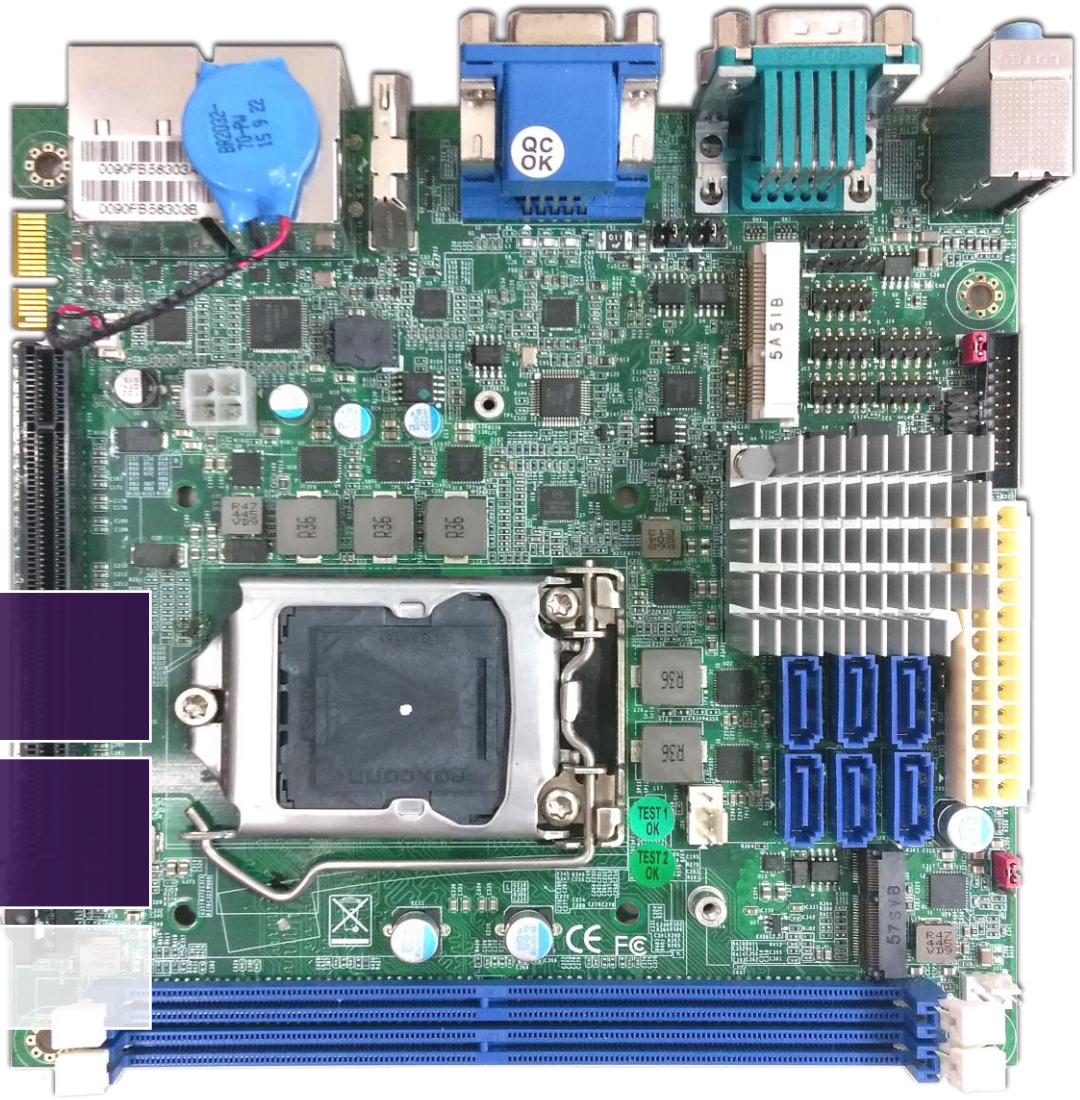

WADE-8017

Industrial Mini-ITX Board

Version 1.C

Revision History

R1.0	Preliminary
R1.1	update 4.1,(page 14) ,add J34(page 27)
R1.2	Updated typing word
R1.3	ADD J34(Page.27)
R1.4	(1) Update 4.1(Page.14) (2) Update 4.2 Jump Funtion List(Page.15) (3) Update J1-J5 & ADD J6(Page16-17) & J34(Page.27)
R1.5	Update support KBL information
R1.6	Add support KBL information
R1.7	Change title page photo
R1.8	Add BIOS socket location(U10) information
R1.9	Add H110 information in Block Diagram
R1.A	Update GPIO information & Front panel header
R1.B	Update page 8(GPIO) & 14(Jumpers map) information
R1.C	Update page 23 (COM6 Pin Header) &page 91(mSATA and SATA port 0(J23) function only can choose one function at the same Time) information

Contents

Preface

This user's guide provides information about the components, features, connectors and BIOS Setup menus available on the WADE-8017. This document should be referred to when designing Mini-ITX application. The other reference documents that should be used include the following:

- ✧Intel Kaby Lake / Sky Lake Design Guide
- ✧Intel Kaby Lake / Sky Lake Specification

Please contact Portwell Sales Representative for above documents.

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1 Introduction

WADE-8017 based on the Intel® Core™ Processor which offers 14nm Hi-K process technology with energy efficient architecture. WADE-8017 support dual channels DDR4 Long - DIMM up to 32GB.

Desktop solution is still popular in the market of DVR and Factory Automation which can fulfill most of these applications; therefore, with high performance and high-end specifications, WADE-8017 is our first generation Kaby Lake / Sky Lake -S chip architecture on Mini-ITX line.

2 Specifications

Main Processor	◆ Intel® Kaby Lake / Sky Lake -S Core™ i Processors
System Chipset	◆ Intel®Q170 / H110 or C236 Express chipset
System BIOS	◆ AMI UEFI BIOS
Main Memory	◆ Up to 32 GB in 2 slots DDR4 Long-DIMM sockets. Supports dual channel DDR4 1866/2133 MHz SDRAM
Graphics	◆ Controller: Intel® Gfx Gen 9, HD graphics ◆ VGA: Supports VGA up to resolution 1920 x 1200 ◆ DP: Supports DP up to resolution 4096 x 2304 ◆ HDMI: Supports HDMI up to resolution 4096 x 2160
Expansion Interface	◆ One mini-PCIe socket，H110 just only support mSATA ◆ One M.2 E type socket，H110 not support M.2 function ◆ One PCIe x1 G/F support SEB
SATA Interface	◆ Six SATA ports(SATA 6Gb/s)，H110 only four SATA ports
Input/Output	◆ Serial Ports: 4x RS-232 & 2x RS-232/422/485 ◆ USB Port: 4x USB 3.0 on REAR I/O, 2x USB 2.0 on board header ◆ GPIO connector: 8bit GPIO(4in/4out), programmable ◆ Audio Interface: Mic-In / Line-Out / Line-in
Ethernet	◆ Supports dual 10/100/1000 Mbps Ethernet port (s) via PCI Express x1 bus which provides 500 MB/s data transmission rate
High Drive GPIO	◆ One pin-header for GPIO 8bit GPIO(4in/4out), programmable

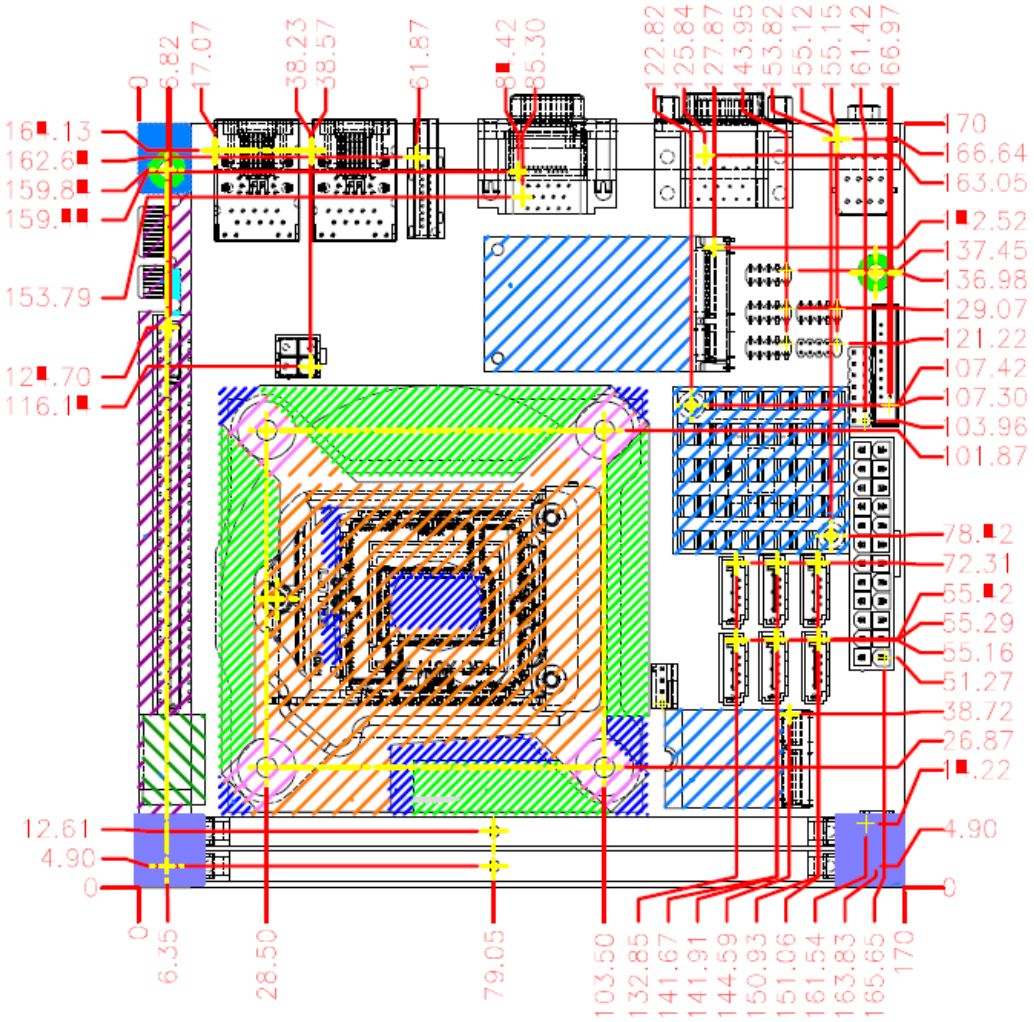
Mechanical and environmental specifications	◆ Operating temperature: 0 ~ 60° C ◆ Storage temperature:-20 ~ 80° C ◆ Humidity: 5 ~ 90% non-condensing ◆ Power supply voltage: ATX ◆ Board size: 170mm x 170 mm

2.1 Supported Operating Systems

The WADE-8017 supports the following operating systems.

✧ Windows 7/e support
✧ Windows 8.1 / WEI 8.1 support
✧ Windows 10 full support
✧ Kernel.org Distribution
✧ Yocto based Embedded Linux Distribution

2.2 Mechanical Dimensions



2.3 Power Consumption

Test Configuration	
CPU Type	Intel® Core™ i7-6700TE CPU @ 2.4GHz (ES) L3: 8MByte
SBC BIOS	Portwell, Inc. WADE-8017 TEST BIOS (51104T00)
Memory	WARIS UB-DIMM DDR4 2133 8GB*2 (SEC K4A4G085WD)
VGA Card	Onboard Intel® HD Graphics 530
VGA Driver	Intel® HD Graphics 530 Version: 20.19.15.4300
LAN Card	Onboard Intel® Ethernet Connection(2) I219-LM
LAN Driver	Intel® Ethernet Connection(2) I219-LM Version: 12.13.17.7
LAN Card #2	Onboard Intel® I210 Gigabit Network Connection
LAN Driver #2	Intel® I210 Gigabit Network Connection Version: 12.14.7.0
Audio Card	Onboard Realtek ALC886 High Definition Audio
Audio Driver	Realtek ALC886 High Definition Audio Version: 6.0.1.7083
Chipset Driver	Intel® Skylake-S Chipset Device Software Version: 10.0.27
USB 3.0 Driver	Intel® USB 3.0 eXtensible Host Controller Adaptation Driver Version: 6.3.9600.16384
SATA HDD	HITACHI Z5K320-250 250GB
Power Supply	FSP460-60PFB 460W / GADIWA 5V/12V DC POWER
CPU Type	Intel® Core™ i7-6700TE CPU @ 2.4GHz (ES) L3: 8MByte

Power consumption

ATX:

Item	Power ON	Full Loading 10Min	Full Loading 30Min
CPU +12V	0.98A	2.05A	1.98A
System +12V	0.83A	1.48A	1.26A
System +3.3V	0.55A	0.65A	0.69A
System +5V	1.11A	1.37A	1.34A
System+ Device +12V	0.97A	1.81A	1.56A
System+ Device +5V	1.87A		
USB2.0 Loading Test	4.98 V/ 570 mA		

2.4 Environmental Specifications

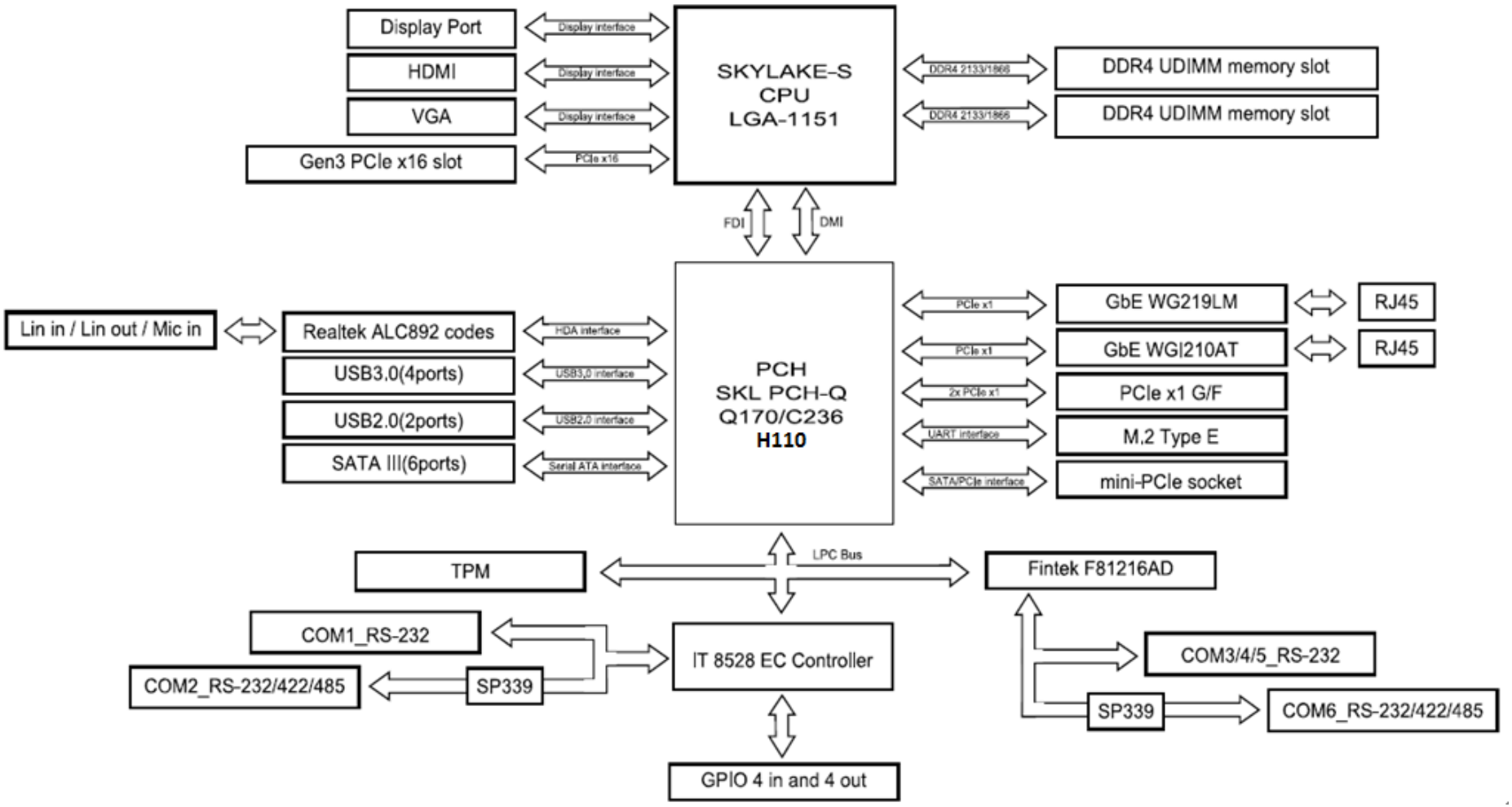
Storage Temperature : -20~80°C

Operation Temperature : 0~60°C

Storage Humidity : 5~90%

Operation Humidity: 10~90%

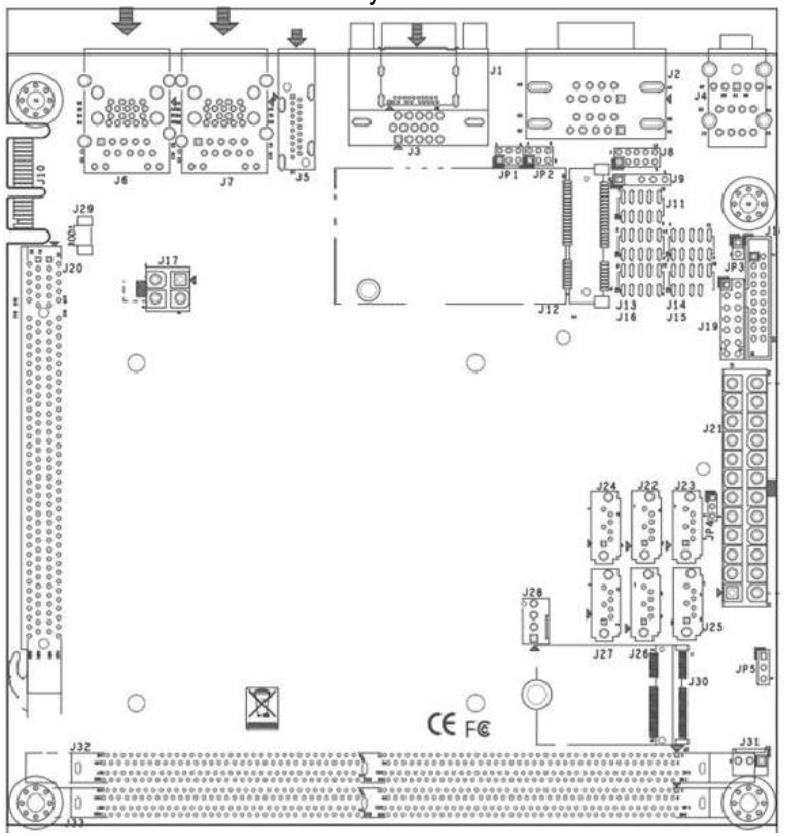
3 Block Diagram



4 Hardware Configuration

4.1 Jumpers and Connectors

This chapter indicates jumpers', headers' and connectors' locations. Users may find useful information related to hardware settings in this chapter.



4.2 Jumpers Settings

For users to customize WADE-8017's features. In the following sections, Short means covering a jumper cap over jumper pins; Open or N/C (Not Connected) means removing a jumper cap from jumper pins. Users can refer to Figure 1 for the Jumper allocations.

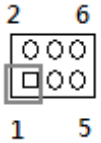
Jumper Table

The jumper settings are schematically depicted in this manual as follows:

Jump Function List:

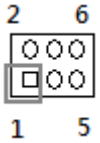
Jump	Function	Remark
JP1	COM1 RI Select Header	Header3Px2/2mm
JP2	COM2 RI Select Header	Header3Px2/2mm
JP3	MiniPCIE & MSATA SETTING	Header2Px1/2.54mm
JP4	ATX &AT Mode Selection	Header3Px1/2mm
JP5	Clear CMOS Selection	PH3Px1/2.54mm
JP6	H/W write protect	PH3Px1/2mm

JP1: COM1 RI Select Header



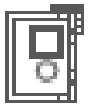
PIN No.	Signal Description
3-4 Short	RI# ★
3-1 Short	5V
3-5 Short	12V

JP2:COM2RI Select Header



PIN No.	Signal Description
3-4 Short	RI# ★
3-1 Short	5V
3-5 Short	12V

JP3: Mini PCIE & MSATA SETTING



PIN No.	Signal Description
1-2 Open	Mini PCIE ★
1-2 Short	MSATA

JP4: ATX &AT Mode Selection

PIN No.	Signal Description
1-2 Short	AT
2-3 Short	ATX ★

JP5: Clear CMOS Selection

PIN No.	Signal Description
1-2 Short	X ★
2-3 Short	Clear CMOS

JP6: H/W write protect

PIN No.	Signal Description
1-2 Short	Disable write protect ★
2-3 Short	Enable write protect

4.3 Connector Settings

Connector Allocation

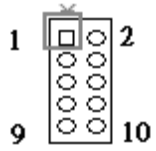
I/O peripheral devices are connected to the interface connectors

Connector Function List

Connector	Function	Remark
J1	DP Connector	
J2	COM1 & COM2 CONNECTOR	
J3	VGA CONNECTOR	
J4	AUDIO CONNECTOR	
J5	HDMI CONNECTOR	
J6	LAN & USB3.0X2 CONNECTOR	
J7	LAN & USB3.0X2 CONNECTOR	
J8	4in/4out GPIO Pin Header	
J9	SMBUS Pin Header	
J11	COM5 Pin Header	
J12	Mini-PCI-E /MSATA CONNECTOR	H110 just only support mSATA
J13	COM3 Pin Header	
J14	COM4 Pin Header	
J15	USB2.0X2 Pin Header	
J16	COM6 Pin Header	
J17	ATX 4P CONNECTOR	
J18	TPM Pin header	
J19	Front panel header	
J20	PCIEx16 CONNECTOR	

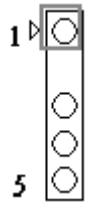
J21	ATX 24P CONNECTOR	
J22	SATA CONNECTOR	H110 remove connector
J23	SATA CONNECTOR	
J24	SATA CONNECTOR	H110 remove connector
J25	SATA CONNECTOR	
J26	SATA CONNECTOR	
J27	SATA CONNECTOR	
J28	CPU FAN header	
J29	BATTERY header	
J30	M.2 Type E CONNECTOR	H110 not support M.2 function
J31	SYSTEM FAN header	
J32	DDR4 UDIMMA Socket	
J33	DDR4 UDIMMB Socket	
J34	PCI Express Bifurcation	
U10	BIOS EEPROM Socket	

J8: 8bit GPIO(4in/4out), programmable Pin Header



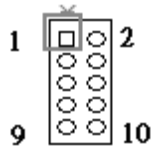
PIN No.	Signal Description	PIN No.	Signal Description
1	GPIO0	2	GPIO4
3	GPIO1	4	GPIO5
5	GPIO2	6	GPIO6
7	GPIO3	8	GPIO7
9	GND	10	VCC5

J9: SMBUS Pin Header



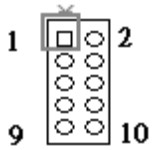
PIN No.	Signal Description
1	SMB_CLK
2	X
3	GND
4	SMB_DATA
5	VCC5

J11: COM5 CONNECTOR



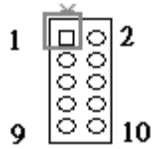
PIN No.	Signal Description	PIN No.	Signal Description
1	DCD#5	2	RXD#5
3	TXD#5	4	DTR#5
5	GND	6	DSR#5
7	RTS#5	8	CTS#5
9	RI#5	10	X

J13: COM3 Pin Header



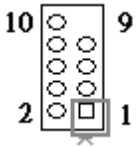
PIN No.	Signal Description	PIN No.	Signal Description
1	DCD#3	2	RXD#3
3	TXD#3	4	DTR#3
5	GND	6	DSR#3
7	RTS#3	8	CTS#3
9	RI#3	10	X

J14: COM4 Pin Header



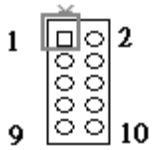
PIN No.	Signal Description	PIN No.	Signal Description
1	DCD#4	2	RXD#4
3	TXD#4	4	DTR#4
5	GND	6	DSR#4
7	RTS#4	8	CTS#4
9	RI#4	10	X

J15: USBx2 Pin Header



PIN No.	Signal Description	PIN No.	Signal Description
1	VCC_USBH0	2	VCC_USBH0
3	D5-	4	D6-
5	D5+	6	D6+
7	GND	8	GND
9	X	10	GND

J16: COM6 Pin Header

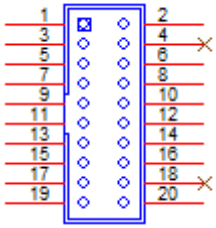


PIN No.	RS-232	RS-422	RS-485
1	DCD#6	TX-	DATA-
2	RXD#6	TX+	DATA+
3	TXD#6	RX+	N/C
4	DTR#6	RX-	N/C
5	GND	GND	GND
6	DSR#6	N/C	N/C
7	RTS#6	N/C	N/C
8	CTS#6	N/C	N/C
9	RI#6	N/C	N/C
10	X	N/C	N/C

J17: ATX 4P CONNECTOR

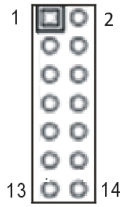
PIN No.	Signal Description
1	Ground
2	Ground
3	+12V
4	+12V

J18: TPM CONNECTOR



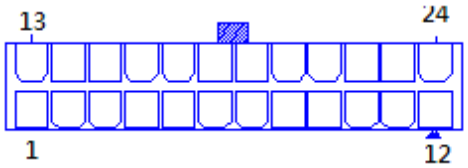
PIN No.	Signal Description	PIN No.	Signal Description
1	CLK_TPM_33M	2	GND
3	LFRAME#	4	X
5	RUF_PLT_RST#	6	5V
7	LAD3	8	LAD2
9	3.3V	10	LAD1
11	LAD0	12	GND
13	SMB_CLK	14	SMB_DATA
15	3V_DUAL	16	SERIRQ
17	GND	18	X
19	LPCPD	20	X

J19: Front panel header



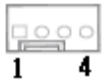
PIN No.	Signal Description	PIN No.	Signal Description
1	VCC5	2	5VSB
3	HD_LED#	4	SUSLED
5	GND	6	PWRBTN
7	RESET#	8	GND
9	VCC	10	BUZZER#
11	GND	12	GND
13	VCC	14	NC

J21: ATX 24P CONNECTOR



PIN No.	Signal Description	PIN No.	Signal Description
1	+3.3V	13	+3.3V
2	+3.3V	14	-12V
3	Ground	15	Ground
4	+5V	16	PS_ON#
5	Ground	17	Ground
6	+5V	18	Ground
7	Ground	19	Ground
8	ATX_PWROK	20	-5V
9	+5VSB	21	+5V
10	+12V1	22	+5V
11	+12V1	23	+5V
12	+3.3V	24	Ground

J28: CPU FAN CONNECTOR

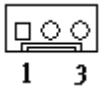


PIN No.	Signal Description
1	Ground
2	+12V
3	Fan on/off output
4	Fan Speed control

J29: BATTERY CONNECTOR

PIN No.	Signal Description
1	+3.3V
2	GND

J31: SYSTEM FAN CONNECTOR



PIN No.	Signal Description
1	Ground
2	Fan speed control
3	Fan on/off output

J34: PCI Express Bifurcation

ON=0; OFF=1

PEG Mode	PIN[1:2]
PCIE 1X8,2X4	00
PCIE 2X8	10
PCIE 1X16	11★

5 Signal Descriptions

5.1 Watch Dog Signal

```
#Define WDTCFG 0x06 //WDT Timer Counter Register
#Define WDTMIN 0x07  //WDT Timer Counter Register (Minute)
#Define WDTSEC 0x08 //WDT Timer Counter Register (Second)


VOID    Write_EC_SRAM(UINT8 Offset,UINT8 Value){

  IoWrite8(0xE300+Offset,Value);
}

Byte Read_EC_SRAM(UINT8 Offset){
  IoRead8(0xE300+offset,Value);
  return Value;
}

void WDT()
{
        // Enable WDT 30sec
```

```
    Write_EC_SRAM(WDTSEC,30);
    Write_EC_SRAM(WDTCFG,0x01);//Bit0: WDT Enable, BIT1: 0:Second Mode

    // Enable WDT 5min
    Write_EC_SRAM(WDTSEC,5);
    Write_EC_SRAM(WDTCFG,0x03);//Bit0: WDT Enable, BIT1: 1:Minute Mode

    // Enable WDT 10min, 20sec
    Write_EC_SRAM(WDTSEC,20);
    Write_EC_SRAM(WDTSEC,10);
    Write_EC_SRAM(WDTCFG,0x03);//Bit0: WDT Enable, BIT1: 1:Minute Mode
}
```

5.2 GPIO Signal

```
#Define GPCR 0x2B//GPIO Counter Register, Bit7 = GPIO7, Bit6 = GPIO6, ..., 0: Output; 1: Input
#Define GPDR 0x2C//GPIO Data Register, Bit7 = GPIO7, Bit6 = GPIO6, ..., 0: Low; 1: High

VOID    Write_EC_SRAM(UINT8 Offset,UINT8 Value){

  IoWrite8(0xE300+Offset,Value);
}

Byte Read_EC_SRAM(UINT8 Offset){
  IoRead8(0xE300+offset,Value);
  return Value;
}

void GPIO()
{
        int Temp;
        // Get GPIO data
        Temp = Read_EC_SRAM(GPDR);

        // Set GPIO7 High
        Temp |= 0x80;
```

```
    Write_EC_SRAM(GPDR,Temp);              //Bit7: GPIO7 status, 0: Low 1: High
}
```

6 System Resources

6.1 Intel® Kabylake/Skylake-S PCH

Intel® Q170 Chipset (Intel® GL82Q170 PCH)
Intel® H110 Chipset (Intel® GL82H110 PCH)
Intel® C236 Chipset (Intel® GL82C236 PCH)

6.2 Main Memory

WADE-8017 provides 2 x 260-pin Long-DIMM sockets which supports DDR4 ECC/non-ECC memory. The maximum memory can be up to 32GB. Memory clock and related settings can be detected by BIOS via SPD interface.

Watch out the contact and lock integrity of memory module with socket, it will impact on the system reliability. Follow normal procedures to install memory module into memory socket. Before locking, make sure that all modules have been fully inserted into the card slots.

6.3 Installing the Single Board Computer

To install your WADE-8017 into standard chassis or proprietary environment, please perform the following:
Step 1 : Check all jumpers setting on proper position
Step 2 : Install and configure CPU,CPU cooling and memory module on right position
Step 3 : Place WADE-8017 into the dedicated position in the system
Step 4 : Attach cables to existing peripheral devices and secure it

WARNING

Please ensure that mother board is properly inserted and fixed by mechanism.

Note:

Please refer to section 6.3.1 to 6.3.4 to install INF/Graphic/LAN

6.3.1 Chipset Component Driver

WADE-8017 is based on Intel® Q170/H110/C236 chipset and desktop processors including Core™ i7 / i5 / i3 sku . It's a new chipset that some old operating systems might not be able to recognize. To overcome this compatibility issue, for Windows Operating Systems such as Windows 8, please install its INF before any of other Drivers are installed. You can find very easily this chipset component driver in WADE-8017 CD-title

6.3.2 Intel® HD Graphics 530

WADE-8017 has integrated Intel® HD Graphics 530 which supports DirectX 12、OpenCL 2.0、OpenGL 4.4. It is the most advanced design to gain an outstanding graphic performance. WADE-8017 supports VGA, DP, HDMI display output. This combination makes WADE-8017 an excellent performance hardware.

Drivers Support

Please find the Graphic driver in the WADE-8017 CD-title. The driver supports Windows 8.

6.3.3 Intel LAN I210AT/I219LM Gigabit Ethernet Controller

- Intel I210AT Gigabit Ethernet controller and 1x RJ45 connectors on rear I/O
- Intel I219LM Gigabit Ethernet controller and 1x RJ45 connectors on rear I/O

Drivers Support

Please find Intel I210AT/I219LM LAN driver in /Ethernet directory of WADE-8017 CD-title. The driver supports Windows 8.

7 BIOS Setup Items

7.1 Introduction

The following section describes the BIOS setup program. The BIOS setup program can be used to view and change the BIOS settings for the module. Only experienced users should change the default BIOS settings.

7.2 BIOS Setup

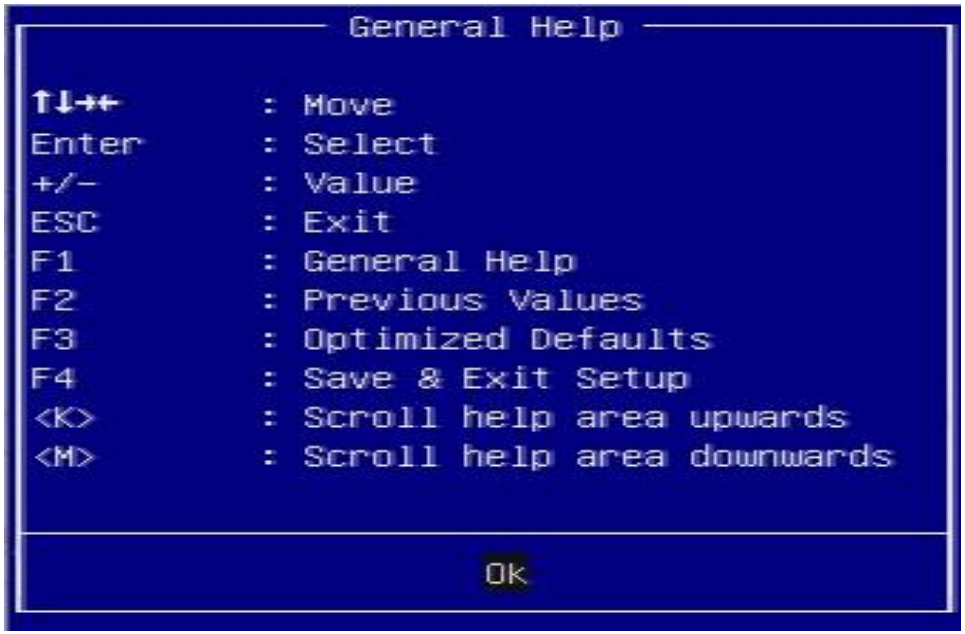
Power on the computer and the system will start POST (Power on Self Test) process. When the message below appears on the screen, press <Delete> or <ESC> key will enter BIOS setup screen.

Press<Delete> or <ESC> to enter SETUP

If the message disappears before responding and still wish to enter Setup, please restart the system by turning it OFF and On or pressing the RESET button. It can be also restarted by pressing <Ctrl>, <Alt>, and <Delete> keys on keyboard simultaneously.

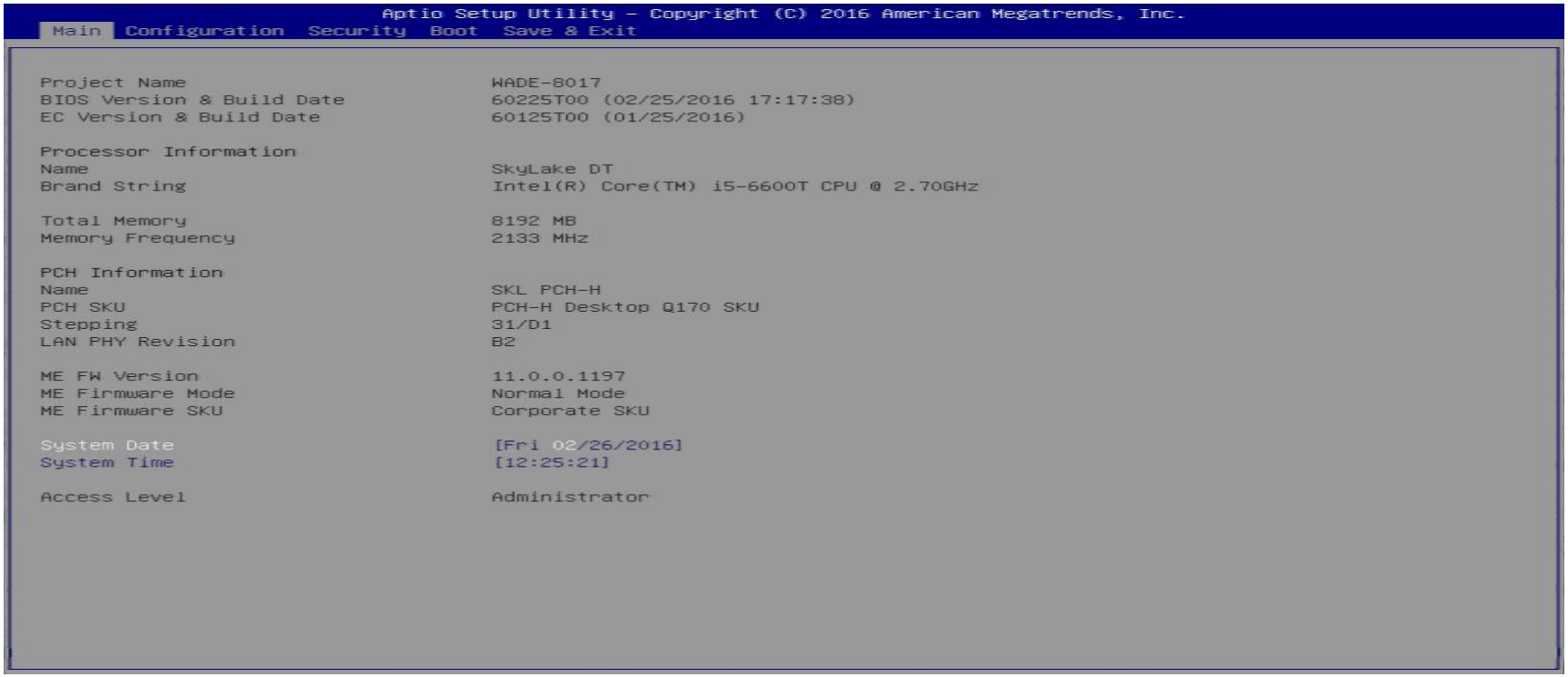
Press <F1> to Run General Help or Resume

The BIOS setup program provides a General Help screen. The menu can be easily called up from any menu by pressing <F1>. The Help screen lists all the possible keys to use and the selections for the highlighted item. Press <Esc> to exit the Help Screen.



7.2.1 Main

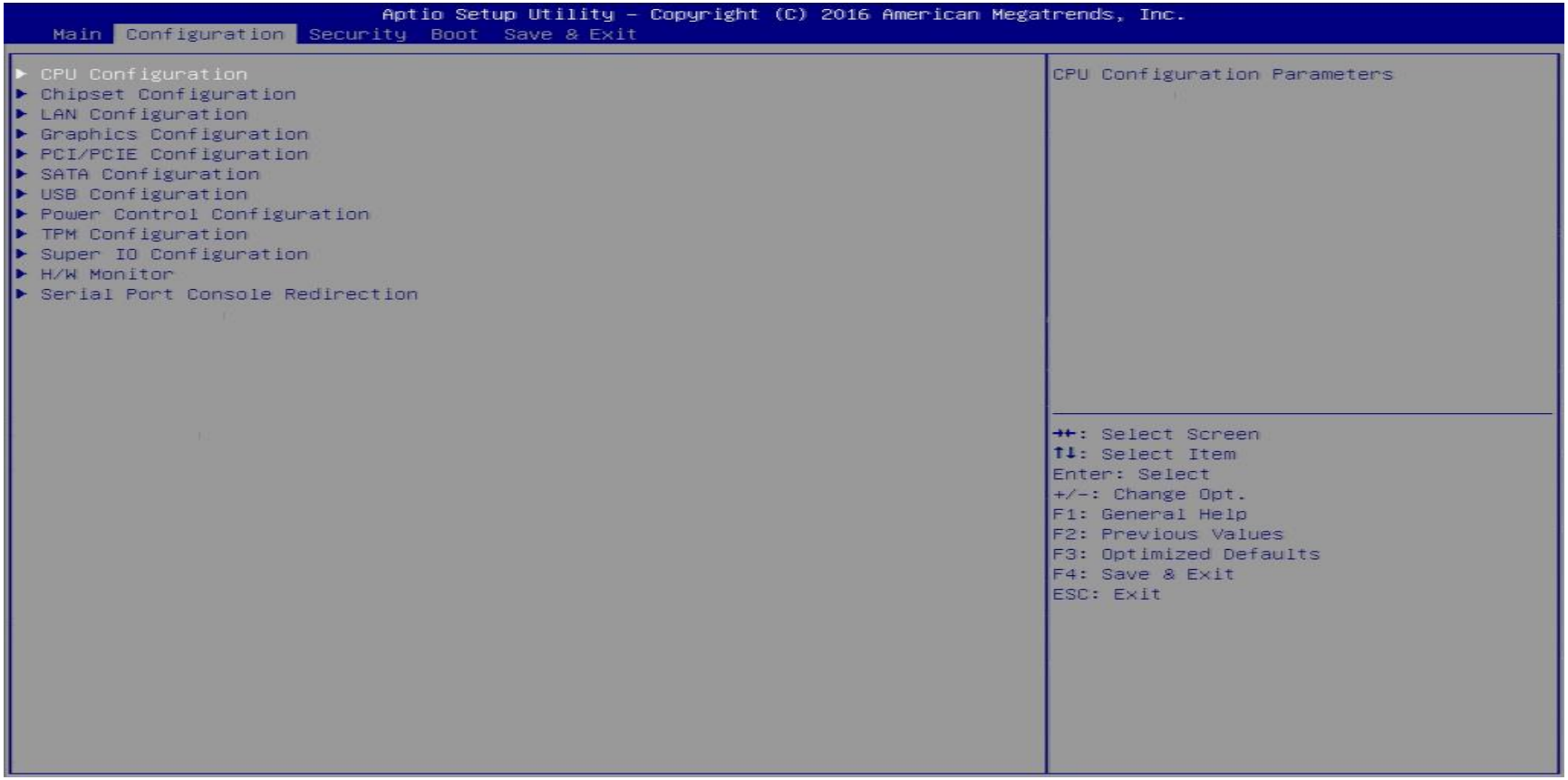
Use this menu for basic system configurations, such as time, date etc.



Feature	Description	Options
System Date	The date format is <Day>, <Month> <Date> <Year>. Use [+] or [—] to configure system Date.	
System Time	The time format is <Hour> <Minute> <Second>. Use [+] or [—] to configure system Time.	

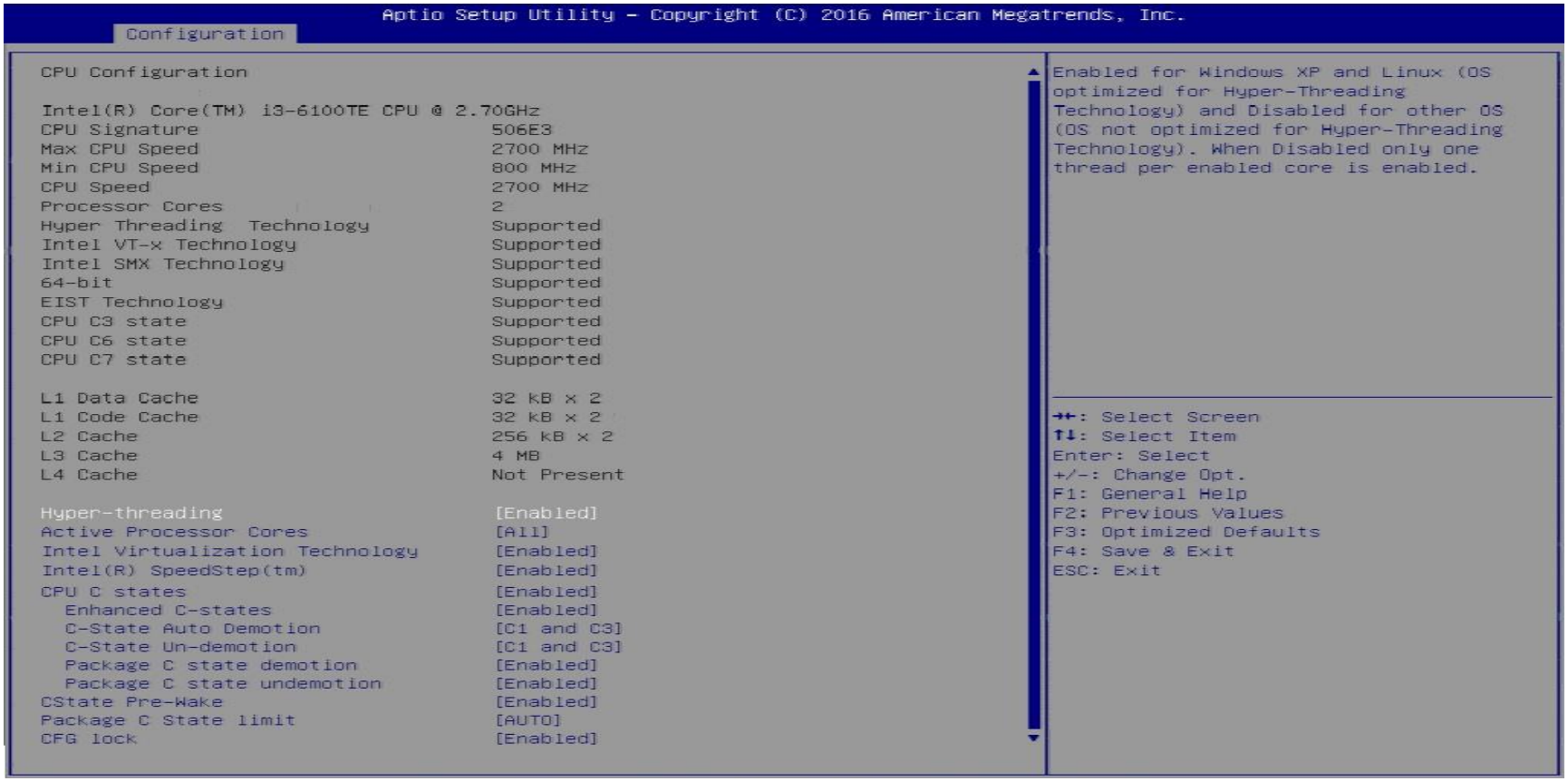
7.2.2 Configuration

Use this menu to set up the items of special enhanced features



CPU Configuration

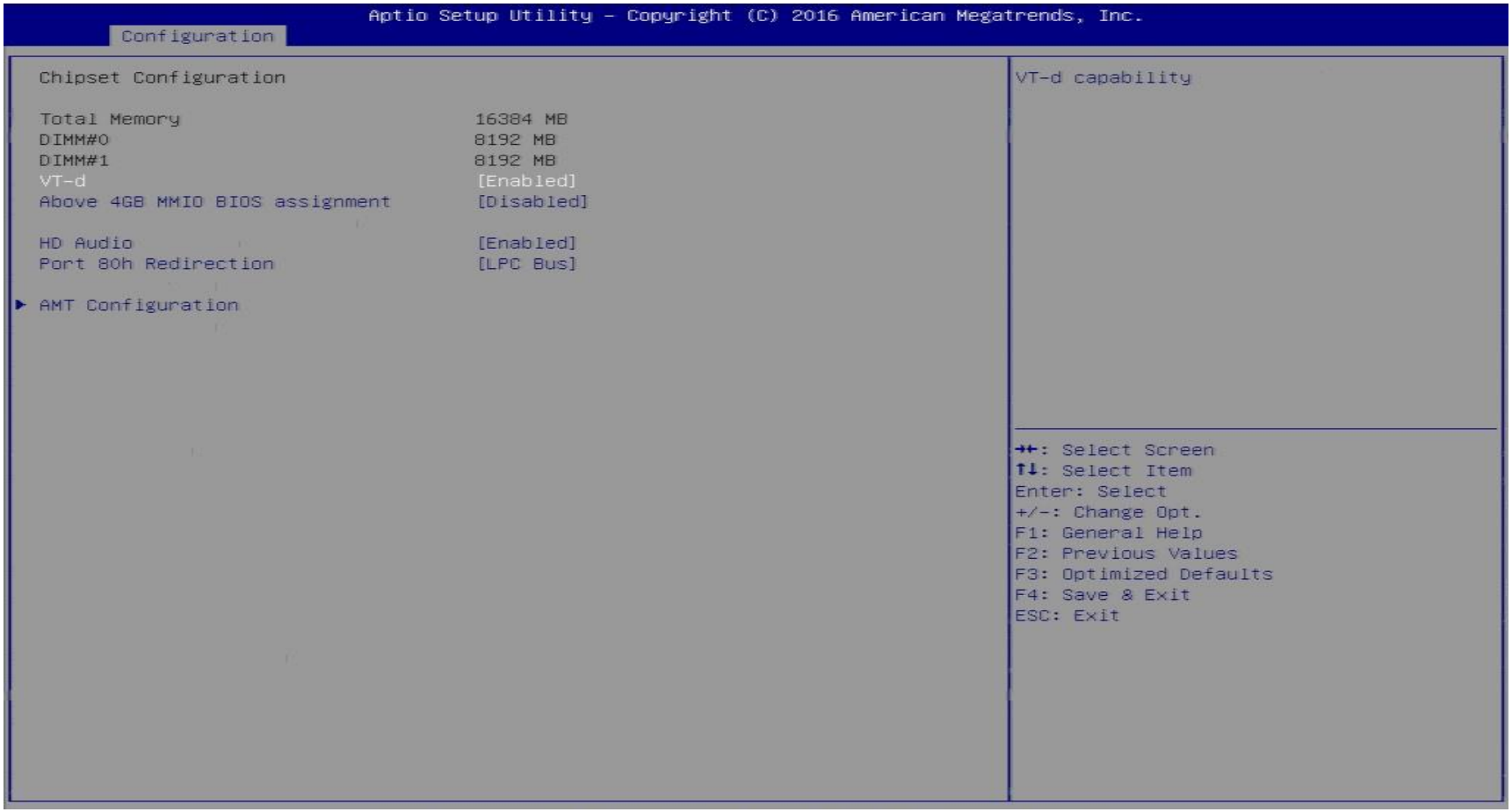
CPU Configuration Parameters



Feature	Description	Options
Active Processor Cores	Number of cores to enable in each processor package.	★ All, 1, 2, 3
Intel Virtualization Technology	When enabled, a VMM can utilize the additional hardware capabilities provided by Vanderpool Technology.	★ Enabled, Disabled
Intel® Speed Step™	Allows more than two frequency ranges to be supported.	★ Enabled, Disabled
Turbo Mode	Turbo Mode.	★ Enabled, Disabled
Configurable TDP Boot Mode	Configurable TDP Mode as Nominal /Up/ Down/ Deactivate TDP selection. Deactivate option will set MSR to Nominal and MMIO to Zero.	★ Nominal, Down, Up, Deactivate
Configurable TDP Lock	Configurable TDP Mode Lock sets the Lock bits on TURBO_ACTIVATION_RATIO and CONFIG_TDP_CONTROL. Note: When CTDP Lock is enabled Custom COnfigTDP Count will be forced to 1 and Custom ConfigTDP Boot Index will be forced to 0.	★ Disabled, Enabled
CTDP BIOS Control	Enables CTDP control via runtime ACPI BIOS methods. This “BIOS only” feature does not require EC or driver support.	★ Disabled, Enabled
CPU C states (Enabled)	Enable or disable CPU C states	★ Disabled, Enabled
Enhanced C-states	Enable/Disable C1E. When enabled, CPU will switch to minimum speed when all cores enter C-State.	Disabled, ★ Enabled
C-State Auto Demotion	Configure C-State Auto Demotion.	Disabled, C1, C3, ★ C1 and C3
C-State Un-demotion	Configure C-State Un-demotion.	Disabled, C1, C3, ★ C1 and C3
Package C State demotion	Enable Package C state demotion.	Disabled, ★ Enabled
Package C state un-demotion	Enable Package C state Un-demotion.	Disabled, ★ Enabled
C State Pre-Wake	Disable – Sets bit 30 of POWER_CTL MSR(0x1FC) to 1 to disable the C State Pre-Wake	Disabled, ★ Enabled
Package C State limit	Package C State limit	C0/C1, C2, C3, C6, C7, C7s, C8, ★ AUTO
CFG lock	Configure MSR 0xE2[15], CFG lock bit.	Disabled, ★ Enabled

Chipset Configuration

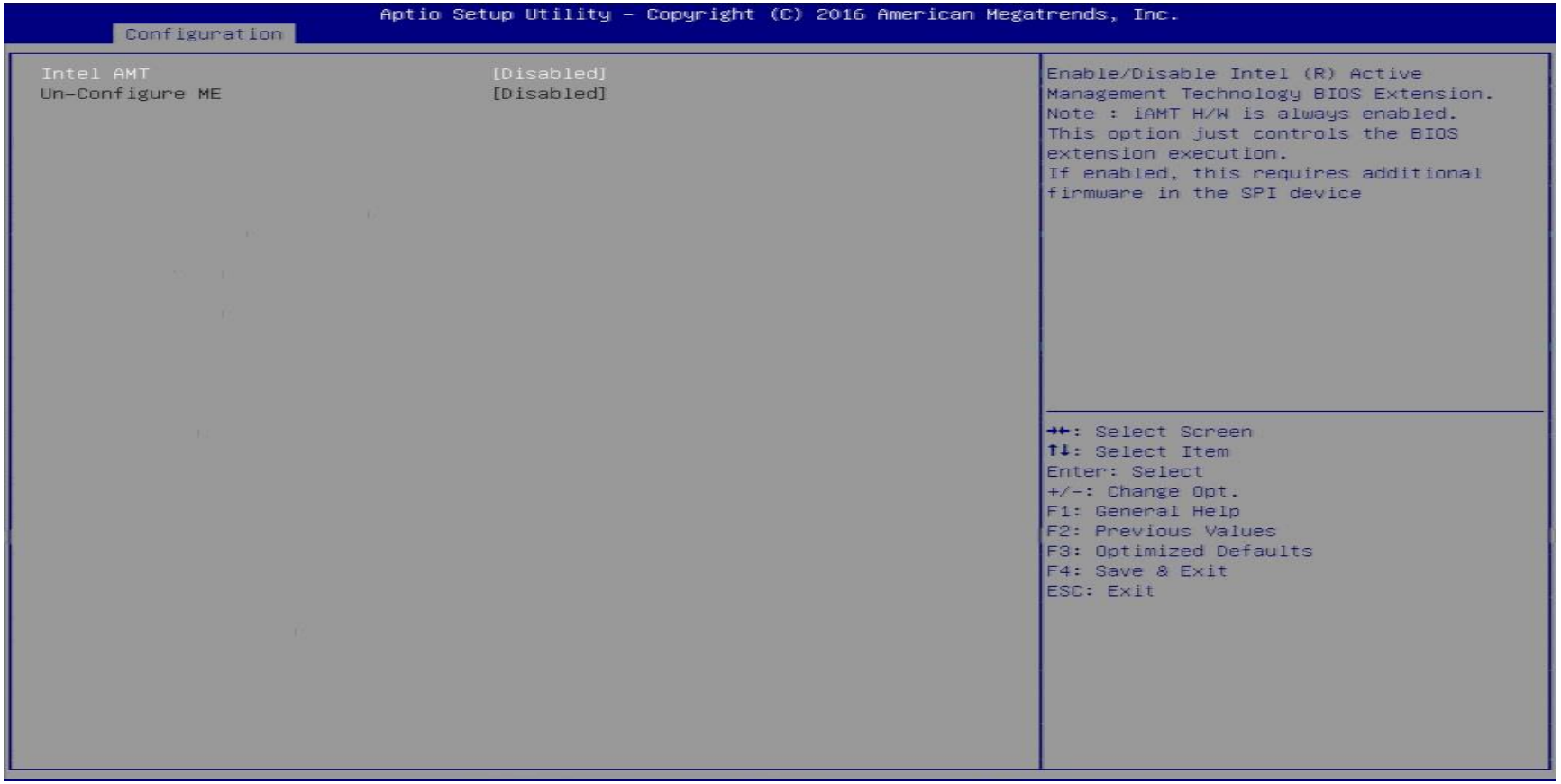
Configuration Chipset feature



Feature	Description	Options
VT-d	VT-d capability	Disabled, ★ Enabled
Above 4GB MMIO BIOS assignment	Enable/Disable above 4GB Memory Mapped IO BIOS assignment. This is disabled automatically when Aperture Size is set to 2048MB.	Enabled, ★ Disabled
HD Audio	Control Detect of the HD-Audio device. Disabled = HAD will be unconditionally disabled Enabled = HAD will be unconditionally Enabled	Disabled, ★ Enabled
Port 80h Redirection	Control where the port 80h cycles are sent.	★ LPC Bus, PCIE Bus

AMT Configuration

Configure Active Management Technology Parameters



Feature	Description	Options
Intel AMT (Enabled)	Enable/Disable Intel ® Active Management Technology BIOS Extension. Note: iAMT H/W is always enabled. This option just controls the BIOS extension execution. If enabled, this requires additional firmware in the SPI device	★ Disabled, Enabled
Un-Configure ME	OEMFlag Bit 15: Un-Configure ME without password.	★ Disabled, Enabled

LAN Configuration

Configuration on Board LAN device.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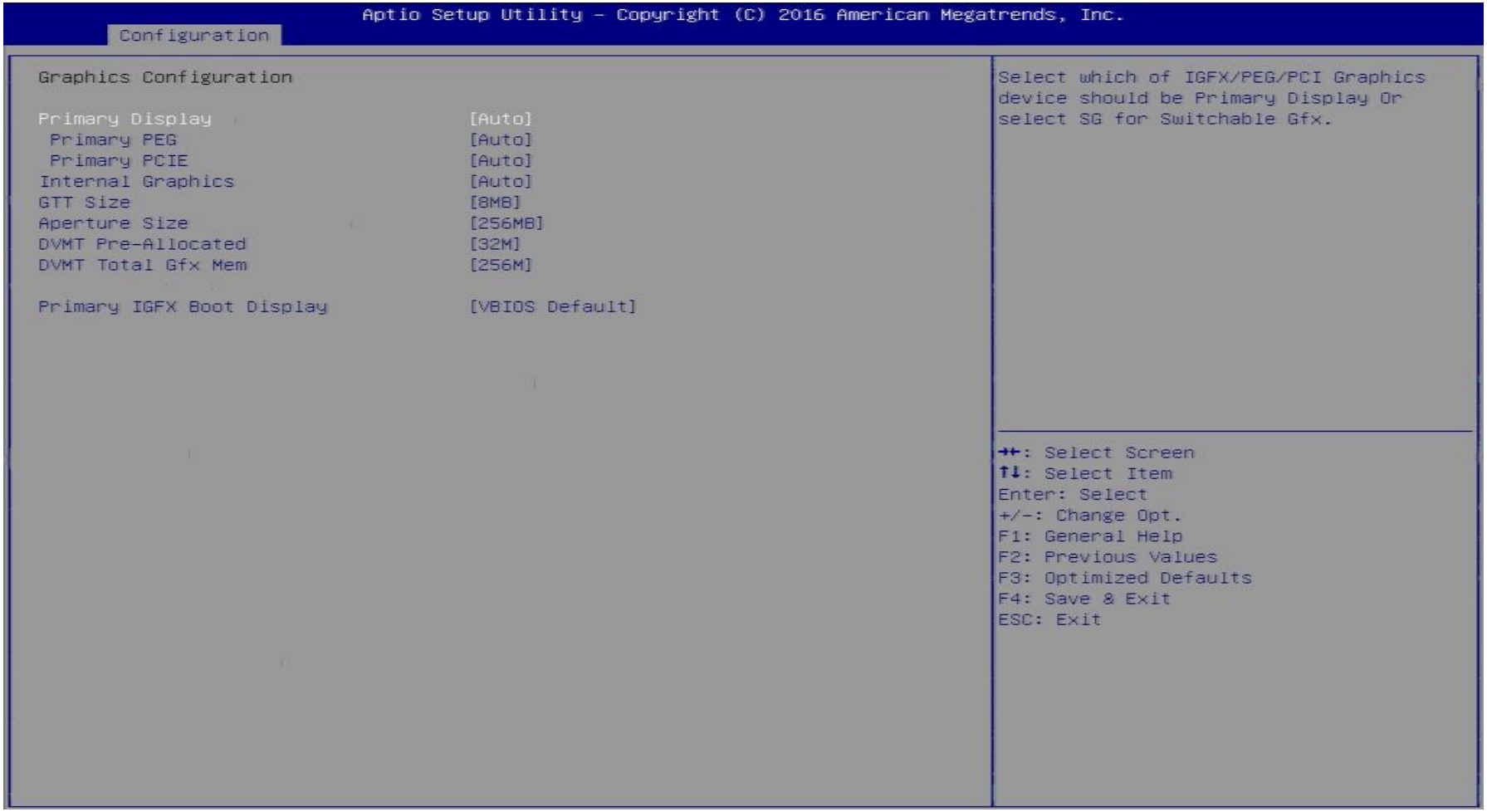
Configuration
LAN Configuration
Intel Ethernet Controller I219-LM
LAN MAC Address 00-90-FB-58-30-36
PCH LAN Controller [Enabled]
Wake on LAN [Enabled]
Launch Legacy PXE Rom [Disable]
Intel Ethernet Controller WGI210AT
LAN MAC Address 00-90-FB-58-30-37
Intel I210 LAN Controller [Enabled]
Launch Legacy PXE Rom [Disable]
Enable or disable onboard NIC.
→←: Select Screen
↑↓: Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previous Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit

Feature	Description	Options
PCH LAN Controller	Enable or disable onboard NIC	★ Enabled, Disabled
Wake on LAN	Enable or disable integrated LAN to wake the system. (The Wake On LAN cannot be disabled if ME is on at Sx state.)	★ Enabled, Disabled
Launch Legacy PXE Rom	Launch Legacy PXE Rom. [Disable] Not launch Rom, [Enable] Force launch Rom, [Auto] Auto detect LAN Cable state to Enable/Disable Rom initial.	★ Disable, Enable, Auto
Intel I210 LAN Controller	Intel I210 LAN Controller.	Disabled, ★ Enabled
Launch Legacy PXE Rom	Launch Legacy PXE Rom. [Disable] Not launch Rom, [Enable] Force launch Rom, [Auto] Auto detect LAN Cable state to Enable/Disable Rom initial.	★ Disable, Enable, Auto

Graphics Configuration

Configuration Graphics Settings

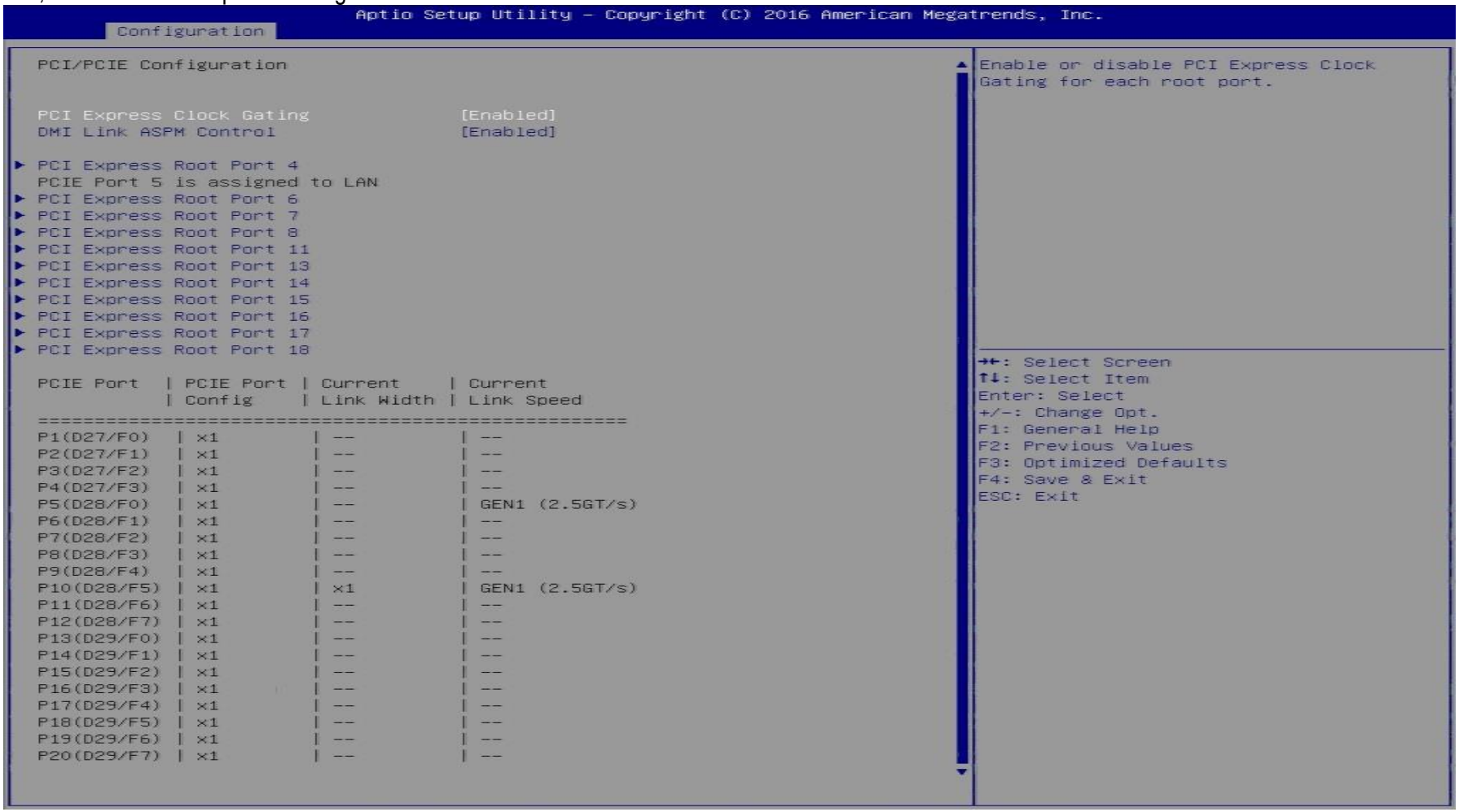


Feature	Description	Options
Primary Display	Select which of IGFX/PEG/PCI Graphics device should be Primary Display Or select SG for Switchable Gfx.	★ Auto, IGFX, PEG, PCIE,SG
Primary PEG	Select Auto/PEG11/ PEG12 Graphics device should be Primary PEG.	★ Auto, PEG11, PEG12
Primary PCIE	Select Auto/PCIE1/ PCIE2/ PCIE3/ PCIE4/ PCIE5/ PCIE6/ PCIE7/ of D28: F0/ F1/ F2/ F3/ F4/ F5/ F6/ F7, PCIE8/ PCIE9/ PCIE10/ PCIE11/ PCIE12/ PCIE13/ PCIE14/ PCIE15/ of D29: F0/ F1/ F2/ F3/ F4/ F5/ F6/ F7, PCIE16/ PCIE17/ PCIE18/ PCIE19 of D27: F0/ F1/ F2/ F3, Graphics device should be Primary PCIE.	★ Auto, PCIE1, PCIE2, PCIE3, PCIE4, PCIE5, PCIE6, PCIE7, PCIE8, PCIE9, PCIE10, PCIE11, PCIE12, PCIE13, PCIE14, PCIE15, PCIE16, PCIE17, PCIE18, PCIE19,
Internal Graphics	Keep IGFX enable based on the setup options.	★ Auto, Disabled, Enabled
GTT Size	Select the GTT Size	2MB, 4MB, ★ 8MB
Aperture Size	Select the Aperture Size Note: Above 4GB MMIO BIOS assignment is automatically enabled when selecting 2048MB aperture. To use this feature, please disable CSM Support.	128MB, ★ 256MB,512MB,1024MB,2048MB,4096MB
DVMT Pre-Allocated	Select DVMT 5.0 Pre-Allocated (Fixed Graphics Memory size used by the Internal Graphics Device.	★ 32M,64M,96M,128M, 160M,192M,224M,256M,288M ,320M,352M,384M,416M,448 M,480M,512 M,1024M,1536M,2048 M,4M,8M,12M,16M,20M,24M, 28M,32M,/F7,36M,40M,44M,4 8M,52M,56M
DVMT Total Gfx Mem	Select DVMT5.0 Total Graphic Memory size used by the Internal Graphics Device	128M, ★ 256,MAX
Primary IGFX Boot Display	Select the Video Device which will be activated during POST. This has no effect if external graphics present. Secondary boot display selection will appear based on your selection.	★ VBIOS Default, DP, VGA, HDMI

	VGA modes will be supported only on primary display	
Secondary IGFX Boot Display	Select Secondary Display Device	★ Disabled, DP, VGA, HDMI

PCI/PCIE Configuration

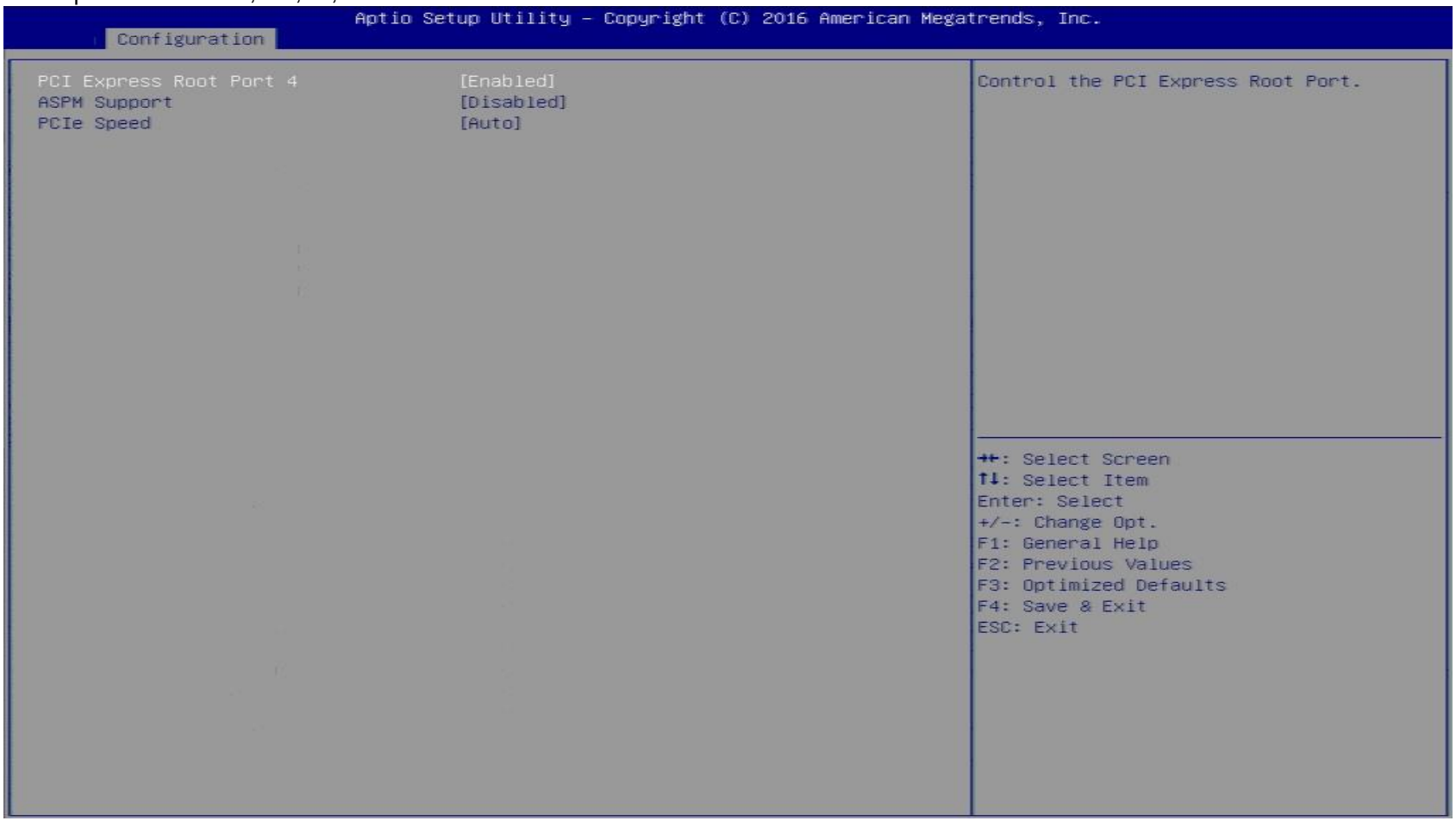
PCI, PCI-X and PCI Express Settings.



Feature	Description	Options
PCI Express Clock Gating	Enable or disable PCI Express Clock Gating for each root port.	Disabled ★ Enabled
DMI Link ASPM Control	Enable/Disable the control of Active State Power Management on SA side of the DMI Link.	Disabled ★ Enabled

PCI Express Root Port4, 6-8, 11, 13-18

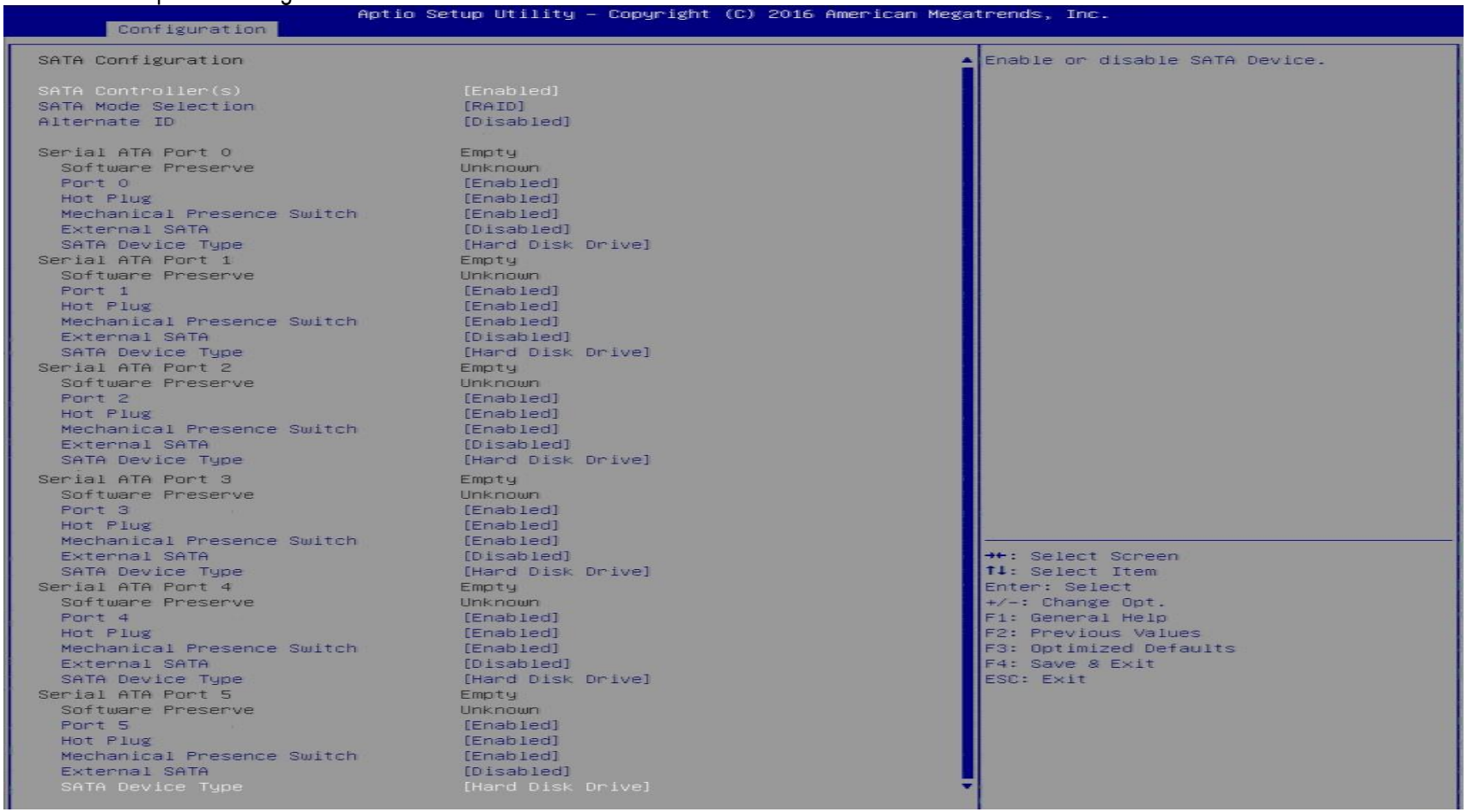
PCI Express Root Port 4, 6-8, 11, 13-18



Feature	Description	Options
PCI Express Root Port 4, 6-8, 11, 13-18	Control the PCI Express Root Port.	Disabled, ★ Enabled
ASPM Support	Set the ASPM Level: Force L0s – Force all links to L0s State AUTO-BIOS auto configure, DISABLE – Disables ASPM	★ Disabled, L0s, L1, L0sL1, Auto
PCIe Speed	Select PCI Express port speed	★ Auto,Gen1,Gen2,Gen3

SATA Configuration

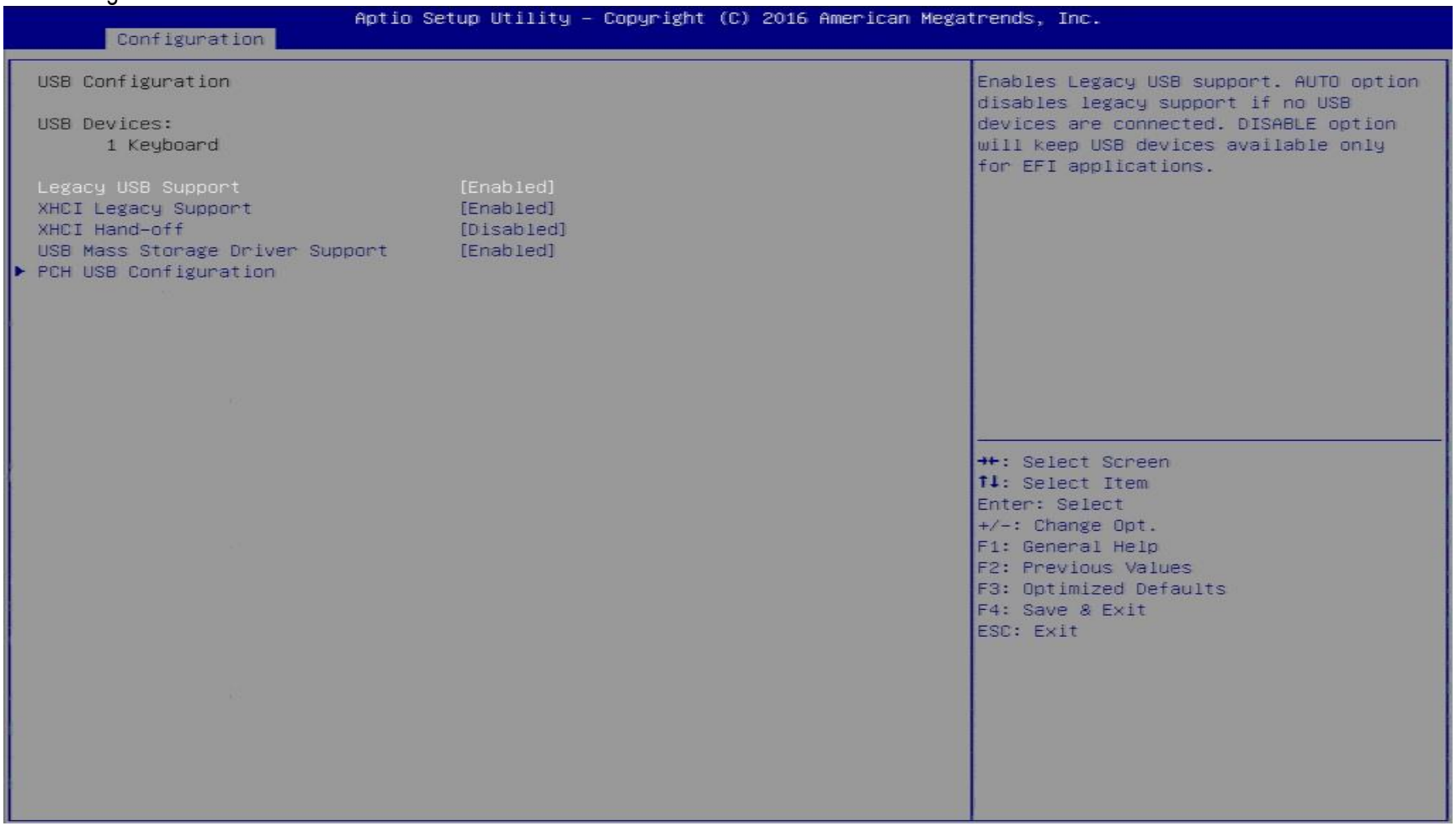
SATA Device Options Settings



Feature	Description	Options
SATA Controller(s)	Enable or disable SATA Device.	★ Enabled, Disabled
SATA Mode Selection	Determines how SATA controller(s) operate.	★ AHCI, RAID
Port 0-5	Enable or Disable SATA Port	Disabled, ★ Enable
Hot Plug	Designates this port as Hot Pluggable	★ Disabled, Enabled
External SATA	External SATA Support.	★ Disabled, Enabled
SATA Device Type	Indentify the SATA port is connected to Solid State Drive or Hard Disk Drive.	★ hard Disk Drive, Solid State Drive

USB Configuration

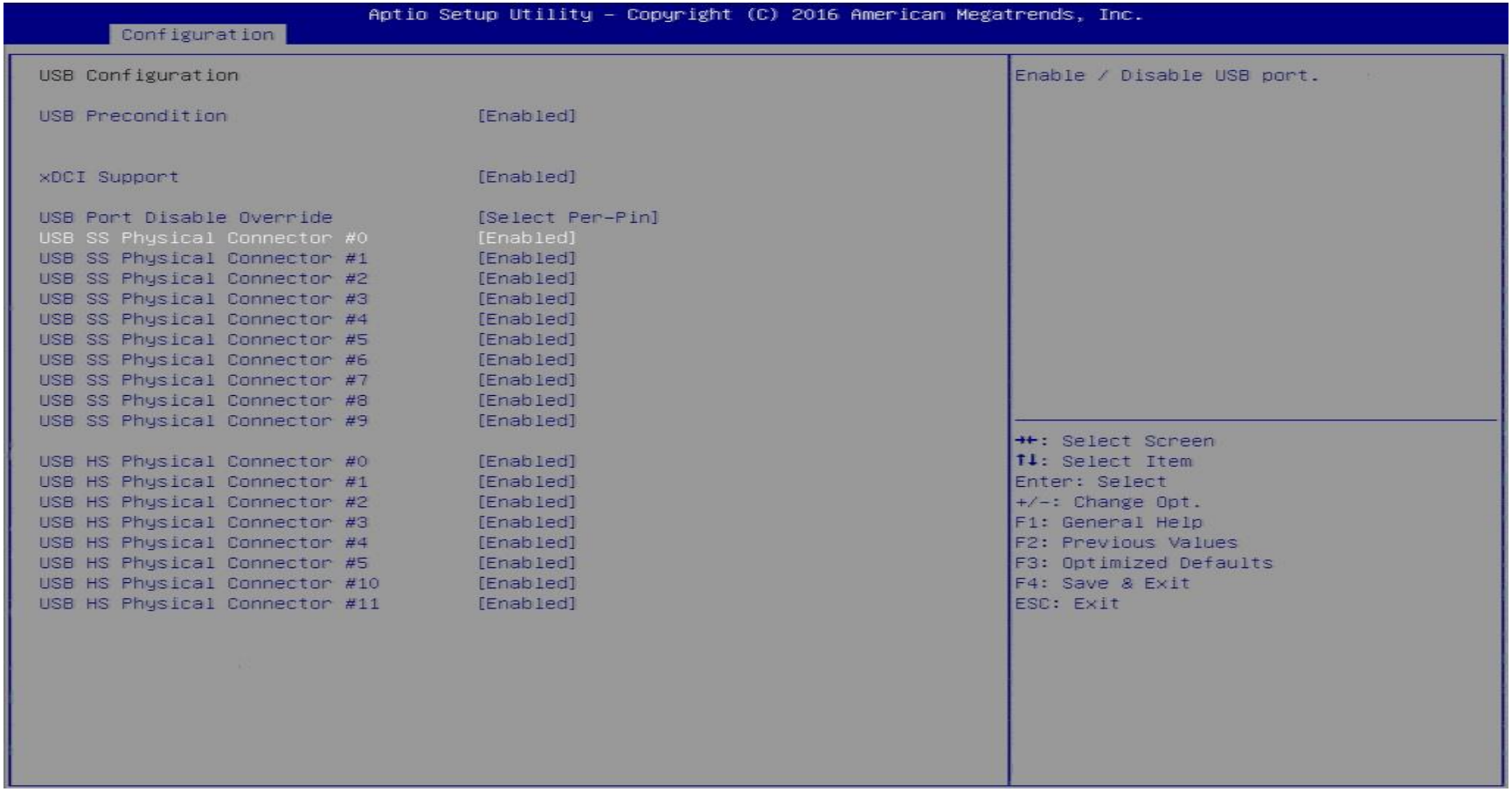
USB Configuration Parameters.



Feature	Description	Options
Legacy USB Support	Enables Legacy USB support. AUTO option disables legacy support if no USB Devices are connected. DISBLE option will keep USB devices available only for EFI applications.	★ Enabled, Disabled, Auto
XHCI Legacy Support	Enable/Disable XHCI Controller Legacy support.	★ Enable, Disabled
XHCI Hand-off	This is workaround for OSes without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.	Enabled, ★ Disabled
USB Mass Storage Driver Support	Enable/Disable USB Mass Storage Driver Support.	Disabled, ★ Enabled

PCH USB Configuration

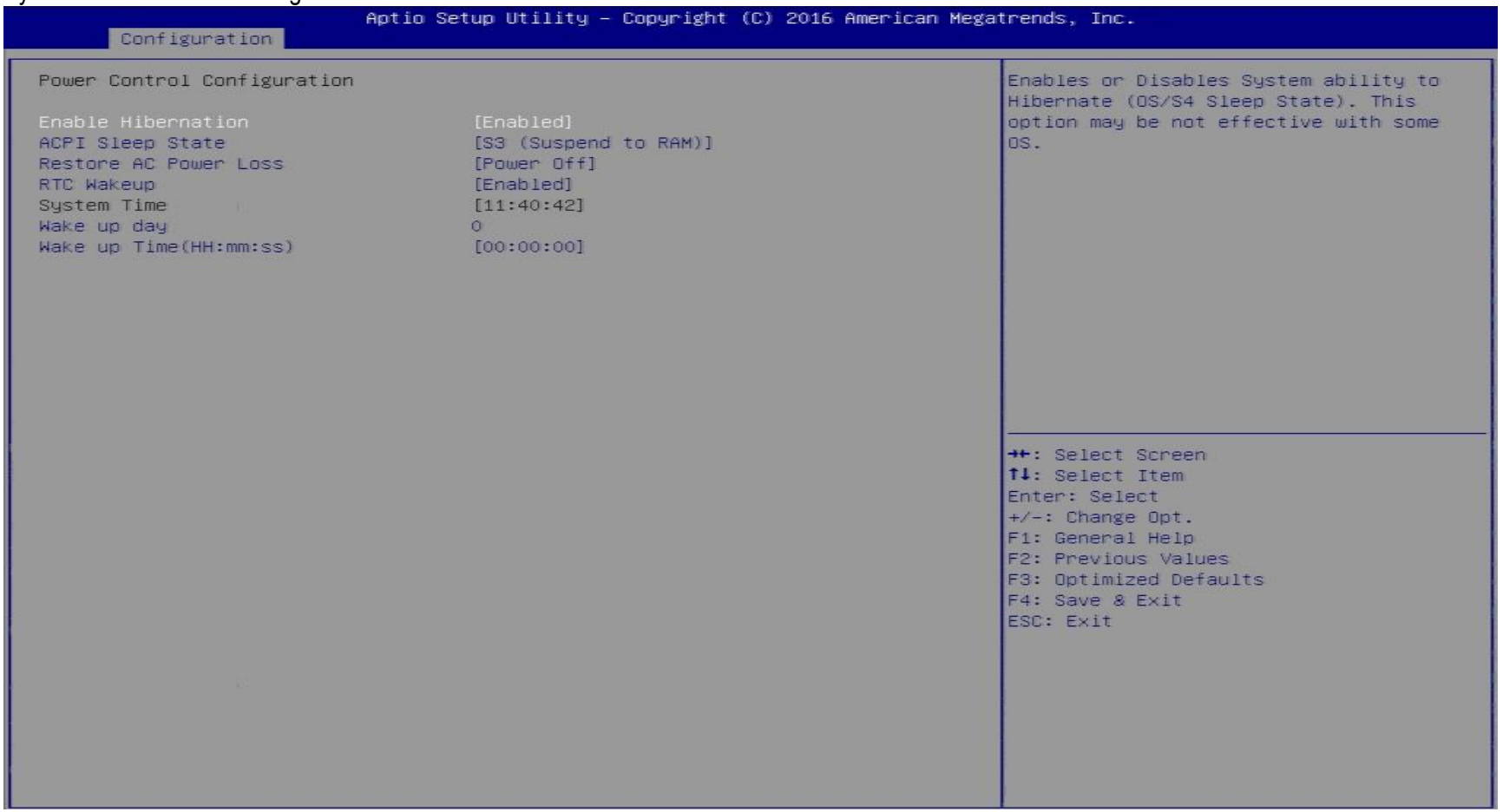
PCH USB Configurtion



Feature	Description	Options
USB Precondition	Precondition work on USB host controller and root ports for faster Enumeration.	Enabled, ★ Disabled
xDCI Support	Enable/Disable xDCI (USB OTG Device).	★ Disabled, Enabled
USB Port Disable Override (Select Per-Pin)	Selectively Enable/Disable the corresponding USB port from reporting a Device Connection to the controller.	★ Disabled, Select Per-Pin
USB SS Physical Connector #0-9	Enable /Disable USB port.	★ Enabled, Disabled
USB HS Physical Connector #0-5, 10-11	Precondition work on USB host controller and root ports for faster enumeration.	Disabled, ★ Enabled

Power Control Configuration

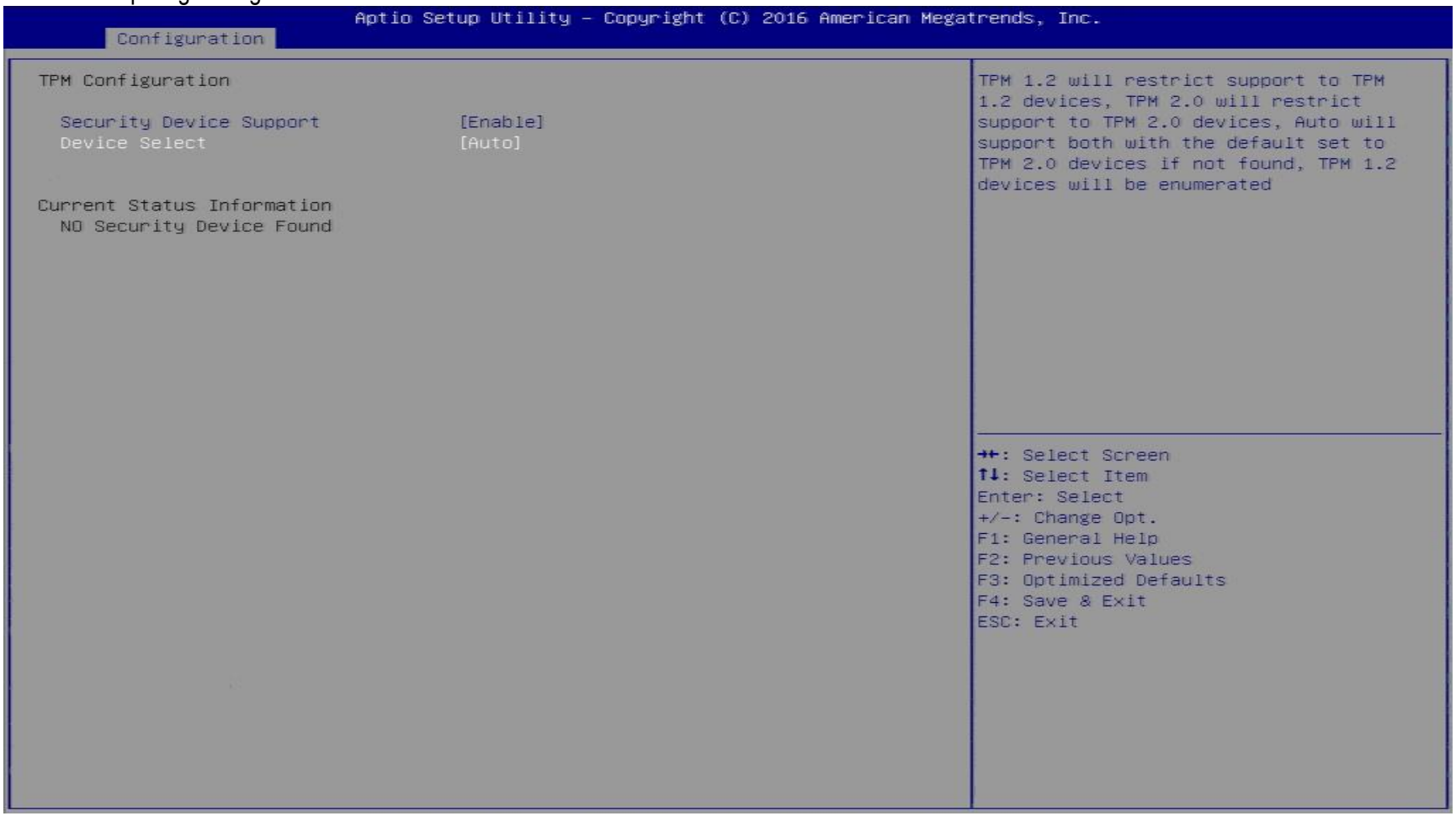
System Power Control Configuration Parameters



Feature	Description	Options
Enable Hibernation	Enables or Disables System ability to Hibernate (OS/S4 Sleep State). This option may be not effective with some OS.	Disabled, ★ Enabled
ACPI Sleep State	Select the highest ACPI sleep state the system will enter when the SUSPEND button is pressed.	Suspend Disabled, ★ S3 (Suspend to RAM)
Restore AC Power Loss	Specify what state to go to when power is re-applied after a power failure (G3 state)	Power On, ★ Power Off
RTC Wake up (Enabled)	Enable or disable System wake on alarm event. [Enabled], system will wake up the Hour: Min: Sec specified. [Disabled] Turn off RTC Wakeup.	★ Disabled, Enabled
Wake up day	Select 0 for daily system wake up 1-31 for which day of the month that you would like the system to wake up	
Wake up Time(HH: mm: ss)	Use [Enter], [TAB] to select field, HH: 0-23, mm: 0-59, ss: 0-59	

TPM Configuration

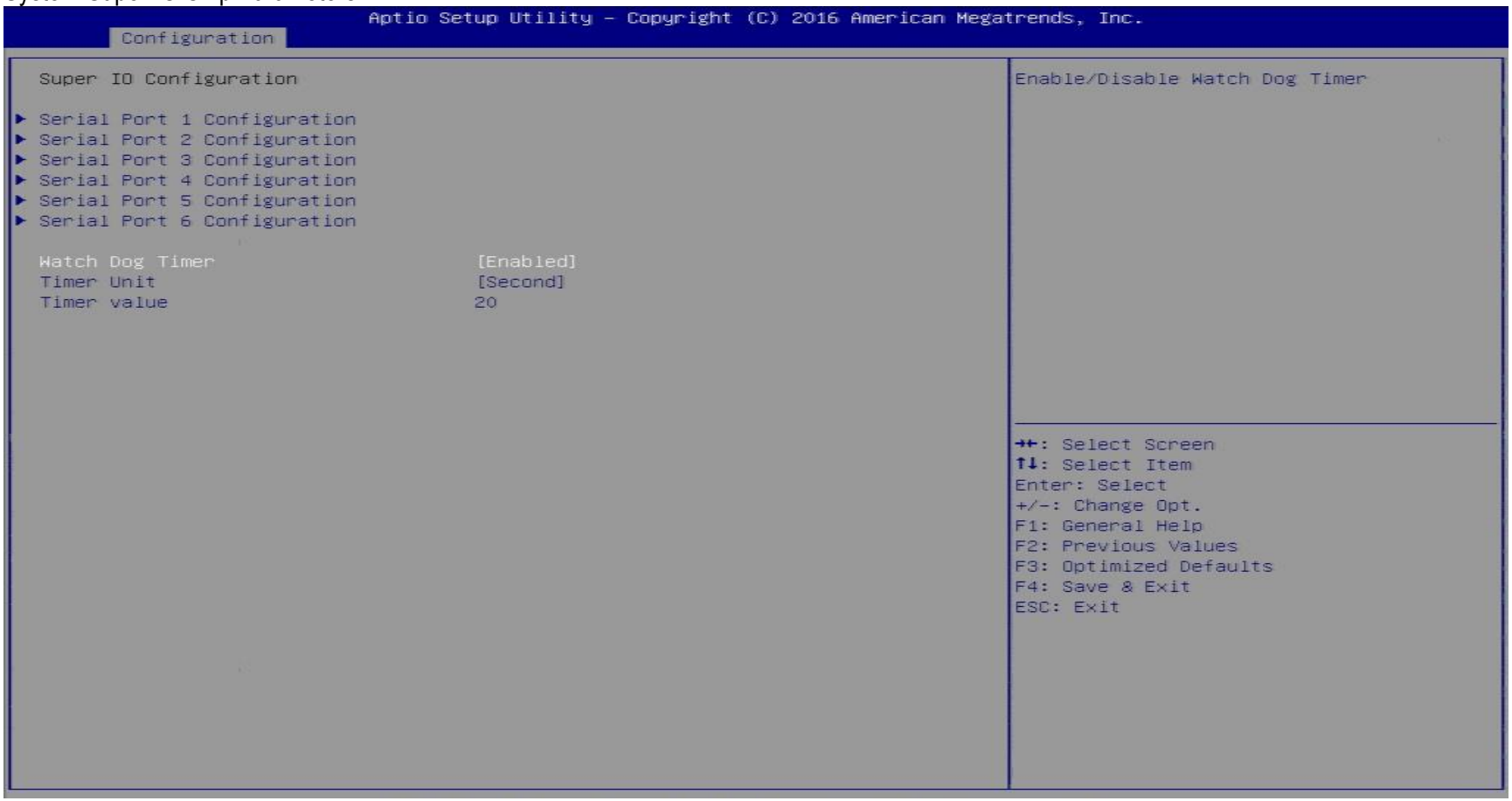
Trusted Computing settings



Feature	Description	Options
Security Device Support (Enabled)	Enables or Disables BIOS support for security device. O.S. will not show Security Device. TCG EFI protocol and INT1A Interface will not be available.	★ Disabled, Enabled
Device Select	TPM 1.2 will restrict support to TPM 1.2 devices, TPM 2.0 will restrict support to TPM 2.0 devices, Auto will support both with the default set to TPM 2.0 devices if not found, TPM 1.2 devices will be enumerated.	TPM 1.2, TPM 2.0, ★ Auto

Super IO Configuration

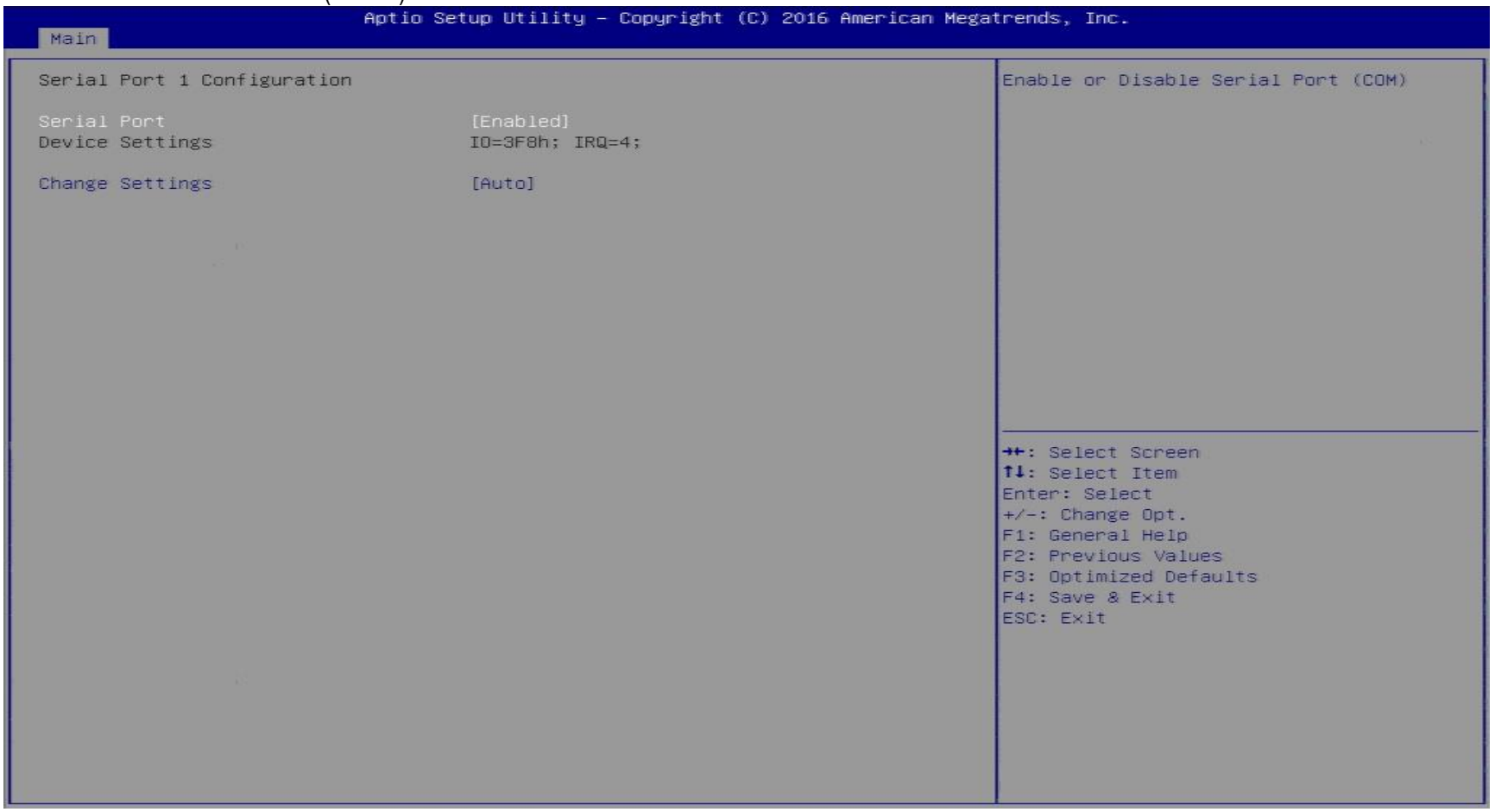
System Super IO Chip Parameters.



Feature	Description	Options
Watch Dog Timer (Enabled)	Enable/Disable Watch Dog Timer	★ Disabled, Enabled
Timer Unit	Select Timer count unit of WDT	★ Second, Minute
Timer value	Set WDT Timer value	★ 20

Serial Port 1 Configuration

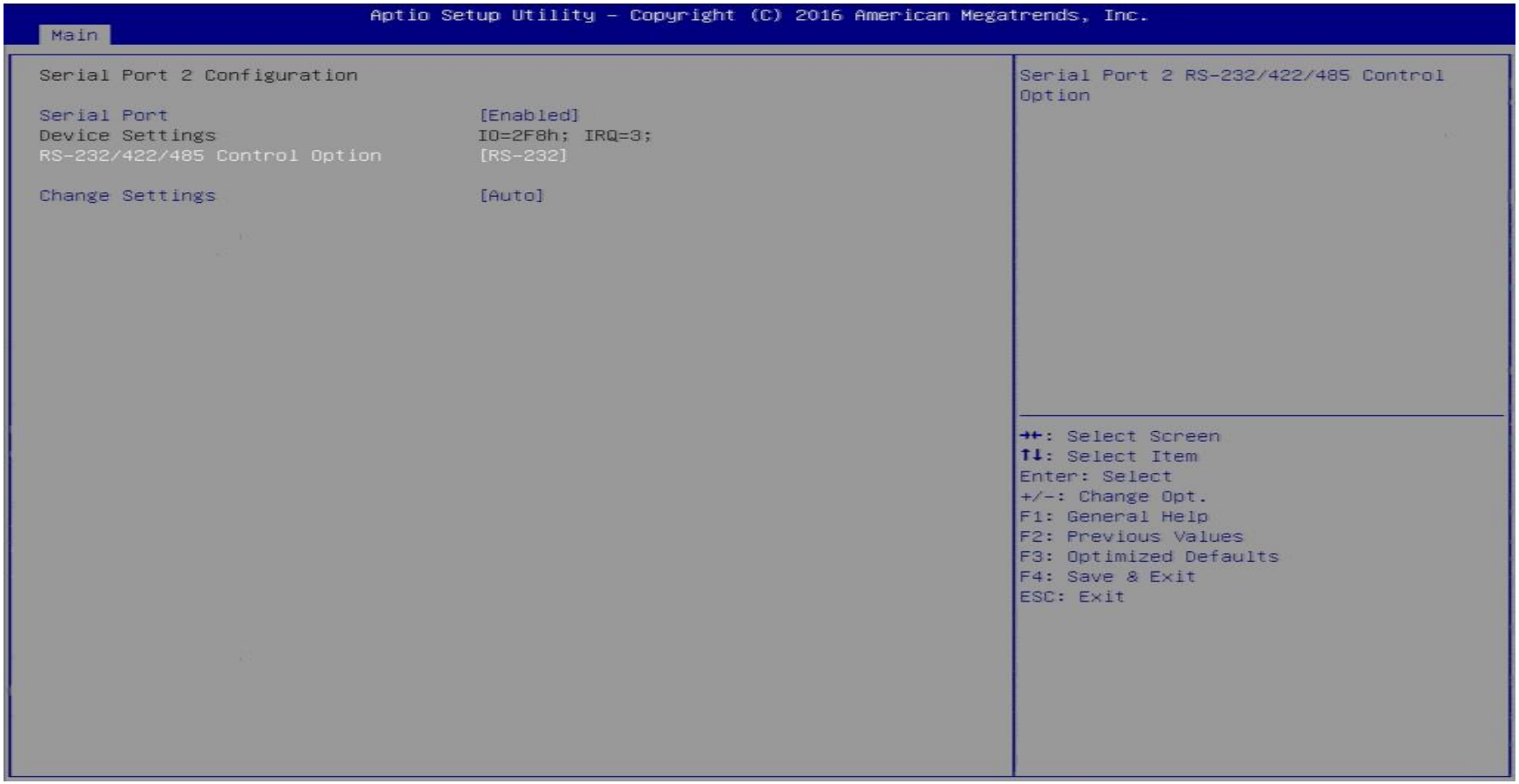
Set Parameters of Serial Port 1 (COMA)



Feature	Description	Options
Serial Port	Enable or Disable Serial Port (COM)	Disabled, ★ Enabled
Change Settings	Select an optimal settings for Super IO Device	★ Auto, IO=3F8h; IRQ=4; IO=3F8h; IRQ=3,4,5,6,7,9,10,11,12 IO=2F8h; IRQ=3,4,5,6,7,9,10,11,12 IO=3E8h; IRQ=3,4,5,6,7,9,10,11,12 IO=2E8h; IRQ=3,4,5,6,7,9,10,11,12

Serial Port 2 Configuration

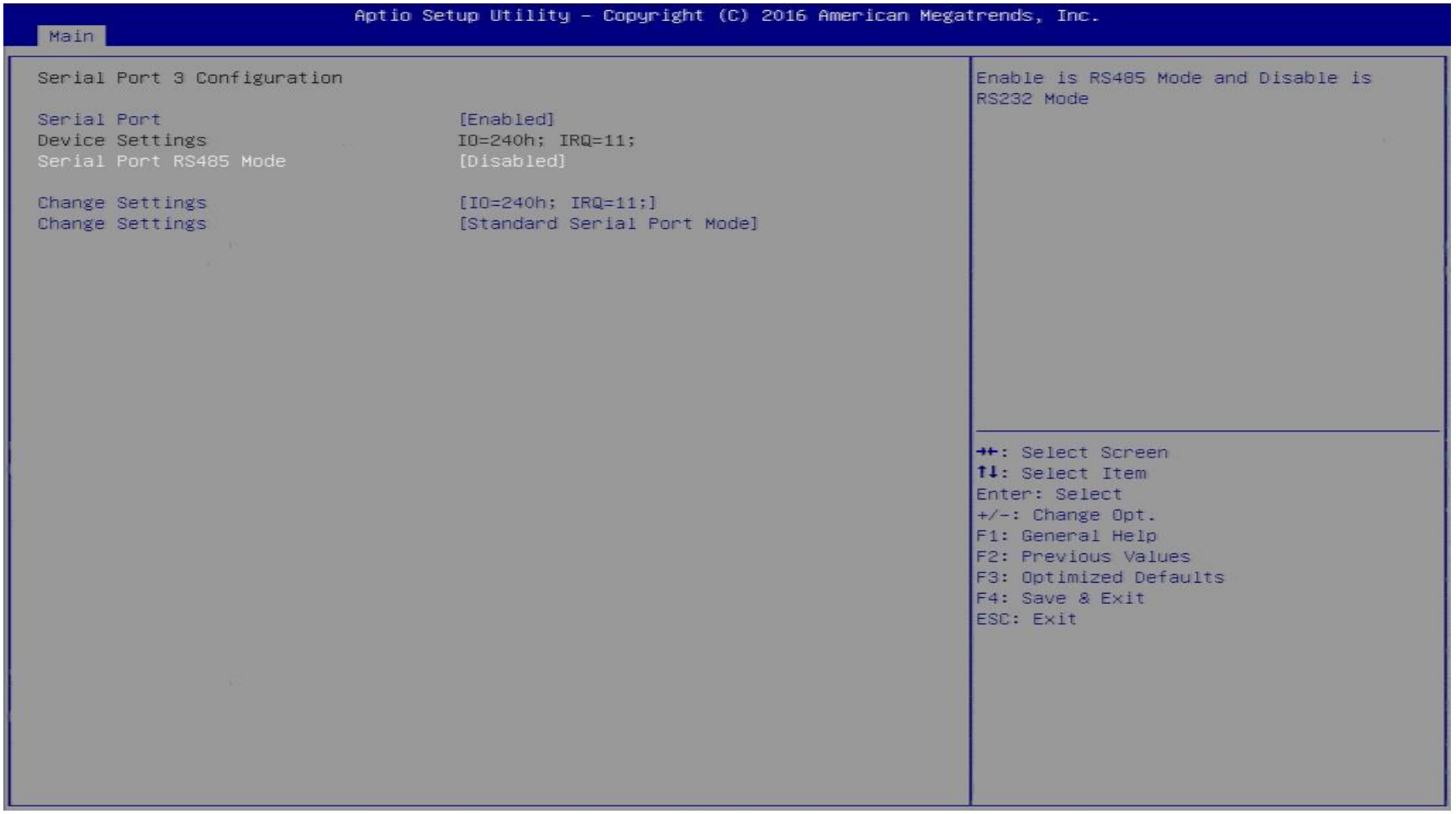
Set Parameters of Serial Port 2 (COMB)



Feature	Description	Options
Serial Port	Enable or Disable Serial Port (COM)	Disabled, ★ Enabled
RS-232/422/485 Control Option	Serial Port 2 RS-232/422/485 Control Option	★ RS-232, RS-485 HALF DUPLEX, RS-485/422 FULL DUPLEX
Change Settings	Select an optimal settings for Super IO Device.	★ Auto, IO=2F8h; IRQ=3; IO=3F8h; IRQ=3,4,5,6,7,9,10,11,12 IO=2F8h; IRQ=3,4,5,6,7,9,10,11,12 IO=3E8h;IRQ=3,4,5,6,7,9,10,11,12 IO=2E8h;IRQ=3,4,5,6,7,9,10,11,12

Serial Port 3 Configuration

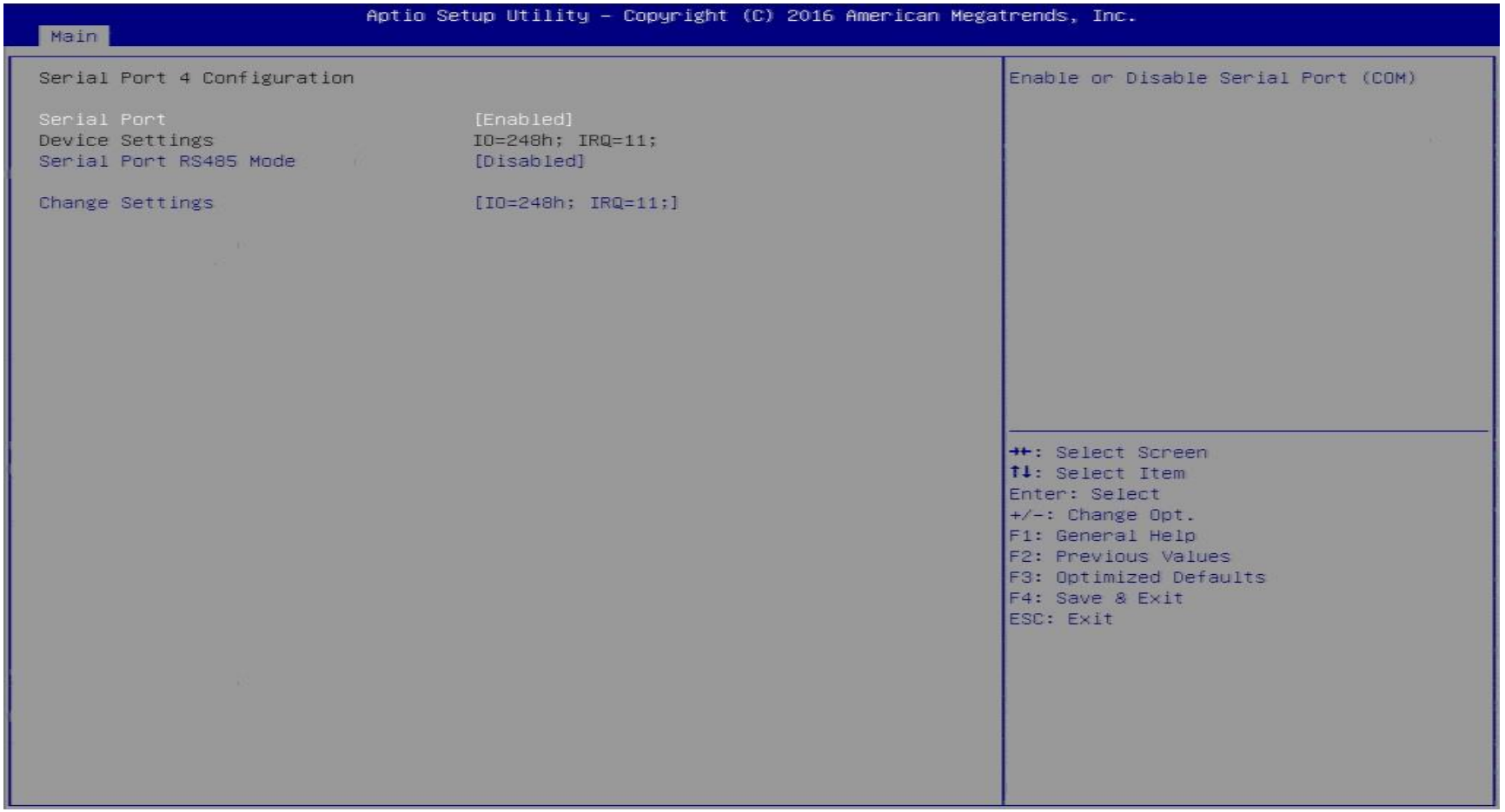
Set Parameters of Serial Port 3 (COMC)


Aptio Setup Utility – Copyright (C) 2016 American Megatrends, Inc.
Main
Serial Port 3 Configuration
Serial Port [Enabled]
Device Settings IO=240h; IRQ=11;
Serial Port RS485 Mode [Disabled]
Change Settings [IO=240h; IRQ=11;]
Change Settings [Standard Serial Port Mode]
Enable is RS485 Mode and Disable is RS232 Mode
→←: Select Screen
↑↓: Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previous Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit

Feature	Description	Options
Serial Port	Enable or Disable Serial Port (COM)	Disabled, ★ Enabled
Serial Port RS-485 Mode	Enabled is RS485 Mode and Disable is RS232 Mode	★ Disabled, Enabled
Change Settings	Select an optimal setting for Super IO Device.	Auto, ★ IO=240h; IRQ=11, IO=240h; IRQ=3,4,5,6,7,10,11,12 IO=248h; IRQ=3,4,5,6,7,10,11,12 IO=250h; IRQ=3,4,5,6,7,10,11,12 IO=258h; IRQ=3,4,5,6,7,10,11,12
Change Settings	Select an optimal setting for Super IO Device	★ Standard Serial Port Mode, IrDA Active pulse 1.6 uS, Full Duplex, IrDA Active pulse 1.6 uS, Half Duplex, IrDA Active pulse 3/16 bit time, Full Duplex, IrDA Active pulse 3/16 bit time, Half Duplex

Serial Port 4 Configuration

Set Parameters of Serial Port 4 (COMD)



Feature	Description	Options
Serial Port	Enable or Disable Serial Port (COM)	Disabled, ★ Enabled
Serial Port RS485 Mode	Enable is RS485 Mode and Disable is RS232 Mode	★ Disabled, Enabled
Change Settings	Select an optimal settings for super IO Device	Auto, ★ IO=248h; IRQ=11, IO=240h; IRQ=3,4,5,6,7,10,11,12; IO=248h; IRQ=3,4,5,6,7,10,11,12; IO=250h; IRQ=3,4,5,6,7,10,11,12; IO=258h; IRQ=3,4,5,6,7,10,11,12;

Serial Port 5 Configuration

Set Parameters of Serial Port 5 (COME)

Feature	Description	Options
Serial Port	Enable or Disable Serial Port (COM)	Disabled, ★ Enabled
Serial Port RS485 Mode	Enable is RS485 Mode and Disable is RS232 Mode	★ Disabled, Enabled
Change Settings	Select an optimal settings for super IO Device	Auto, ★ IO=250h; IRQ=10, IO=240h; IRQ=3,4,5,6,7,10,11,12; IO=248h; IRQ=3,4,5,6,7,10,11,12; IO=250h; IRQ=3,4,5,6,7,10,11,12; IO=258h; IRQ=3,4,5,6,7,10,11,12;

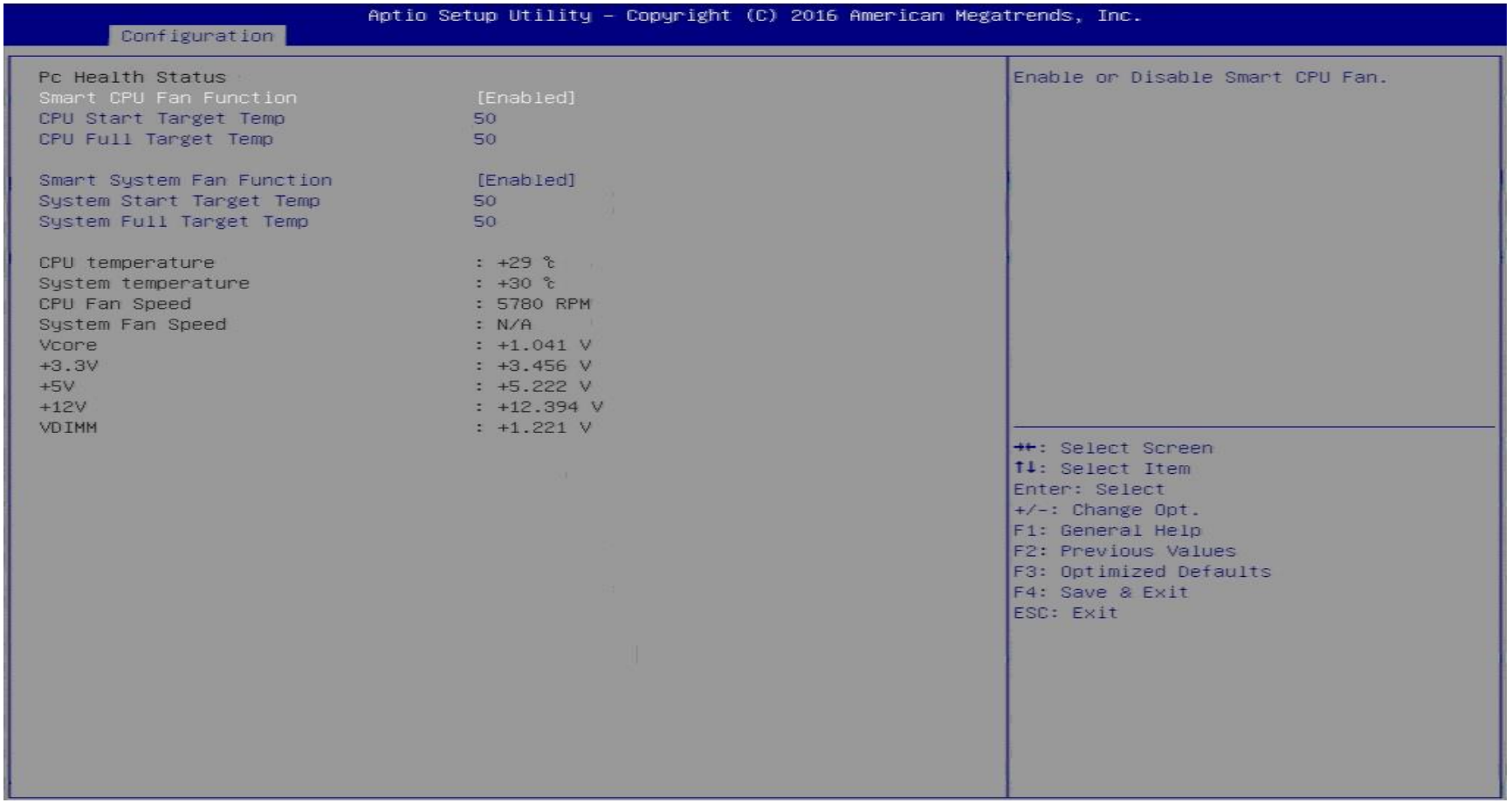
Serial Port 6 Configuration

Set Parameters of Serial Port 6 (COMF)

Feature	Description	Options
Serial Port	Enable or Disable Serial Port (COM)	Disabled, ★ Enabled
RS-232/422/485 Control Option	Serial Port 6 RS-232/422/485 Control Option	★ RS-232, RS-485 HALF DUPLEX, RS-485/422 FULL DUPLEX
Serial Port RS485 Mode	Enable is RS485 Mode and Disable is RS232 Mode	★ Disabled, Enabled
Change Settings	Select an optimal settings for Super IO Device	Auto, ★ IO=258h; IRQ=10, IO=240h; IRQ=3,4,5,6,7,10,11,12; IO=248h; IRQ=3,4,5,6,7,10,11,12; IO=250h; IRQ=3,4,5,6,7,10,11,12; IO=258h; IRQ=3,4,5,6,7,10,11,12;

H/W Monitor Configuration

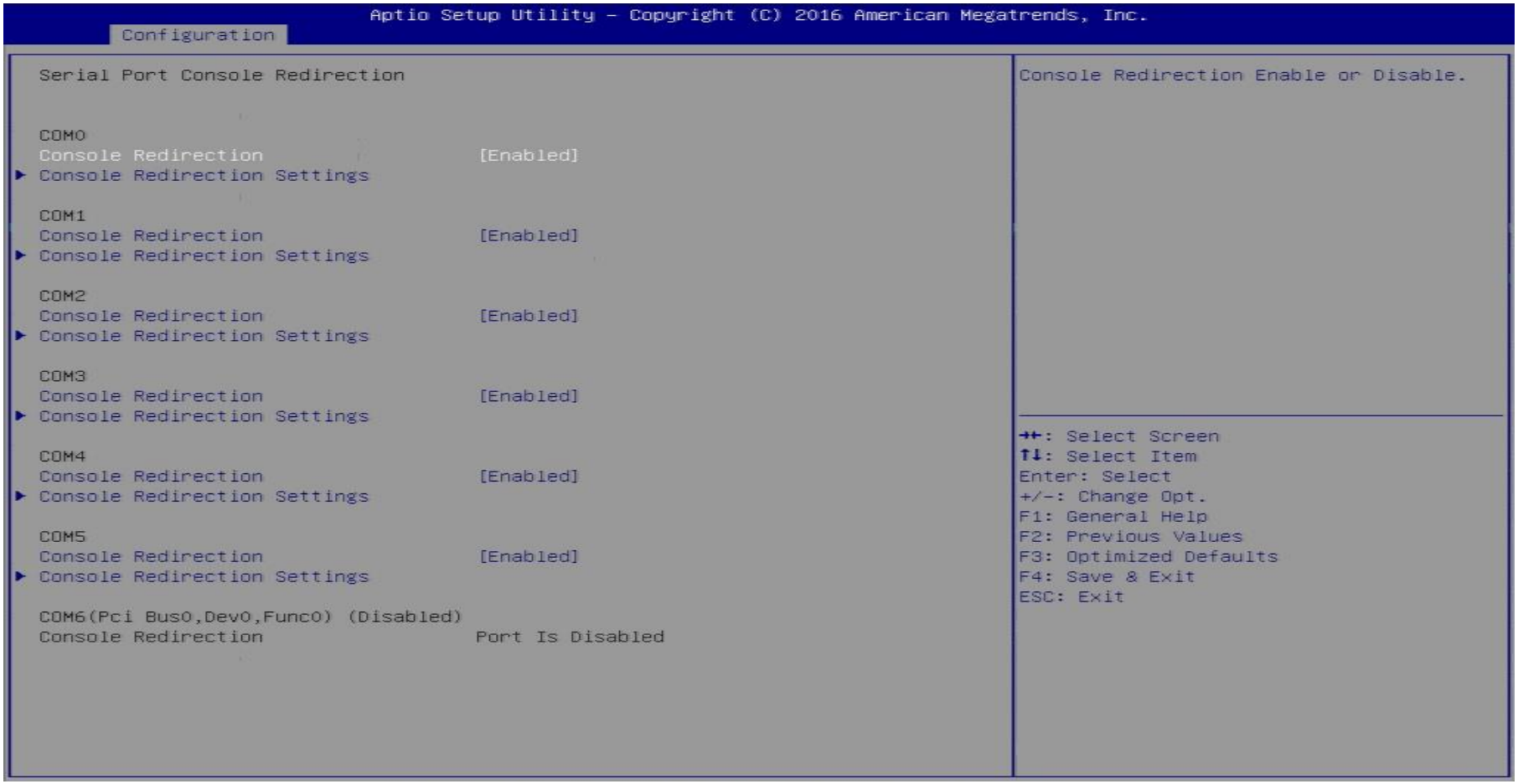
Monitor hardware status



Feature	Description	Options
Smart CPU Fan Function (Enabled)	Enable or Disable Smart CPU Fan	★ Disabled, Enabled
CPU Start Target Temp	CPU Start Fan Target Temperature.	50
CPU Full Target Temp	CPU Full Fan Target Temperature.	50
Smart System Fan Function	Enable or Disable Smart System Fan	★ Disabled, Enabled
System Start Target Temp	System Start Fan Target Temperature.	50
System Full Target Temp	System Full Fan Target Temperature.	50

Serial Port Console Redirection

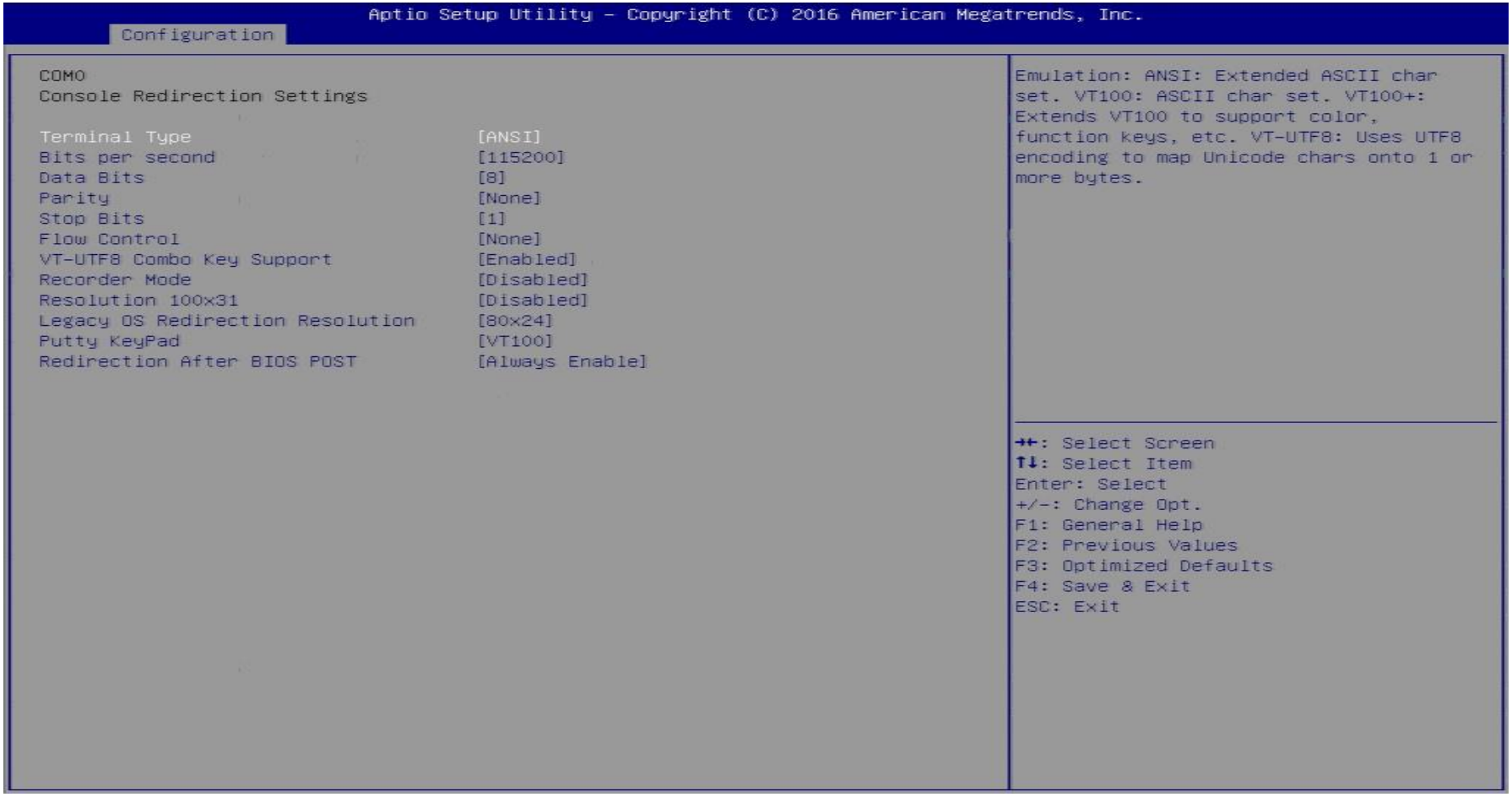
Serial Port Console Redirection



Feature	Description	Options
Console Redirection (COM 0-5) (Enabled)	Console Redirection Enable or Disable.	★ Disabled, Enabled

COM 0-5 Serial Port Console Redirection

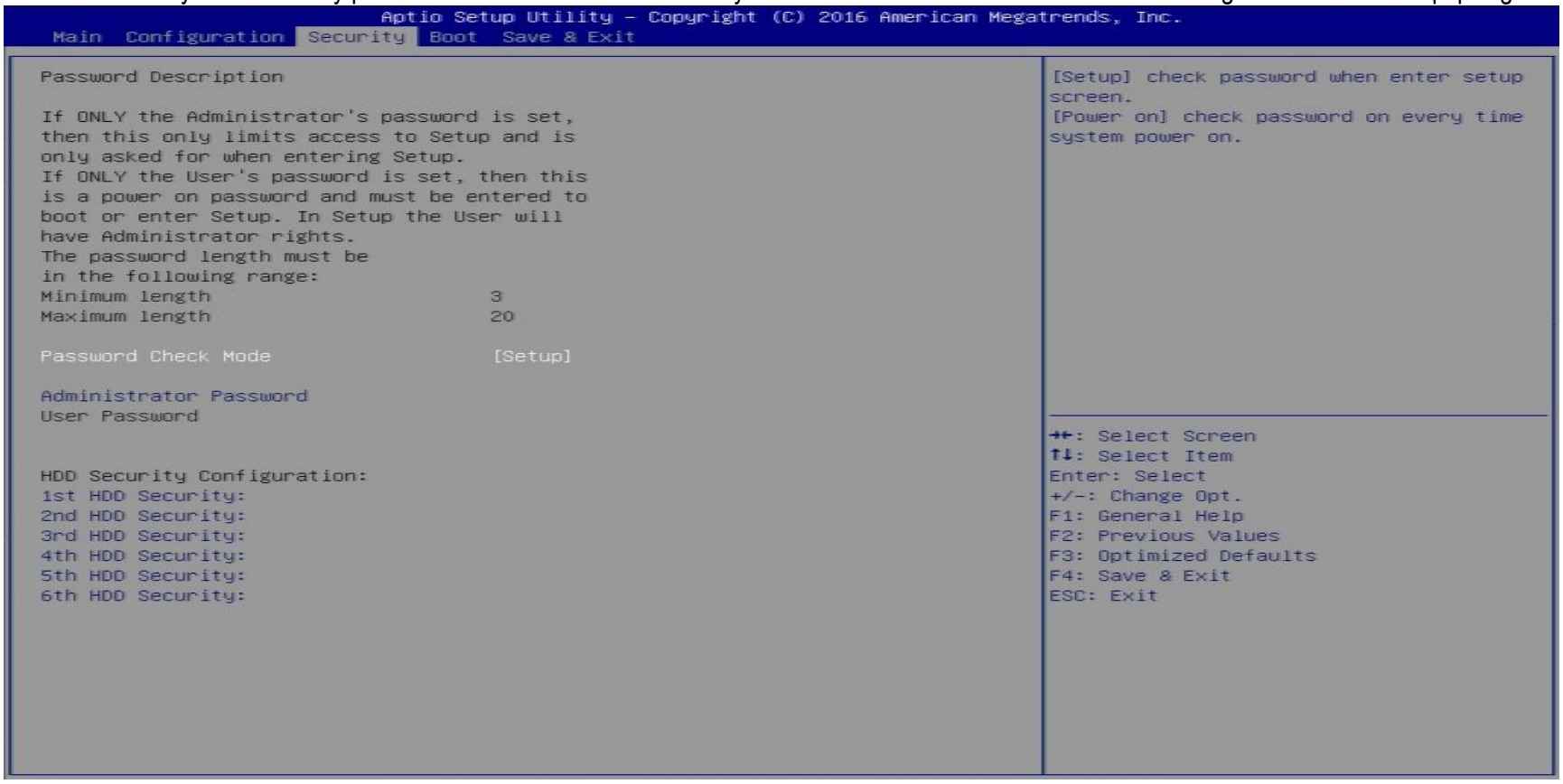
Serial Port Console Redirection



Feature	Description	Options
Terminal Type	Emulation: ANSI: Extended ASCII char set. VT100: ASCII char set. VT100+: Extends VT100 to support color, function keys, etc. VT-UTF8: Uses UTF8 encoding to map Unicode chars onto 1 or more bytes.	VT100, VT100+, VT-UTF8, ★ ANSI
Bits per second	Select Serial port transmission speed. The speed must be matched on other side. Long or noisy lines may require lower speeds.	9600, 19200, 38400,57600,★ 115200
Data bits	Data bits	7, ★ 8
Parity	A parity bit can be sent with the data bits to detect some transmission errors. Even: parity bit is 0 if the num of 1's in the data bits is even. Odd: parity bit is 0 if num of 1's in the data bits is odd. Mark: parity bit is always 1. Space parity bit is always 0. Mark and Space Parity do not allow for error detection. They can be used as an additional data bit.	★ None, Even, Odd, Mark, Space
Stop Bits	Stop bits indicate the end of a serial data packet. (A start bit indicates the beginning). The standard setting is 1 stop bit. Communication with slow devices may require more than 1 stop bit.	★ 1,2
Flow Control	Flow control can prevent data loss from buffer overflow. When sending data, if the receiving buffers are full, a 'stop' signal can be sent to stop the data flow. Once the buffers are empty, a 'start' signal can be sent to re-start the flow. Hardware flow control uses two wires to send start/stop signal.	★ None, Hardware RTS/CTS
VT-UTFB Combo Key Support	Enable VT-UTF8 Combination Key Support for ANSI/VT100 terminals	Disabled, ★ Enabled
Recorder Mode	With this mode enabled only text will be sent. This is to capture Terminal data.	★ Disabled, Enabled
Resolution 100x31	Enables or disables extended terminal resolution	★ Disabled, Enabled
Legacy OS Redirection Resolution	On Legacy OS, the Number of Rows and Columns supports redirection	★ 80x24, 80x25
Putty KeyPad	Select FunctionKey and KeyPad on Putty	★ VT100, LINUX,XTERMR6, SCO,ESCN,VT400
Redirection After BIOS POST	The settings specify if BootLoader is selected then Legacy console redirection is disabled before booting to legacy OS. Default value is Always Enable with means Legacy console Redirection is enabled for Legacy OS.	★ Always Enable, BootLoader

7.2.3 Security

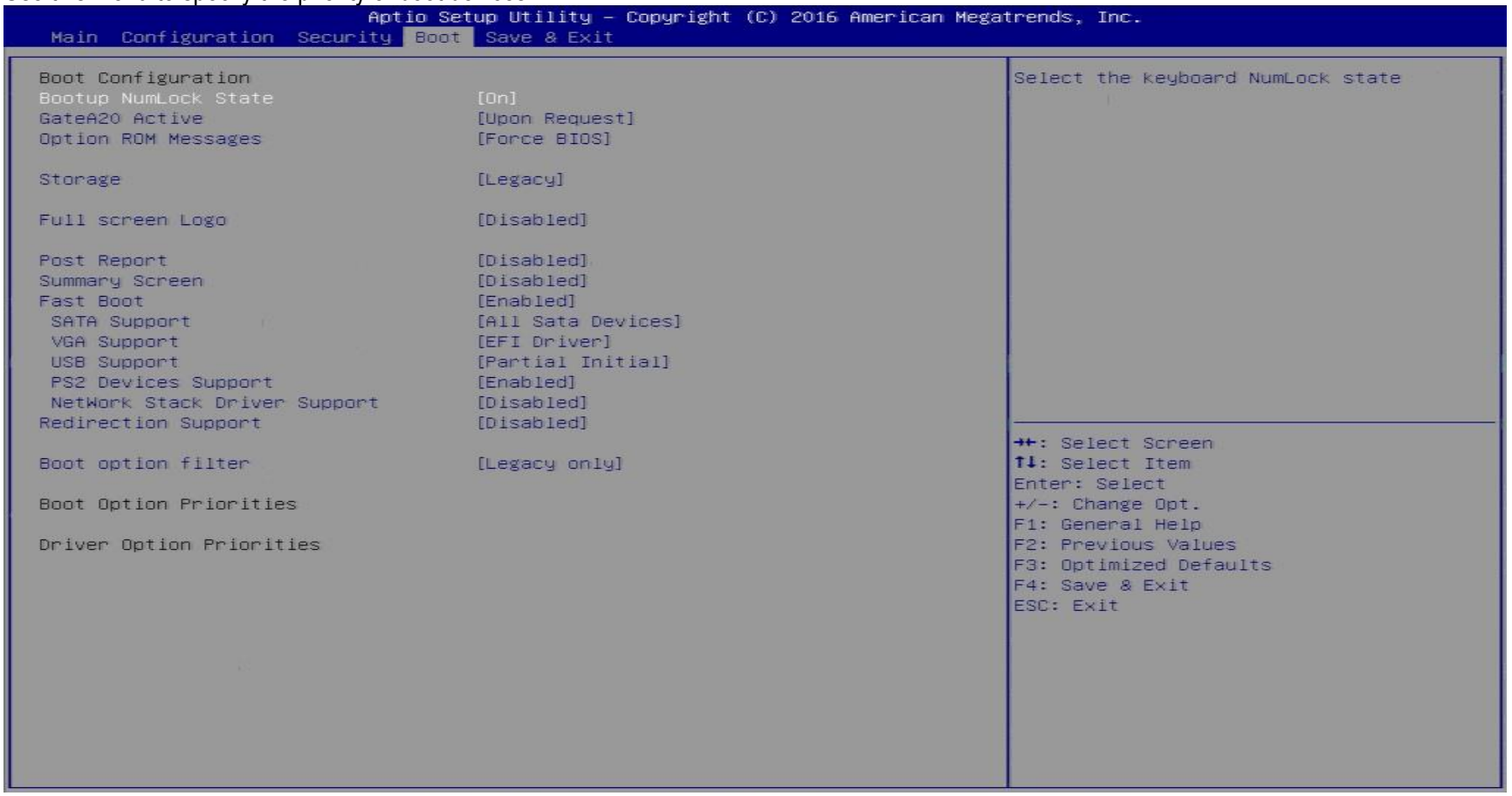
This section lets you set security passwords to control access to the system at boot time and/or when entering the BIOS setup program.



Feature	Description	Options
Password Check Mode	[Setup] check password when enter setup screen. [Power on] check password on every time system power on.	★ Setup, Power on
Administrator Password	Set Administrator Password	
1st-6th HDD Security	HDD Security Configuration for selected drive.	

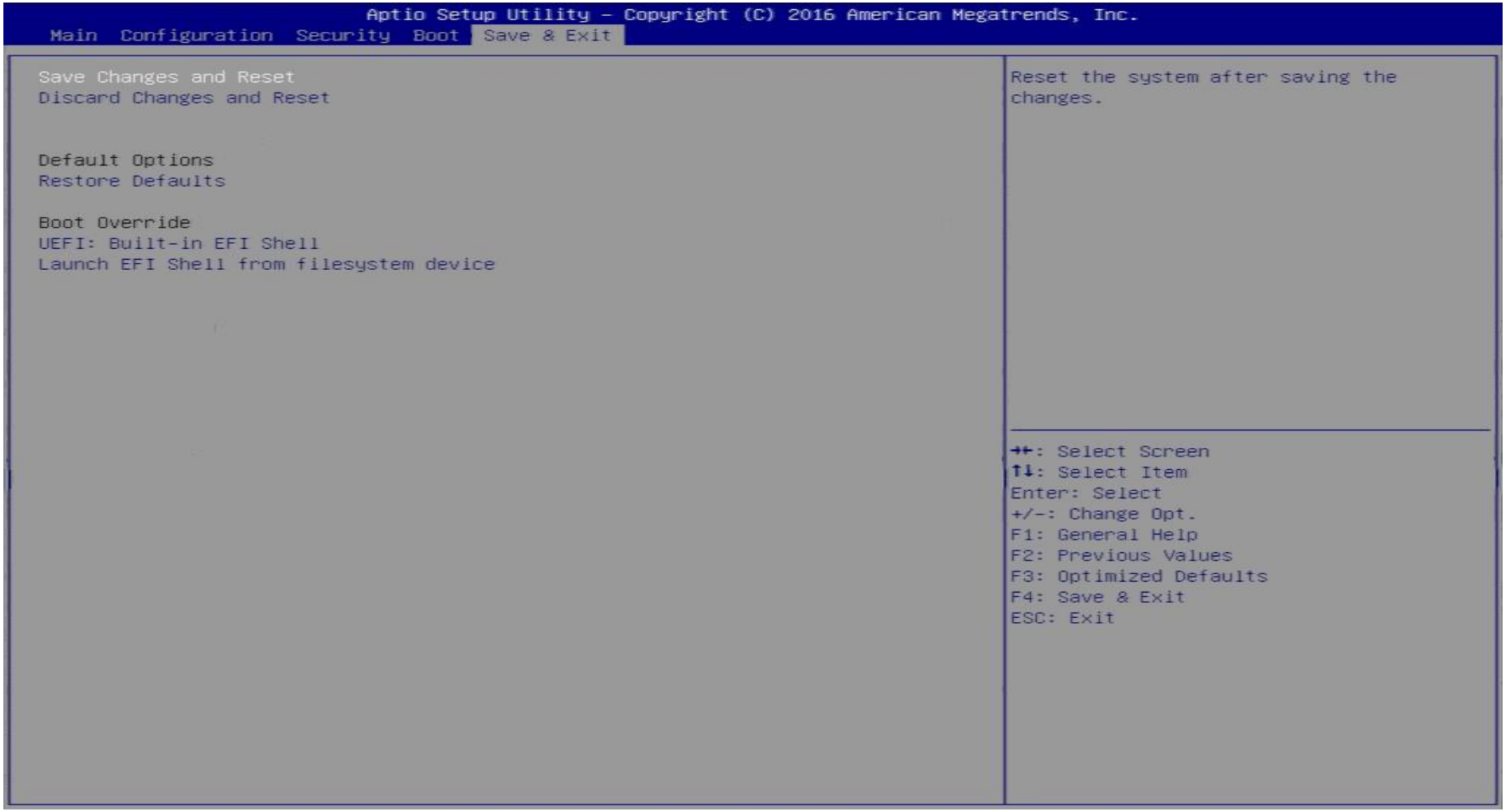
7.2.4 Boot

Use this menu to specify the priority of boot devices.



Feature	Description	Options
Bootup NumLock State	Select the keyboard NumLock state	★ On, Off
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.	★ Upon Request, Always
Option ROM Messages	Set display mode for Opion ROM	★ Force BIOS, Keep Current
Storage	Controls the execution of the UEFI and Legacy Storage OpROM	Do not Launch, UEFI, ★ Legacy
Full screen Logo	Enables or disables Quiet Boot option and Full screen Logo.	★ Disabled, Enabled
Post Report	Post Report Support Enabled/Disabled	★ Disabled, Enabled
Summary Screen	Summary Screen Support Enabled/Disabled	★ Disabled, Enabled
Fast Boot	Enables or disables boot with initialization of a minimal set of devices required to launch active boot option. Has no effect for BBS boot options.	★ Disabled, Enabled
Boot option filter	This option controls Legacy/UEFI ROMs priority	★ Legacy only, UEFI only

7.2.5 Save & Exit


Aptio Setup Utility – Copyright (C) 2016 American Megatrends, Inc.
Main Configuration Security Boot Save & Exit
Save Changes and Reset
Discard Changes and Reset
Default Options
Restore Defaults
Boot Override
UEFI: Built-in EFI Shell
Launch EFI Shell from filesystem device
Reset the system after saving the changes.
→←: Select Screen
↑↓: Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previous Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit

Feature	Description	Options
Save Changes and Reset	Equal to F10, save all changes of all menus, then exit setup configure driver. Finally resets the system automatically.	
Discard Changes and Reset	Equal to ESC, never save changes, then exit setup configure driver.	
Restore Defaults	Restore/Load Default values for all the setup options.	
UEFI: Built-in EFI Shell (Boot option filter: UEFI only)	Reset the system after saving the changes.	
Launch EFI Shell from filesystem device	Attempts to Launch EFI Shell application (Shell.efi) from one of the available filesystem devices.	

8 Troubleshooting

This section provides a few useful tips to quickly get WADE-8017 running with success. This section will primarily focus on system integration issues, in terms of BIOS setting, and OS diagnostics.

8.1 Hardware Quick Installation

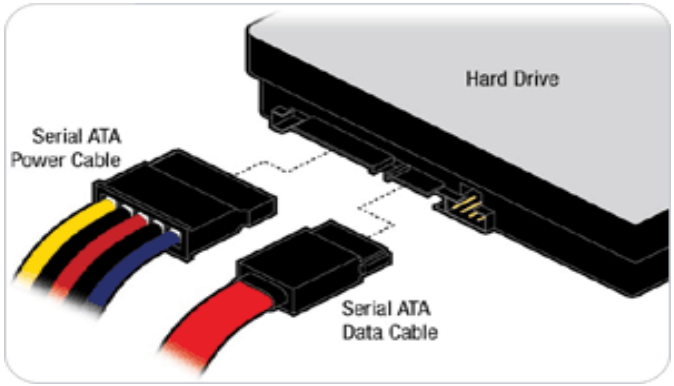
ATX Power Setting

Unlike other Single board computer, WADE-8017 supports ATX only. Therefore, there is no other setting that needs to be set up. However, there are only two connectors that must be connected—J17 (4 pins ATX power connector) & J21 (20 pins ATX Power Connector) on the WADE-8017 boardn.

Serial ATA

Unlike IDE bus, each Serial ATA channel can only connect to one SATA hard disk at a time;

The installation of Serial ATA is simpler and easier than IDE, because SATA hard disk doesn't require setting up Master and Slave, which can reduce mistake of hardware installation.



WADE-8017 can support six SATA interface (SATAII, 3.0Gb/s) on board. It has six J22 ,J23, J24, J25, J26, J27 SATA ports on board.(WADE-8017-H110 just support four J23, J25, J26, J27 SATA ports on board.)

WADE-8017 also supports one mSATA socket (mini-PCIe slot) (mSATA and SATA port 0(J23) function only can choose one function at the same Time). The SATA interface shall support both 1.5/3.0Gb & 6.0Gb operation per the SATA specification.

8.2 BIOS Setting

It is assumed that users have correctly adopted modules and connected all the devices cables required before turning on ATX power. DDR4 long DIMM Memory, keyboard, mouse, SATA hard disk, VGA connector, power cable of the device, ATX accessories are good examples that deserve attention. With no assurance of properly and correctly accommodating these modules and devices, it is very possible to encounter system failures that result in malfunction of any device.

To make sure that you have a successful start with WADE-8017, it is recommended, when going with the boot-up sequence, to hit “delete ” or ” Esc” key and enter the BIOS setup menu to tune up a stable BIOS configuration so that you can wake up your system far well.

Loading the default optimal setting

When prompted with the main setup menu, please scroll down to “Restore Defaults”, press “Enter” and select “Yes” to load default optimal BIOS setup. This will force your BIOS setting back to the initial factory configurations. It is recommended to do this so you can be sure the system is running with the BIOS setting that Portwell has highly endorsed. As a matter of fact, users can load the default BIOS setting at any time when system appears to be unstable in boot up sequence.

8.3 FAQ

Information & Support

Question: I forgot my password of system BIOS, what am I supposed to do?

Answer: You can switch off your power supply then find the JP5 on the WADE-8017 board to set it from 1-2 short to 2-3 short and wait 5 seconds to clean your password then set it back to 1-2 short to switch on your power supply.

JP5：CMOS Setting

	Jumper Setting Describe
*1-2	Default
2-3	Clean CMOS

Question: How to update the BIOS file of WADE-8017?

Answer: 1. Please visit web site of Portwell download center as below hyperlink

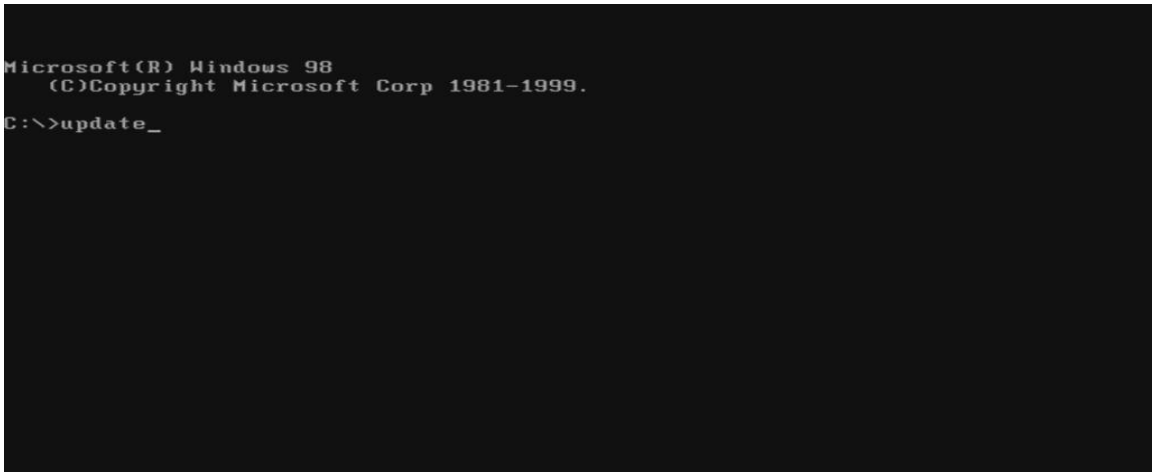
http://www.portwell.com.tw/support/download_center.php

Registering an account in advance is a must. (The E-Mail box should be an existing Company email address that you check regularly.)

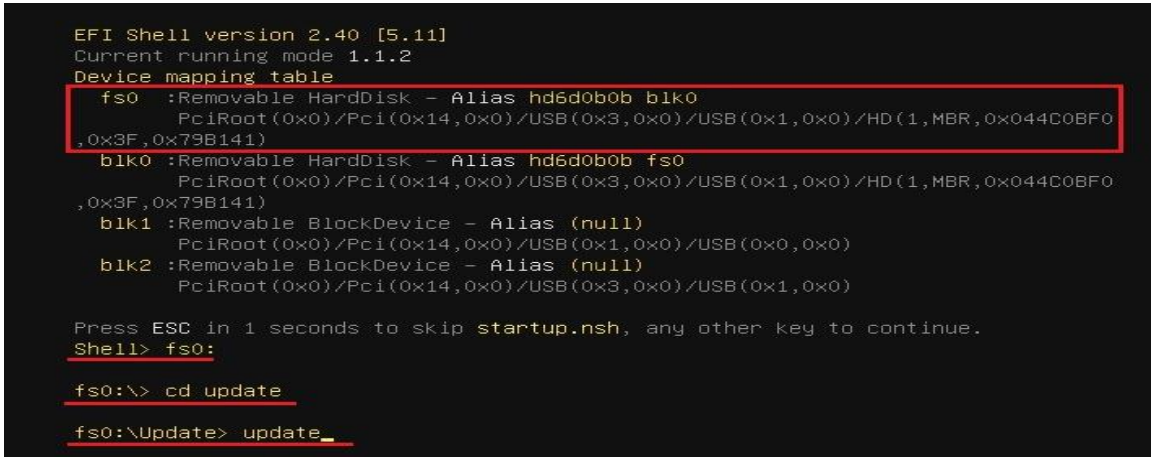
http://www.portwell.com.tw/member/newmember.php

2. Type in your User name and password and log in the download center.
3. Select "Search download" and type the keyword "WADE-8017".
4. Find the "BIOS "page and download the ROM file and flash utility.
5. Unzip file to bootable USB flash drive which can boot to dos mode. Then execute the "update.bat" or "update.efi ". It will start to update BIOS.

NOTE: Once you use "update.efi" to update BIOS, it must be get into the SHELL MODE to update BIOS

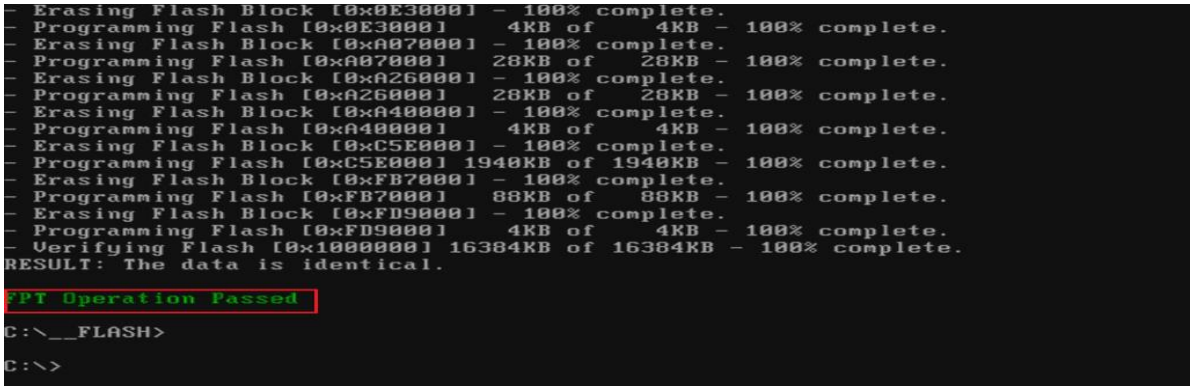


DOS MODE: update.bat

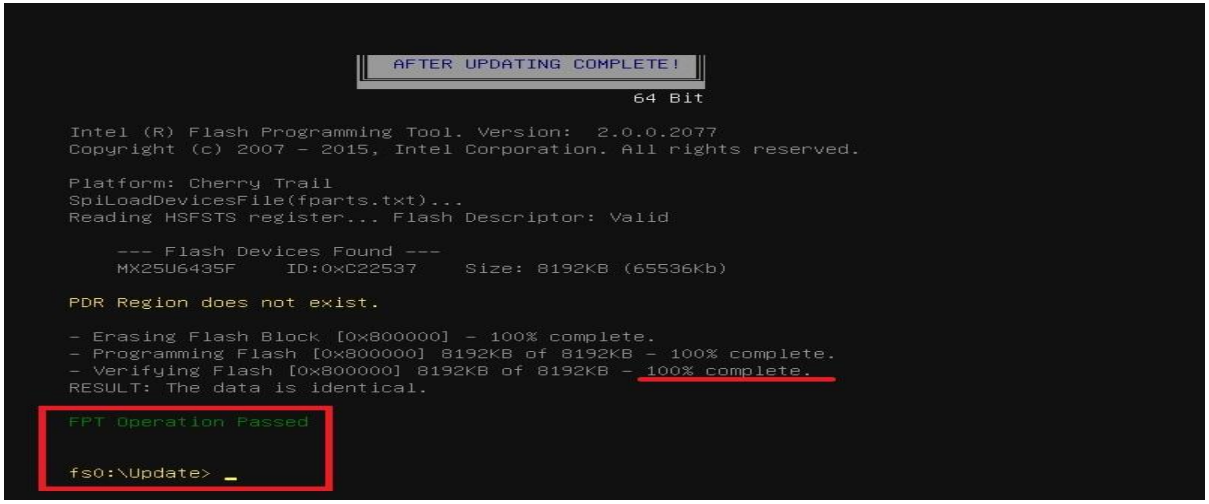


SHELL MODE: SHELL MODE

6. When you see the "FPT Operation Passed" message, which means the BIOS update processes finished. Please cut the AC power off and **wait for 10 seconds** before powering on.

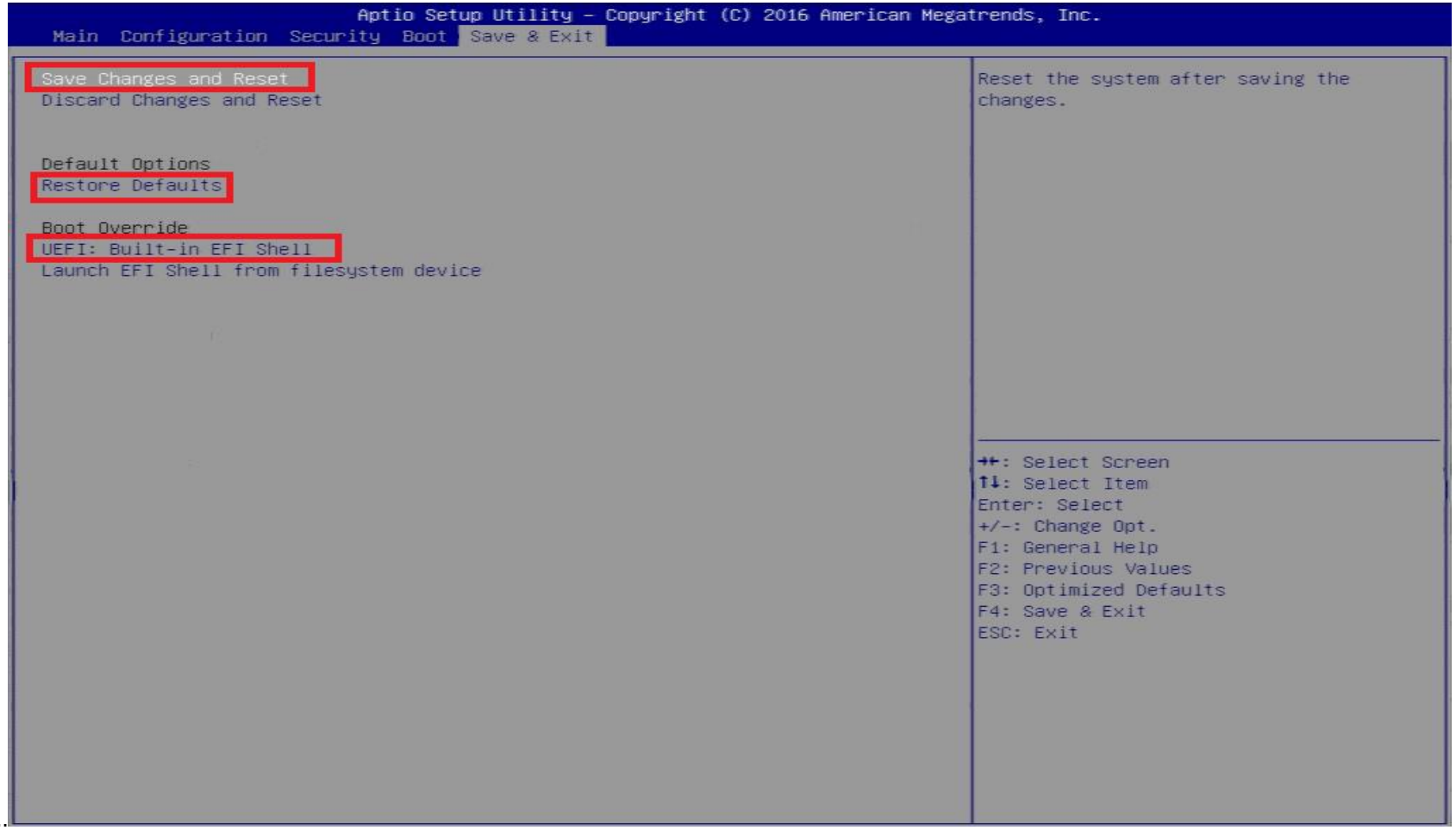


DOS MODE: update.bat



SHELL MODE: SHELL MODE

7. Press **"del"** key into the BIOS setup menu and switch to **"Save & Exit"** page then select **"Restore Defaults"** option and press **"Yes"** then select **"Save Changes and Reset"** to finish all BIOS update processes.



Question: What are the display options while using WADE-8017 board?

Answer: -The Motherboard supports one VGA port on rear I/O (DP to VGA: Port 0)

-The Motherboard supports one HDMI port on rear I/O

-The Motherboard supports one DP port on rear I/O and support DP++ (DP to DP:Port 2)

Note:

Please visit our Download Center to get the Catalog, User manual, BIOS, and driver files.

http://www.portwell.com.tw/support/download_center.php

If you have other additional technical information or request which is not covered in this manual, please fill in the technical request form as below hyperlink.

http://www.portwell.com.tw/support/problem_report.php

We will do our best to provide a suggestion or solution for you.

Thanks

9 Portwell Software Service

Portwell Evaluation Tool (PET)

The Portwell Evaluation Tool (PET) is an API which Portwell's customers can access the GPIO, I2C, SMBus, etc under Windows and Linux OS. For more information please contact Portwell.

Portwell BIOS web Tool (PBT)

The Portwell BIOS web Tool (PBT) is a brand new on-line utility which innovated by Portwell. PBT now is available for Portwell's premiere customers who are able to add customized BIOS logo and change BIOS default settings on American Megatrends (AMI) BIOS. Please contact Portwell for more information.

Portwell EC Auto Test Tool (PECAT)

The Portwell EC Auto Test Tool (PECAT) is a brand new utility which innovated by Portwell. PECAT now is available for Portwell's premiere customers, who are able to Test Embedded Controller Function in UEFI Mode. Please contact Portwell for more information.

10 Industry Specifications

10.1 Industry Specifications

The list below provides links to industry specifications that apply to Portwell modules.

Low Pin Count Interface Specification, Revision 1.0 (LPC) http://www.intel.com/design/chipsets/industry/lpc.htm
Universal Serial Bus (USB) Specification, Revision 2.0 http://www.usb.org/home
PCI Specification, Revision 2.3 https://www.pcisig.com/specifications
Serial ATA Specification, Revision 3.0 http://www.serialata.org/
PCI Express Base Specification, Revision 2.0 https://www.pcisig.com/specifications