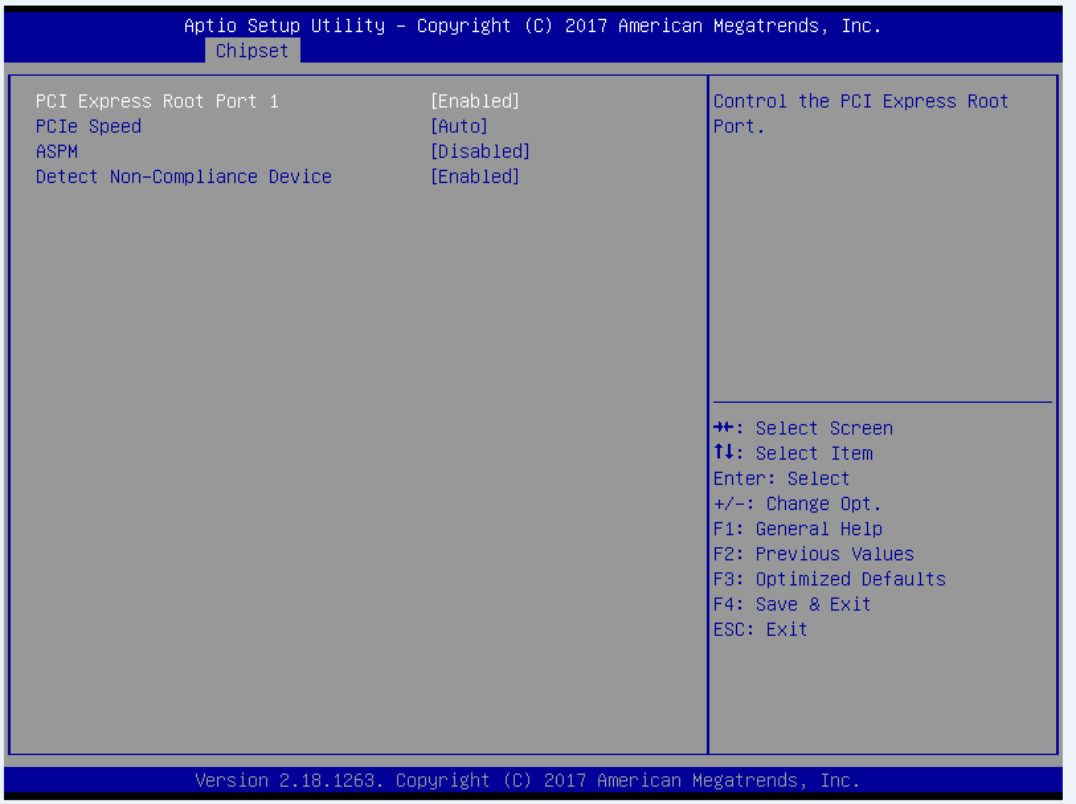
- **USB Configuration**
  This screen shows USB configuration.



XHCI Disable Compliance Mode
Options to disable Compliance Mode. Default is FALSE to not disable Compliance Mode. Set TRUE to disable Compliance Mode.

- **PCI Express Configuration**
  This screen shows PCI Express configuration.



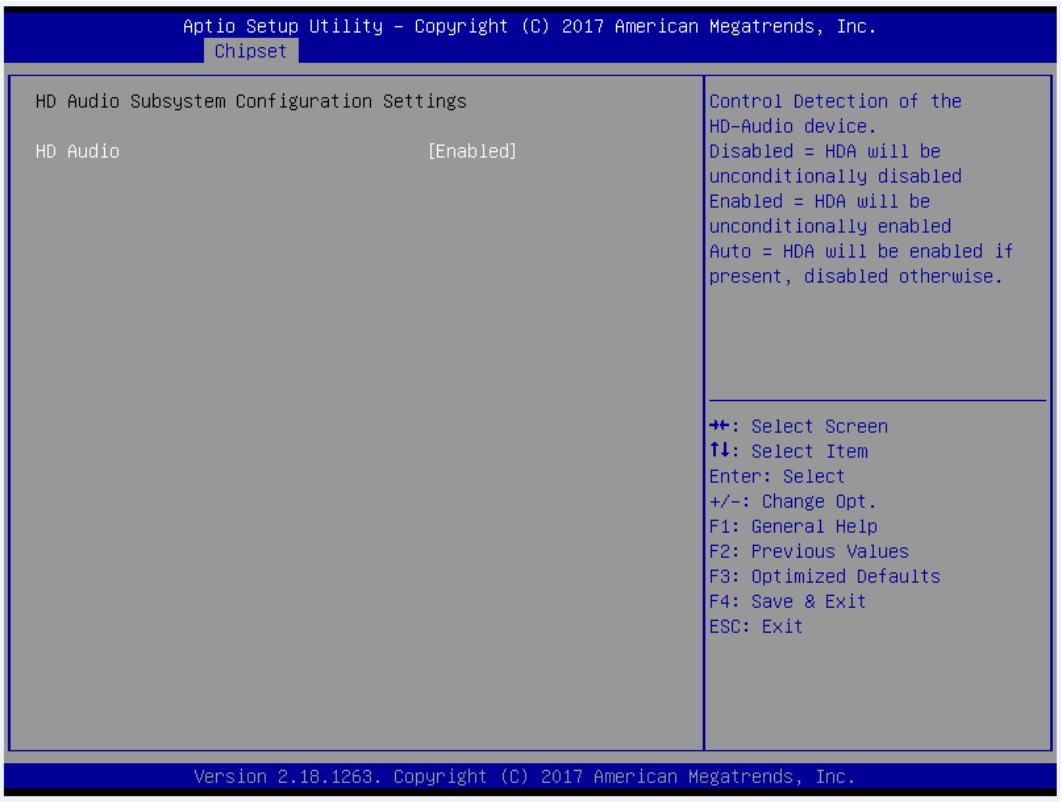


PCIe Speed
Configure PCIe Speed.

ASPM
Set the ASPM Level:\nForce L0s - Force all links to L0s State\nAUTO - BIOS auto configure\nDISABLE - Disables ASPM.

Detect Non-Compliance Device
Detect Non-Compliance PCI Express Device. If enable, it will take more time at POST time.

- **HD Audio Configuration**
  This screen shows HD Audio information



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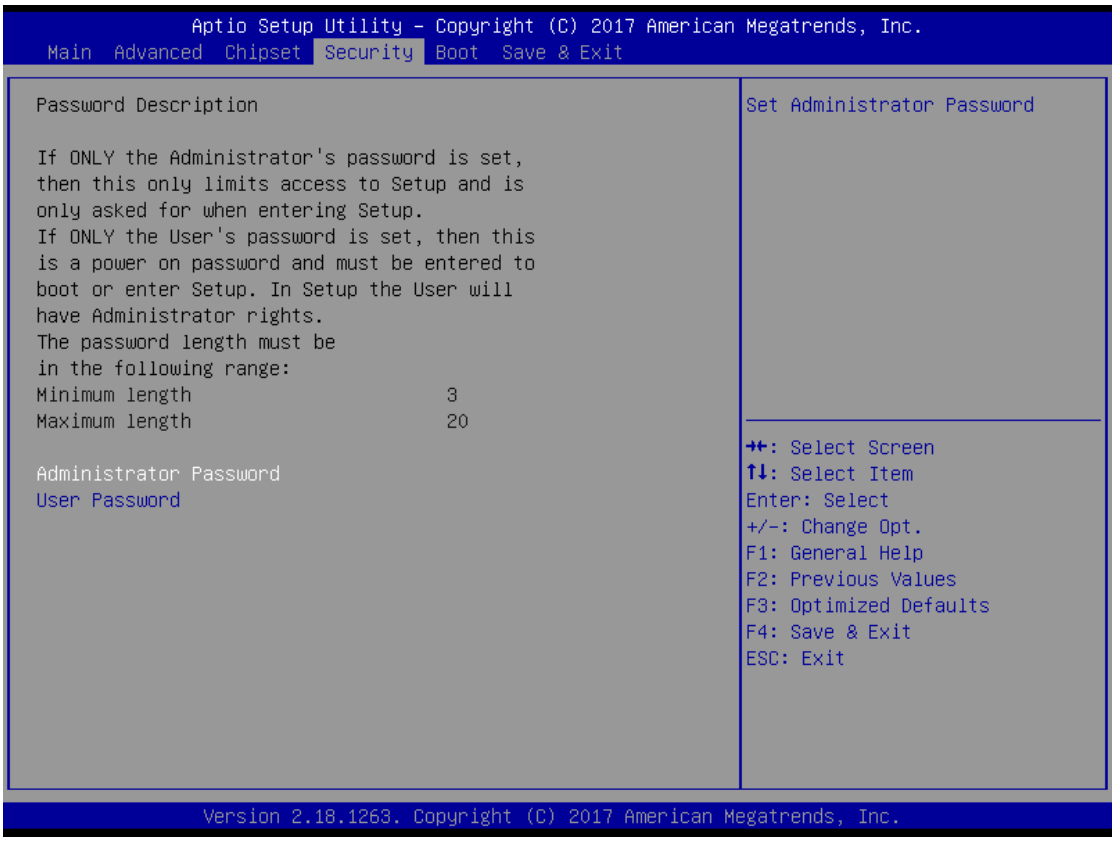
4.6 Security Menu

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

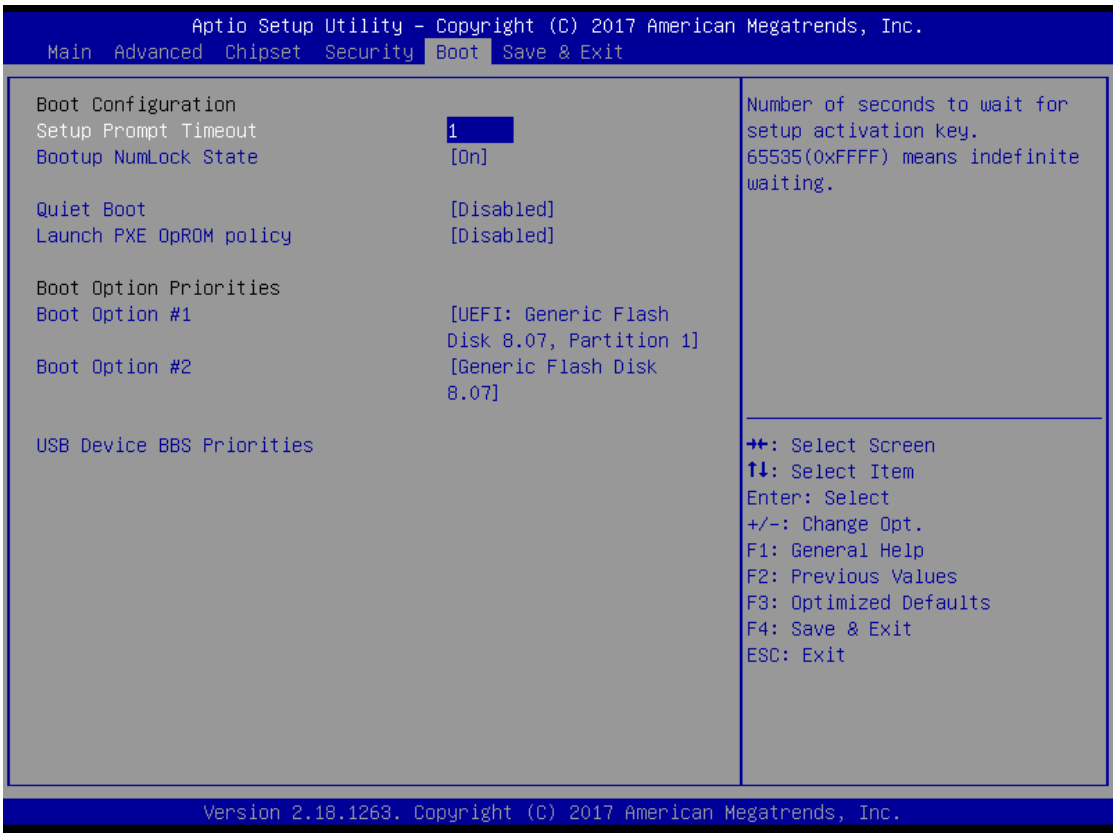


- **Administrator Password**
  This item indicates whether an administrator password has been set (installed or uninstalled).

- **User Password**
  This item indicates whether a user password has been set (installed or uninstalled).

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.

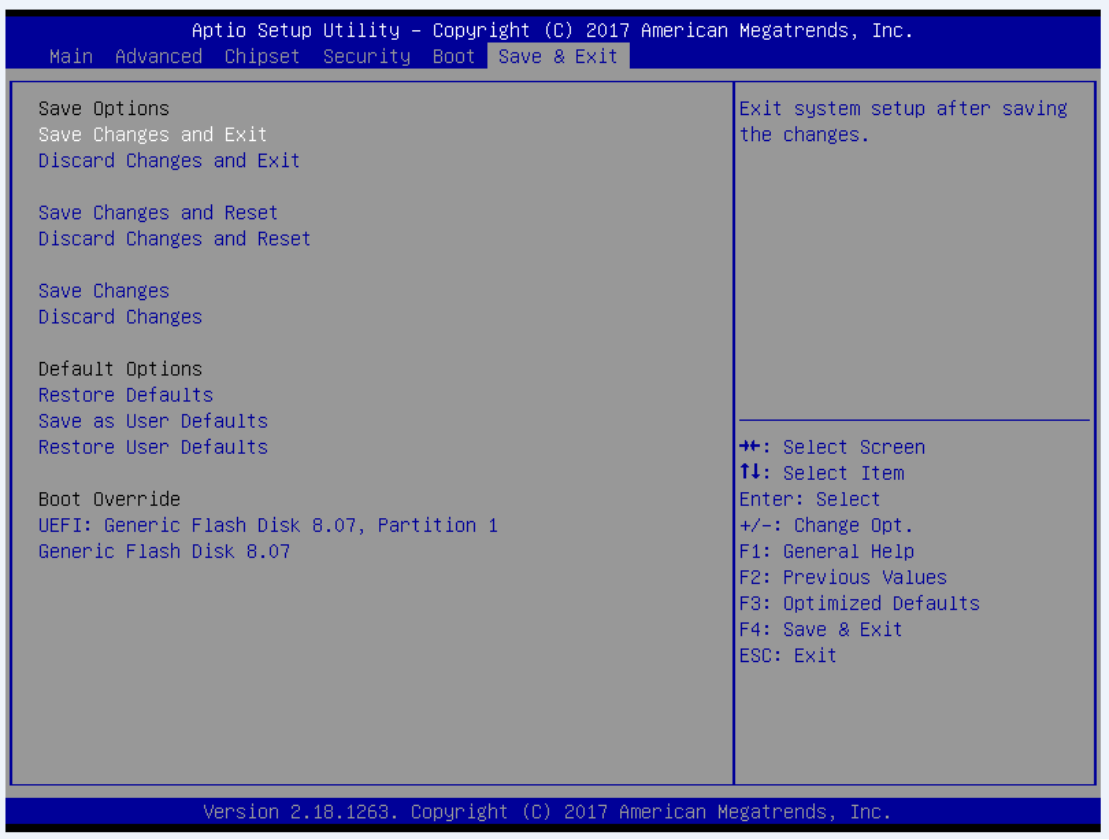
- **Quiet Boot**
  Select to display either POST output messages or a splash screen during boot-up.

- **Launch 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**
  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.

Appendix A
Watchdog Timer

A.1 About Watchdog Timer

Software stability is major issue in most application. Some embedded systems are not watched by human 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 Sample Program

1. Enter **ADU**, and press <F4> to select the **superior ITE**
2. **PORT** setting **002E, 002F**
3. Address **07h** setting **07 GPIO**
4. Address **72h** to set the countdown, for example Sec: **C0**, Min: **40**
5. Address **73h** set the countdown time, for example 10sec: **0A**

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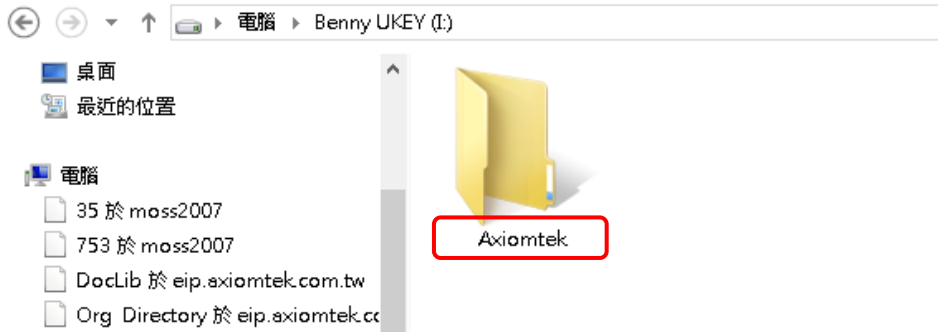
Appendix B
BIOS Flash Utility

The BIOS Flash utility is a new helpful function in BIOS setup program. With this function you can easily update system BIOS without having to enter operating system. In this appendix you may learn how to do it in just a few steps. Please read and follow the instructions below carefully.

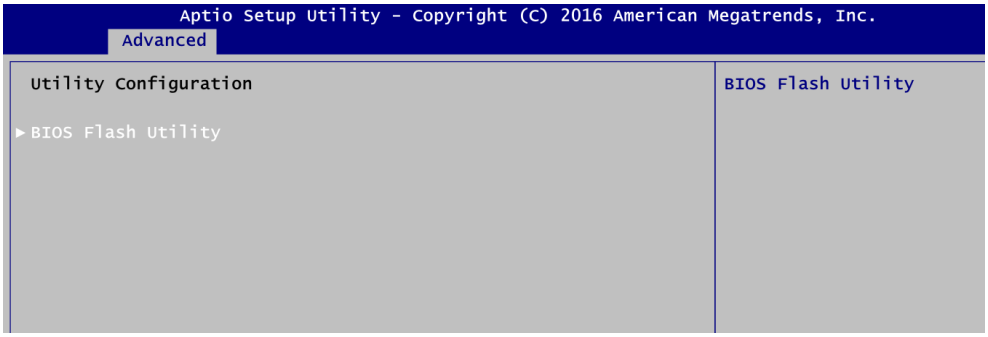
1. In your USB flash drive, create a new folder and name it “Axiomtek”, see figure below.



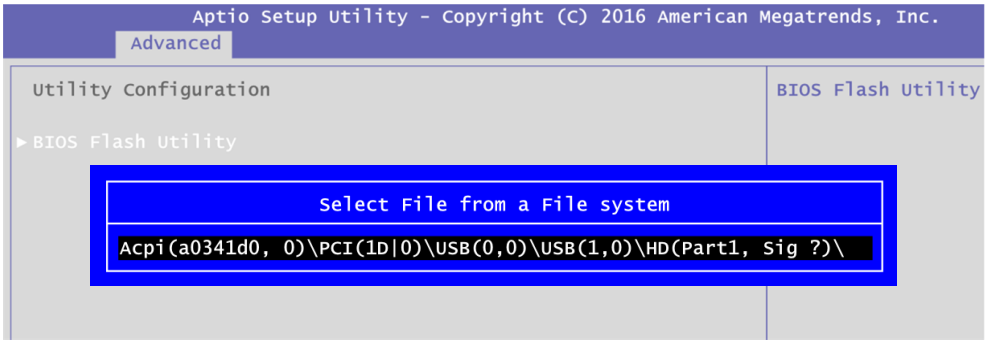
2. Copy BIOS ROM file (e.g. MMB501.005) to “Axiomtek” folder.

3. Insert the USB flash drive to your system.

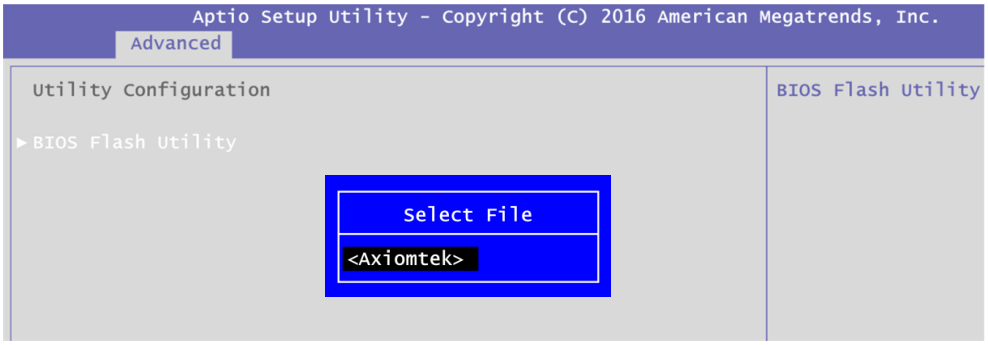
4. Enter BIOS setup menu and go to Advanced\Utility Configuration. Select BIOS Flash Utility and press <Enter>.



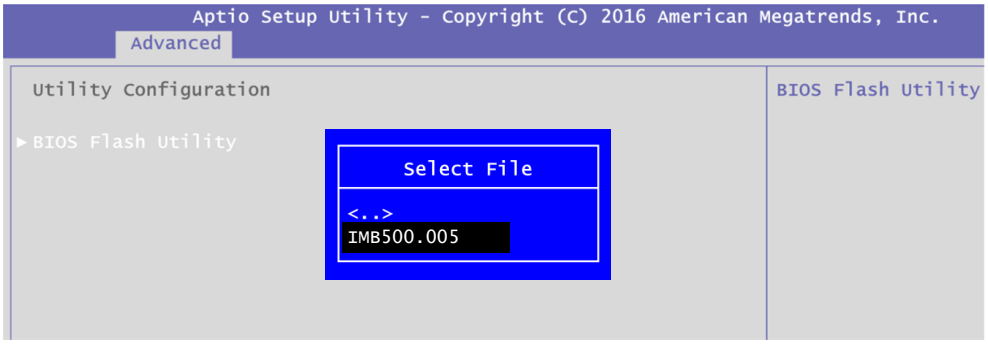
5. BIOS automatically detect all USB drive(s) attached to the system. In this example only one USB drive is attached to the system. That's why, you can see only one device is displayed in figure below.



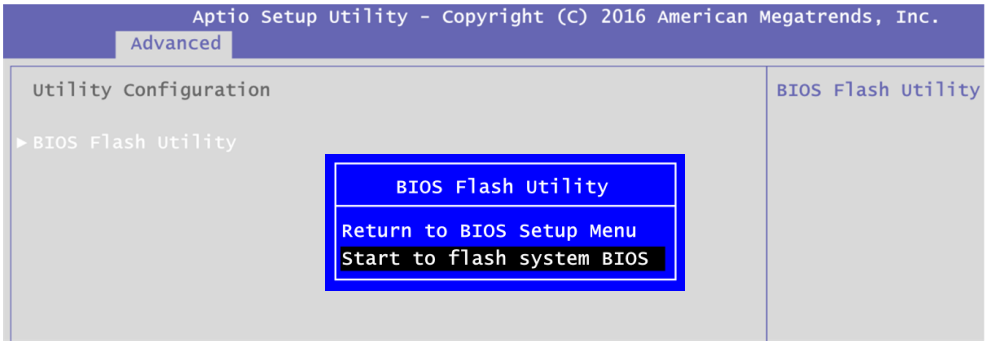
6. Select the USB drive containing BIOS ROM file you want to update using the <↑> or <↓> key. Then press <Enter> to get into "Axiomtek" folder.



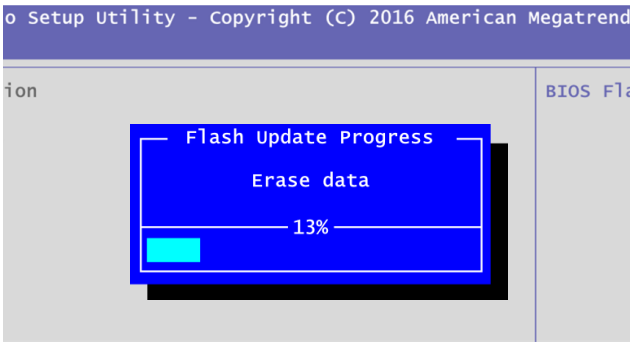
7. Now you can see the BIOS ROM file on the screen, press <Enter> to select.

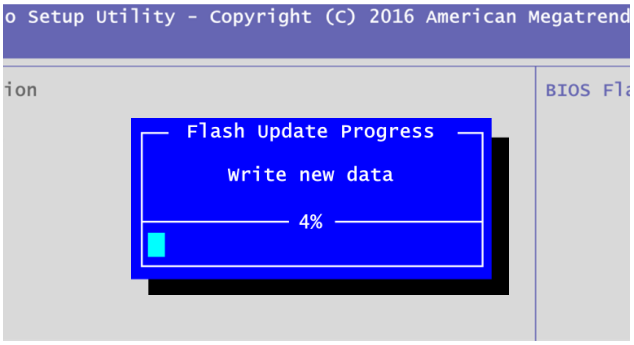


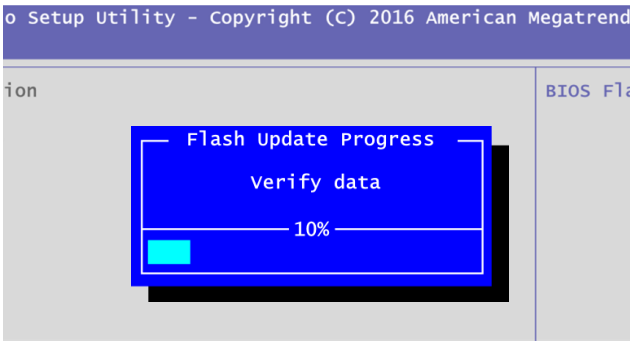
8. Select Start to flash system BIOS option to begin updating procedure.



9. Please wait while BIOS completes the entire flash update process: erase data, write new data and verify data.







10. When you see the following figure, press <Enter> to finish the update process. After that the system will shut down and restart immediately.