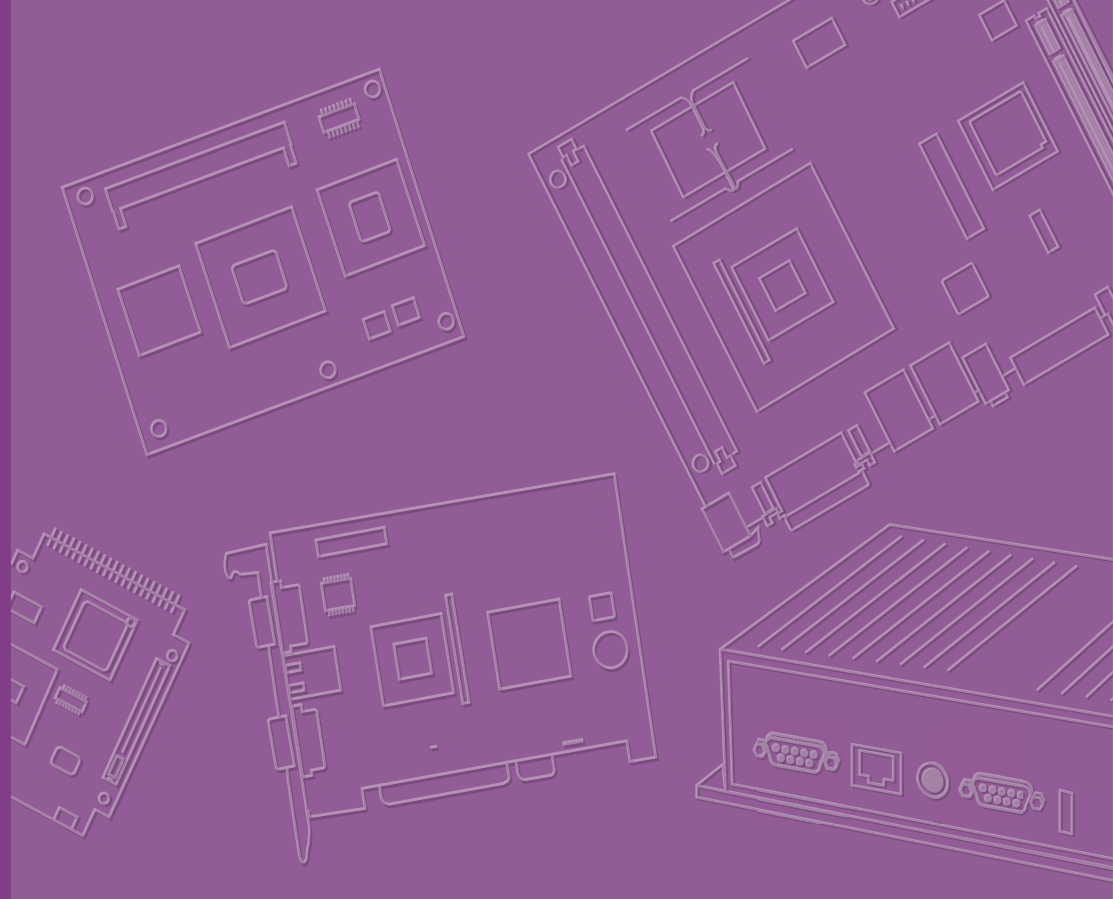


User Manual



SOM-5899Refresh

ADVANTECH

Enabling an Intelligent Planet

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If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any on-screen messages you get when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain an RMA (return merchandise authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

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Declaration of Conformity

CE

This product has passed the CE test for environmental specifications. Test conditions for passing included the equipment being operated within an industrial enclosure. In order to protect the product from being damaged by electrostatic discharge (ESD) and EMI leakage, we strongly recommend the use of CE-compliant industrial enclosure products.

FCC Class B

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FM

This equipment has passed the FM certification. According to the National Fire Protection Association, work sites are classified into different classes, divisions and groups, based on hazard considerations. This equipment is compliant with the specifications of Class I, Division 2, Groups A, B, C and D indoor hazards.

Technical Support and Assistance

1. Visit the Advantech website at <http://support.advantech.com> where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
 - Product name and serial number
 - Description of your peripheral attachments
 - Description of your software (operating system, version, application software, etc.)
 - A complete description of the problem
 - The exact wording of any error messages

Warnings, Cautions, and Notes

Warning! Warnings indicate conditions, which if not observed, can cause personal injury!



Caution! Cautions are included to help you avoid damaging hardware or losing data. e.g.



There is a danger of a new battery exploding if it is incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Note! Notes provide optional additional information.



Document Feedback

To assist us in making improvements to this manual, we welcome comments and constructive criticism. Please send all such, in writing, to: support@advantech.com

Packing List

Before setting up the system, check that the items listed below are included and in good condition. If any item does not accord with the table, please contact your dealer immediately.

- SOM-5899Refresh CPU module
- 1960081253T001 Heatspreader of SOM-5899Refresh

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a stable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. **DO NOT COVER THE OPENINGS.**
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient over-voltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
 - The power cord or plug is damaged.
 - Liquid has penetrated into the equipment.
 - The equipment has been exposed to moisture.
 - The equipment does not work well, or you cannot get it to work according to the user's manual.
 - The equipment has been dropped and damaged.
 - The equipment has obvious signs of breakage.
15. **DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.**
16. **CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.**

The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

- To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.
- Disconnect power before making any configuration changes. The sudden rush of power resulting from connecting a jumper or install a card may damage sensitive electronic components.

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Chapter 1

General Information

This chapter gives background information on the SOM-5899Refresh CPU Computer on Module

Sections include:

- Introduction
- Functional Block Diagram
- Product Specification

1.1 Introduction

The SOM-5899Refresh series is equipped with 9th Gen Intel® Core™/Xeon Product Family 14nm processor technology. This product supports 1.2V power design DDR4 2666MT/s, a 96GB capacity, and ECC memory with specific SKU. SOM-5899Refresh facilitates a higher memory bandwidth - featuring an i7-9850HE SKU upgrade to hex-core for enhanced computing performance. SOM-5899Refresh is able to support PCIe x16, 8 PCIe x1, and PCIe x1, x2, x4, x8 configuration devices via BIOS customization.

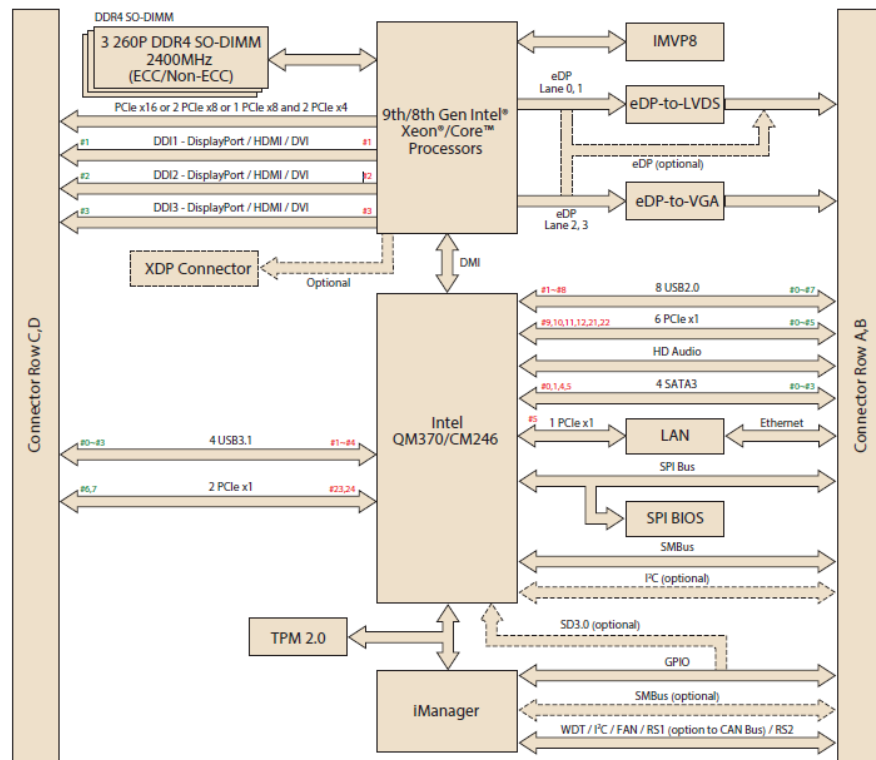
Compared with previous platforms, the SOM-5899Refresh enables a 50% growth in processor performance. It also supports multiple-display options: including dual and triple-displays. SOM-5899Refresh offers HDMI/DisplayPorts with 4K2K resolution support. Dual-channels for LVDS at 1920x1080 full HD resolution are also available.

The Advantech iManager (SUSI4) is designed to satisfy numerous embedded application requirements such as voltage and temperature monitoring, thermal protection and mitigation through processor throttling, LCD backlight on/off toggling and brightness control, embedded storage for customized information, and includes a multi-level watchdog timer (WDT). When combined with Advantech WISE-PaaS/DeviceOn, it can remotely monitor and control devices through the Internet for easy maintenance. All Advantech COM Express modules integrate iManager and WISE-PaaS/DeviceOn for added value in customer applications.

Capable of performance under extreme conditions, and featuring embedded platform power consumption and multiple expansion I/O interfaces, the SOM-5899Refresh is a product that is computing centric, thermal sensitive, graphics/media insensitive, and appropriate for demanding I/O applications.

Acronyms	
Term	Definition
AC'97	Audio CODEC (Coder-Decoder)
ACPI	Advanced Configuration Power Interface - standard for implementing power saving modes in PC-AT systems
BIOS	Basic Input Output System - firmware in PC-AT system that is used to initialize system components before handing control over to the operating system
CAN	Controller Area Network (CAN or CAN-bus) is a vehicle bus standard allowing micro-controllers to communicate with each other within a vehicle without a host computer
DDI	Digital Display Interface - containing DisplayPort, HDMI/DVI, and SDVO
EAPI	<p>Embedded Application Programmable Interface Software interface for COM Express' specific industrial functions</p> <ul style="list-style-type: none"> ■ System information ■ Watchdog timer ■ I²C Bus ■ Flat-panel brightness control ■ User storage area ■ GPIO
GbE	Gigabit Ethernet
GPIO	General Purpose Input Output
HDA	Intel® High Definition Audio (HD Audio) refers to the specification released by Intel® in 2004 for delivering high definition audio that is capable of playing back more channels at higher quality than AC'97
I ² C	Inter Integrated Circuit - 2 wire (clock and data) signaling scheme allowing communication between integrated circuits. Primarily used to read and load register values
ME	Management Engine
PC-AT	"Personal Computer - Advanced Technology" - an IBM trademark term used to refer to Intel® based personal computers in 1990s
PEG	PCI Express Graphics
RTC	Real Time Clock - battery backed circuit in PC-AT systems that keeps system time and date as well as certain system setup parameters
SPD	Serial Presence Detect - refers to serial EEPROM on DRAMs that has DRAM Module configuration information
TPM	Trusted Platform Module, chip to enhance the security features of a computer system
UEFI	Unified Extensible Firmware Interface
WDT	Watchdog Timer

1.2 Functional Block Diagram



***Display Configuration Table**

	DDI 1	DDI 2	DDI 3	LVDS/eDP	VGA
Default	DP++	DP++	HDMI/DVI	LVDS	VGA
Option 1	DP++	DP++	HDMI/DVI	eDP (2-lane)	VGA
Option 2	DP++	DP++	DP++	eDP (4-lane)	None

Support maximum 3 independent displays simultaneously.

1.3 Product Specifications

1.3.1 Compliance

- PICMG COM.0 (COM Express) Revision 3.0
- Basic Size - 125 x 95mm (4.9 x 3.7in)
- Pin-out Type 6 compatible

1.3.2 Feature List

Feature Type	Connector Row	Feature	Type 6 Define		SOM-5899Refresh
			Max.	Min.	
Display	A-B	LVDS Channel A (18/24-bit)	1	0	1
	A-B	LVDS Channel B (18/24-bit)	1	0	1
	A-B	eDP (muxed on LVDS Channel A)	1	0	1
	A-B	VGA	1	0	1
Expansion	A-B	PCI Express x1	6	1	6
	A-B	LPC	1	1	1
Serial	A-B	SMBus	1	1	1
	A-B	I ² C Bus	1	1	1
	A-B	Serial Port	2	0	2
	A-B	CAN Bus (muxed on SER1)	1	0	1
I/O	A-B	LAN Port 0 (Gigabit Ethernet)	1	1	1
	A-B	SATA	4	1	4
	A-B	USB 2.0	8	4	8
	A-B	USB Client	1	0	0
	A-B	HD Audio	1	0	1
	A-B	SPI Bus	2	1	1
	A-B	General Purpose I/O (GPIO)	8	8	8
	A-B	SDIO (muxed on GPIO)	1	0	1
	A-B	Watchdog Timer Output	1	0	1
	A-B	Speaker Out	1	1	1
	A-B	External BIOS ROM Support	2	0	2
	A-B	Power Button Support	1	1	1
	A-B	Power Good	1	1	1
	A-B	VCC_5V_SBY Contacts	4	4	4
	A-B	Sleep	1	0	1
	A-B	Thermal Protection	1	0	1
	A-B	Lid Input	1	0	1
	A-B	Battery Low Alarm	1	0	1
	A-B	Suspend/Wake Signals	3	0	3
	A-B	Fan PWM / Tachometer	2	0	2
A-B	Trusted Platform Modules	1	0	1	
Display	C-D	Digital Display Interfaces 1 - 3	3	0	3
I/O	C-D	PEG (PCI Express x16)	1	0	1
	C-D	PCI Express x1	2	0	2
	C-D	USB 3.0	4	0	4
	C-D	Rapid Shutdown	1	0	1

1.3.3 Processor System

CPU	Std. Freq.	Max. Turbo Freq.	Core	Cache (MB)	CPU TDP
E-2276ME	2.8	4.5GHz	6	12	45W
E-2276ML	2	4.2GHz	6	12	25W
I7-9850HE	2.7	4.4GHz	6	9	45W
I7-9850HL	1.9	4.1GHz	6	9	25W
I3-9100HL	1.6	2.9GHz	4	6	25W
Celeron G4930E	2.4	2.4GHz	2	2	35W

1.3.4 Memory

There are a total of 3 memory sockets on SOM-5899Refresh, supporting a 96GB capacity (utilizing ECC memory modules with specific SKU), 2 DDR4 260pin SOD-IMM sockets, different channels on the front side (dual-channel), and 1 socket DDR4 SODIMM on the reverse side.

1.3.5 Graphics/Audio

Graphics Core: 9th gen Intel® HD/P630 Graphics Core supports DX12, OGL5.0, OCL2.1, and MPEG2, HEVC/H265, VC1/WMV9 HW decode/encode/transcode acceleration.

CPU	Graphic Core	Base Freq.	Max Freq.
E-2276ME	Intel® UHD Graphics P630	350MHz	1.15GHz
E-2276ML	Intel® UHD Graphics P630	350MHz	1.15GHz
I7-9850HE	Intel® UHD Graphics 630	350MHz	1.15GHz
I7-9850HL	Intel® UHD Graphics 630	350MHz	1.15GHz
I3-9100HL	Intel® UHD Graphics 630	350MHz	1.10GHz
Celeron G4930E	Intel® UHD Graphics 610	350MHz	1.05GHz

1.3.6 Expansion Interface

1.3.6.1 PCIe x1

PCI Express x1: Supports default 8 ports PCIe x1 compliant to PCIe Gen3 (8.0 GT/s) specifications, configurable to PCIe x4 or PCIe x2. Several configurable combinations may need BIOS modification. Please contact the Advantech sales or FAE for more details.

Type 6		Row A,B					Row C,D		
		P0	P1	P2	P3	P4	P5	P6	P7
Default	Config.	X1	X1	X1	X1	X1	X1	X1	X1
Option 1		X1	X1	X2		X1	X1	X2	
Option 2		X2		X2		X2		X2	
Option 3		X4				X4			

1.3.6.2 LPC

Supports Low Pin Count (LPC) 1.1 specification, without DMA or bus mastering. Enables connection to Super I/O, embedded controller, or TPM. 25MHz LPC clock.

1.3.7 Serial Bus

1.3.7.1 SMBus

Supports SMBus 2.0 specification with Alert pin.

1.3.7.2 I²C Bus

Supports I²C bus 8-bit and 10-bit address modes, at both 100KHz and 400KHz.

1.3.8 I/O

1.3.8.1 Gigabit Ethernet

Ethernet: Intel® I219LM Gigabit LAN supports 10/100/1000 Mbps Speed.

1.3.8.2 SATA

Supports 2 ports SATA Gen3 (6.0 Gb/s), backward compliant to SATA Gen2 (3.0 Gb/s) and Gen1 (1.5 Gb/s). The maximum data rate is 600 MB/s. Supports AHCI 1.3.1 mode (does not support IDE mode).

1.3.8.3 USB 3.0 (3.1)/USB 2.0

COM-Express supports USB 3.0 but SOM-5899Refresh supports 4 USB 3.1 Gen2 (10 Gbps) ports and 4 USB 2.0 (480 Mbps) ports which are reverse compatible to USB1.x. For USB 3.1, product supports LPM (U0, U1, U2, and U3) for power efficiency.

Notice: To meet USB 3.1 Gen2 performance, Advantech strongly recommends using a certificated cable.

1.3.8.4 USB 3.0

Type 6	P0	P1	P2	P3
SoC	P0	P1	P2	P3
Type 6	OC_01		OC_23	
SoC USB_OC#	OC_0		OC_2	

1.3.8.5 USB 2.0

Type 6	P0	P1	P2	P3
SoC	P0	P1	P2	P3
Type 6	OC_01		OC_23	
SoC USB_OC#	OC_0		OC_2	

1.3.8.6 SPI Bus

Supports BIOS flash only. SPI clock can be 50MHz, 33MHz, or 20MHz, with capacity up to 16MB.

1.3.8.7 GPIO

8 programmable general purpose input or output (GPIO).

1.3.8.8 Watchdog Timer

Supports multi-level watchdog time-out output. Provides 1-65535 level, from a 100ms to 109.22 minute intervals.

1.3.8.9 Serial Port

2 x 2-wire serial port (Tx/Rx) supports 16550 UART compliance.

- Programmable FIFO or character mode
- 16-byte FIFO buffer on transmitter and receiver in FIFO mode
- Programmable serial-interface characteristics: 5, 6, 7, or 8-bit character
- Even, odd, or no parity bit selectable
- 1, 1.5, or 2 stop bit selectable
- Baud rate up to 115.2K

1.3.8.10 TPM

Supports TPM 2.0 module by default.

1.3.8.11 Smart Fan

Supports 2 Fan PWM control signals and 2 tachometer input for fan speed detection. Provides 1 on module with connector and the other to the carrier board following PICMG COM Express R3.0 specifications.

1.3.8.12 BIOS

The BIOS chip is on module by default. Users can place BIOS chip on the carrier board with appropriate design and jumper setting in BIOS_DIS#[1:0].

BIOS_DIS0#	BIOS_DIS#1	Boot up destination/function
Open	Open	Boot from Module's SPI BIOS
Open	GND	SPI_CS0# to Carrier Board, SPI_CS1# to Module
GND	GND	SPI_CS0# to Module, SPI_CS1# to Carrier Board

Note! *If system COMS is cleared, Advantech strongly suggests going to the BIOS setup menu and loading default settings on the first boot up.*



1.3.9 Power Management

1.3.9.1 Power Supply

Supports both ATX and AT power modes. VSB is for suspended power and can be optional if not required by standby (suspend-to-RAM) support. RTC battery may be optional if date/timekeeping is not required.

VCC: 8.5V (9V-5%) – 20V (19V+5%)

VSB: 5V +/- 5% (Suspend power)

RTC Battery Power: 2.0V – 3.3V

1.3.9.2 PWROK

Power-good from the main power supply. A high value indicates the power level is good. This signal can be used to postpone module startup allowing Carrier-based FPGAs or other configurable devices time to be programmed.

1.3.9.3 Power Sequence

According to PICMG COM Express COM.0 R 3.0 specification

1.3.9.4 Wake Event

Various wake event support allows users to apply different scenarios.

- Wake-on-LAN(WOL): Wake to S0 from S3/S4/S5
- USB Wake: Wake to S0 from S3
- PCIe Device Wake: depends on user inquiry and may need customized BIOS
- LPC Wake: depends on user inquiry and may need customized BIOS

1.3.9.5 Advantech S ECO Mode (Deep Sleep Mode)

Advantech iManager provides additional features allowing the system to enter a very low suspended power mode – S5 ECO mode. In this mode, the module will cut all power, including suspended and active power to the chipset, and keep an on-module controller active. Only power under 50MW will be consumed, meaning user battery packs can last longer. While this mode is enabled in the BIOS, the system (or module) only allows power button boot instead of other methods such as WOL.

1.3.10 Environment

1.3.10.1 Temperature

- Operating: 0 ~ 60° C (32 ~ 140° F)
Storage: -40 ~ 85° C (-40 ~ 185° F)

1.3.10.2 Humidity

- Operating: 40° C @ 95% relative humidity, non-condensing
Storage: 60° C @ 95% relative humidity, non-condensing

1.3.10.3 Vibration

IEC60068-2-64: Random vibration test under operation mode, 3.5 Grms

1.3.10.4 Drop Test (Shock)

Federal Standard 101 Method 5007 test procedure with standard packing

1.3.10.5 EMC

CE EN55022 Class B and FCC Certifications: validated with standard development boards in Advantech chassis

1.3.11 MTBF

Please refer Advantech SOM-5899Refresh Series Reliability Prediction report on the website: Link: <http://com.advantech.com>

1.3.12 OS Support (Repeated in S/W chapter)

The mission of Advantech Embedded Software Services is to "Enhance quality of life with Advantech platforms and Microsoft Windows Embedded technology." We enable Windows Embedded software products on Advantech platforms to more effectively support the embedded computing community. Customers are freed from the hassle of dealing with multiple vendors (hardware suppliers, system integrators, embedded OS distributors) for projects. Our goal is to make Windows Embedded software solutions easily and widely available to the embedded computing community.

To install drivers, please connect to the website <http://support.advantech.com.tw> to download the setup file.

1.3.13 Advantech iManager

Supports APIs for GPIO, smart fan control, multi-stage watchdog timer, temperature sensor, and hardware monitoring. Follows PICMG EAPI 1.0 specifications with backward compatibility.

1.3.14 Power Consumption

Power Consumption Table (Watt.)						
VCC=12V, VSB=5V	Active Power Domain			Suspend Power Domain		Mechanical off
Power State	S0 Max. Load	S0 Burn-in	S0 Idle	S5	S5 Deep Sleep	RTC (uA)
SOM-5899RC7Q-U7A1	108.74W	64.704W	8.277W	1.016W	0.418W	6.48uA

Hardware Configurations:

1. MB: SOM-5899RC7Q-U7A1 (PCB: A101-2)
2. DRAM: 16GB DDR4 2666MHz x 3
3. Carrier board: SOM-DB5830 A101-2

Testing Conditions:

1. Test temperature: room temperature (about 25 °C)
2. Test voltage: rated voltage DC +12.0V
3. Test loading:
 - Maximum load mode: According to Intel thermal/power test tools
 - Burn-in mode: Burn-in test V8.1 Pro (1023) for 64 bit Windows (CPU, RAM, 2D&3D Graphics and Disk with 100%)
 - Idle mode: DUT power management off and not running any program
4. OS: Windows 10 Enterprise

1.3.15 Performance

To compare performance or benchmark data with other modules, please refer to “Advantech COM Performance & Power Consumption Table.”

1.3.16 Selection Guide w/ P/N

Part No.	CPU	Base Freq.	Core	CPU TDP	PCH	DDR4 SODIMM	Thermal solution	Operating Temp.
SOM-5899RE6C-U8A1	E-2276ME	2.8	6	45W	CM246	ECC	Active	0~60 °C
SOM-5899RE6C-U0A1	E-2276ML	2	6	25W	CM246	ECC	Active	0~60 °C
SOM-5899RC7Q-U7A1	I7-9850HE	2.7	6	45W	QM370	non-ECC	Active	0~60 °C
SOM-5899RC7Q-S9A1	I7-9850HL	1.9	6	25W	QM370	non-ECC	Active	0~60 °C
SOM-5899RC3Q-S6A1	I3-9100HL	1.6	4	25W	QM370	non-ECC	Active	0~60 °C
SOM-5899RC3C-S6A1	I3-9100HL	1.6	4	25W	CM246	ECC	Active	0~60 °C
SOM-5899RCRC-U4A1	Celeron G4930E	2.4	2	35W	CM246	ECC	Active	0~60 °C
SOM-5899RE6CX-U8A1	E-2276ME	2.8	6	45W	CM246	ECC	Active	-40~85 °C
SOM-5899RC7QX-U7A1	I7-9850HE	2.7	6	45W	QM370	non-ECC	Active	-40~85 °C
SOM-5899RC3QX-S6A1	I3-9100HL	1.6	4	25W	QM370	non-ECC	Active	-40~85 °C

1.3.17 Packing List

Part No.	Description	Quantity
-	SOM-5899Refresh CPU module	1
1960081253T001	Heatspreader of SOM-5899Refresh	1

1.3.18 Development Board

Part No.	Description
SOM-DB5830-00A1	COMe level. Board COMe R3.0 Type6 pint-out (SOM-DB5830)

1.3.19 Optional Accessories

Part No.	Description
1960048820N001	Semi-Cooler 125 x 95 x 33 mm (4.9 x 3.7 x 1.2 in) with 12V fan
1960094209T001	QFCS 125 x 97 x 27 mm (4.9 x 3.8 x 1.0 in)

1.3.20 Pin Description

Advantech provides useful checklists for schematic design and layout routing. Schematic checklists will specify details about each pin's electrical properties and how to connect them in different user scenarios. The layout checklist will specify the layout constraints and recommendations for trace length, impedance, and other relevant information during design. Please contact your nearest Advantech branch office for design documents and other advanced support.

Chapter 2

Mechanical Information

This chapter details mechanical information on the SOM-5899Refresh CPU Computer on Module

Sections include:

- Board Information
- Mechanical Drawing
- Assembly Drawing

2.1 Board Information

The figures below show the location of the main chips on the SOM-5899Refresh Computer-on-Module.

When designing customized boards, be aware of positioning to avoid contact with thermal solutions and other components for optimal performance.

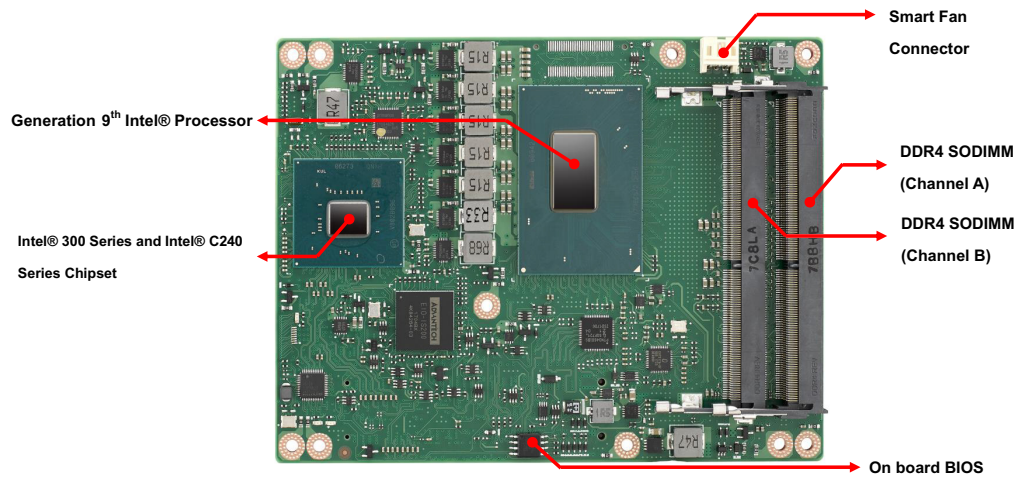


Figure 2.1 Board Chips ID – Front

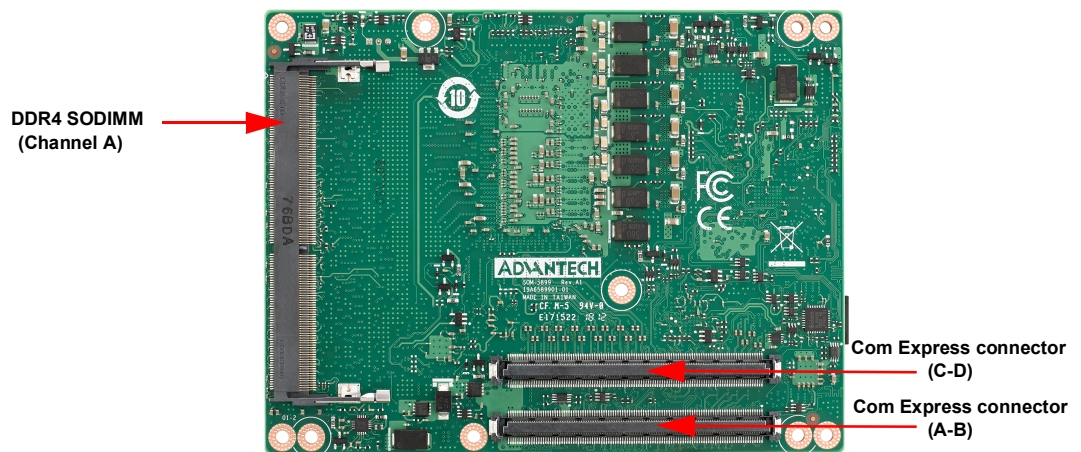
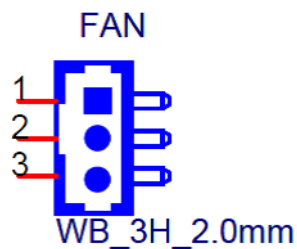


Figure 2.2 Board Chips ID – Rear

2.1.1 Connector List

Table 2.1: FAN1 Fan

FAN1	Fan
Description	Wafer 2.0mm (.86in) 3P 90D (M) DIP 2001-WR-03-LF W/Lock
Pin	Pin Name
1	Fan Tach-Input
2	Fan Out
3	GND



2.2 Mechanical Diagram

For more details regarding 2D/3D models, please visit the Advantech COM support service website: <http://com.advantech.com>.

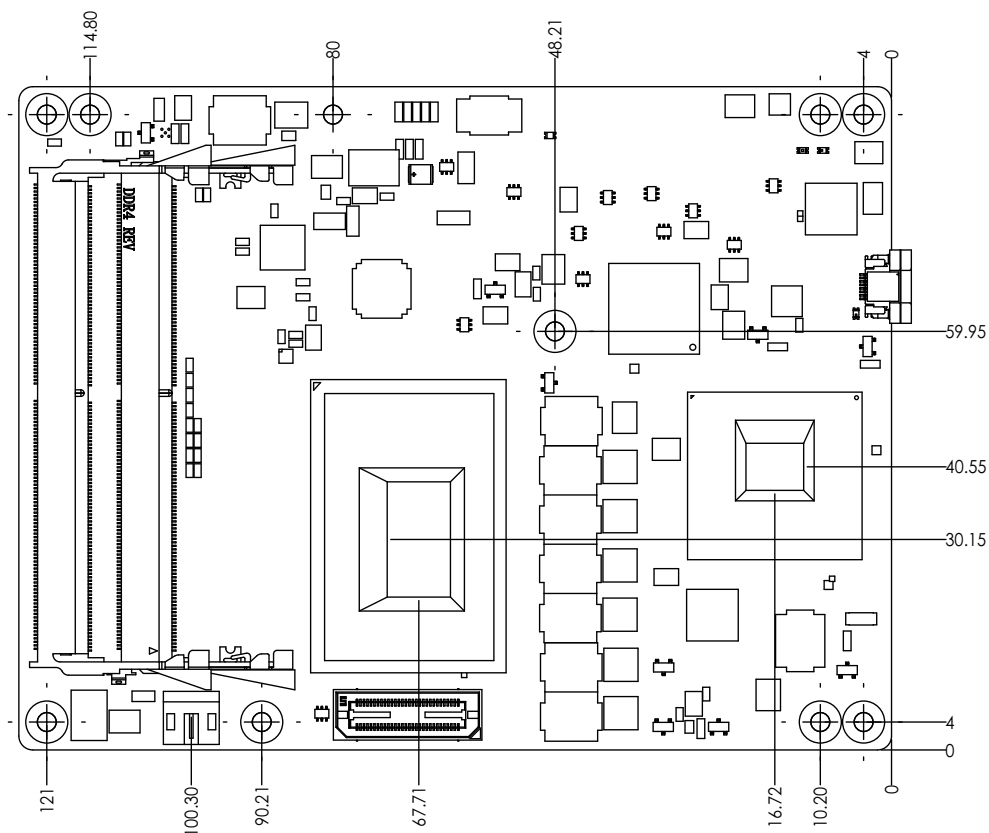


Figure 2.3 Board Mechanical Diagram – Front

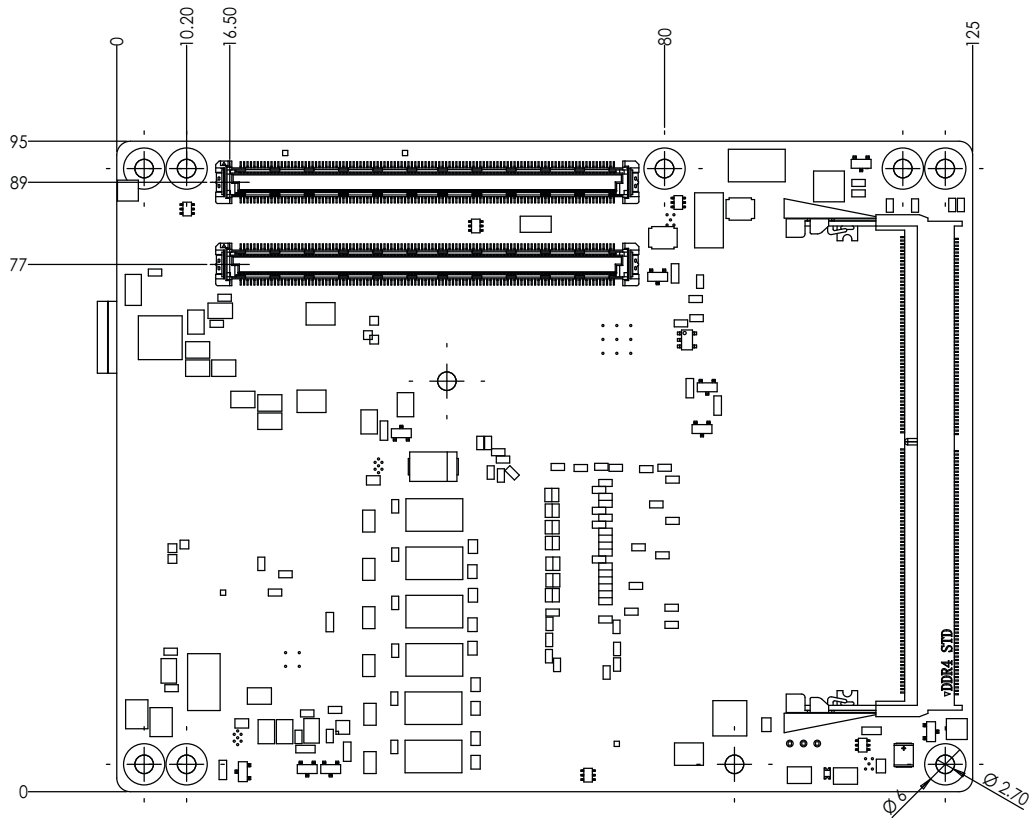


Figure 2.4 Board Mechanical Diagram – Rear

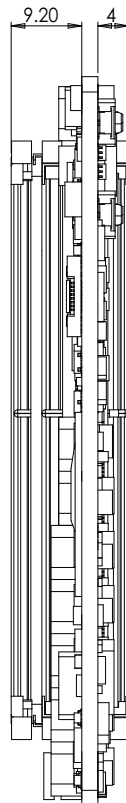


Figure 2.5 Board Mechanical Diagram – Side

2.3 Assembly Diagram

These figures demonstrate the order of assembly for attaching the thermal module and COM module to carrier board.

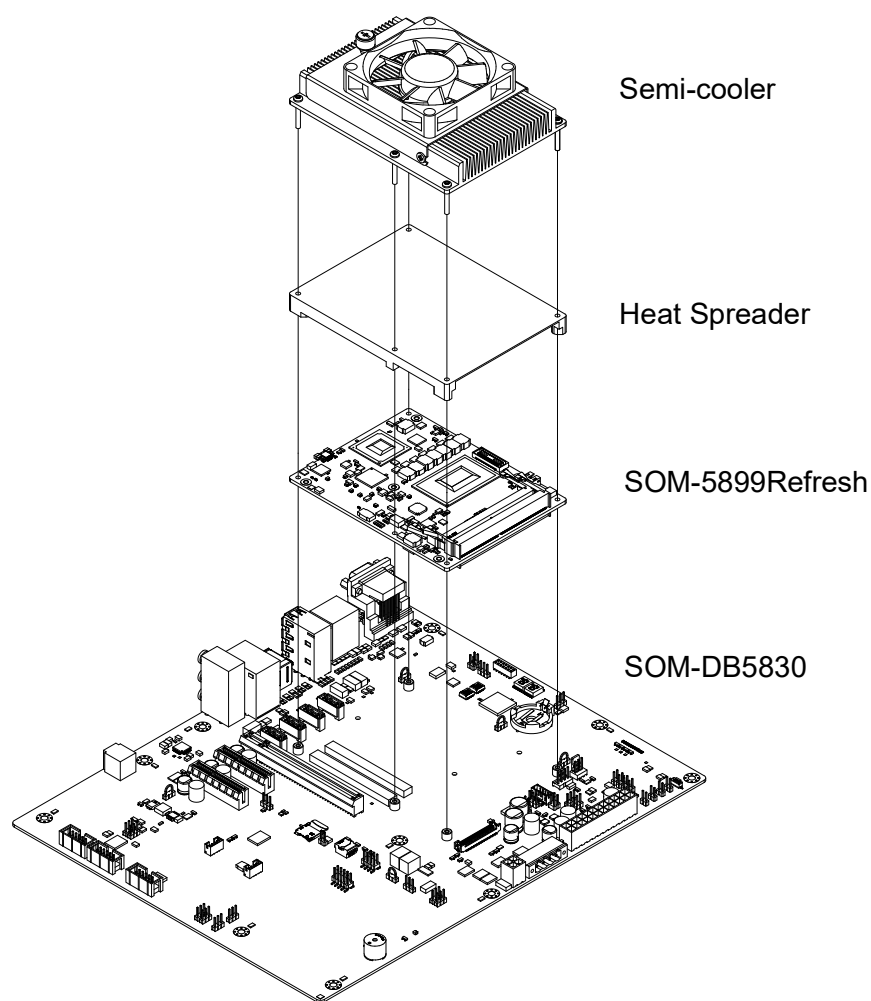


Figure 2.6 Assembly Diagram

There are 5 reserved screw holes for SOM-5899Refresh to be pre-assembled with the heat spreader.

2.4 Assembly Diagram

Please consider the CPU and chip height tolerance when designing your thermal solution.

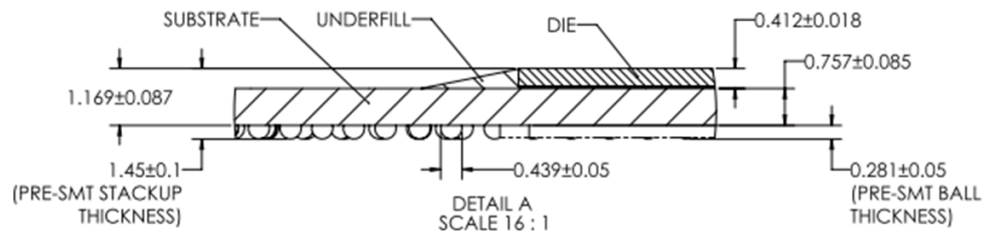


Figure 2.7 CPU 6C + GT2 Height and Tolerance

(For all other SKUs please contact Advantech's sales team or FAE for more details)

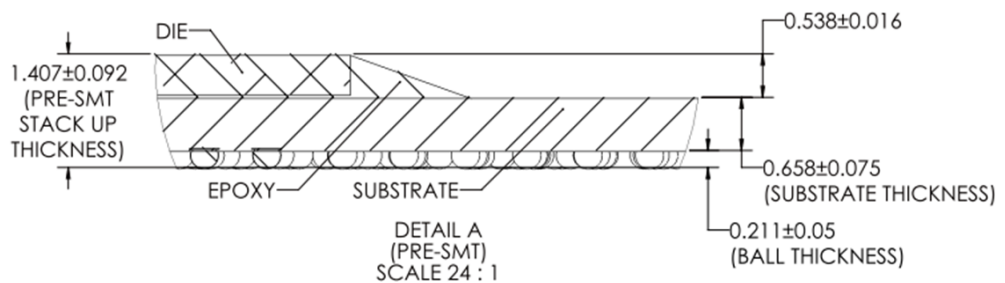


Figure 2.8 PCH Height and Tolerance Diagram

Chapter 3

AMI BIOS

This chapter details BIOS setup information for the SOM-5899Refresh CPU Computer-on Module

Sections include:

- Introduction
- Entering Setup
- Hot/Operation Key
- Exit BIOS Setup Utility

3.1 Starting

The SOM-5899Refresh BIOS is stored on a flash ROM which can be inserted into a BIOS socket on the board. Users can modify BIOS settings and control various system features with the BIOS Setup program. This chapter describes the basic navigation of the SOM-5899Refresh BIOS setup screens.

Advantech will have revisions for product optimization so customers can re-flash the latest BIOS through the AFU utility. Please contact Advantech sales or FAE for more information.

Entering the BIOS

To enter the BIOS Setup screens, follow the steps below:

1. Power on the motherboard.
2. Press the Delete or Esc key on your keyboard when you see the following text prompt: Press Delete or Esc to enter setup.
3. After you press the Delete key, the main BIOS Setup menu will appear. You can access the other BIOS function settings.



The BIOS Setup screen has three main frames. The left frame displays all information and configurable items. Grayed-out text is information only. Blue items are options that can be configured. White text is the item currently selected.

The right-upper frame is an area reserved for a text message. When an option is selected from the left frame, a help message will show in this area.

The following table shows the hotkey operation guide.

Hotkey	Description
→ Right	The left and right < > keys allow you to select a BIOS setup page.
← Left	For example: Main page, Advanced page, Chipset page, and so on.

↑ Up ↓ Down	The Up and Down < > keys allow you to select a BIOS setup item or sub-screen.
+ - Plus/Minus	The plus and minus keys allow you to change the field value of a particular setup item. For example: System Date and System Time.
F1	The <F1> key allows you to display the General Help screen. Press the <F1> key to open the General Help screen.
F2	Load Previous Values. Ignore modified configurations.
F3	Load Optimized Defaults.
F4	Save configuration and exit.
ESC	The <Esc> key allows you to go back to upper menu items. At root page, <Esc> key is used to Quit without saving.
Enter	Entering sub-menu or display option items.

SOM-5899Refresh BIOS has a built-in setup program that allows users to modify the basic system configuration. This information is stored in flash ROM so it retains the Setup information when the power is turned off.

3.1.1 Main Setup

When users first enter the BIOS Setup Utility, they will enter the Main setup screen. You can always return to the Main setup screen by selecting the Main tab. The Main BIOS Setup screen is shown below.



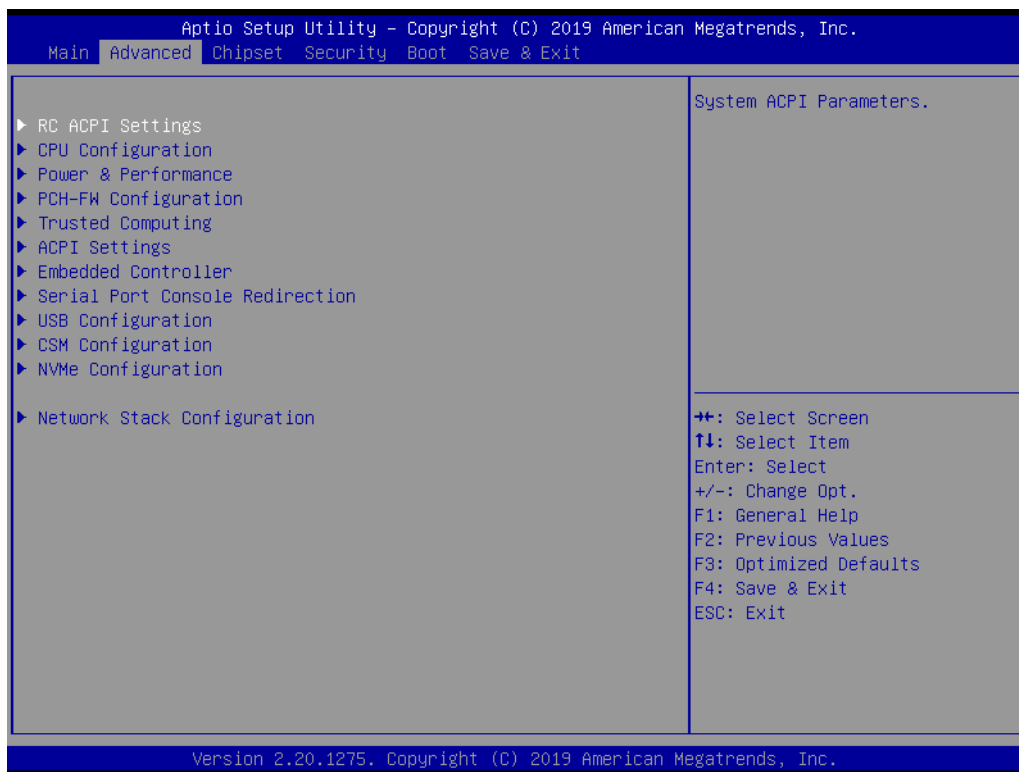
The Main page shows BIOS Information

Feature	Options	Description
BIOS Information	No Option	Subtitle.
BIOS Vender	No Option	Displays the BIOS vendor where suppliers are licensed.
Core Version	No Option	Displays the BIOS vendor's kernel core version.

Compliance	No Option	Displays this BIOS supporting industry standards compliance.
Project Version	No Option	Displays the project version of Advantech projects.
Build Date and Time	No Option	Displays this BIOS build date and time.
Access Level	No Option	Please refer to session "3.1.4 Security".
Total Memory	No Option	Displays the total memory size of the system.
Memory Frequency	No Option	Displays the memory frequency.
System Date	mm/dd/yyyy	Set the system Date. Use Tab to switch between Date elements. Use + / - or numbers to change the value.
System Time	hh:mm:ss	Set the system time. Use Tab to switch between Date elements. Use + / - or numbers to change the value.

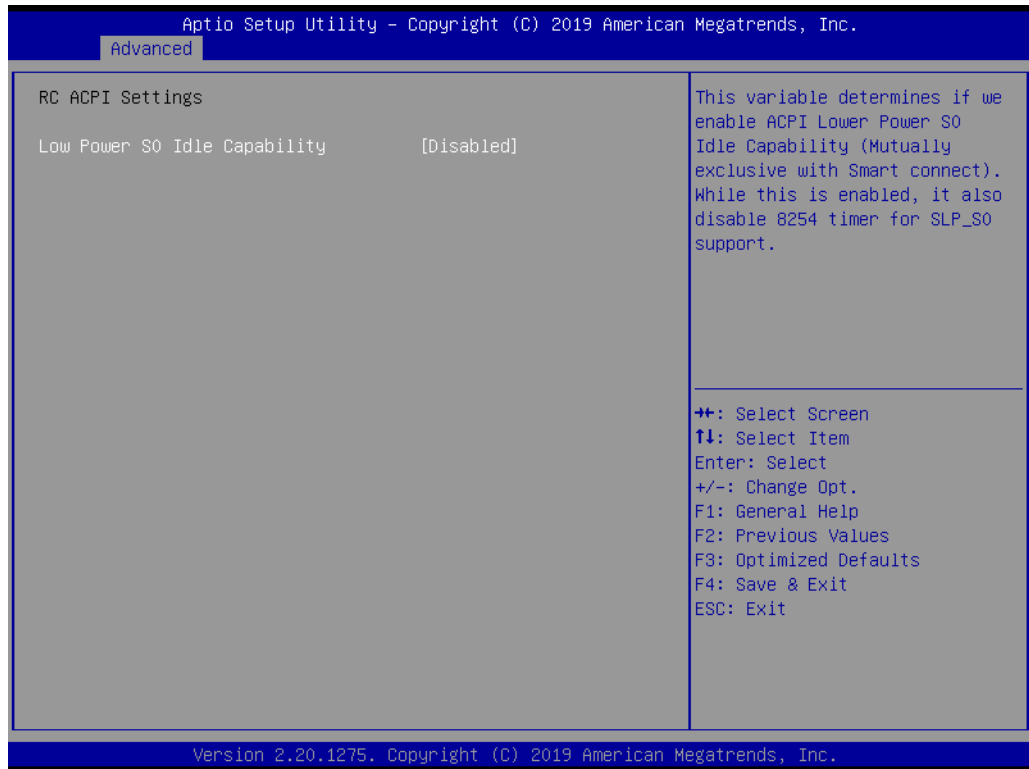
3.1.2 Advanced BIOS Features Setup

Select the Advanced tab from the SOM-5899Refresh setup screen to enter the Advanced BIOS Setup screen. Users can select any item in the left frame of the screen, such as CPU Configuration, to go to the sub menu for that item. Users can display an Advanced BIOS Setup options by highlighting them using the <Arrow> keys. All Advanced BIOS Setup options are described in this section. The Advanced BIOS Setup screens are shown below. The sub menus are described on the following pages.



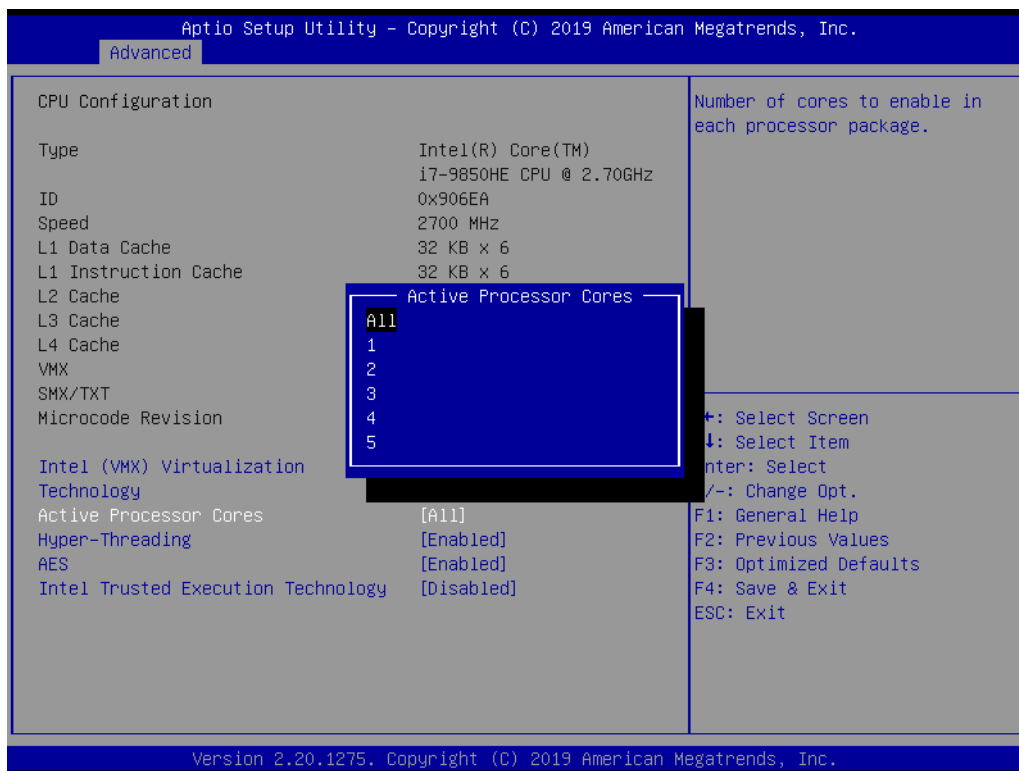
Feature	Options	Description
RC ACPI Settings	<Sub Menu>	System ACPI Parameters.
CPU Configuration	<Sub Menu>	CPU Configuration Parameters.
Power & Performance	<Sub Menu>	Power & Performance Options.
PCH-FW Configuration	<Sub Menu>	Configure Management Engine Technology Parameters.
Trusted Computing	<Sub Menu>	Trusted Computing Settings.
ACPI Settings	<Sub Menu>	System ACPI Parameters.
Embedded Controller	<Sub Menu>	Embedded Controller Parameters.
Serial Port Console Redirection	<Sub Menu>	Serial Port Console Redirection.
USB Configuration	<Sub Menu>	USB Configuration Parameters.
Network Stack Configuration	<Sub Menu>	Network Stack Settings.
CSM Configuration	<Sub Menu>	CSM configuration: Enable/Disable, Option ROM execution settings, etc.
NVMe Configuration	<Sub Menu>	NVMe Device Options Settings.

3.1.2.1 RC ACPI Settings



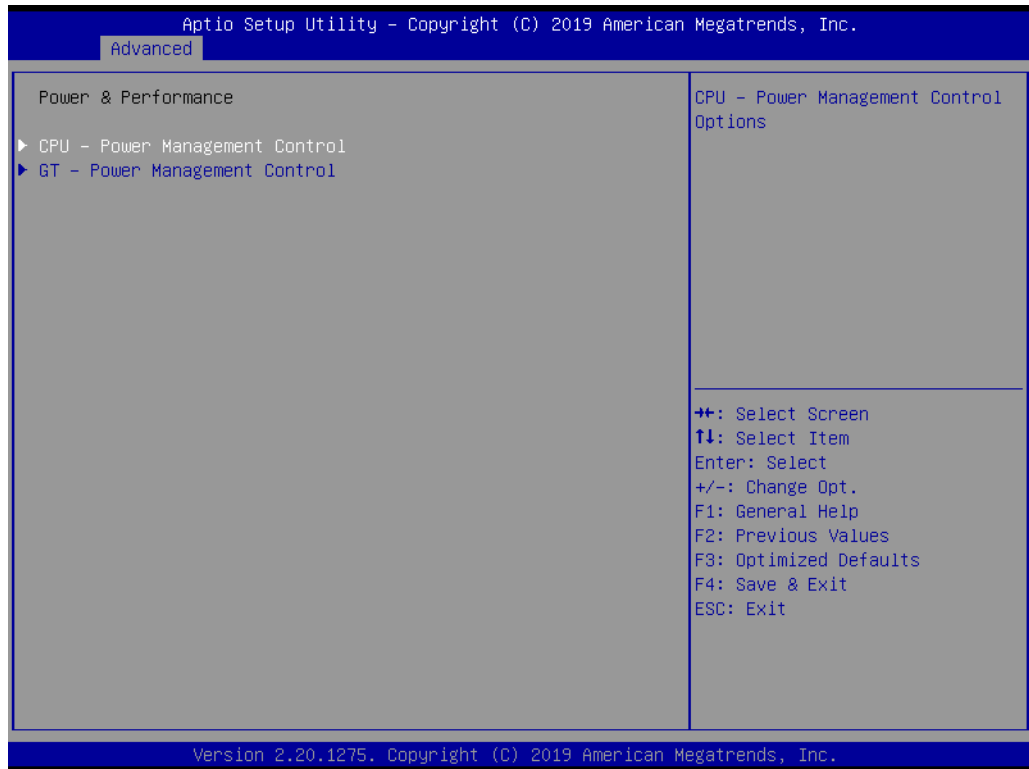
Feature	Options	Description
Low Power S0 Idle Capability	Disabled Enabled	This variable determines if we enable the ACPI Lower Power S0 Idle Capability (Mutually exclusive with Smart connect). While this is enabled, it also disables the 8254 timer for SLP_S0 support.

3.1.2.2 CPU Configuration



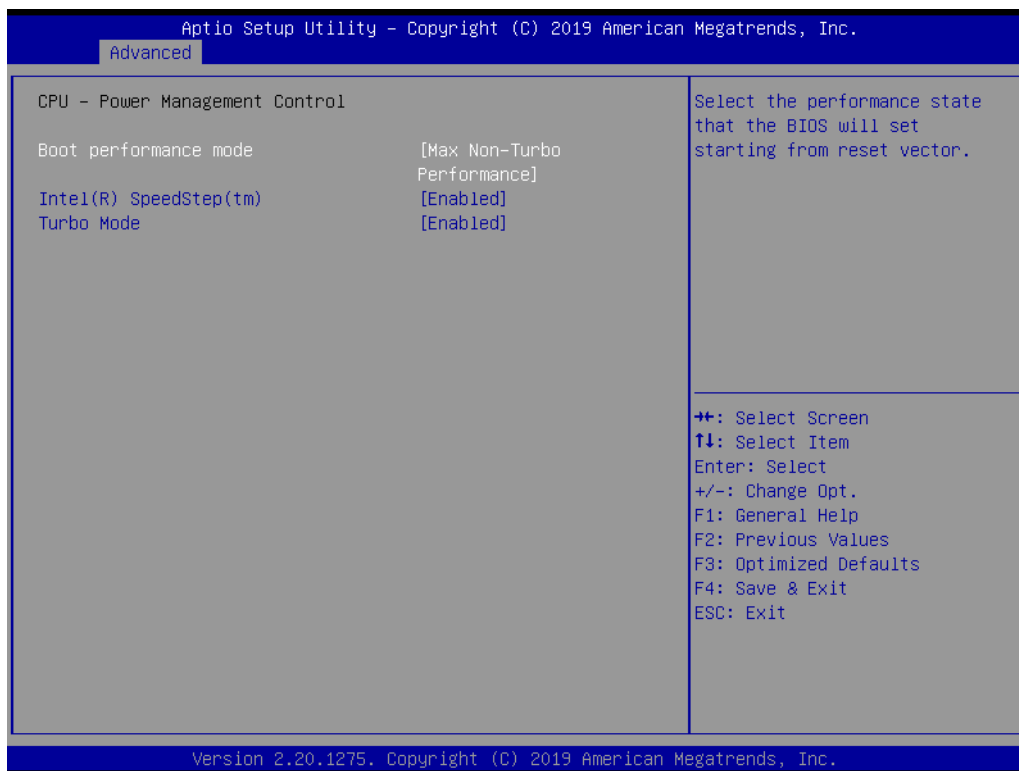
Feature	Options	Description
Intel® (VMX) Virtualization Technology	Disabled Enabled	When enabled, a VMM can utilize the additional hardware capabilities provided by Vanderpool Technology.
Active Processor Cores	All 1 2 3 4 5	Number of cores to enable in each processor package.
Hyper-Threading	Disabled Enabled	Enabled for Windows XP and Linux (OS optimized for Hyper-Threading Technology) and Disabled for other OS (OS not optimized for Hyper-Threading Technology).
AES	Disabled Enabled	Enable/Disable AES (Advanced Encryption Standard).

3.1.2.3 Power & Performance



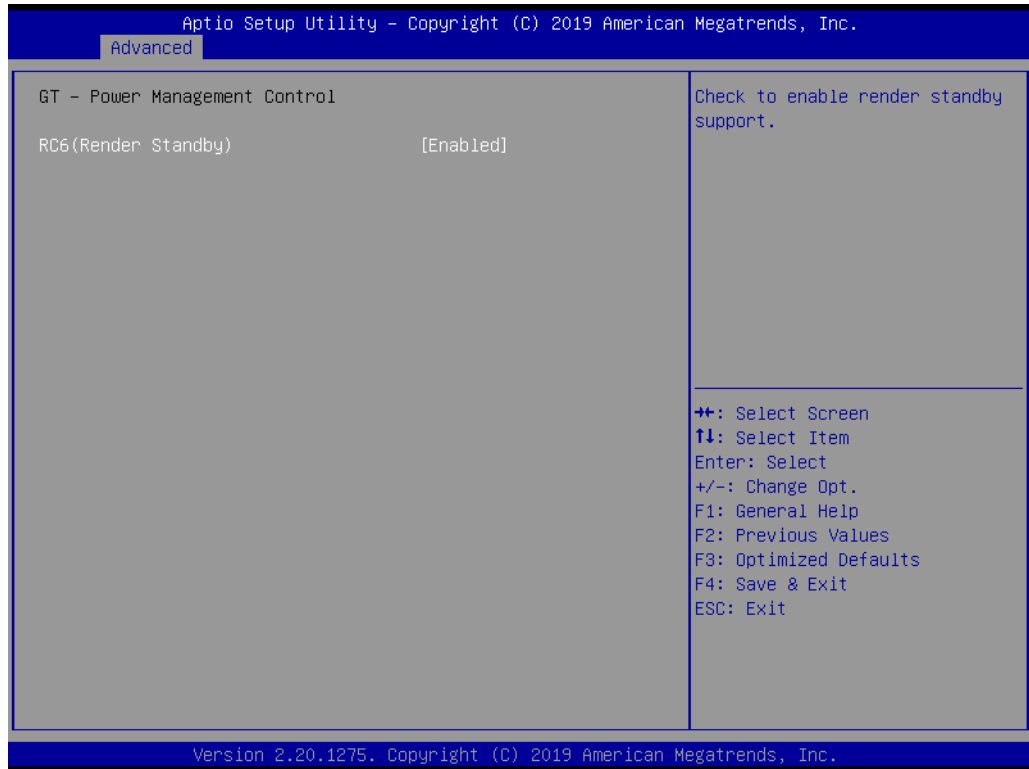
Feature	Options	Description
CPU - Power Management Control	<Sub Menu>	CPU - Power Management Control Options.
GT - Power Management Control	<Sub Menu>	GT - Power Management Control Options.

■ CPU - Power Management Control



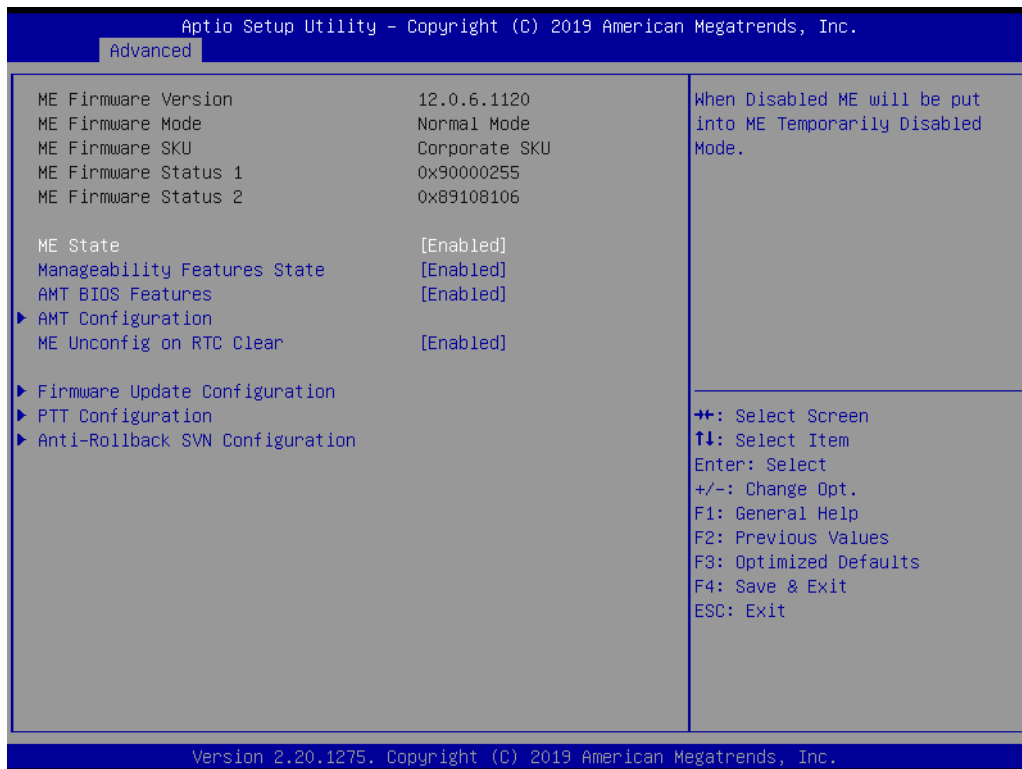
Feature	Options	Description
Boot Performance Mode	Max Battery Max Non-Turbo Performance Turbo Performance	Select the performance state that the BIOS will set starting from the reset vector.
Intel® Speed-Step™	Disabled Enabled	Allows more than two frequency ranges to be supported.
Turbo Mode	Disabled Enabled	Enable/Disable processor Turbo Mode (requires Intel Speed Step or Intel

■ **GT - Power Management Control**



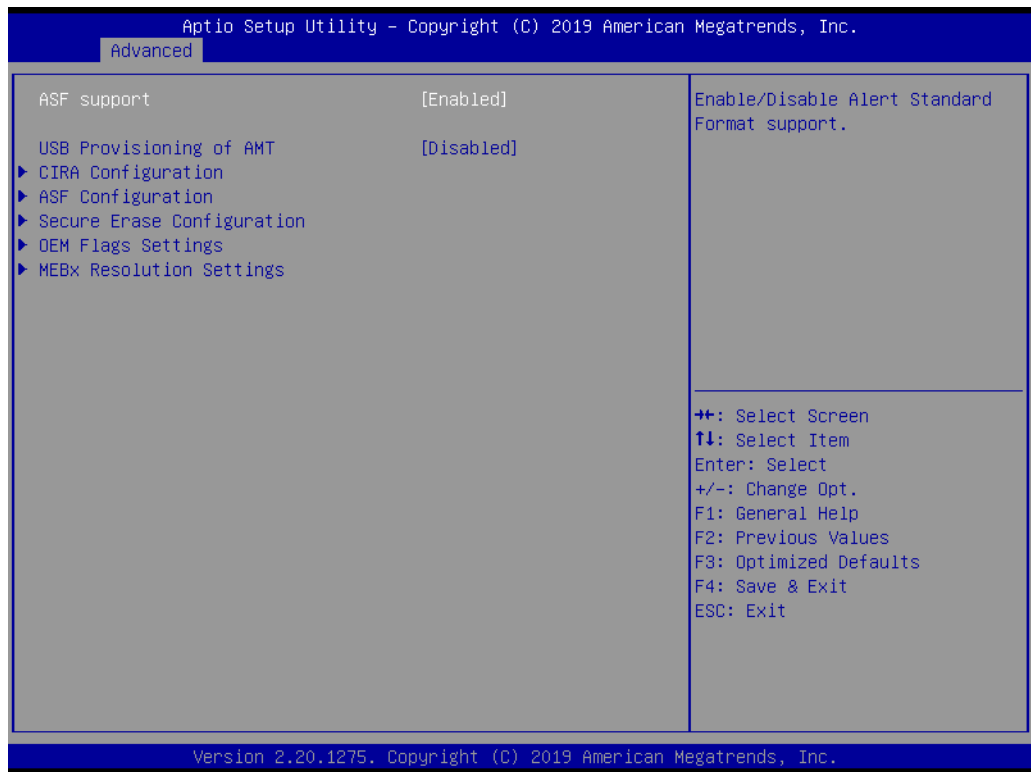
Feature	Options	Description
RC6 (Render Standby)	Disabled Enabled	Check to enable render standby support.

3.1.2.4 PCH-FW Configuration



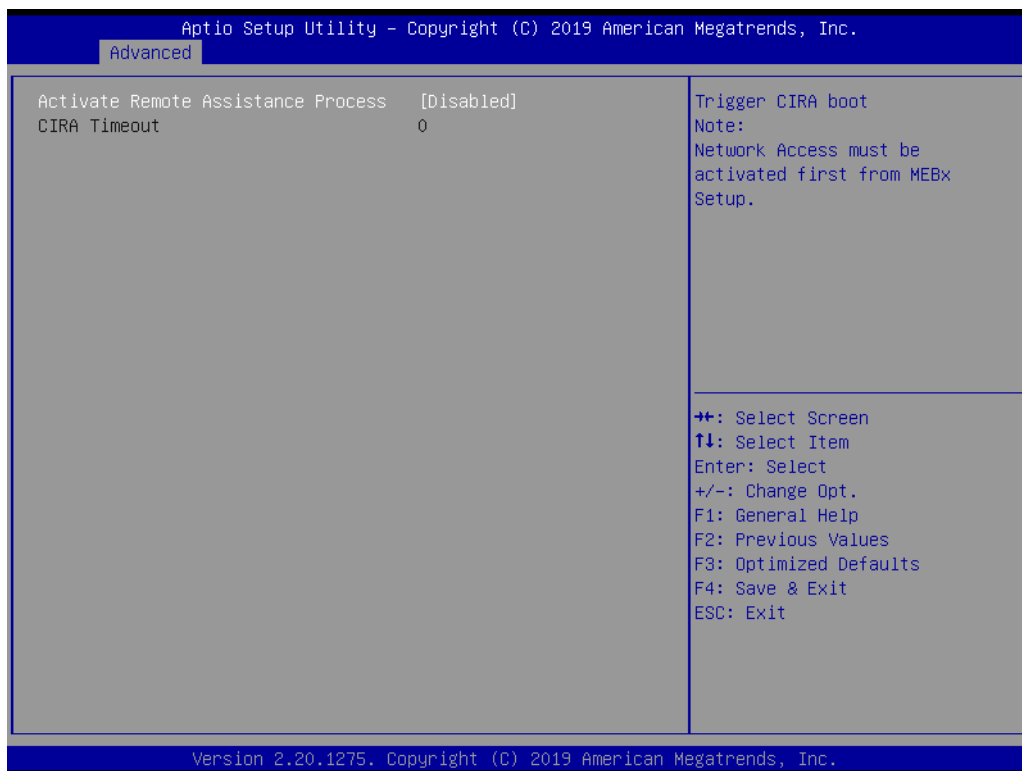
Feature	Options	Description
AMT Configuration	<Sub Menu>	Configure Intel® Active Management Technology Parameters.
ME Unconfig on RTC Clear	Disabled Enabled	When Disabled ME will not be unconfigured on RTC Clear.
Firmware Update Configuration	<Sub Menu>	Configure Management Engine Technology Parameters.
PTT Configuration	<Sub Menu>	Check to enable render standby support.

■ AMT Configuration



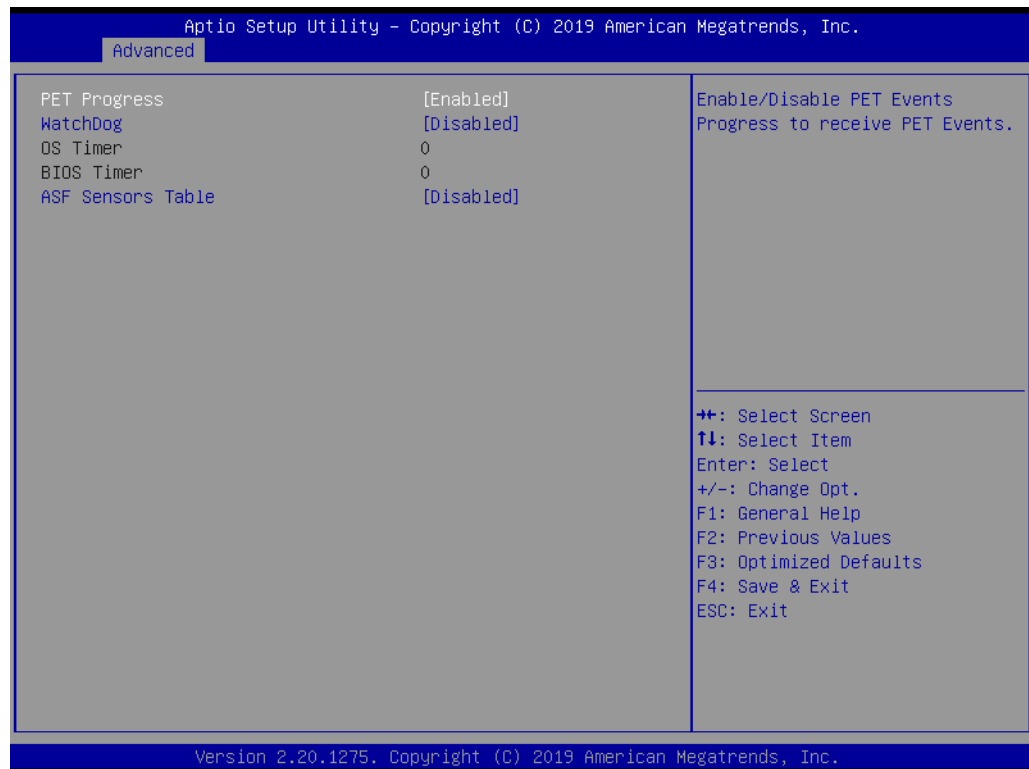
Feature	Options	Description
ASF support	Disabled Enabled	Enable/Disable Alert Standard Format support.
USB Provisioning of AMT	Disabled Enabled	Enable/Disable of AMT USB Provisioning.

■ CIRA Configuration



Feature	Options	Description
Activate Remote Assistance Process	Disabled Enabled	Trigger CIRA boot Note: Network Access must be activated first from MEBx Setup.
CIRA Timeout	No Options	OEM defined timeout for MPS connection to be established. 0 - use the default timeout value of 60 seconds. 255 - MEBx waits until the connection succeeds.

■ ASF Configuration



Feature	Options	Description
PET Progress	Disabled Enabled	Enable/Disable PET Events Progress to receive PET Events.
Watchdog Timer	Disabled Enabled	Enable/Disable Watchdog Timer.
OS Timer	No Option	Set OS Watchdog timer.
BIOS Timer	No Option	Set BIOS Watchdog timer.
ASF Sensors Table	Disabled Enabled	Adds ASF Sensor Table into ASF! ACPI Table.

■ Secure Erase Configuration



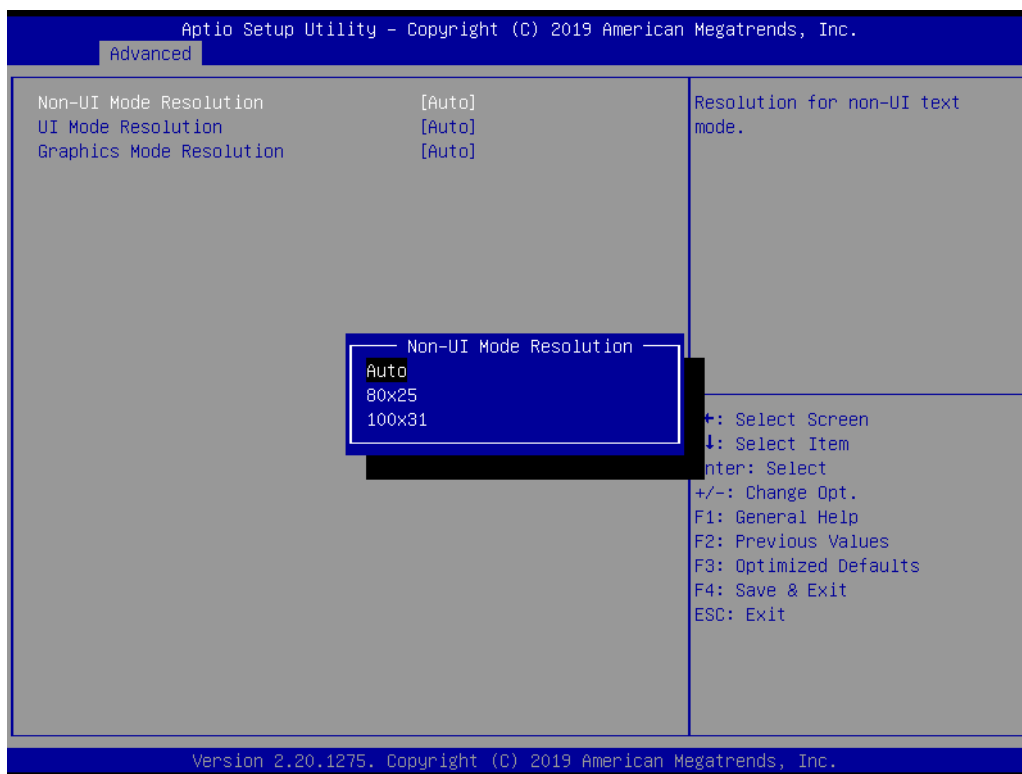
Feature	Options	Description
Secure Erase Configuration	Simulated Real	Secure Erase configuration menu.
Force Secure Erase	Disabled Enabled	Force Secure Erase on next boot.

■ OEM Flags Settings



Feature	Options	Description
MEBx Hotkey Pressed	Disabled Enabled	OEMFLag Bit 1: Enable automatic MEBx hotkey press.
MEBx Selection Screen	Disabled Enabled	OEMFLag Bit 2: Enable MEBx selection screen with 2 options: Press 1 to enter ME Configuration Screens. Press 2 to initiate a remote connection. Note: Network Access must be activated from MEBx Setup for this screen to be displayed.
Hide Unconfigure ME Confirmation Prompt	Disabled Enabled	OEMFLag Bit 6: Hide Unconfigure ME confirmation prompt when attempting ME unconfiguration.
MEBx OEM Debug Menu Enable	Disabled Enabled	OEMFLag Bit 14: Enable OEM debug menu in MEBx.
Unconfigure ME	Disabled Enabled	OEMFLag Bit 15: Unconfigure ME with resetting MEBx password to default.

■ MEBx Resolution Settings



Feature	Options	Description
Non-UI Mode Resolution	Auto 80x25 100x31	Resolution for non-UI text mode.
UI Mode Resolution	Auto 80x25 100x31	Resolution for UI text mode.
Graphics Mode Resolution	Auto 640x480 800x600 1024x768	Resolution for graphics mode.

■ Firmware Update Configuration



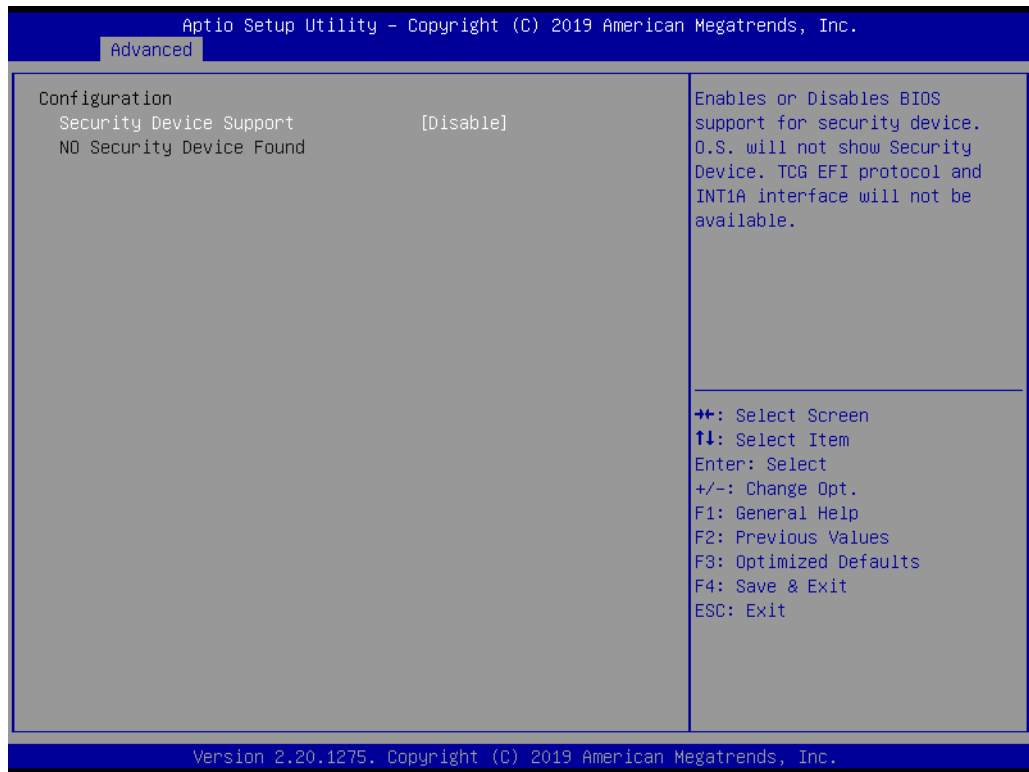
Feature	Options	Description
Me FW Image Re-Flash	Disabled Enabled	Enable/Disable Me FW Image Re-Flash function.

■ PTT Configuration



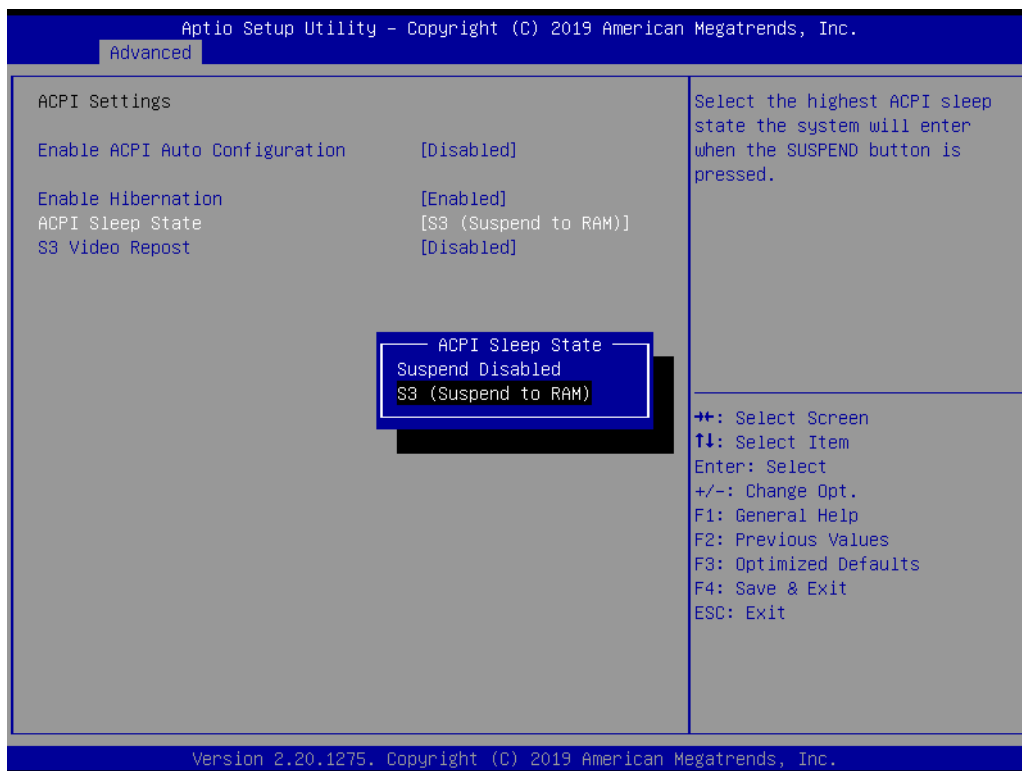
Feature	Options	Description
PTT Capability / State	No Option	N/A
TPM Device Selection	dTPM PTT	Selects TPM device: PTT or dTPM. PTT - Enables PTT in SkuMgr dTPM 1.2 - Disables PTT in SkuMgr Warning! PTT/ dTPM will be disabled and all data saved on it will be lost.

3.1.2.5 Trusted Computing



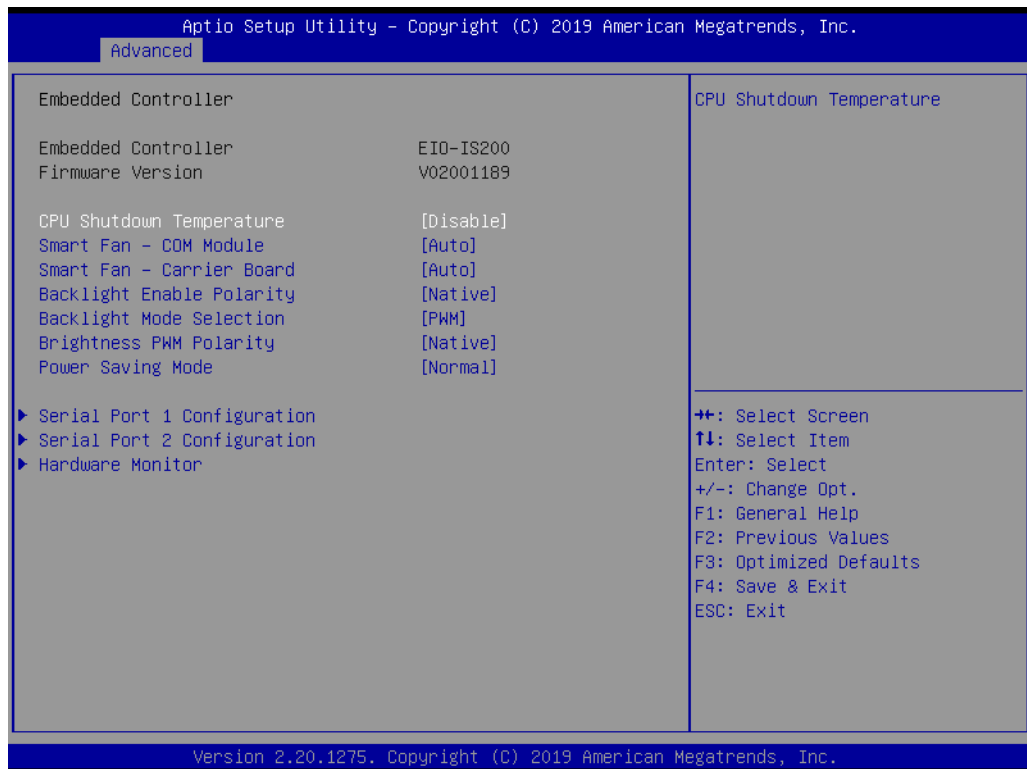
Feature	Options	Description
Security Device Support	Disabled Enabled	Enables or Disables BIOS Support for security device. O.S. will not show security device. TCG EFI protocol and INT1A interface will not be available.

3.1.2.6 ACPI Settings



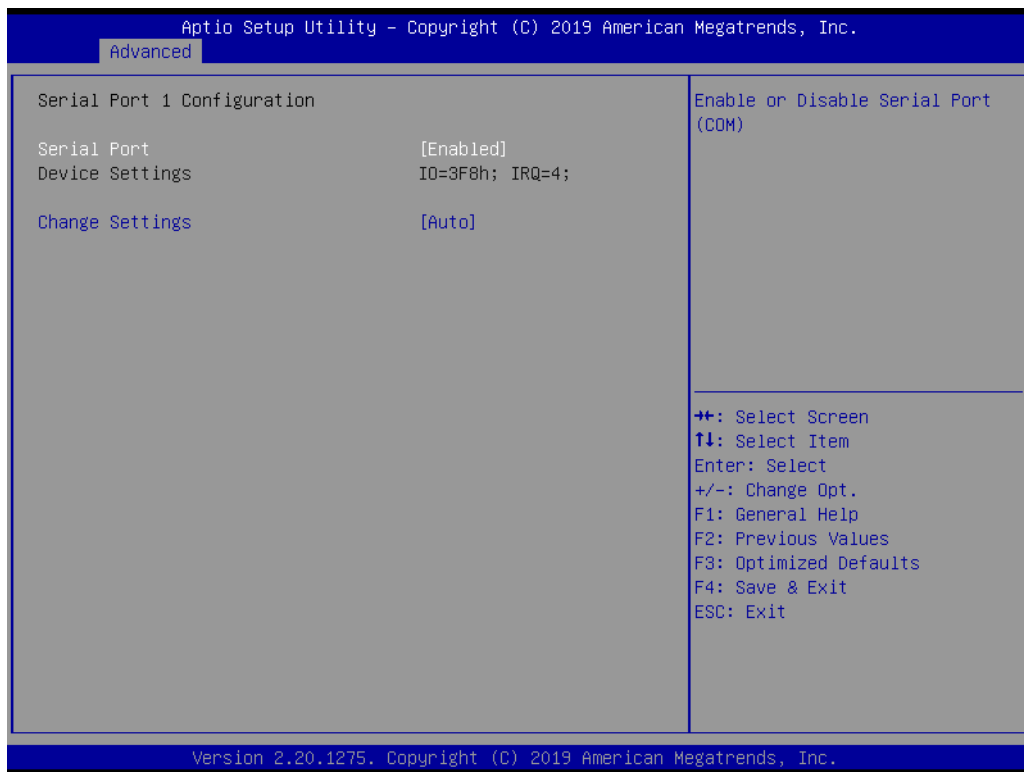
Feature	Options	Description
Enable ACPI Auto Configuration	Disabled Enabled	Enables or Disables BIOS ACPI Auto-Configuration.
Enable Hibernation	Disabled Enabled	Enables or Disables system's ability to Hibernate (OS/S4 Sleep State). This option may not be effective with some operating systems.
ACPI Sleep State	Suspend Disabled S3 (Suspend to RAM)	Select the highest ACPI sleep state the system will enter when the SUSPEND button is pressed.
S3 Video Repost	Disabled Enabled	Enable or Disable S3 Video Repost.

3.1.2.7 Embedded Controller



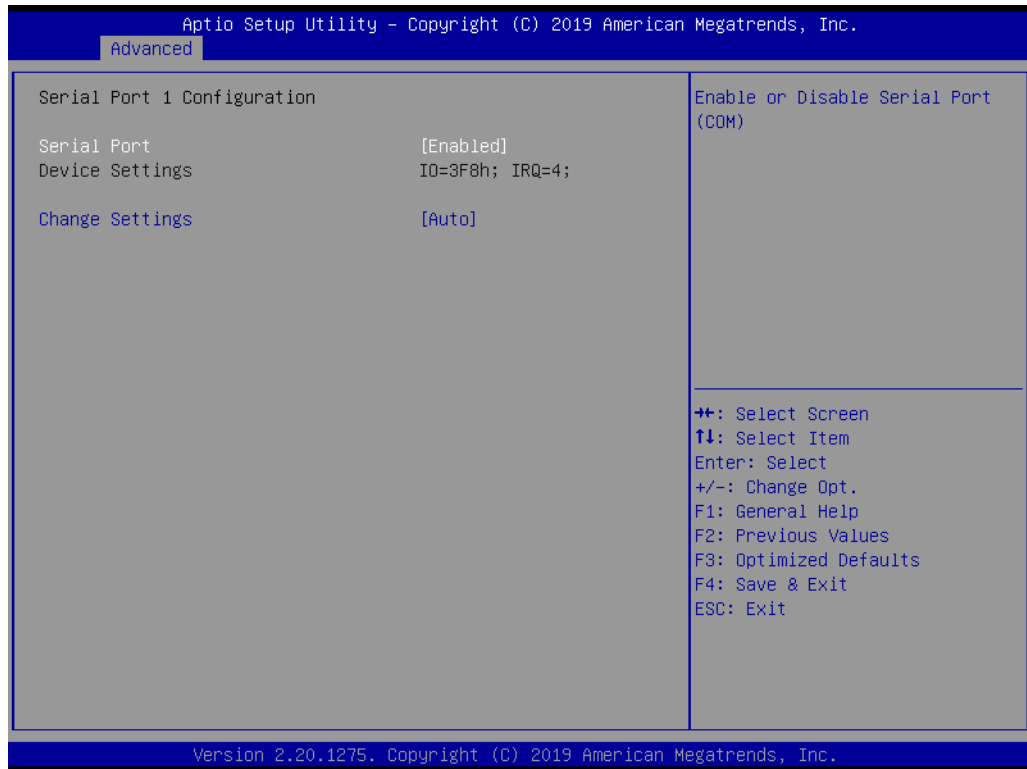
Feature	Options	Description
CPU Shutdown Temperature	Disable 70 °C / 158 °F 75 °C / 167 °F 80 °C / 176 °F 85 °C / 185 °F 90 °C / 194 °F 95 °C / 203 °F 100 °C / 212 °F	CPU shutdown temperature.
Smart Fan - COM Module	Stop Full Manual Auto	Control COM Module Smart FAN function. Get value from EC and set value via Save Changes.
Smart Fan - Carrier Board	Stop Full Manual Auto	Control Carrier Board Smart FAN function. Get value from EC and only set value when Save Changes.
Backlight Enable Polarity	Native Invert	Switch Backlight Enable Polarity for Native or Invert.
Backlight Mode Selection	PWM DC	Switch backlight control to PWM or DC mode.
Brightness PWM Polarity	Native Invert	Backlight Control Brightness PWM Polarity for Native or Invert.
Power Saving Mode	Normal Deep Sleep	Select Power Saving Mode.
Serial Port 1 Configuration	<Sub Menu>	Set Parameters of Serial Port 1 (COMA).
Serial Port 2 Configuration	<Sub Menu>	Set Parameters of Serial Port 2 (COMB).

Serial Port 1 Configuration



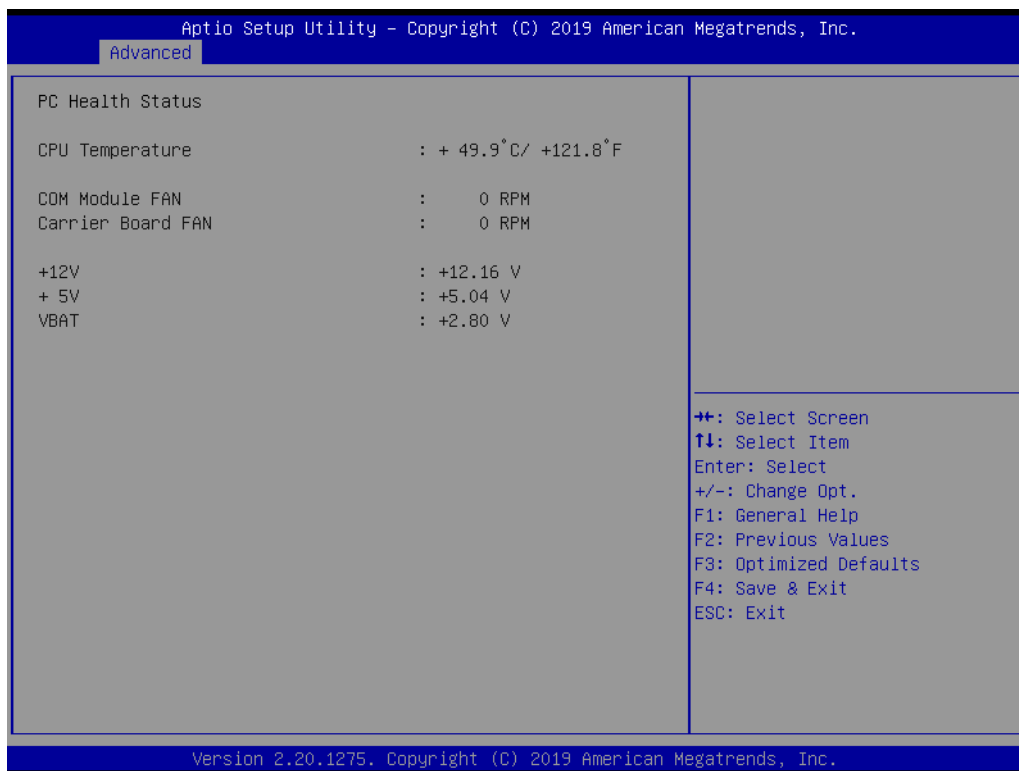
Feature	Options	Description
Serial Port	Disabled Enabled	Enable or Disable Serial Port (COM).
Device Settings	No Option	Device settings for Super IO Device.
Change Settings	I/O=3F8h; IRQ=4; I/O=2F8h; IRQ=4; I/O=3E8h; IRQ=4; I/O=2E8h; IRQ=4;	Select an optimal setting for Super I/O Device.

■ Serial Port 2 Configuration



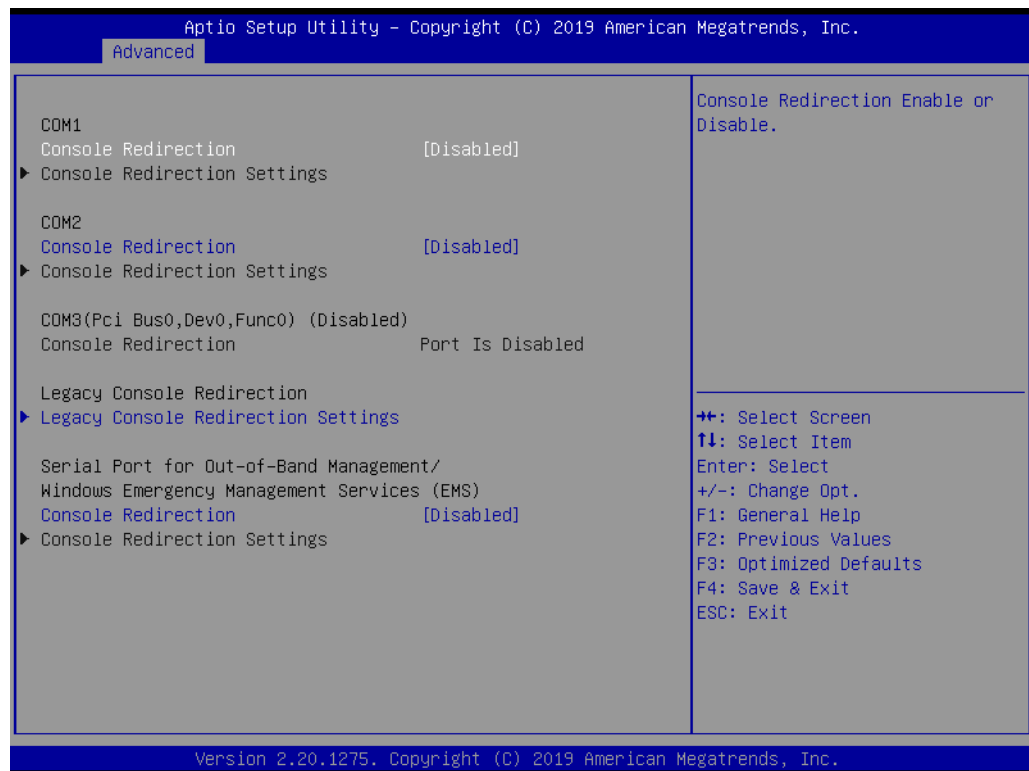
Feature	Options	Description
Serial Port	Disabled Enabled	Enable or Disable Serial Port (COM).
Device Settings	No Option	Device settings for Super I/O Device.
Change Settings	I/O=3F8h; IRQ=3; I/O=2F8h; IRQ=3; I/O=3E8h; IRQ=3; I/O=2E8h; IRQ=3;	Select an optimal settings for Super I/O Device.

■ Hardware Monitor



Feature	Options	Description
CPU Temperature	No option	Shows the current status.
COM Module FAN	No option	Shows the current status.
Carrier Board FAN	No option	Shows the current status.
+12V	No option	Shows the current status.
+ 5V	No option	Shows the current status.
VBAT	No option	Shows the current status.

3.1.2.8 Serial Port Console Redirection



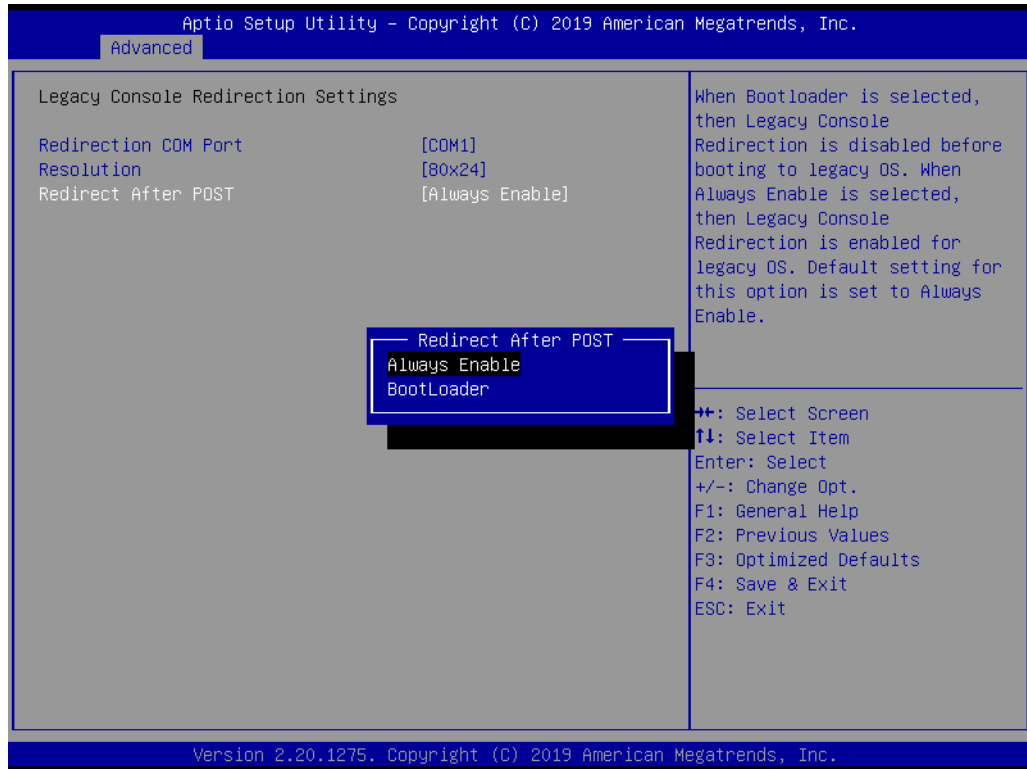
Feature	Options	Description
COM1	Disabled Enabled	Console Redirection Enable or Disable.
Console Redirection Settings	<Sub Menu>	
COM2	Disabled Enabled	Console Redirection Enable or Disable.
Console Redirection Settings	<Sub Menu>	
Legacy Console Redirection Settings	<Sub Menu>	Legacy Console Redirection Settings.
Serial Port for Out-of-band Management / Windows Emergency Management Services (EMS)	Disabled Enabled	Console Redirection Enable or Disable.
Console Redirection Settings	<Sub Menu>	

COMx parameter:

Feature	Options	Description
Terminal Type	VT100 VT100+ VT-UTF8 ANSI	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.

Bits per second	9600 19200 38400 57600 115200	Selects serial port transmission speed. The speed must be matched on the other side. Long or noisy lines may require lower speeds.
Data Bits	7 8	Set Data Bits.
Parity	None Even Odd Mark Space	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.
Stop Bits	1 2	Stop bits indicates 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.
Flow Control	None Hardware RTS/CTS	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 restart the flow. Hardware flow control uses two wires to send start/stop signals.
VT-UTF8 Combo Key Support	Disabled Enabled	Enable VT-UTF8 Combination key support for ANSI/VT100 terminals.
Recorder Mode	Disabled Enabled	With this mode enabled only text will be sent. This is to capture Terminal data.
Resolution 100x31	Disabled Enabled	Enables or disables extended terminal resolution
Putty Keypad	VT100 LINUX XTERMR6 SCO ESCN VT400	Select Function key and keypad on Putty.

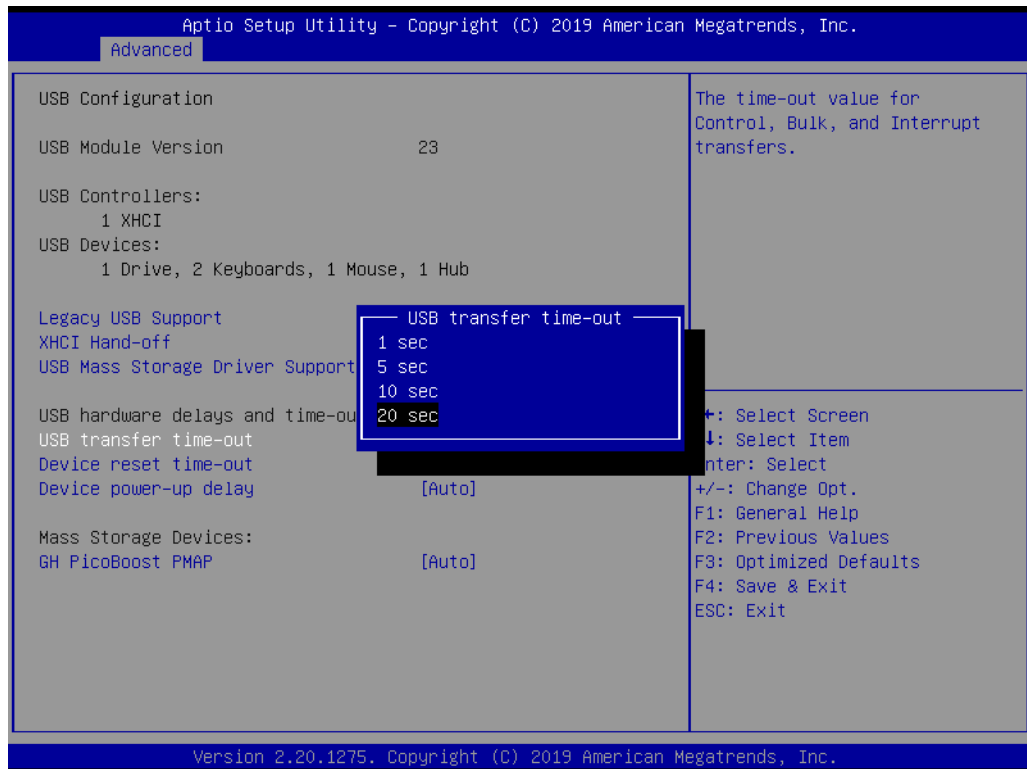
■ Legacy Console Redirection Settings



Feature	Options	Description
Redirection COM Port	COM1 COM2 COM2 (Pci Bus0,Dev0,Func0) (Disabled)	Select a COM port to display redirection of Legacy OS and Legacy OPRM Messagescharson to 1 or more bytes.
Resolution	80x24 80x25	On Legacy OS, the Number of Rows and Columns supported redirection lines may require lower speeds.
Redirect After POST	Always Enable BootLoader	When Bootloader is selected, then Legacy Console Redirection is disabled before booting to legacy OS. When Always Enable is selected, then Legacy Console Redirection is enabled for legacy OS. Default setting for this option is set to Always Enable.
Console Redirection Settings (EMS)		
Feature	Options	Description
Out-of-Band Mgmt Port	COM1 COM2 COM2(Pci Bus0,Dev0,Func0) (Disabled)	Microsoft Windows Emergency Management Services (EMS) allows for remote management of a Windows Server OS through a serial port.

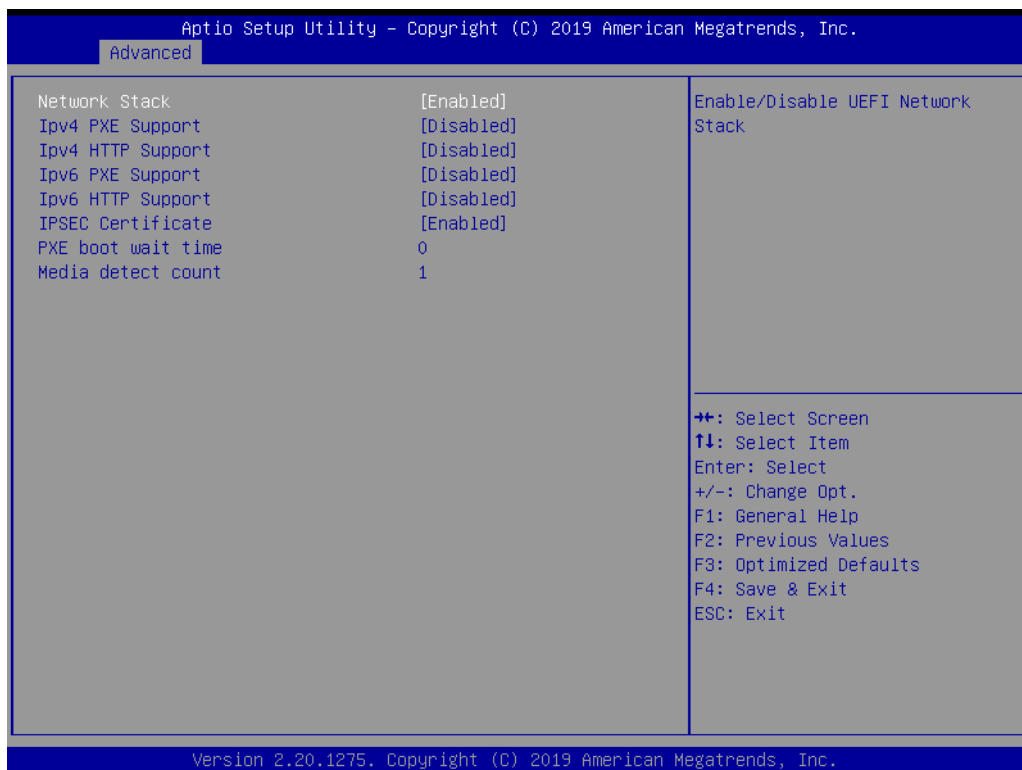
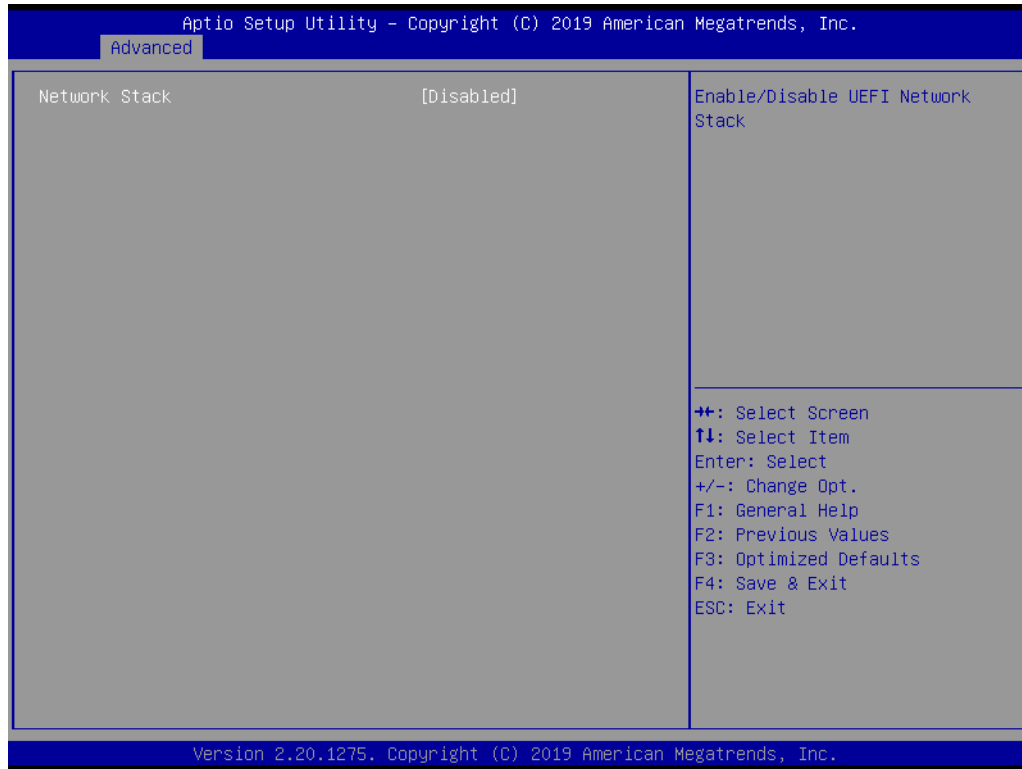
Terminal Type	VT100 VT100+ VT-UTF8 ANSI	VT-UTF8 is the preferred terminal type for out-of-band management. The next best choice is VT100+ and then VT100. See above, in Console Redirection Settings page, for more Help with Terminal Type/Emulation.
Bits Per Second	9600 19200 57600 115200	Selects serial port transmission speed. The speed must be matched on the other side. Long or noisy lines may require lower speeds.
Flow Control	None Hardware RTS/CTS Software Xon/Xoff	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 signals.
Data Bits	No Option	Data Bits
Parity	No Option	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.
Stop Bits	No Option	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.

3.1.2.9 USB Configuration



Feature	Options	Description
Legacy USB Support	Disabled Enabled	Enables Legacy USB support. AUTO option disables legacy support if no USB devices are connected. DISABLE option will keep USB devices available only for EFI applications.
XHCI Hand-off	Disabled Enabled	This is a workaround for OS without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.
USB Mass Storage Driver Support	Disabled Enabled	Enable/Disable USB Mass Storage Driver support.
USB transfer time-out	1 sec 5 sec 10 sec 20 sec	The time-out value for Control, Bulk, and Interrupt transfers.
Device reset time-out	10 sec 20 sec 30 sec 40 sec	USB mass storage device Start Unit command time-out.
Device power-up delay	Auto Manual	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.

3.1.2.10 Network Stack Configuration




Feature	Options	Description
Network Stack	Disabled Enabled	Enable/Disable UEFI Network Stack.
Ipv4 PXE Support	Disabled Enabled	Enable/Disable IPv4 PXE boot support. If disabled, IPv4 PXE boot support will not be available.
Ipv4 HTTP Support	Disabled Enabled	Enable/Disable IPv4 HTTP boot support. If disabled, IPv4 HTTP boot support will not be available.
Ipv6 PXE Support	Disabled Enabled	Enable/Disable IPv6 PXE boot support. If disabled, IPv6 PXE boot support will not be available.
Ipv6 HTTP Support	Disabled Enabled	Enable/Disable IPv6 HTTP boot support. If disabled, IPv6 HTTP boot support will not be available.
IPSEC Certificate	Disabled Enabled	Support to Enable/Disable IPSEC certificate for Ikev.
PXE boot wait time	0~5	Wait time in seconds to press ESC key to abort the PXE boot. Use either +/- or numeric keys to set the value.
Media detect count	1~50	Number of times the presence of media will be checked. Use either +/- or numeric keys to set the value.

3.1.2.11 CSM Configuration

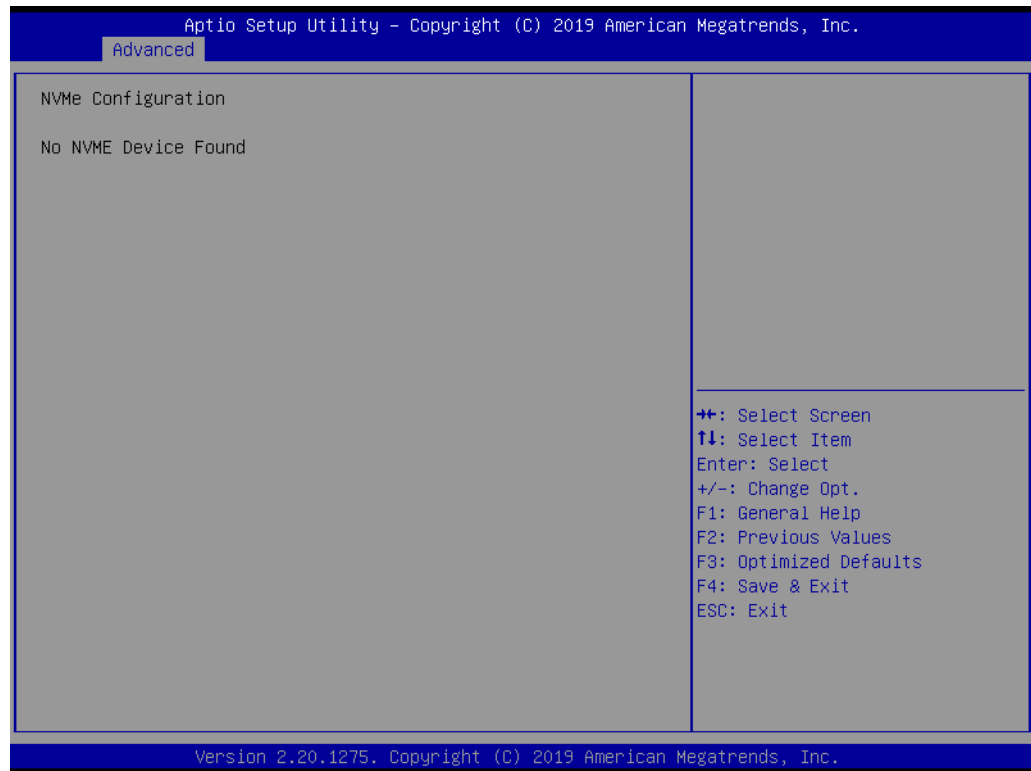


Feature	Options	Description
CSM Support	Disabled Enabled	Enable/Disable CSM Support.
Gate A20 Active	Upon Request Always	UPON REQUEST - GA20 can be disabled using BIOS services. ALWAYS - do not allow disabling GA20; this option is useful when any RT code is executed above 1MB.
INT19 Trap Response	Immediate Postponed	BIOS reaction on INT19 trapping by Option ROM: IMMEDIATE - execute the trap right away; POSTPONED - execute the trap during legacy boot.
Boot option filter	UEFI and Legacy Legacy only UEFI only	This option controls Legacy/UEFI ROMs priority.
Network	Do not launch UEFI Legacy	Controls the execution of UEFI and Legacy PXE OpROM.
Storage	Do not launch UEFI Legacy	Controls the execution of UEFI and Legacy Storage OpROM.
Video	Do not launch UEFI Legacy	Controls the execution of UEFI and Legacy Video OpROM.
Other PCI Devices	Do not launch UEFI Legacy	Determines OpROM execution policy for devices other than Network, Storage, or Video.

Note!  *CSM: The Compatibility Support Module (CSM) is a component of the UEFI firmware that provides legacy BIOS compatibility by emulating a BIOS environment, allowing legacy operating systems and some option ROMs that do not support UEFI to still be used.*

CSM also provides required legacy System Management Mode (SMM) functionality, called CompatibilitySmm, as an addition to features provided by the UEFI SMM. This is optional and highly chipset- and platform-specific. An example of such a legacy SMM functionality is providing USB legacy support for keyboard and mouse, by emulating their classic PS/2 counterparts.

3.1.2.12 NVMe Configuration



NVMe Device Options Settings

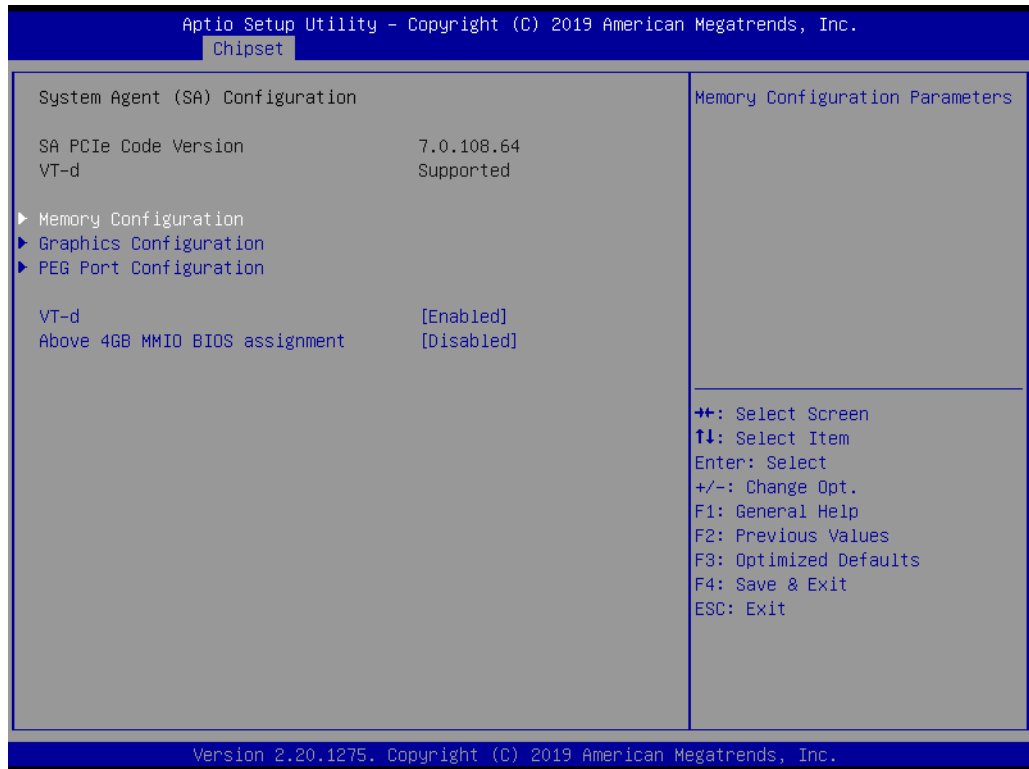
3.1.3 Chipset

Select the Chipset tab from the SOM-5899Refresh setup screen to enter the Chipset BIOS Setup screen. You can display a Chipset BIOS Setup option by highlighting it using the <Arrow> keys. All plug-and-play BIOS Setup options are described in this section. The plug-and-play BIOS Setup screen is shown below.



Feature	Options	Description
System Agent (SA) Configuration	<Sub Menu>	System Agent (SA) Parameters
PCH-IO Configuration	<Sub Menu>	PCH Parameters

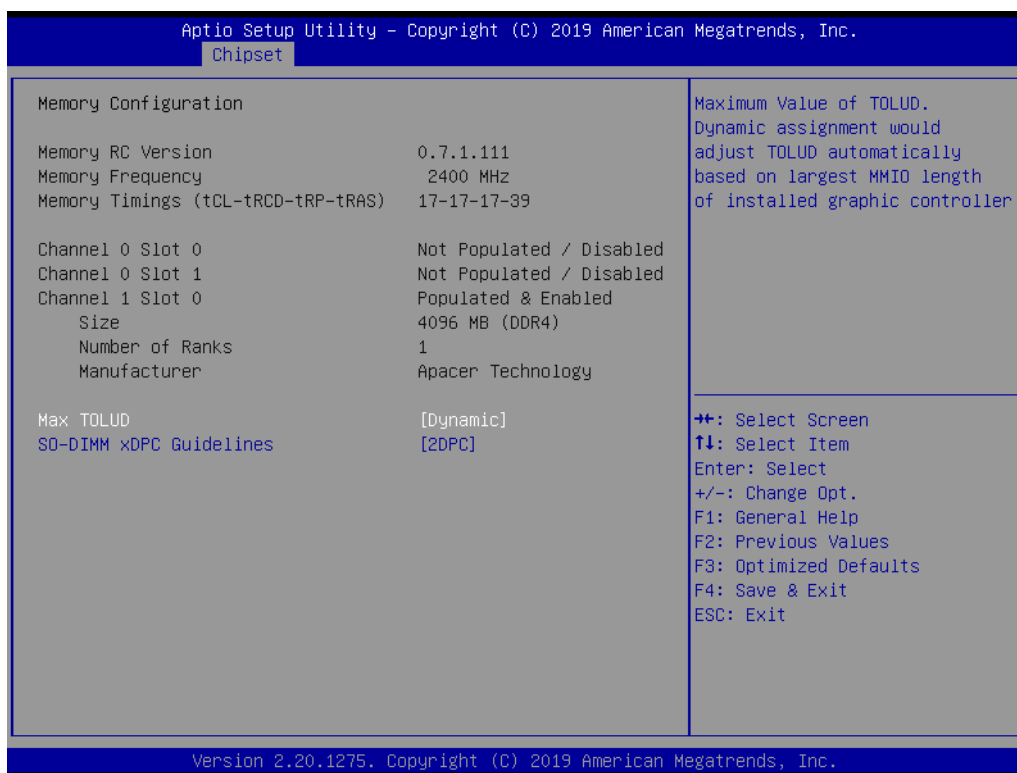
3.1.3.1 System Agent (SA) Configuration



Feature	Options	Description
SA PCIe Code Version	No Option	SA PCIe Code Version (7.0.42.32).
VT-d	No Option	VT-d capability (Supported).
Memory Configuration	<Sub Menu>	Memory Configuration Parameters.
Graphics Configuration	<Sub Menu>	Graphics Configuration.
PEG Port Configuration	<Sub Menu>	PEG Port Options.
VT-d	Disabled Enabled	VT-d capability.
Above 4GB MMIO BIOS Assignment	Disabled Enabled	Enable/Disable above 4GB Memory-MappedIO BIOS assignment. This is enabled automatically when Aperture Size is set to 2048MB.

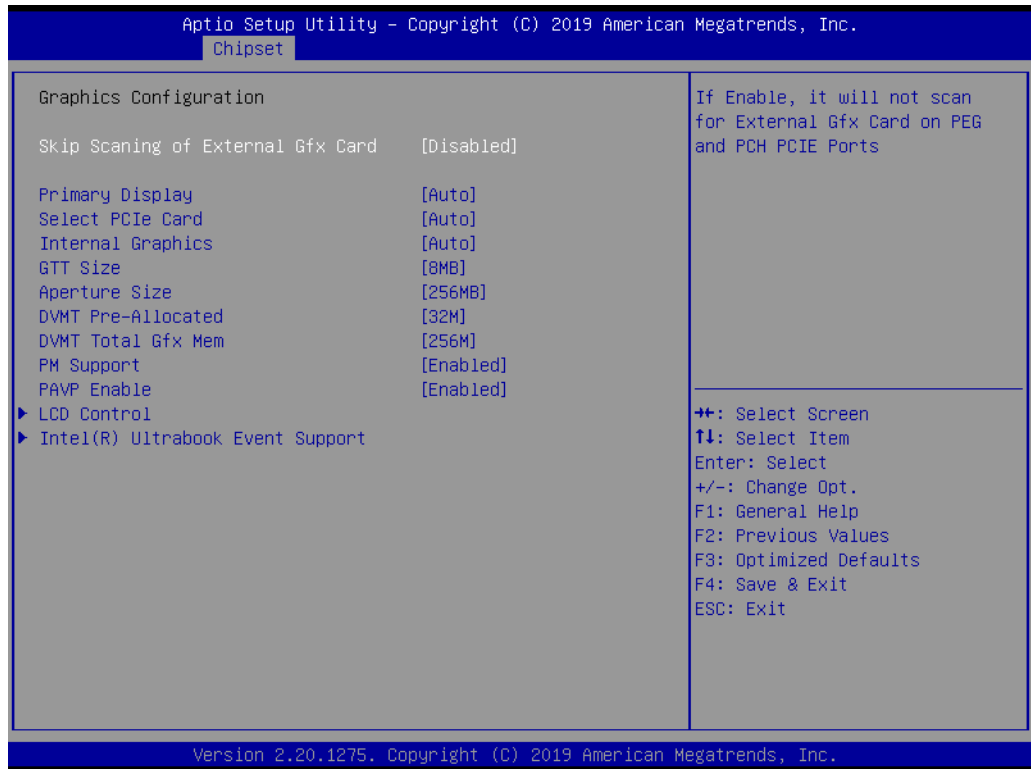
■ Memory Configuration

This page shows memory information.



Feature	Options	Description
Max TOLUD	Dynamic	Maximum Value of TOLUD. Dynamic assignment would adjust TOLUD automatically based on largest MMIO length of installed graphic controller
	3.5GB	
	3.25GB	
	3GB	
	2.75GB	
	2.5GB	
	2.25GB	
	2GB	
	1.75GB	
	1.5GB	
	1.25GB	
1GB		

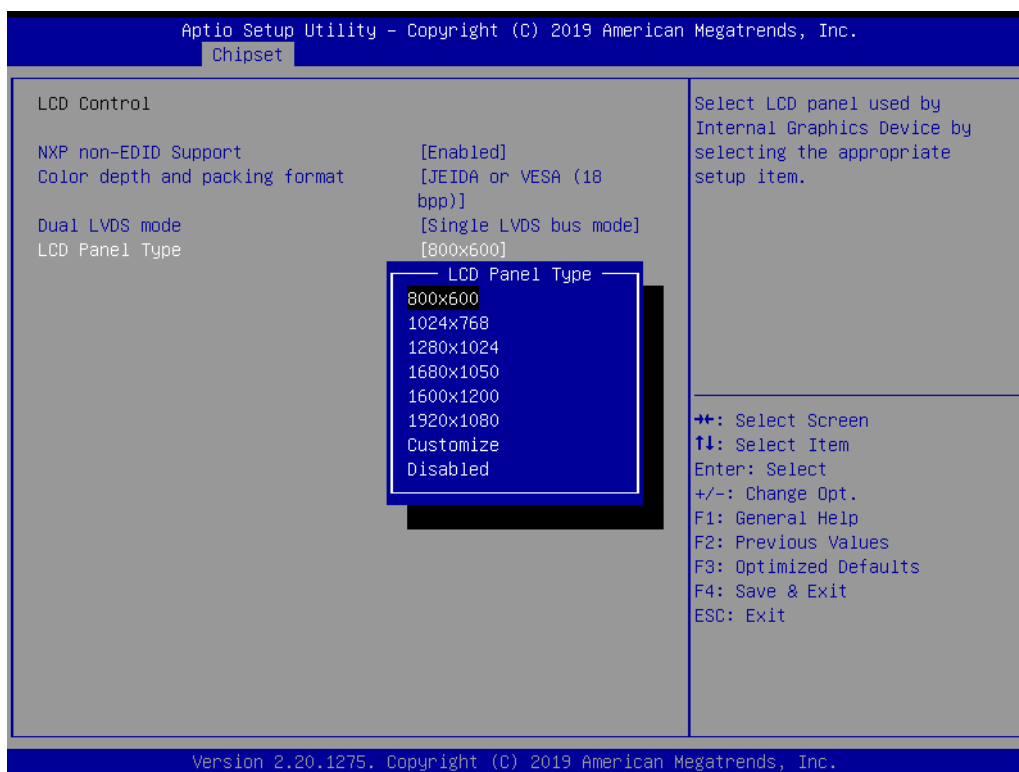
■ Graphics Configuration



Feature	Options	Description
Skip Scanning of External Gfx Card	Disabled Enabled	If Enabled, it will not scan for External Gfx Card on PEG or PCH PCIE Ports.
Primary Display	Auto IGFX PEG PCI SG	Select which of IGFX/PEG/PCI Graphics devices should be Primary Display Or select SG for Switchable Gfx.
Select PCIe Card	Auto Elk Creek 4 PEG Eval	Select the card used on the platform Auto: Skip GPIO based Power Enable to dGPU . Elk Creek 4: D.GPU Power Enable = ActiveLow PEG Eval: DGPU Power Enable = ActiveHigh.
Internal Graphics	Auto Disabled Enabled	Keep IGFX enabled based on the setup options.
GTT Size	2MB 4MB 8MB	Select the GTT Size.
Aperture Size	128MB 256MB 512MB 1024MB 2048MB	Select the Aperture Size.

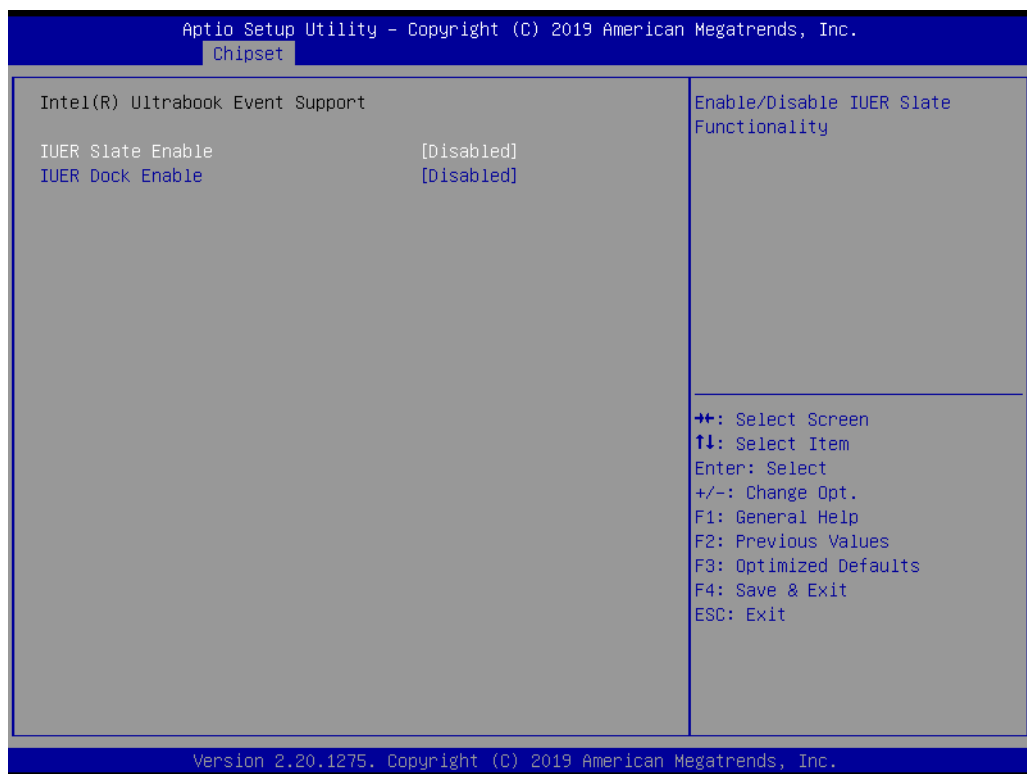
DVMT Pre-Allocated	0M	Select DVMT 5.0 Pre-Allocated (Fixed) Graphics Memory size used by the Internal Graphics Device.
	4M	
	8M	
	12M	
	16M	
	20M	
	24M	
	28M	
	32M	
	32M/F7	
	36M	
	40M	
	44M	
48M		
52M		
56M		
60M		
64M		
DVMT Total Gfx Mem	128M 256M MAX	Select DVMT5.0 Total Graphic Memory size used by the Internal Graphics Device.
PM Support	Disabled Enabled	Enable/Disable PM Support
PAVP Enable	Disabled Enabled	Enable/Disable PAVP

LCD Control



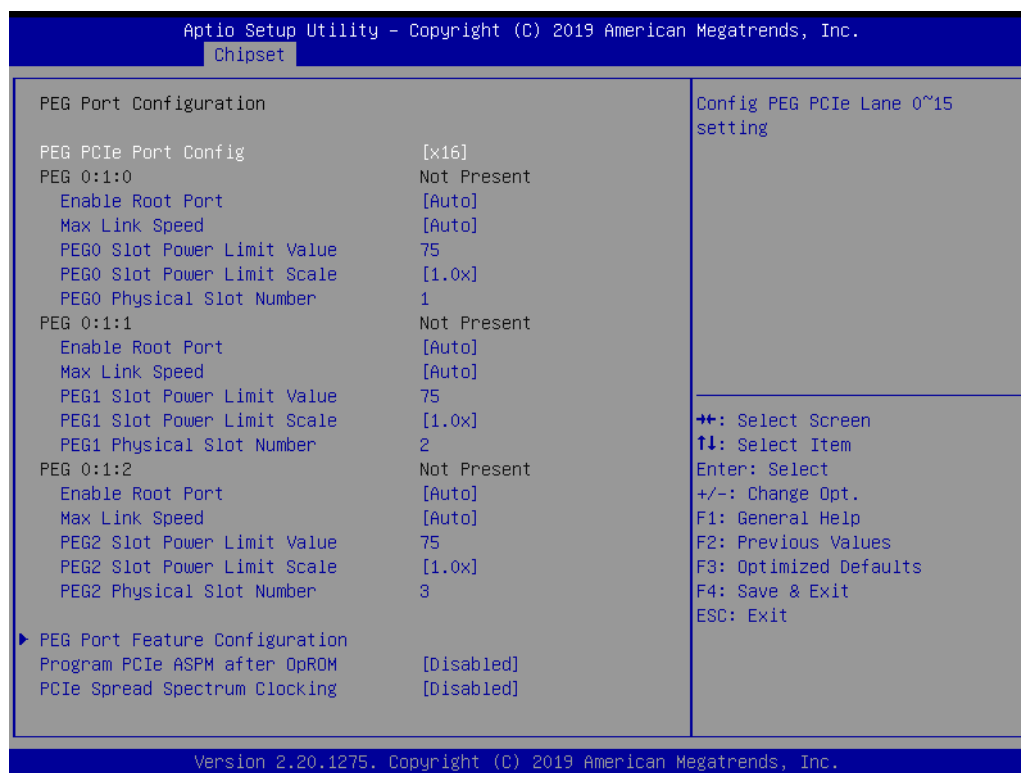
Feature	Options	Description
NXP non-EDID Support	Disabled Enabled	NXP PTN3460 Support: Enable: Used internal EDID setting; Disable: Get EDID from DDC bus.
Color depth and packing format	JEIDA or VESA (18 bpp) JEIDA (24 bpp) VESA (24 bpp)	Color depth and packing format.
Dual LVDS mode	Single LVDS bus mode Dual LVDS bus mode	Dual LVDS mode.
LCD Panel Type	800x600 1024x768 1280x1024 1680x1050 1600x1200 1920x1080 Customize Disabled	Select LCD panel used by Internal Graphics Device by selecting the appropriate setup item.

Intel(R) Ultrabook Event Support PEG Port Configuration



Feature	Options	Description
IUER Slate Enable	Disabled Enabled	Enable/Disable IUER Slate Functionality.
IUER Dock Enable	Disabled Enabled	Enable/Disable IUER Dock Functionality.

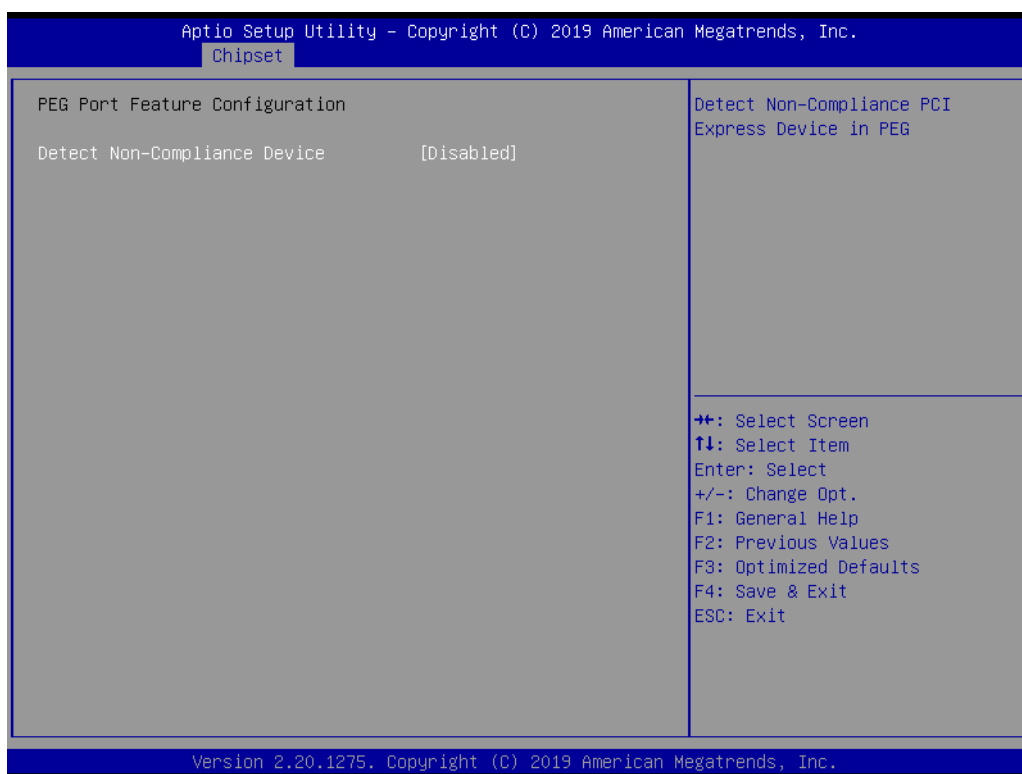
■ PEG Port Configuration



Feature	Options	Description
PEG PCIe Port Config	X16 X8x8 X8x4x4	Config PEG PCIe Lane 0~15 setting.
PEG 0:1:0		
Enable Root Port	Disabled Enabled Auto	Enable or Disable the Root Port.
Max Link Speed	Auto Gen1 Gen2 Gen3	Configure PEG 0:1:0 Max Speed.
PEG0 Slot Power Limit Value	0~255	Set the upper limit on power supplied by slot. Power limit (in Watts) is calculated by multiplying this value by the Slot Power limit Scale. Values 0-255.
PEG0 slot Power Limit Scale	1.0x 0.1x 0.01x 0.001x	Select the scale used for the Slot Power Limit Value.
PEG0 Physical Slot Number	0~8191	Set the physical slot number attached to be globally unique within the chassis Values 0-8191.
PEG 0:1:1		

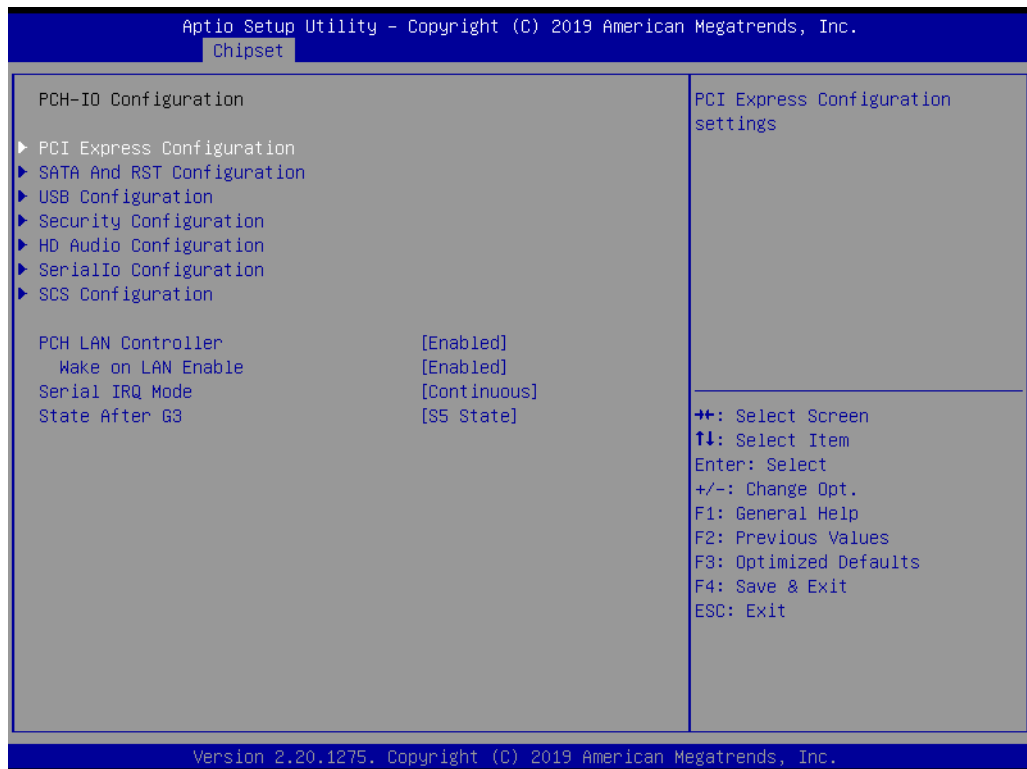
Enable Root Port	Disabled Enabled Auto	Enable or Disable the Root Port.
Max Link Speed	Gen1 Gen2 Gen3	Configure PEG 0:1:1 Max Speed.
PEG1 Slot Power Limit Value	0~255	Set the upper limit on power supplied by slot. Power limit (in Watts) is calculated by multiplying this value by the Slot Power limit Scale. Values 0-255.
PEG1 Slot Power Limit Scale	1.0x 0.1x 0.01x 0.001x	Select the scale used for the Slot Power Limit Value.
PEG1 Physical Slot Number	0~8191	Set the physical slot number attached to be globally unique within the chassis Values 0-8191.
PEG 0:1:2		
Enable Root Port	Disabled Enabled Auto	Enable or Disable the Root Port.
Max Link Speed	Auto Gen1 Gen2 Gen3	Configure PEG 0:1:2 Max Speed.
PEG2 Slot Power Limit Value	0~255	Set the upper limit on power supplied by slot. Power limit (in Watts) is calculated by multiplying this value by the Slot Power limit Scale. Values 0-255.
PEG2 Slot Power Limit Scale	1.0x 0.1x 0.01x 0.001x	Select the scale used for the Slot Power Limit Value.
PEG2 Physical Slot Number	0~8191	Set the physical slot number attached to be globally unique within the chassis Values 0-8191.
PEG Port Feature Configuration	<Sub Menu>	PEG Port Feature Configuration.
Program PCIe ASPM After OpROM		Enabled: PCIe ASPM will be programmed after OpROM. Disabled: PCIe ASPM will be programmed before OpROM.
PCIe Spread Spectrum Clocking		Allows disabling Spread Spectrum Clocking for compliance testing.

PEG Port Feature Configuration



Feature	Options	Description
Detect Non-Compliance Device	Disabled Enabled	Detect Non-Compliance PCI Express Device in PEG.

3.1.3.2 PCH-IO Configuration



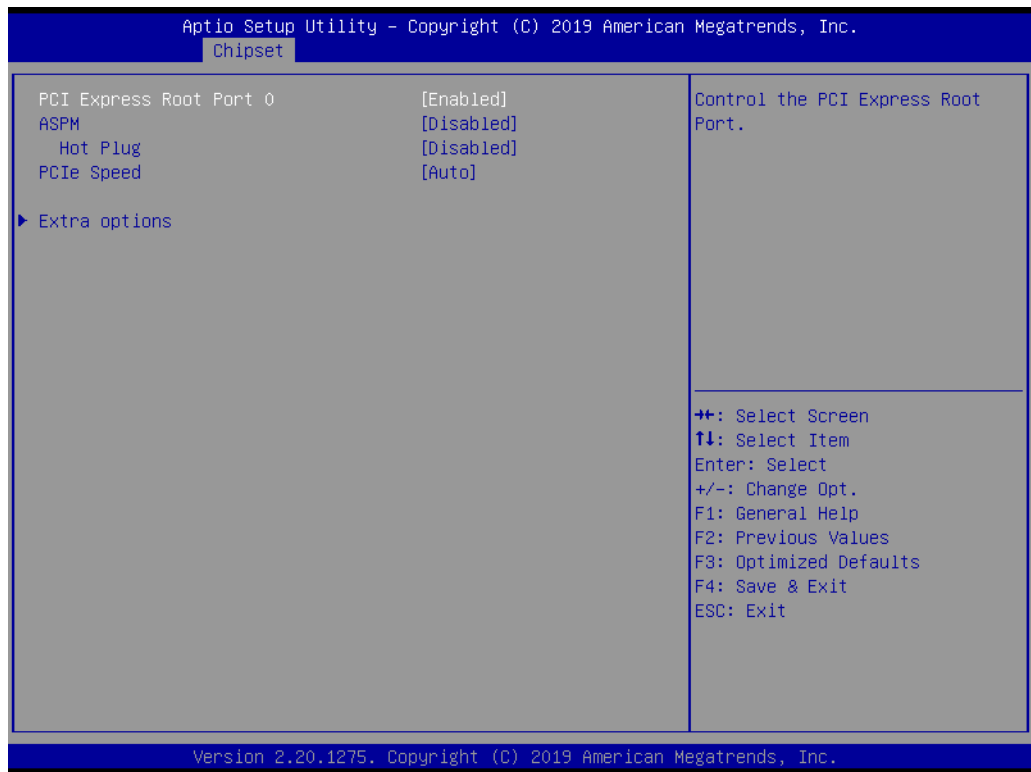
Feature	Options	Description
PCI Express Configuration	<Sub Menu>	PCI Express Configuration settings.
SATA And RST Configuration	<Sub Menu>	SATA Device Options settings.
USB Configuration	<Sub Menu>	USB Configuration settings.
Security Configuration	<Sub Menu>	Security Configuration settings.
HD Audio Configuration	<Sub Menu>	HD Audio Subsystem Configuration settings.
SerialIo Configuration	<Sub Menu>	SerialIo Configuration settings.
SCS Configuration	<Sub Menu>	Storage and Communication Subsystem (SCS) Configuration.
PCH LAN Controller	Disabled Enabled	Enable/Disable onboard NIC.
Wake on LAN Enable	Disabled Enabled	Enable/Disable integrated LAN to wake the system.
Serial IRQ Mode	Quiet Continuous	Config Serial IRQ Mode.
State After G3	S0 State S5 State	Specify what state to go to when power is re-applied after a power failure (G3 state).

■ PCI Express Configuration



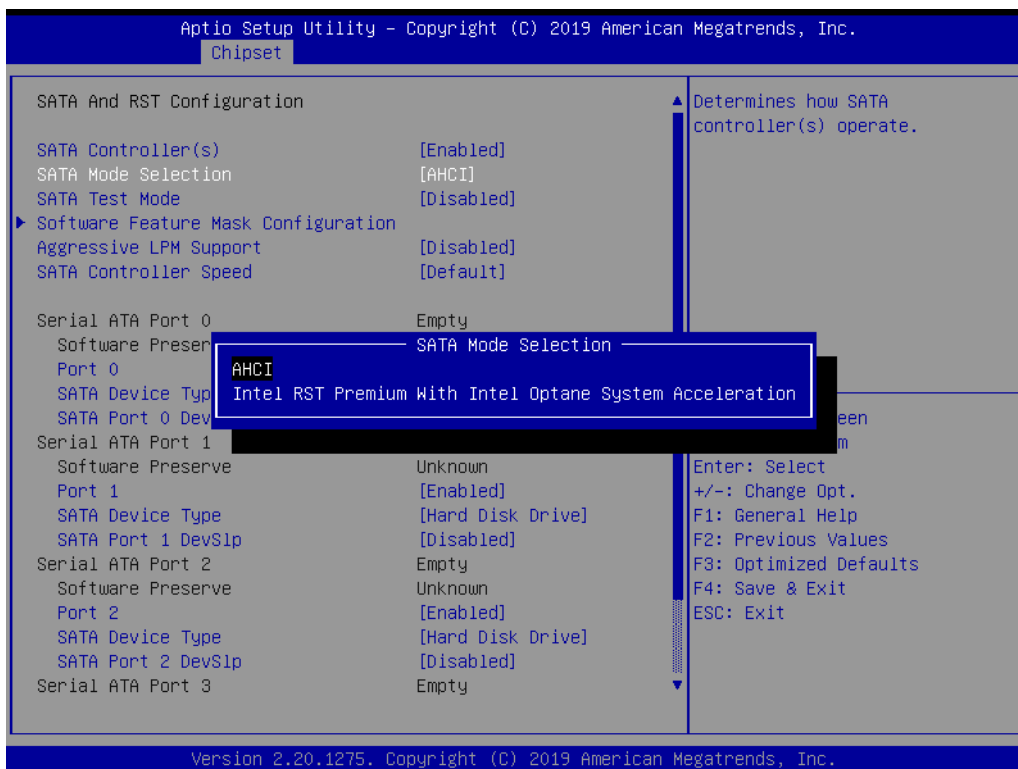
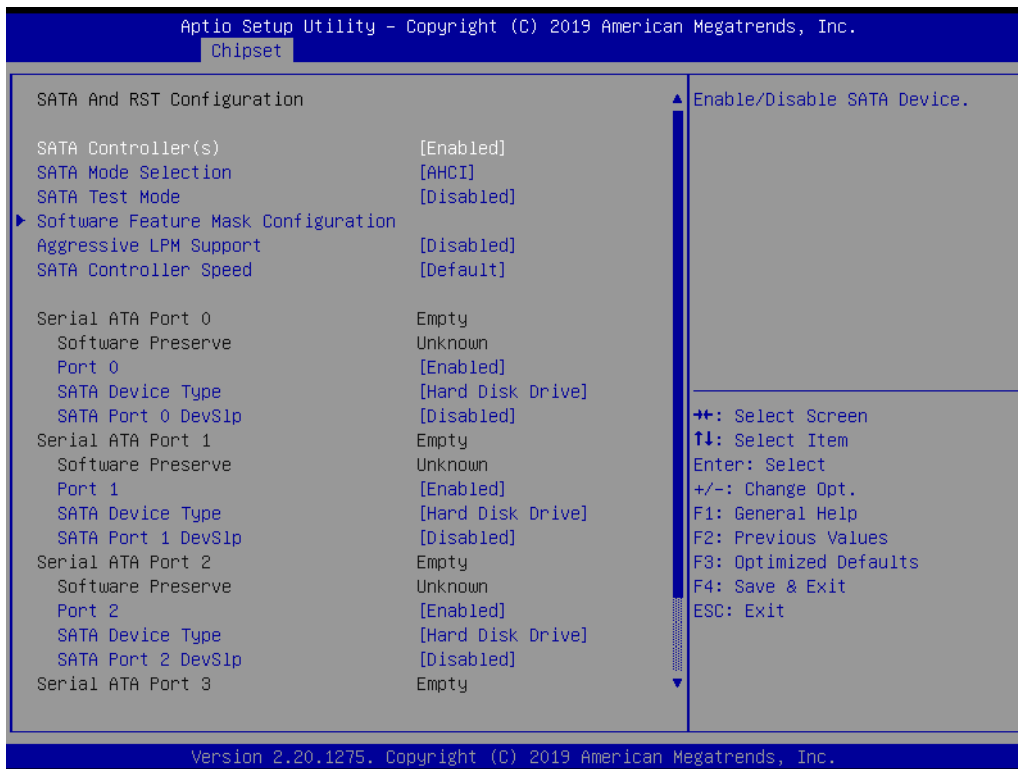
Feature	Options	Description
PCH PCIe Port Config 1	x1x1x1x1 x4	Config PCH PCIe Lane 0~3 setting.
PCH PCIe Port Config 2	x1x1x1x1 x4	Config PCH PCIe Lane 4~7 setting.
DMI Link ASPM Control	Disabled L0s L1 L0sL1 Auto	The control of Active State Power Management of the DMI Link.
PCI Express Root Port 0~7	<Sub Menu>	PCI Express Root Port settings.

PCI Express Root Port 0~7



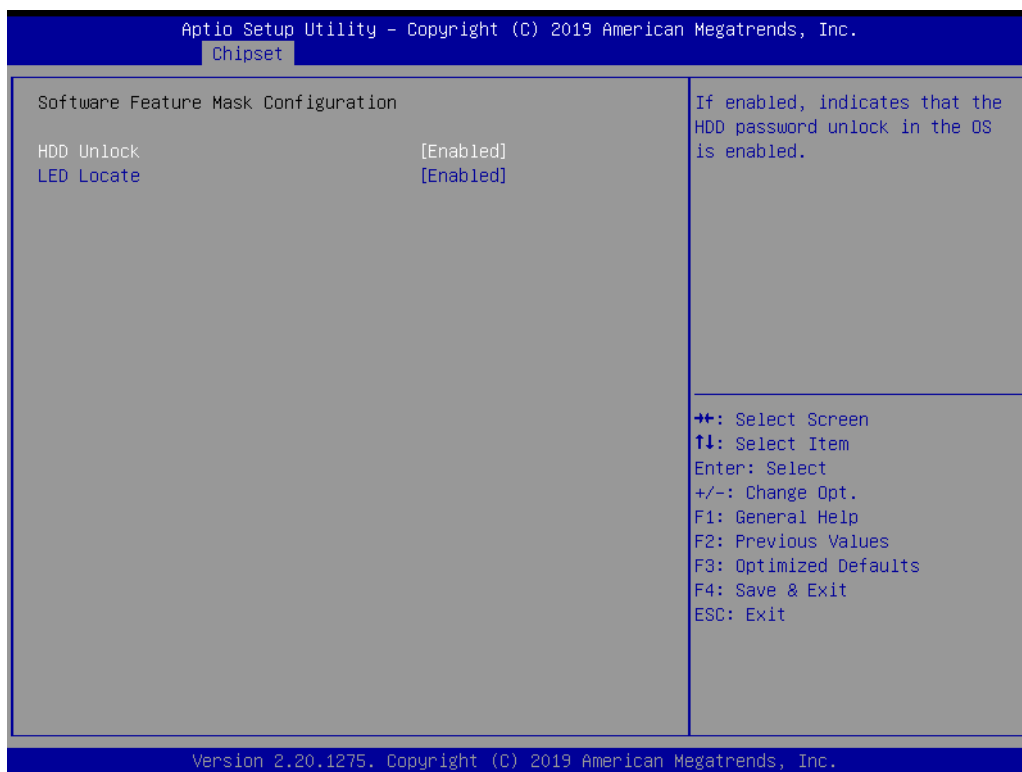
Feature	Options	Description
PCI Express Root Port 0~7	Disabled Enabled	Control the PCI Express Root Port.
ASPM	Disabled L0s L1 L0sL1 Auto	Set the ASPM Level: Force L0s - Force all links to L0s State. AUTO - BIOS auto configure . DISABLE - Disables ASPM.
Hot Plug	Disabled Enabled	PCI Express Hot Plug Enable/Disable.
PCIe Speed	Auto Gen1 Gen2 Gen3	Configure PCIe Speed.

■ SATA And RST Configuration



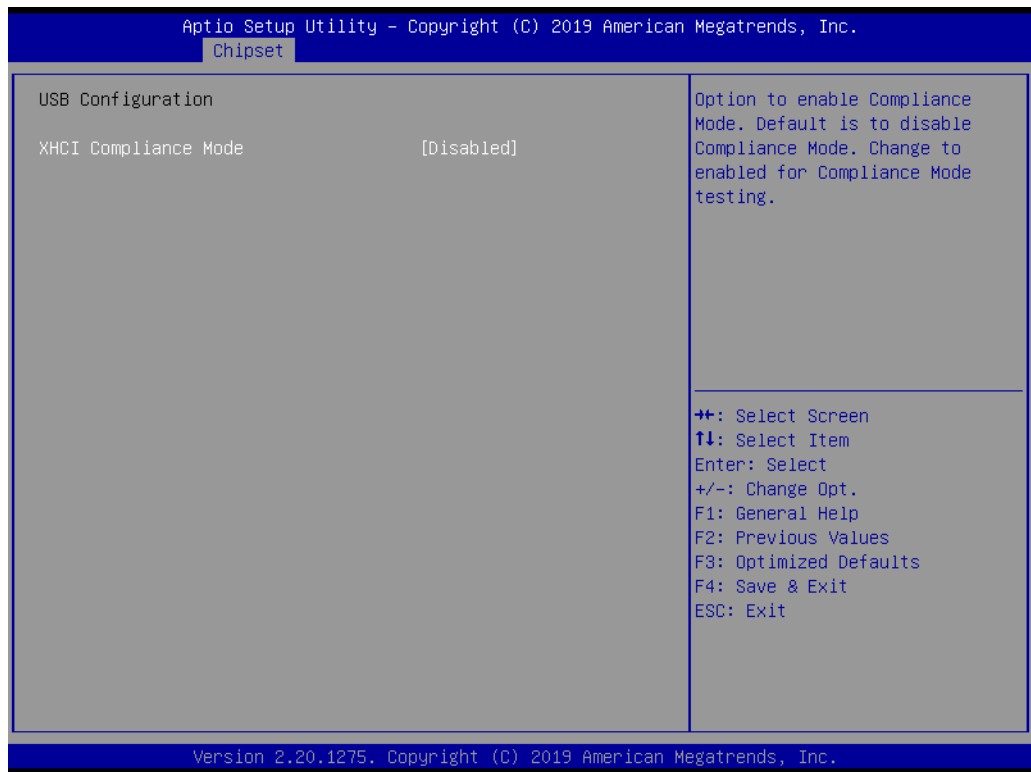
Feature	Options	Description
SATA Controller(s)	Disabled Enabled	Enable/Disable SATA Device.
SATA Mode Selection	AHCI Intel RST Premium With Intel® Optane™ System Acceleration	Determines how SATA controller(s) operate.
SATA Test Mode	Disabled Enabled	Test Mode Enable/Disable (Loop Back).
Software Feature Mask Configuration	<Sub Menu>	RST Legacy OROM/RST UEFI driver will refer to the SWFM configuration to enable/disable the storage features.
Aggressive LPM Support	Disabled Enabled	Enables PCH to aggressively enter link power state.
SATA Controller Speed	Default Gen1 Gen2 Gen3	Indicates the maximum speed the SATA controller can support.
Port [0,1,2,3,5]	Disabled Enabled	Enable or Disable SATA Port.
SATA Device Type (Port 0,1,2,3,5)	Hard Disk Drive Solid State Drive	Identify the SATA port is connected to Solid State Drive or Hard Disk Drive.
SATA Port [0,1,2,3,5] DevSlp	Disabled Enabled	Enable/Disable SATA Port [0,1,2,3,5] DevSlp. For DevSlp to work, both hard drive and SATA port need to support DevSlp function, otherwise an unexpected behavior might occur. Please check board design before enabling it.

Software Feature Mask Configuration



Feature	Options	Description
HDD Unlock	Disabled	If enabled, indicates that the HDD password unlock in the OS is enabled.
	Enabled	
LED Locate	Disabled	If enabled, indicates that the LED/SGPIO hardware is attached and ping to locate feature is enabled on the OS.
	Enabled	

■ USB Configuration



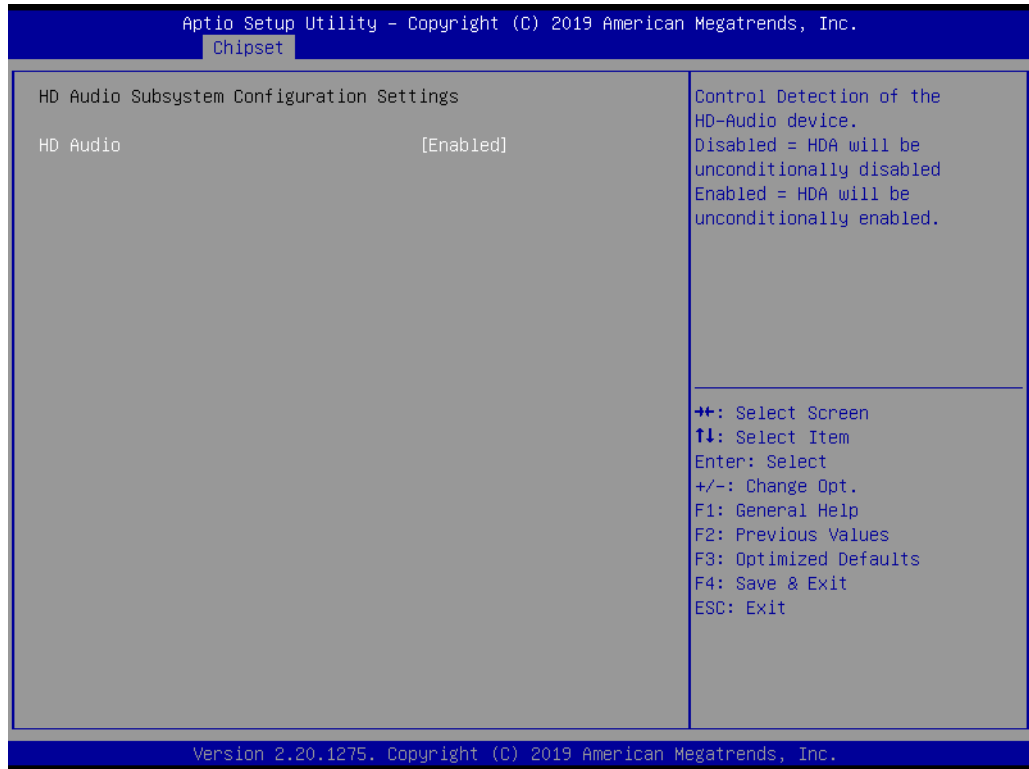
Feature	Options	Description
XHCI Compliance Mode	Disabled Enabled	Option to enable Compliance Mode. Default is to disable Compliance Mode. Change to enabled for Compliance Mode testing.

■ Security Configuration



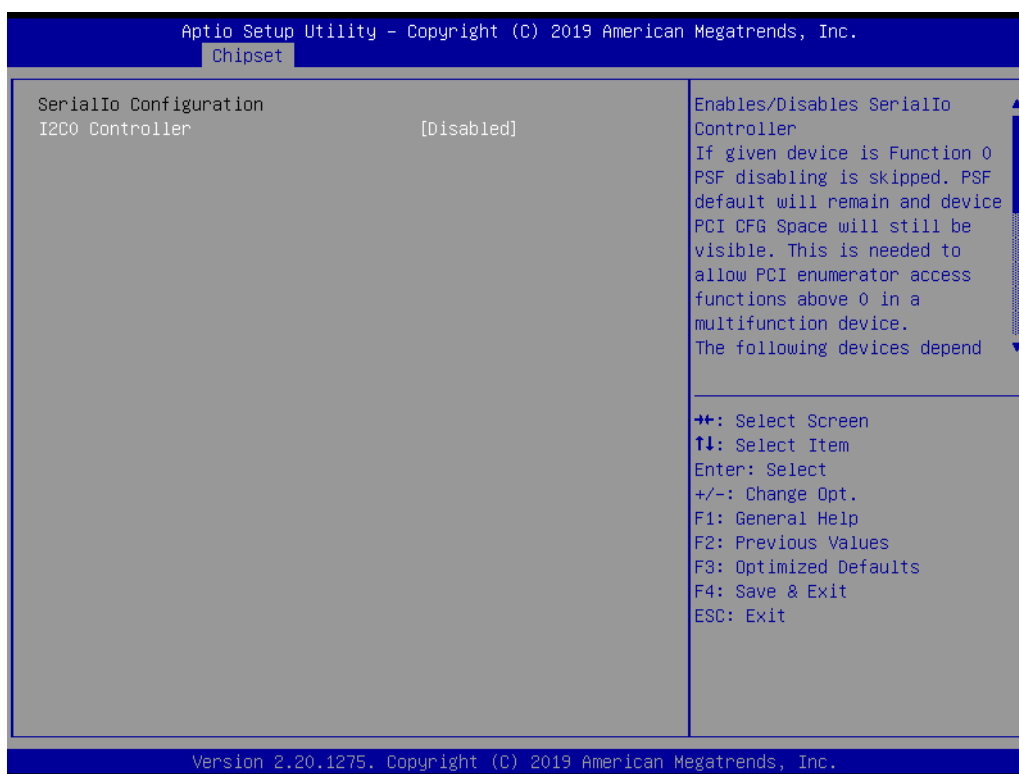
Feature	Options	Description
RTC Memory Lock	Disabled Enabled	Enable will lock bytes 38h-3Fh in the lower/upper 128-byte bank of RTC RAM.
BIOS Lock	Disabled Enabled	Enable/Disable the PCH BIOS Lock Enable feature. Required to be enabled to ensure SMM protection of flash.

■ HD Audio Configuration



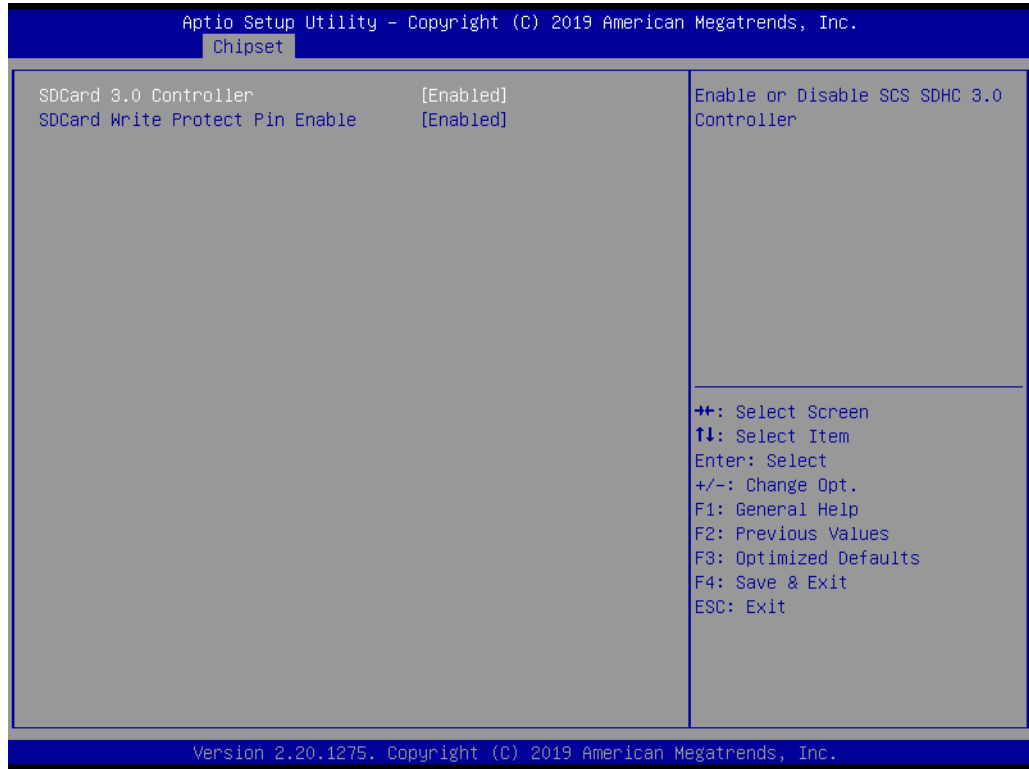
Feature	Options	Description
HD Audio	Disabled Enabled	HD Audio Subsystem Configuration Settings.

SerialIo Configuration



Feature	Options	Description
I2C0 Controller	Disabled Enabled	Enables/Disables SerialIo Controller If given device is Function 0 PSF disabling is skipped. PSF default will remain and device PCI CFG Space will still be visible. This is needed to allow PCI enumerator access functions above 0 in a multifunction device. The following devices depend on each other: I2C0 and I2C1,2,3 UART0 and UART1,SPI0,1 UART2 and I2C4,5

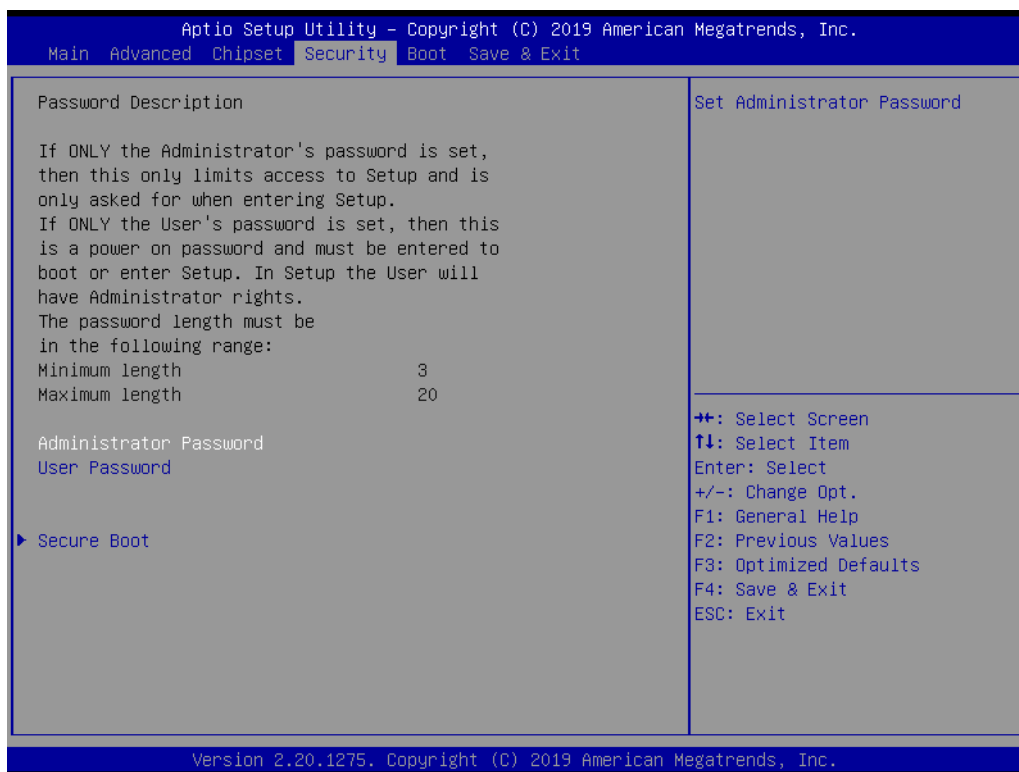
■ SCS Configuration



Feature	Options	Description
SDCard 3.0 Controller	Disabled Enabled	Enable or Disable SCS SDHC 3.0 Controller.

3.1.4 Security

Select Security tab from the SOM-5899Refresh main BIOS setup menu. All security setup options, such as password protection are described in this section. To access the sub menu for the following items, select the item and press <Enter>:



Feature	Options	Description
Administrator Password	<Insert Password>	Set Administrator Password.
User Password	<Insert Password>	Set User Password.
Secure Boot	<Sub Menu>	Secure Boot configuration.

Change Administrator / User Password: Select this option and press Enter to access the sub menu, and then type in the password.

The password length is minimum 3 digits and maximum 20 digits.

If you set "Administrator Password" only, it will require a password only when entering the BIOS Setup.

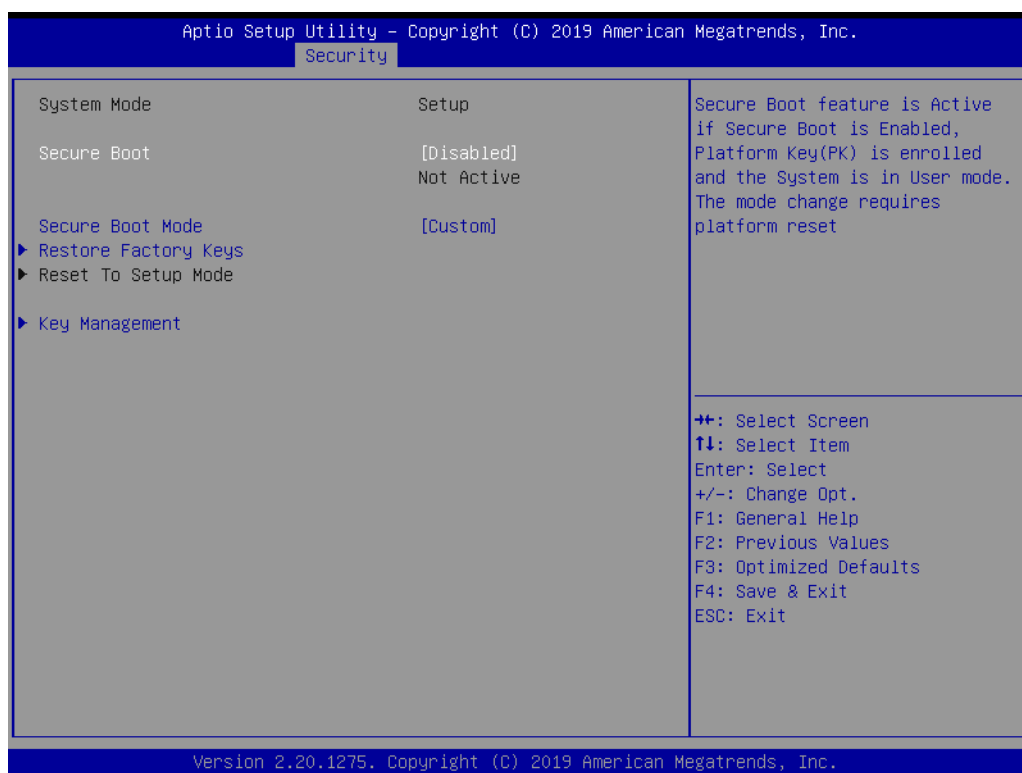
If you set "User Password" only, it will require a password every boot-up. However, if the Administrator password is not set, using "User Password" to enter the BIOS Setup will permit all access privileges.

If you set both passwords, it will require a password every boot-up. To boot into the OS, you can use either password. To enter BIOS Setup, "Administrator Password" gives all privileges to access all items, while "User Password" only gives partial privileges.

Note! Please keep your password safe. For security reasons, the BIOS password can't be reset by clearing CMOS. If you forget your password, please contact Advantech for technical support.

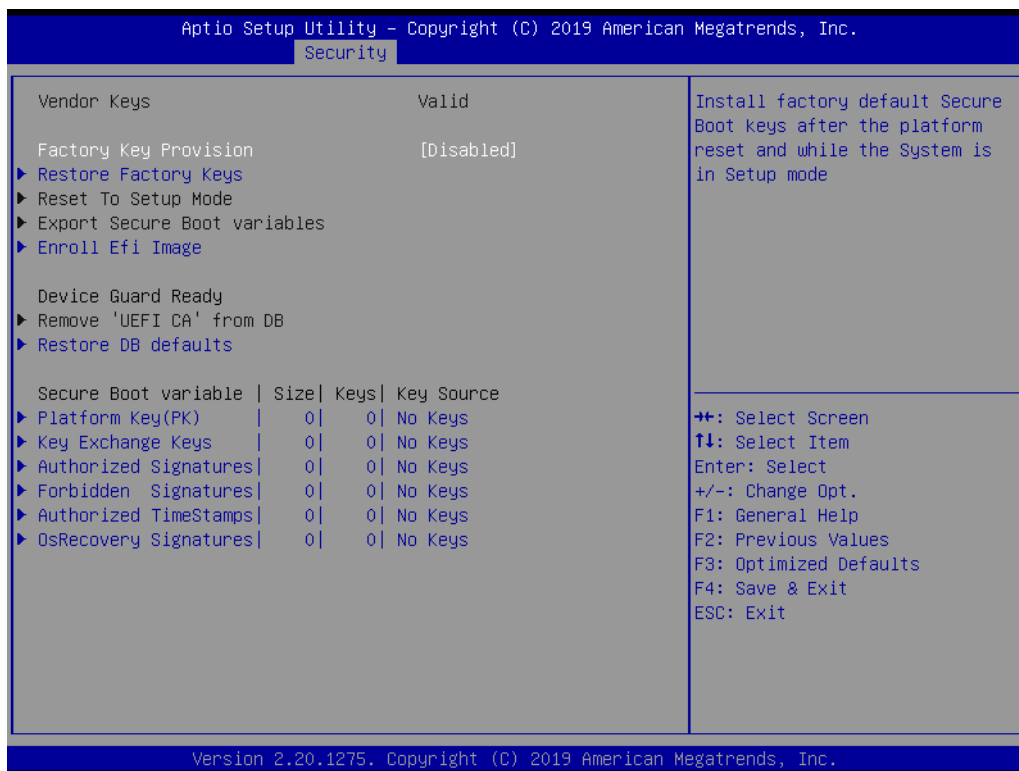


3.1.4.1 Secure Boot



Feature	Options	Description
Secure Boot	Disabled Enabled	Set Administrator Password.
Secure Boot Mode	Standard Custom	Set User Password.
Restore Factory Keys	Yes No	Secure Boot Configuration.
Reset To Setup Mode	Yes No	Secure Boot Configuration.
Key Management	<Sub Menu>	Secure Boot Configuration.

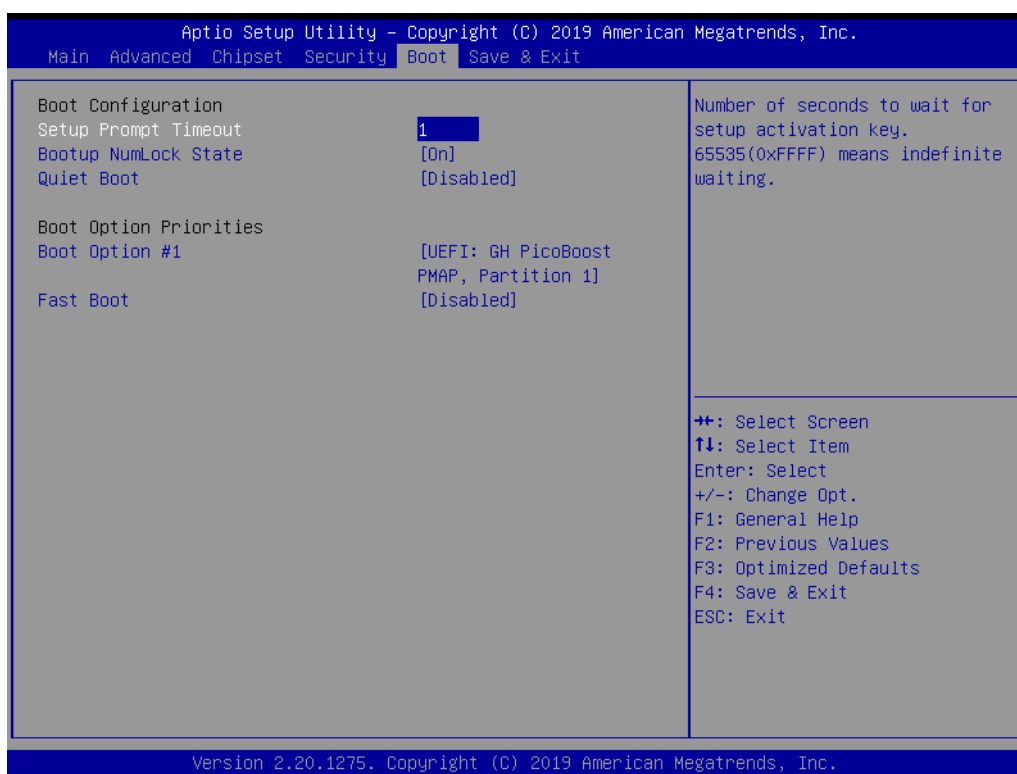
■ Key Management



Feature	Options	Description
Factory Key Provision	Disabled Enabled	Install factory default Secure Boot keys after the platform reset and while the System is in Setup mode.
Restore Factory Keys	Yes No	Force System to User Mode. Install factory default Secure Boot key databases.
Reset To Setup Mode	Yes No	Delete all Secure Boot key databases from NVRAM.
Export Secure Boot variables	<Export variables>	Copy NVRAM content of Secure Boot variables to files in a root folder on a file system device.
Enroll Efi Image	<Enroll Efi Image>	Allow the image to run in Secure Boot mode. Enroll SHA256 Hash certificate of a PE image into Authorized Signature Database (db).
Remove 'UEFI CA' from DB	Yes No	Device Guard ready system must not list 'Microsoft UEFI CA' Certificate in Authorized Signature database (db).
Restore DB defaults	Yes No	Restore DB variable to factory defaults.

Secure Boot variable information	No Option	Enroll Factory Defaults or load certificates from a file: 1.Public Key Certificate: a)EFI_SIGNATURE_LIST b)EFI_CERT_X509 (DER) c)EFI_CERT_RSA2048 (bin) d)EFI_CERT_SHAXXX 2.Authenticated UEFI Variable 3.EFI PE/COFF Image(SHA256) Key Source: Factory,External,Mixed.
Platform Key(PK)	Details Export Update Delete	One of Secure Boot variable.
Key Exchange Keys	Details Export Update Append Delete	One of Secure Boot variable.
Authorized Signatures	Details Export Update Append Delete	One of Secure Boot variable.
Forbidden Signatures	Details Export Update Append Delete	One of Secure Boot variable.
Authorized TimeStamps	Update Append	One of Secure Boot variable.
Os Recovery Signatures	Update Append	One of Secure Boot variable.

3.1.5 Boot Settings



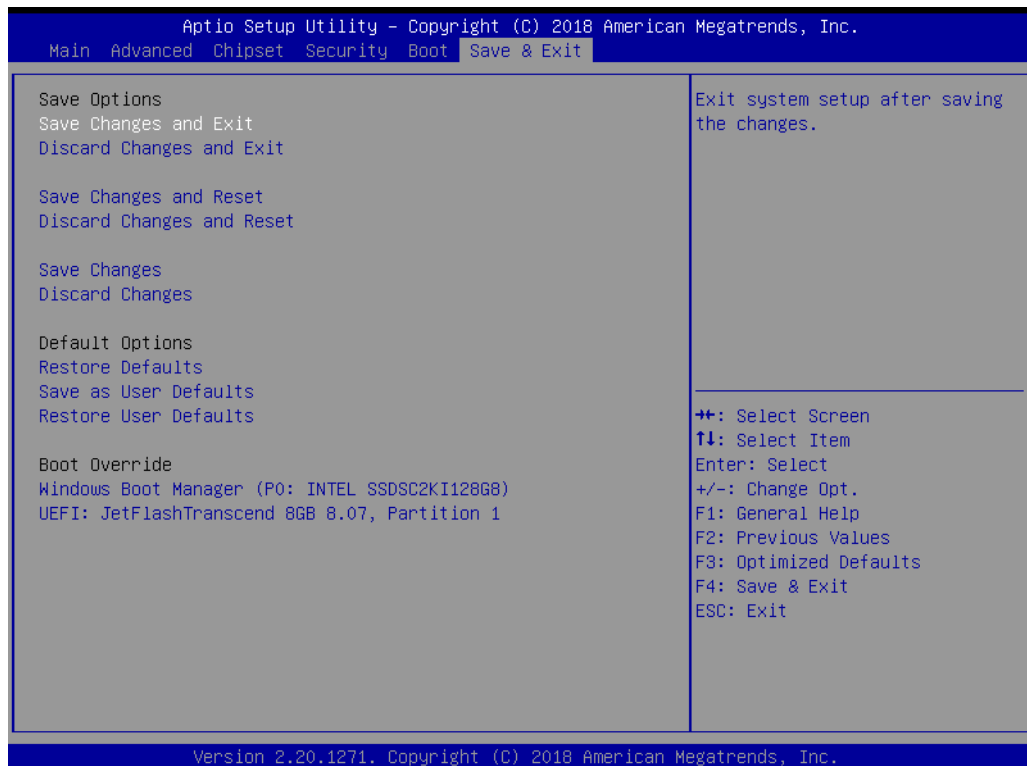
Feature	Options	Description
Boot Configuration		
Setup Prompt Timeout	1~65535	Number of seconds to wait for setup activation key. 65535 (0xFFFF) means indefinite waiting.
Bootup NumLock State	On Off	Select the keyboard Numlock state.
Quiet Boot	Disabled Enabled	Enables or disables Quiet Boot option.
Boot Option Priorities		
Fast Boot	Disabled Enabled	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.
SATA Support (Note)	Last Boot HDD Only All SATA Devices	If Last Boot HDD Only, Only last boot HDD device will be available in Post. If All Sata Devices, all SATA devices will be available in OS and Post.
VGA Support (Note)	Auto EFI Driver	If Auto, only install Legacy OpRom with Legacy OS and logo would NOT be shown during post. Efi driver will still be installed with EFI OS.

USB Support (Note)	Disabled Full Initial Partial Initial	If Disabled, all USB devices will NOT be available until after OS boot. If Partial Initial, USB Mass Storage and specific USB port/device will NOT be available before OS boot. If Enabled, all USB devices will be available in OS and Post.
PS2 Devices Support (Note)	Disabled Enabled	If Disabled, PS2 devices will be skipped.
Network Stack Driver Support (Note)	Disabled Enabled	If Disabled, NetWork Stack Driver will be skipped.
Redirection Support (Note)	Disabled Enabled	If disable, Redirection function will be disabled.

Note! These items will be hidden when "Fast Boot" is disabled.



3.1.6 Save & Exit



Feature	Options	Description
Save Options		
Save Changes and Exit	Yes	Exit system setup after saving the changes.
	No	
Discard Changes and Exit	Yes	Exit system setup without saving any changes.
	No	
Save Changes and Reset	Yes	Reset the system after saving the changes.
	No	
Discard Changes and Reset	Yes	Reset system setup without saving any changes.
	No	
Save Changes	Yes	Save Changes done so far to any of the setup options.
	No	
Discard Changes	Yes	Discard changes done so far to any of the setup options.
	No	
Default Options		
Restore Defaults	Yes	Restore/Load Default values for all the setup options.
	No	
Save as User Defaults	Yes	Save the changes done so far as User Defaults.
	No	
Restore User Defaults	Yes	Restore the User Defaults to all the setup options.
	No	

Chapter 4

S/W Introduction & Installation

- S/W Introduction
- Driver Installation
- Advantech iManager

4.1 S/W Introduction

The mission of Advantech Embedded Software Services is to "enhance quality of life with Advantech platforms and Microsoft Windows Embedded technology." We enable Windows Embedded software products on Advantech platforms to more effectively support the embedded computing community. Customers are freed from the hassle of dealing with multiple vendors (hardware suppliers, system integrators, embedded OS distributors) for projects. Our goal is to make Windows Embedded software solutions easily and widely available to the embedded computing community.

4.2 Driver Installation

The Intel® Chipset Software Installation (CSI) utility installs the Windows INF files that outline to the operating system to which chipset components will be configured.

4.2.1 Windows Driver Setup

To install the drivers on a Windows-based operating system, please connect to the Internet, go to the website: <http://support.advantech.com.tw>, download the drivers you want to install, and follow Driver Setup instructions to complete the installation process.

4.2.2 Other OS

SOM-5899Refresh supports Linux:

Ubuntu-17.10.1-desktop (4.13.0-21)

Fedora 27 Workstation (4.13.9-300)

4.3 Advantech iManager

Advantech platforms come equipped with iManager, a micro controller that provides embedded features for system integrators. Embedded features have been moved from the OS/BIOS level to the board level to increase reliability and simplify integration. iManager works whether the operating system is running or not. It can count the boot times and running hours of a device, monitor device health, and provide an advanced watchdog to handle errors as they happen. iManager also comes with a secure and encrypted EEPROM for storing important security keys or other customer defined information. All the embedded functions are configured through API and provide corresponding utilities. These APIs comply with PICMG EAPI (Embedded Application Programmable Interface) specifications and unify in the same structures. Embedded features easily integrate, speed up the development schedule, and provide the customer's with software continuity while upgrading hardware. For more details regarding how to use the APIs and utilities, please refer to the Advantech iManager 2.0 software API User Manual.

Control



GPIO

General Purpose Input/Output is a flexible parallel interface that allows a variety of custom connections. It allows users to monitor the level of signal input or set the output status to switch on/off a device. Our API also provides Programmable GPIO, which allows developers to dynamically set the GPIO input or output status.



SMBus

SMBus is the System Management Bus defined by Intel® Corporation in 1995. It is used in personal computers and servers for low-speed system management communications. The SMBus API allows a developer to interface a embedded system environment and transfer serial messages using the SMBus protocols, allowing multiple simultaneous device control.



I2C

I2C is a bi-directional two wire bus that was developed by Philips for use in their televisions in the 1980s. The I2C API allows a developer to interface with an embedded system environment and transfer serial messages using the I2C protocols, allowing multiple simultaneous device control.

Display



Brightness Control

The Brightness Control API allows a developer to interface with an embedded device to easily control brightness.



Backlight

The Backlight API allows a developer to control the backlight (screen) on/off in an embedded device.

Monitor



Watchdog

A watchdog timer (WDT) is a device that performs a specific operation after a certain period of time if something goes wrong and the system does not recover on its own. A watchdog timer can be programmed to perform a warm boot (restarting the system) after a certain number of seconds.



Hardware Monitor

The Hardware Monitor (HWM) API is a system health supervision API that inspects certain condition indexes, such as fan speed, temperature and voltage.



Hardware Control

The Hardware Control API allows developers to set the PWM (Pulse Width Modulation) value to adjust fan speed or other devices; it can also be used to adjust the LCD brightness.

Power Saving



CPU Speed

Make use of Intel SpeedStep technology to reduce power consumption. The system will automatically adjust the CPU Speed depending on system loading.



System Throttling

Refers to a series of methods for reducing power consumption in computers by lowering the clock frequency. These APIs allow the user to lower the clock from 87.5% to 12.5%.

Appendix **A**

Pin Assignment

This appendix details the hardware pin assignment of the SOM-5899Refresh CPU System on Module

Sections include:

- SOM-5899Refresh Type 6 Pin Assignment

A.1 SOM-5899Refresh Type 6 Pin Assignment

This section details SOM-5899Refresh pin assignment for the COM Express connector, which is compatible with COM R.0 R3.0 Type 6 pin-out definitions. For further details on how to use these pins or for design reference, please contact Advantech for the design guide, checklist, reference schematic, and other hardware/software support.

SOM-5899Refresh Row A,B			
A1	GND (FIXED)	B1	GND (FIXED)
A2	GBE0_MDI3-	B2	GBE0_ACT#
A3	GBE0_MDI3+	B3	LPC_FRAME#
A4	GBE0_LINK100#	B4	LPC_AD0
A5	GBE0_LINK1000#	B5	LPC_AD1
A6	GBE0_MDI2-	B6	LPC_AD2
A7	GBE0_MDI2+	B7	LPC_AD3
A8	GBE0_LINK#	B8	N/A
A9	GBE0_MDI1-	B9	N/A
A10	GBE0_MDI1+	B10	LPC_CLK
A11	GND (FIXED)	B11	GND (FIXED)
A12	GBE0_MDI0-	B12	PWRBTN#
A13	GBE0_MDI0+	B13	SMB_CK
A14	N/A	B14	SMB_DAT
A15	SUS_S3#	B15	SMB_ALERT#
A16	SATA0_TX+	B16	SATA1_TX+
A17	SATA0_TX-	B17	SATA1_TX-
A18	SUS_S4#	B18	SUS_STAT#
A19	SATA0_RX+	B19	SATA1_RX+
A20	SATA0_RX-	B20	SATA1_RX-
A21	GND (FIXED)	B21	GND (FIXED)
A22	SATA2_TX+	B22	SATA3_TX+
A23	SATA2_TX-	B23	SATA3_TX-
A24	SUS_S5#	B24	PWR_OK
A25	SATA2_RX+	B25	SATA3_RX+
A26	SATA2_RX-	B26	SATA3_RX-
A27	BATLOW#	B27	WDT
A28	(S)ATA_ACT#	B28	N/A
A29	HDA_SYNC	B29	HDA_SDIN1
A30	HDA_RST#	B30	HDA_SDIN0
A31	GND (FIXED)	B31	GND (FIXED)
A32	HDA_BITCLK	B32	SPKR
A33	HDA_SDOUT	B33	I2C_CK
A34	BIOS_DIS0#	B34	I2C_DAT
A35	THRMTRIP#	B35	THRM#
A36	USB6-	B36	USB7-
A37	USB6+	B37	USB7+
A38	USB_6_7_OC#	B38	USB_4_5_OC#
A39	USB4-	B39	USB5-

A40	USB4+	B40	USB5+
A41	GND (FIXED)	B41	GND (FIXED)
A42	USB2-	B42	USB3-
A43	USB2+	B43	USB3+
A44	USB_2_3_OC#	B44	USB_0_1_OC#
A45	USB0-	B45	USB1-
A46	USB0+	B46	USB1+
A47	VCC_RTC	B47	N/A
A48	RSVD	B48	USB_HOST_PRSENT
A49	N/A	B49	SYS_RESET#
A50	LPC_SERIRQ	B50	CB_RESET#
A51	GND (FIXED)	B51	GND (FIXED)
A52	PCIE_TX5+	B52	PCIE_RX5+
A53	PCIE_TX5-	B53	PCIE_RX5-
A54	GPI0	B54	GPO1
A55	PCIE_TX4+	B55	PCIE_RX4+
A56	PCIE_TX4-	B56	PCIE_RX4-
A57	GND	B57	GPO2
A58	PCIE_TX3+	B58	PCIE_RX3+
A59	PCIE_TX3-	B59	PCIE_RX3-
A60	GND (FIXED)	B60	GND (FIXED)
A61	PCIE_TX2+	B61	PCIE_RX2+
A62	PCIE_TX2-	B62	PCIE_RX2-
A63	GPI1	B63	GPO3
A64	PCIE_TX1+	B64	PCIE_RX1+
A65	PCIE_TX1-	B65	PCIE_RX1-
A66	GND	B66	WAKE0#
A67	GPI2	B67	WAKE1#
A68	PCIE_TX0+	B68	PCIE_RX0+
A69	PCIE_TX0-	B69	PCIE_RX0-
A70	GND (FIXED)	B70	GND (FIXED)
A71	LVDS_A0+	B71	LVDS_B0+
A72	LVDS_A0-	B72	LVDS_B0-
A73	LVDS_A1+	B73	LVDS_B1+
A74	LVDS_A1-	B74	LVDS_B1-
A75	LVDS_A2+	B75	LVDS_B2+
A76	LVDS_A2-	B76	LVDS_B2-
A77	LVDS_VDD_EN	B77	LVDS_B3+
A78	LVDS_A3+	B78	LVDS_B3-
A79	LVDS_A3-	B79	LVDS_BKLT_EN
A80	GND (FIXED)	B80	GND (FIXED)
A81	LVDS_A_CK+	B81	LVDS_B_CK+
A82	LVDS_A_CK-	B82	LVDS_B_CK-
A83	LVDS_I2C_CK	B83	LVDS_BKLT_CTRL
A84	LVDS_I2C_DAT	B84	VCC_5V_SBY
A85	GPI3	B85	VCC_5V_SBY
A86	N/A (Note 1)	B86	VCC_5V_SBY
A87	eDP_HPD	B87	VCC_5V_SBY

A88	PCIE_CLK_REF+	B88	BIOS_DIS1#
A89	PCIE_CLK_REF-	B89	VGA_RED
A90	GND (FIXED)	B90	GND (FIXED)
A91	SPI_POWER	B91	VGA_GRN
A92	SPI_MISO	B92	VGA_BLU
A93	GPO0	B93	VGA_HSYNC
A94	SPI_CLK	B94	VGA_VSYNC
A95	SPI_MOSI	B95	VGA_I2C_CK
A96	TPM_PP	B96	VGA_I2C_DAT
A97	N/A	B97	SPI_CS#
A98	SER0_TX	B98	N/A
A99	SER0_RX	B99	N/A
A100	GND (FIXED)	B100	GND (FIXED)
A101	SER1_TX	B101	FAN_PWMOUT
A102	SER1_RX	B102	FAN_TACHIN
A103	LID#	B103	SLEEP#
A104	VCC_12V	B104	VCC_12V
A105	VCC_12V	B105	VCC_12V
A106	VCC_12V	B106	VCC_12V
A107	VCC_12V	B107	VCC_12V
A108	VCC_12V	B108	VCC_12V
A109	VCC_12V	B109	VCC_12V
A110	GND (FIXED)	B110	GND (FIXED)

SOM-5899Refresh Row C,D

C1	GND (FIXED)	D1	GND (FIXED)
C2	GND	D2	GND
C3	USB_SSRX0-	D3	USB_SSTX0-
C4	USB_SSRX0+	D4	USB_SSTX0+
C5	GND	D5	GND
C6	USB_SSRX1-	D6	USB_SSTX1-
C7	USB_SSRX1+	D7	USB_SSTX1+
C8	GND	D8	GND
C9	USB_SSRX2-	D9	USB_SSTX2-
C10	USB_SSRX2+	D10	USB_SSTX2+
C11	GND (FIXED)	D11	GND (FIXED)
C12	USB_SSRX3-	D12	USB_SSTX3-
C13	USB_SSRX3+	D13	USB_SSTX3+
C14	GND	D14	GND
C15	N/A	D15	DDI1_CTRLCLK_AUX+
C16	N/A	D16	DDI1_CTRLDATA_AUX-
C17	N/A	D17	N/A
C18	N/A	D18	N/A
C19	PCIE_RX6+	D19	PCIE_TX6+
C20	PCIE_RX6-	D20	PCIE_TX6-
C21	GND (FIXED)	D21	GND (FIXED)
C22	PCIE_RX7+	D22	PCIE_TX7+
C23	PCIE_RX7-	D23	PCIE_TX7-
C24	DDI1_HPD	D24	N/A

C25	N/A	D25	N/A
C26	N/A	D26	DDI1_PAIR0+
C27	N/A	D27	DDI1_PAIR0-
C28	N/A	D28	N/A
C29	N/A	D29	DDI1_PAIR1+
C30	N/A	D30	DDI1_PAIR1-
C31	GND (FIXED)	D31	GND (FIXED)
C32	DDI2_CTRLCLK_AUX+	D32	DDI1_PAIR2+
C33	DDI2_CTRLCLK_AUX-	D33	DDI1_PAIR2-
C34	DDI2_DDC_AUX_SEL	D34	DDI1_DDC_AUX_SEL
C35	N/A	D35	N/A
C36	DDI3_CTRLCLK_AUX+	D36	DDI1_PAIR3+
C37	DDI3_CTRLCLK_AUX-	D37	DDI1_PAIR3-
C38	DDI3_DDC_AUX_SEL	D38	N/A
C39	DDI3_PAIR0+	D39	DDI2_PAIR0+
C40	DDI3_PAIR0-	D40	DDI2_PAIR0-
C41	GND (FIXED)	D41	GND (FIXED)
C42	DDI3_PAIR1+	D42	DDI2_PAIR1+
C43	DDI3_PAIR1-	D43	DDI2_PAIR1-
C44	DDI3_HPD	D44	DDI2_HPD
C45	N/A	D45	N/A
C46	DDI3_PAIR2+	D46	DDI2_PAIR2+
C47	DDI3_PAIR2-	D47	DDI2_PAIR2-
C48	N/A	D48	N/A
C49	DDI3_PAIR3+	D49	DDI2_PAIR3+
C50	DDI3_PAIR3-	D50	DDI2_PAIR3-
C51	GND (FIXED)	D51	GND (FIXED)
C52	PEG_RX0+	D52	PEG_TX0+
C53	PEG_RX0-	D53	PEG_TX0-
C54	N/A	D54	PEG_LANE_RV#
C55	PEG_RX1+	D55	PEG_TX1+
C56	PEG_RX1-	D56	PEG_TX1-
C57	N/A	D57	TYPE2# (GND)
C58	PEG_RX2+	D58	PEG_TX2+
C59	PEG_RX2-	D59	PEG_TX2-
C60	GND (FIXED)	D60	GND (FIXED)
C61	PEG_RX3+	D61	PEG_TX3+
C62	PEG_RX3-	D62	PEG_TX3-
C63	N/A	D63	N/A
C64	N/A	D64	N/A
C65	PEG_RX4+	D65	PEG_TX4+
C66	PEG_RX4-	D66	PEG_TX4-
C67	RAPID_SHUTDOWN	D67	GND
C68	PEG_RX5+	D68	PEG_TX5+
C69	PEG_RX5-	D69	PEG_TX5-
C70	GND (FIXED)	D70	GND (FIXED)
C71	PEG_RX6+	D71	PEG_TX6+
C72	PEG_RX6-	D72	PEG_TX6-

C73	GND	D73	GND
C74	PEG_RX7+	D74	PEG_TX7+
C75	PEG_RX7-	D75	PEG_TX7-
C76	GND	D76	GND
C77	N/A	D77	N/A
C78	PEG_RX8+	D78	PEG_TX8+
C79	PEG_RX8-	D79	PEG_TX8-
C80	GND (FIXED)	D80	GND (FIXED)
C81	PEG_RX9+	D81	PEG_TX9+
C82	PEG_RX9-	D82	PEG_TX9-
C83	N/A	D83	N/A
C84	GND	D84	GND
C85	PEG_RX10+	D85	PEG_TX10+
C86	PEG_RX10-	D86	PEG_TX10-
C87	GND	D87	GND
C88	PEG_RX11+	D88	PEG_TX11+
C89	PEG_RX11-	D89	PEG_TX11-
C90	GND (FIXED)	D90	GND (FIXED)
C91	PEG_RX12+	D91	PEG_TX12+
C92	PEG_RX12-	D92	PEG_TX12-
C93	GND	D93	GND
C94	PEG_RX13+	D94	PEG_TX13+
C95	PEG_RX13-	D95	PEG_TX13-
C96	GND	D96	GND
C97	N/A	D97	RSVD
C98	PEG_RX14+	D98	PEG_TX14+
C99	PEG_RX14-	D99	PEG_TX14-
C100	GND (FIXED)	D100	GND (FIXED)
C101	PEG_RX15+	D101	PEG_TX15+
C102	PEG_RX15-	D102	PEG_TX15-
C103	GND	D103	GND
C104	VCC_12V	D104	VCC_12V
C105	VCC_12V	D105	VCC_12V
C106	VCC_12V	D106	VCC_12V
C107	VCC_12V	D107	VCC_12V
C108	VCC_12V	D108	VCC_12V
C109	VCC_12V	D109	VCC_12V
C110	GND (FIXED)	D110	GND (FIXED)

Appendix **B**

Watchdog Timer

This appendix details information on the watchdog timer programming for the SOM-5899Refresh CPU System on Module

Sections include:

- Watchdog Timer Programming

B.1 Programming the Watchdog Timer

Trigger Event	Note
IRQ	(BIOS setting default disable)**
NMI	N/A
SCI	Power button event
Power Off	Support
H/W Restart	Support
WDT Pin Activate	Support

** WDT new driver support automatically selects an available IRQ number from BIOS, and then sets to EC. Only Windows 8.1 and 10 support it.

Other OS use the IRQ number from BIOS setting as usual.

For details, please refer to the iManager and the Software API User Manual.

Appendix **C**

Programming GPIO

This Appendix illustrates the General Purpose Input and Output pin settings.

Sections include:

- System I/O ports

C.1 GPIO Register

GPIO Byte Mapping	H/W Pin Name
BIT0	GPO0
BIT1	GPO1
BIT2	GPO2
BIT3	GPO3
BIT4	GPI0
BIT5	GPI1
BIT6	GPI2
BIT7	GPI3

For details, please refer to the iManager and Software API User Manual.

Appendix **D**

System Assignments

This appendix details information about system resource allocation on the SOM-5899Refresh CPU System on Module

Sections include:

- System I/O ports
- DMA Channel Assignments
- Interrupt Assignments
- 1st MB Memory Map

D.1 System I/O Ports

Table D.1: System I/O ports

Addr.Range(Hex)	Device
0000-0CF7	PCI Express root complex
0020-0021	Programmable interrupt controller
0024-0025	Programmable interrupt controller
0028-0029	Programmable interrupt controller
002C-002D	Programmable interrupt controller
002E-002F	Motherboard resources
0030-0031	Programmable interrupt controller
0034-0035	Programmable interrupt controller
0038-0039	Programmable interrupt controller
003C-003D	Programmable interrupt controller
0040-0043	System timer
004E-004F	Motherboard resources
0050-0053	System timer
0060-0060	Standard PS/2 keyboard
0061-0061	Motherboard resources
0062-0062	Microsoft ACPI compliant embedded controller
0063-0063	Motherboard resources
0065-0065	Motherboard resources
0066-0066	Microsoft ACPI compliant embedded controller
0067-0067	Motherboard resources
0070-0070	Motherboard resources
0070-0077	System CMOS/real time clock
0080-0080	Motherboard resources
0092-0092	Motherboard resources
00A0-00A1	Programmable interrupt controller
00A4-00A5	Programmable interrupt controller
00A8-00A9	Programmable interrupt controller
00AC-00AD	Programmable interrupt controller
00B0-00B1	Programmable interrupt controller
00B2-00B3	Motherboard resources
00B4-00B5	Programmable interrupt controller
00B8-00B9	Programmable interrupt controller
00BC-00BD	Programmable interrupt controller
00F0-00F0	Numeric data processor
0200-027F	Motherboard resources
0280-028F	Motherboard resources
0290-029F	Motherboard resources
0299-029A	Motherboard resources
029E-02AD	Motherboard resources
02A0-02BF	Motherboard resources
02C0-02DF	Motherboard resources
02F0-02F7	Motherboard resources
02F8-02FF	Communications port (COM2)

Table D.1: System I/O ports

0300-037F	Motherboard resources
03F8-03FF	Communications port (COM1)
04D0-04D1	Programmable interrupt controller
0680-069F	Motherboard resources
0D00-FFFF	PCI Express Root Complex
164E-164F	Motherboard resources
1800-18FE	Motherboard resources
1854-1857	Motherboard resources
2000-20FE	Motherboard resources
3000-303F	Intel® UHD Graphics 630
3060-307F	Standard SATA AHCI controller
3080-3083	Standard SATA AHCI controller
3090-3097	Standard SATA AHCI controller
EFA0-EFBF	Intel® SMBus - A323
FFF8-FFFF	Intel® Active Management Technology - SOL (COM3)

D.2 Interrupt Assignments

Table D.2: Interrupt Assignments

Interrupt#	Interrupt Source
IRQ 0	System timer
IRQ 3	Communications port (COM2)
IRQ 4	Communications port (COM1)
IRQ 6	Motherboard resources
IRQ 8	System CMOS/real time clock
IRQ 13	Numeric data processor
IRQ 14	Intel® Serial IO GPIO host controller - INT3450
IRQ 54~511	Microsoft ACPI-Compliant System
IRQ 11	Intel® SMBus - A323
IRQ 11	Intel® Thermal subsystem - A379
IRQ 16	High definition audio controller
IRQ 19	Intel SD Host controller
IRQ 19	Intel® Active Management Technology - SOL (COM3)
IRQ 1024	Intel SD Host controller
IRQ 0xFFFFFFFF (-6)	Intel® Ethernet connection (7) I219-LM
IRQ 0xFFFFFFFF (-5)	Intel® Management Engine Interface
IRQ 0xFFFFFFFF (-4)	Intel® USB 3.1 eXtensible Host controller - 1.10 (Microsoft)
IRQ 0xFFFFFFFF (-3)	Intel® UHD Graphics 630
IRQ 0xFFFFFFFF (-2)	Standard SATA AHCI controller

D.3 1st MB Memory Map

Table D.3: 1st MB Memory Map

Addr. Range (Hex)	Device
0x000A0000-0x000BFFFF	PCI Express Root Complex
0x90000000-0x9FFFFFFF	Intel® UHD Graphics 630
0x90000000-0xDFFFFFFF	PCI Express Root Complex
0xA0000000-0xA0FFFFFF	Intel® UHD Graphics 630
0xA1000000-0xA10FFFFF	High Definition Audio Controller
0xA1100000-0xA111FFFF	Intel® Ethernet Connection (7) I219-LM
0xA1120000-0xA112FFFF	Intel® USB 3.1 eXtensible Host controller - 1.10 (Microsoft)
0xA1130000-0xA1133FFF	High Definition Audio controller
0xA1134000-0xA1135FFF	Standard SATA AHCI controller
0xA1138000-0xA11380FF	Intel® SMBus - A323
0xA1139000-0xA11397FF	Standard SATA AHCI controller
0xA113A000-0xA113A0FF	Standard SATA AHCI controller
0xA113D000-0xA113DFFF	Intel® SD Host controller
0xA113F000-0xA113FFFF	Intel® Thermal Subsystem - A379
0xE0000000-0xEFFFFFFF	Motherboard resources
0xFC800000-0xFE7FFFFF	PCI Express Root Complex
0xFD000000-0xFD69FFFF	Motherboard resources
0xFD6A0000-0xFD6AFFFF	Intel® Serial I/O GPIO Host controller - INT3450
0xFD6B0000-0xFD6BFFFF	Intel® Serial I/O GPIO Host controller - INT3450
0xFD6C0000-0xFD6CFFFF	Motherboard resources
0xFD6D0000-0xFD6DFFFF	Intel® Serial I/O GPIO Host controller - INT3450
0xFD6E0000-0xFD6EFFFF	Intel® Serial I/O GPIO Host controller - INT3450
0xFD6F0000-0xFD6FFFFF	Motherboard resources
0xFE000000-0xFE01FFFF	Motherboard resources

Table D.3: 1st MB Memory Map	
0xFE010000- 0xFE010FFF	Intel® SPI (flash) Controller - A324
0xFE1FE000- 0xFE1FEFFF	Intel® Management Engine Interface
0xFE1FF000- 0xFE1FFFFF	Intel® Active Management Technology - SOL (COM3)
0xFE200000- 0xFE7FFFFFFF	Motherboard resources
0xFED00000- 0xFED003FF	High precision event timer
0xFED10000- 0xFED17FFF	Motherboard resources
0xFED18000- 0xFED18FFF	Motherboard resources
0xFED19000- 0xFED19FFF	Motherboard resources
0xFED20000- 0xFED3FFFF	Motherboard resources
0xFED45000- 0xFED8FFFF	Motherboard resources
0xFED90000- 0xFED93FFF	Motherboard resources
0xFEE00000- 0xFEEFFFFFFF	Motherboard resources
0xFF000000- 0xFFFFFFFF	Motherboard resources

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