

User Manual

ARK-1551

Fanless Embedded Box PC

Attention!

This product contains a hard copy of the Chinese user manual for China CCC certification purposes. A PDF of the English user manual is included on the accompanying CD. Please disregard the hard copy of the Chinese user manual if the product is not sold and/or installed in China.

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https://www.advantech.com/products/fanless-embedded-computers/sub_1-2jkeuf

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<http://support.advantech.com.tw/support/>

Product Warranty (2 Years)

Advantech warrants the original purchaser that all of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products that have been repaired or altered by persons other than repair personnel authorized by Advantech, or products that have been subject to misuse, abuse, accident, or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced free of charge during the warranty period. For out-of-warranty repairs, customers are billed according to the cost of replacement materials, service time, and freight. Please consult your dealer for more details.

If you believe that your product is defective, follow the steps outlined below:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software, etc.) Note anything abnormal and list any onscreen messages displayed 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 a return merchandise authorization (RMA) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a completed Repair and Replacement Order Card, and a proof of purchase date (such as a photocopy of your sales receipt) into a shippable container. Products returned without a proof of purchase date are not eligible for warranty service.
5. Write the RMA number clearly on the outside of the package, and ship the package prepaid to your dealer.

Declaration of Conformity

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 residential installations. 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, users are 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 your dealer or an experienced radio/TV technician for help

Technical Support and Assistance

1. Visit the Advantech website at www.advantech.com/support to obtain the latest product information.
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 calling:
 - 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 that if not observed can cause personal injury!*



Caution! *Cautions are included to help prevent hardware damage and data losses.*



Note! *Notes provide additional optional information.*



Safety Instructions

1. Read these safety instructions carefully.
2. Retain this user manual for future reference.
3. Disconnect the equipment from all AC outlets before cleaning. Use only a damp cloth for cleaning. Do not use liquid or sprayed detergent.
4. For pluggable equipment, the power outlet should be near the equipment and easily accessible.
5. Protect the equipment from humidity.
6. Place the equipment on a reliable surface during installation. Dropping or letting the equipment fall may cause damage.
7. The openings on the enclosure are for air convection and protect the equipment from overheating. Do not cover the openings.
8. The power outlet sockets should have grounded connections.
9. Position the power cord away from high-traffic areas. 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 the equipment from the power source to avoid damage from transient over-voltage.
12. Never pour liquid into an opening as this can cause fire or electrical shock.
13. Never open the equipment. For safety reasons, only qualified service personnel should open the equipment.
14. If one of the following occurs, have 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 is malfunctioning or does not operate according to the user manual.
 - The equipment has been dropped and damaged.
 - The equipment shows obvious signs of breakage.
15. Do not leave the equipment in an environment with a storage temperature of below -40 °C (-40 °F) or above 85 °C (185 °F) as this may cause damage. The equipment should be stored in a controlled environment.
16. Any unverified component may cause unexpected damage. To ensure correct installation, always use the components (e.g., screws) provided in the accessory box.
17. **CAUTION:** The equipment is equipped with a battery-powered real-time clock circuit. There is a risk of explosion if a battery is incorrectly replaced. Replace only with same or equivalent type as recommended by the manufacturer. Discard all used batteries according to the manufacturer's instructions.
18. Always disconnect the power cord from the chassis before manually handling the hardware. Do not implement connections or configuration changes while the device is powered on. Sudden power surges may damage sensitive electronic components.
19. In accordance with IEC 704-1:1982 specifications, the sound pressure level at the operator's position does not exceed 70 dB (A).
20. The equipment should only be installed in a restricted access area.
21. **DISCLAIMER:** These instructions are provided according to IEC 704-1 specifications. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

22. ARK-1551 is intended to be powered by a UL Listed dc source suitable for use at Tma 55 °C/ 131 °F minimum. ARK 1551's output is rated 12-24V_{DC}, 7.5-3.75A min., ES1. If further assistance is needed, please contact Advantech for more information.

Consignes de Sécurité

1. Veuillez lire attentivement ces instructions de sécurité.
2. Veuillez conserver ce manuel de l'utilisateur pour référence ultérieure.
3. Veuillez débrancher cet équipement de la prise secteur avant le nettoyage. Utilisez un chiffon humide. Ne pas utiliser de détergent liquide ou pulvérisé pour le nettoyage. Utilisez une feuille ou un chiffon humide pour le nettoyage.
4. Pour les équipements enfichables, la prise de courant doit être à proximité de l'équipement et doit être facilement accessible.
5. S'il vous plaît garder cet équipement de l'humidité.
6. Posez cet équipement sur une surface fiable lors de l'installation. Une chute ou une chute pourrait causer des blessures.
7. Les ouvertures sur le boîtier sont destinées à la convection d'air, protégeant ainsi l'équipement de la surchauffe. **NE COUVREZ PAS LES OUVERTURES.**
8. La prise de courant doit avoir une connexion mise à la terre.
9. Placez le cordon d'alimentation de sorte que personne ne puisse marcher dessus. Ne placez rien sur le cordon d'alimentation.
10. Tous les avertissements et mises en garde sur l'équipement doivent être notés.
11. Si l'appareil n'est pas utilisé pendant une longue période, débranchez-le du secteur pour ne pas être endommagé par une surtension transitoire.
12. Ne jamais verser de liquide dans les ouvertures de ventilation; Cela pourrait provoquer un incendie ou un choc électrique.
13. N'ouvrez jamais l'équipement. Pour des raisons de sécurité, seul le personnel de maintenance qualifié doit ouvrir l'équipement.
14. Si l'une des situations suivantes se présente, faites vérifier le matériel par le personnel de service:
 - Le cordon d'alimentation ou la fiche est endommagé.
 - Un liquide a pénétré dans l'appareil.
 - L'équipement a été exposé à l'humidité.
 - L'équipement ne fonctionne pas bien ou vous ne pouvez pas le faire fonctionner conformément au manuel d'utilisation.
 - Equipment L'équipement est tombé et a été endommagé.
 - Equipment L'équipement présente des signes évidents de rupture.
15. Ne laissez pas cet équipement dans un environnement où la température de stockage peut être inférieure à -40 °C (-40 °F) ou supérieure à 85 °C (185 °F). Cela pourrait endommager l'équipement. L'équipement doit être dans un environnement contrôlé.
16. Tout composant non vérifié peut causer des dommages inattendus. Pour garantir une installation correcte, veuillez toujours utiliser les composants (ex. Vis) fournis avec la boîte d'accessoires.
17. **ATTENTION:** L'ordinateur est équipé d'un circuit d'horloge temps réel alimenté par batterie. Il y a un risque d'explosion si la batterie est remplacée de manière incorrecte. Remplacez uniquement avec le même type ou un type équivalent recommandé par le fabricant. Jetez les piles usagées conformément aux instructions du fabricant.
18. Débranchez toujours complètement le cordon d'alimentation de votre châssis lorsque vous utilisez du matériel. Ne faites pas de connexion quand l'appareil

est sous tension. Les composants électroniques sensibles peuvent être endommagés par des surtensions soudaines.

19. Niveau de pression acoustique au poste de l'opérateur selon la norme CEI 704-1: 1982 n'est pas supérieur à 70 dB (A).
20. L'équipement ne doit être installé que dans une zone d'accès restreint.
21. AVERTISSEMENT: Cet ensemble d'instructions est donné conformément à la norme CEI 704-1. Advantech décline toute responsabilité quant à l'exactitude des déclarations contenues dans ce.
22. Pour les modèles ARK-1551 est destiné à être alimenté par Source cc répertoriée UL à courant continu adaptée à une utilisation à Tma 55 degrés C min. et la sortie est nominale 12-24 Vdc, 7,5-3,75 A min., ES1, si vous avez besoin d'une assistance supplémentaire, veuillez contacter Advantech pour plus d'informations.

Packing List

Before installation, check that the following items were included with the product:

- 1 x ARK-1551 unit
- 1 x 2-pin terminal block
- 1 x 3-pin terminal block
- 1 x 2 years warranty card
- 1 x wall mount kit
- 1 x China RoHS
- 1 x Chinese user manual

Ordering Information

Model Number	Description
ARK-1551-S6A1	ARK-1551 Intel® i5-8365UE, VGA+HDMI, 4 x USB, 4 x COM, and TPM, 12-24V _{DC} In
ARK-1551-U0A1	ARK-1551 Intel® Celeron 4305UE, VGA+HDMI, 4 x USB, 4 x COM, TPM, and 12-24V _{DC} In

Optional Accessories

Part Number	Description
XARK-ADP-90MDH	AC to DC adapter, 19V/90W
96PSA-A120W24T2-3	AC to DC adapter, 24V/120W
1700001524	Power Cable 3-pin 180 cm (70.8 in), USA type (for XARK-ADP-90MDH)
170203183C	Power Cable 3-pin 180 cm (70.8 in), Europe type (for XARK-ADP-90MDH)
170203180A	Power Cable 3-pin 180 cm (70.8 in), UK type (for XARK-ADP-90MDH)
1700008921	Power Cable 3-pin PSE Mark 183 cm (72 in) (for XARK-ADP-90MDH)
1702002600	Power cable 3-pin 183 cm (72 in), USA type (for 96PSA-A120W24T2-3)
1702002605	Power cable 3-pin 183 cm (72 in), EU type (for 96PSA-A120W24T2-3)
1702031801	Power cable 3-pin 183 cm (72 in), UK type (for 96PSA-A120W24T2-3)
1700000237	Power cable 3-pin 183 cm (72 in), PSE type (for 96PSA-A120W24T2-3)
1700023855-01	1M lockable HDMI cable
1700023856-01	3M lockable HDMI cable
AMK-V019E	VESA mounting kit
AMK-R005E	DIN-rail mounting kit

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Chapter 1

General Introduction

This chapter details background information on the ARK-1551 series.

1.1 Introduction

ARK-1551 Fanless Embedded Box PC is an application ready system platform solution. Its electronics are protected in a compact sealed aluminum case for easy integration into a specific housing, or as a stand-alone application. ARK-1551 is suitable for applications with limited space in hazardous environments.

High Performance Slim Box PC

ARK-1551, a high performance system powered by Intel® Core™ i5-8365UE / Celeron® 4305UE CPU processor, can be used in different applications according to different computing requirements. ARK-1551 supports dual DDR4 SO-DIMM memory slots. Each memory slot supports up to 2400MHz 16GB. Users can install up to 32GB of memory. Due to its slim form factor, ARK-1551 can be easily integrated with panel/displays within limited spaces.

Rugged and Multi-Function I/O

ARK-1551 provides 12 - 24VDC input for industrial equipment integration. ARK-1551 offers 3 Grm vibration resistance and 30 G shock resistance. ARK-1551 in broad temperature ranges -20 ~ 55 °C (-4 ~ 131 °F), making it an excellent choice for diverse environments.

ARK-1551 features 4 x USB 3.1 Gen 2, 1 x VGA, 1 x HDMI, 4 x COM, 1 x DIO, 2x Intel® GbE LAN. ARK-1551 also provides one full-size miniPCIe slot and 1 M.2 2230 E Key slot for device integration. ARK-1551 supports two independent storage solutions, including one 2.5" removable HDD/SSD bay and one mSATA slot. ARK-1551 also supports Intel® software RAID 0/1 features.

Built-in Intelligent Management Tools - WISE-PaaS/DeviceOn

Advantech's WISE-PaaS/DeviceOn platform provides a valuable suite of programmable APIs, such as a multi-level watchdog, hardware monitor, system restore, and other user-friendly interfaces. With the inclusion of WISE-PaaS/DeviceOn, ARK-1551 can be used for remotely managing, monitoring, configuring, and controlling numerous terminals to ensure easy maintenance and recovery.

1.2 Product Features

1.2.1 General

- **CPU:**
 - Intel® Core™ i5-8365UE QC 1.6 GHz
 - Intel® Celeron® 4305UE DC 2.0 GHz
- **BIOS:** AMI UEFI 256 Mbit
- **System Memory:** 2 x DDR4 2400MHz 260-pin SO-DIMM, up to 32 GB
- **Watchdog Timer:** Single-chip watchdog with 255-level interval timer, setup via software
- **Serial Port:** 4 x RS-232/422/485 with auto flow control, COM3 with 5V/12V power via jumper
- **USB:** USB 3.1 Gen 2
- **Audio:** High-definition (HD) audio, Line Out or Mic In
- **Storage:**
 - 1 x full-size mSATA (shared with full-size PCIe) and 1 x 2.5" SATA SSD (max. height: 7 mm)
- **Expansion Interface:**
 - 1 x full-size mini PCIe with SIM holder
 - 1 x M.2 2230 E key

1.2.2 Display

- **Controller:**
 - Intel® UHD Graphics 620 (Core i5)
 - Intel® UHD Graphics 610 (Core Celeron®)
- **Resolution:**
 - 1 x HDMI 1.4b, up to 4096x2160 @ 30Hz
 - 1 x VGA, up to 1920x1200 @ 60Hz
- **Dual Display:** HDMI + VGA

1.2.3 Ethernet

- **Chipset:**
 - LAN1 Intel® I210
 - LAN2 Intel® I219
- **Speed:** 10/100/1000 Mbps
- **Interface:** 2 x RJ45
- **Standard:** Compliant with IEEE 802.3, IEEE 802.3u, IEEE 802.3x, IEEE 802.3y, IEEE 802.ab.

1.3 Chipset

1.3.1 Functional Specifications

1.3.1.1 Processor

Processor	Intel® Core i5-8365UE QC 1.6 GHz Intel® Celeron® Celeron 4305UE DC 2.0 GHz
Memory	Supports DDR4 2400MHz up to 16GB in each slot 2 x 260-pin SODIMM socket type, up to 32G totally

1.3.1.2 Chipset

Internal Graphics Features	OpenGL 4.5, DirectX 11.3/12, OpenCL 2.1 Display Ports: 1 x HDMI +1 x VGA
Video Accelerator	H/W accelerated video decoding Video decoder: H.264 AVC, H.265 8b/10b, M/JPEG, MPEG2, VC-1, VP8, VP9
SATA Interface	Supports several optional selections of Serial ATA III: Supports mSATA socket (shared with miniPCle)
USB Interface	USB host interface with support for up to 4 x USB 3.1 Gen2 ports All ports are High-Speed, Full-Speed, and Low-Speed capable Supports legacy keyboard/mouse software
BIOS	UEFI 256 Mbit

1.3.1.3 Others

Serial Ports	■ 4 x RS-232/422/485, supports auto-flow control; COM3 supports 5V/12V power COM Connector: D-SUB connector 9P
Ethernet	LAN1 Intel® I210, LAN2 Intel® I219 ■ Compliant with IEEE 802.3, IEEE 802.3u, IEEE 802.3x, IEEE 802.3y, and IEEE 802.ab ■ Supports 10/100/1000 Mbps. LAN Connectors: Phone Jack RJ45 8P 90D(F)
Audio	Audio Codec: Realtek ALC892: ■ Compliant with HD audio specifications ■ Supports 16/20/24-bit DAC and 16/20/24-bit ADC resolution ■ Supports Line Out or Mic In audio Connectors: 1 x Earphone jacks
Battery	■ 1 x 3V/210 mAh battery with wire

1.3.2 WISE-PaaS/DeviceOn

Sequence Control	Supported
Watchdog Timer	Multi-level WDT, programmable 1 ~ 255 sec/min
Hardware Monitor	CPU temperature/input current/input voltage
Power Saving	Deep sleep S5 mode
System Information	Running HR/boot record

1.4 Mechanical Specifications

1.4.1 System Dimensions

L x W x D: 195 x 55 x 140 mm (7.68 x 2.16 x 5.52 in)

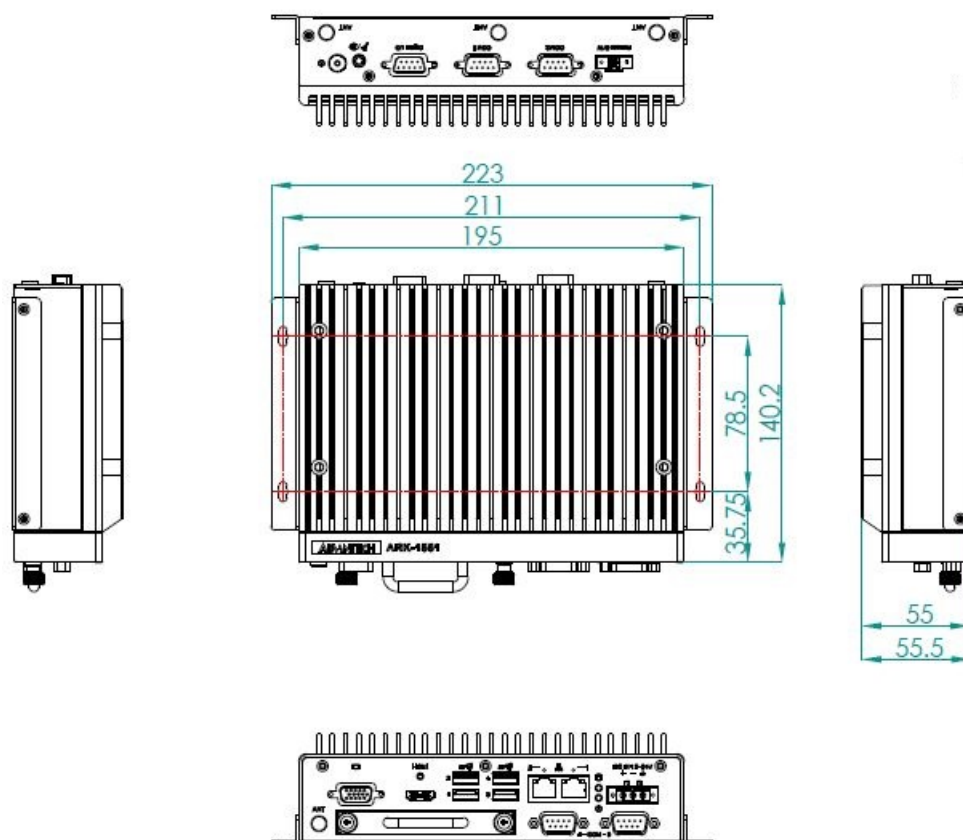


Figure 1.1 ARK-1551 Mechanical Dimensions

1.4.2 Weight

- 1.9 kg (4.19 lb)

1.5 Power Requirements

1.5.1 System Power

- **Minimum Power Input:** 12 ~ 24V_{DC}
- **Optional Adaptor:**
 - 90W @19V/4.74A power adapter (optional)
 - 120W @ 24V/5A power adapter (optional)

1.5.2 RTC Battery

- **Lithium:** 3 V/210 mAH

1.6 Environmental Specifications

1.6.1 Operating Temperature

- With industrial-grade SSD/mSATA: -20 ~ 55 °C (-4 ~ 131 °F), with airflow rate = 0.7 m/sec
- With 2.5-inch hard disk: 0 ~ 40 °C (32 ~ 104 °F), with airflow rate = 0.7 m/sec

1.6.2 Relative Humidity

- 95% @ 40 °C/104 °F (non-condensing)

1.6.3 Storage Temperature

- -40 ~ 85 °C (-40 ~ 185 °F)

1.6.4 Vibration Tolerance

- When the system is equipped with an SSD/mSATA: 3 Grms, IEC 60068-2-64, random, 5 ~ 500 Hz, 1 hr/axis, (x, y, z) 3 axes

1.6.5 Shock Tolerance

- When the system is equipped with an SSD/mSATA: 30 G, IEC 60068-2-27, half sine, 11 ms duration

1.6.6 Safety Certification

- UL, CB, CCC, BSMI

1.6.7 EMC Certification

- CE, FCC, CCC, BSMI

Chapter 2

Hardware Installation

This chapter details instructions for installing ARK-1551 hardware and external I/O.

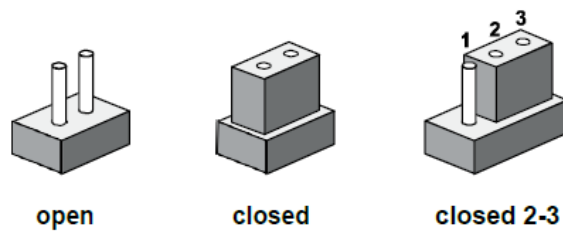
2.1 Introduction

The following sections show the internal jumper settings and the external connector pin assignments.

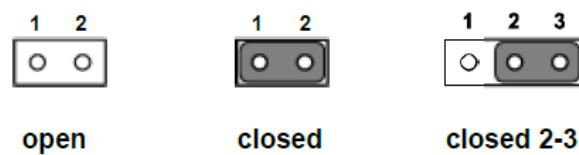
2.2 Jumpers

2.2.1 Jumper Description

ARK-1551 can be configured to satisfy specific application requirements by setting jumpers. A jumper is a metal bridge used to close an electric circuit. It consists of two metal pins and a small metal clip (often protected by a plastic cover) that slides over the pins to connect them. To close a jumper, connect the pins with the clip. To open a jumper, remove the clip. Sometimes a jumper will have three pins, labeled 1, 2, and 3. For these jumpers, connect either pins 1 and 2, or 2 and 3.



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



A pair of needle-nose pliers may be necessary when working with jumpers. Users with concerns regarding the ideal hardware configuration for your application should contact your local distributor or sales representative before making any changes. Generally, only a standard cable is required to make most connections.

2.2.2 Jumper List

Table 2.1: Jumper Settings

J1	ATX/AT mode
J3	COM3 5V/12V Power Mode
SW1	CMOS Clear
SW6	COM 1 RS422/RS485 Fail Safe Mode
SW7	COM 2 RS422/RS485 Fail Safe Mode

2.2.3 Jumper Locations

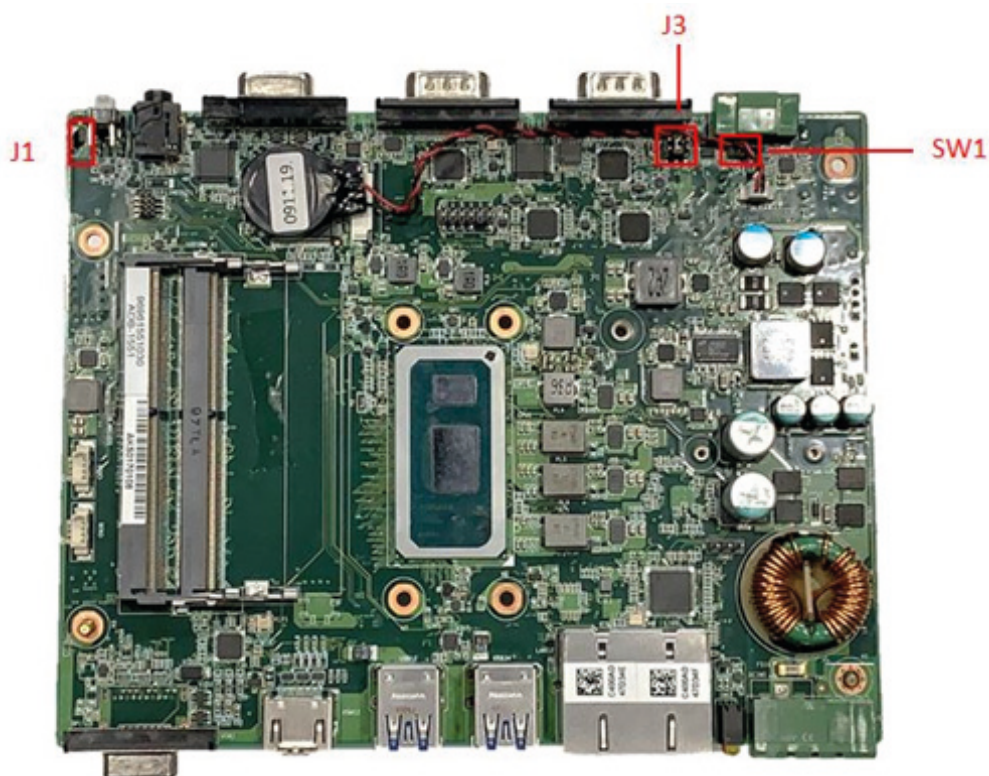


Figure 2.1 Jumper Location (Top)

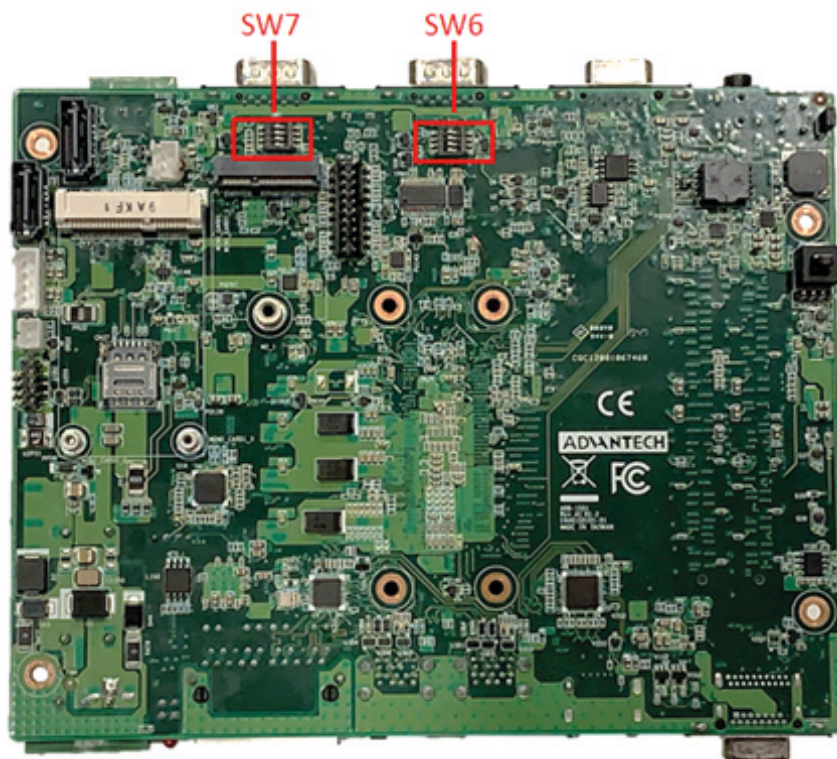
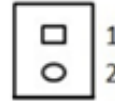


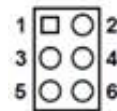
Figure 2.2 Jumper Location (Bottom)

2.2.4 Jumper Settings

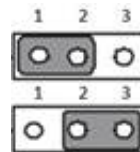
J1	AT power mode setting
Part Number	1653002101-02
Description	PIN HEADER 2x1P 2.0 mm 180D(M) DIP 21N12050
Default Setting	NC: ATX mode; power on via power button
Jumper Setting	(1-2): AT Mode



J3	COM3 5V/12V Power Setting
Part Number	1653003260
Description	PIN HEADER 3x2P 2.0 mm 180D(M) SMD 21N22050
Default Setting	(3-4): Ring signal on pin9
Jumper Setting	(1-2): 5V on pin9
Jumper Setting	(5-6):12V on pin9



SW1	CMOS Clear
Part Number	1600000071
Description	SLIDE SW CJS-1201TA1 SMD 3P SPDT P=6.0mm W=2.5mm
Default Setting	(1-2): Normal
Jumper Setting	(2-3): Clear CMOS



SW6	COM 1 RS422/RS485 Fail Safe Mode
Part Number	1600000402
Description	DIP SW SMD 8P SPST P=1.27mm W=5.4mm KHS42E
Default Setting	(1):OFF (2):OFF (3):OFF (4):OFF
Jumper Setting	(8):ON (7):ON (6):ON (5):ON

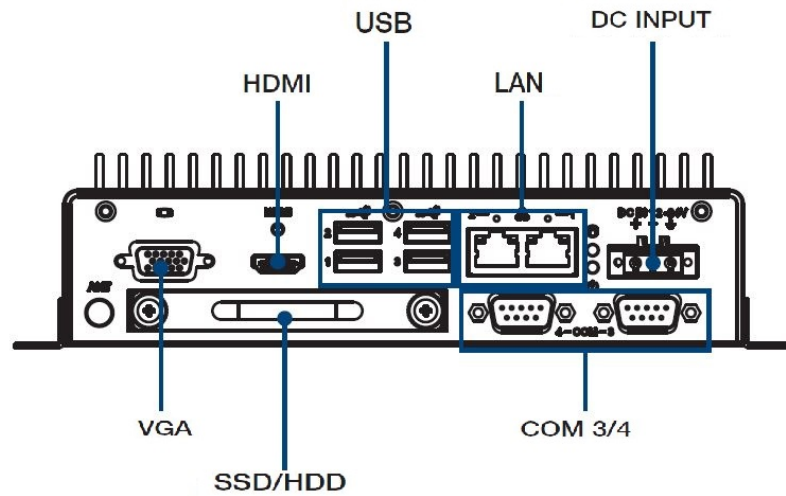


SW7	COM 2 RS422/RS485 Fail Safe Mode
Part Number	1600000402
Description	DIP SW SMD 8P SPST P=1.27mm W=5.4mm KHS42E
Default Setting	(1):OFF(2):OFF(3):OFF(4):OFF
Jumper Setting	(8):ON(7):ON(6):ON(5):ON

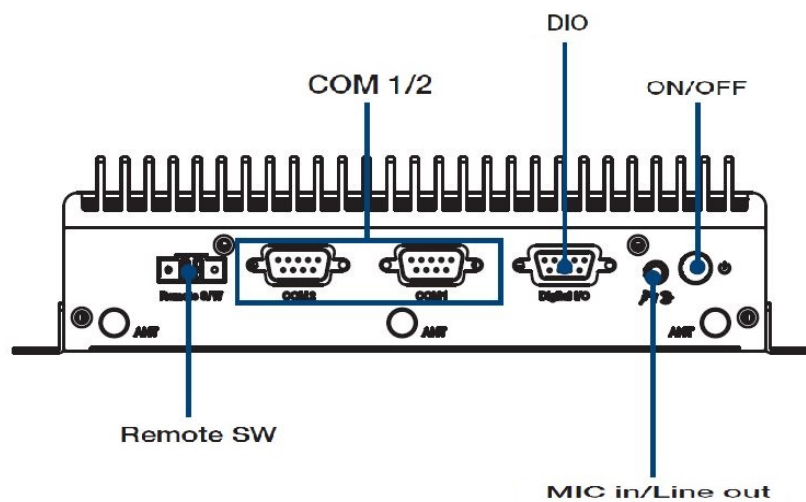


2.3 System I/O

Front View



Rear View



2.4 External I/O

2.4.1 Power On/Off Button

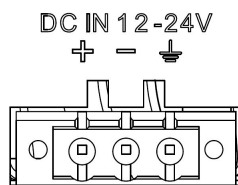
ARK-1551 features a Power On/Off button with an LED indicators on the top side that show On/(Green LED).



Figure 2.3 Power On/Off Button

2.4.2 Power Input Connector

The power input connector supports 12 ~ 24 V. The 3 pins are defined as +, -, and GND.



2.4.3 Ethernet Connector (LAN)

ARK-1551 is equipped with Intel® I210 Ethernet controllers and Intel® I219 Ethernet controllers that are fully compliant with IEEE 802.3u 10/100/1000 Mbps CSMA/CD standards and connected to LAN1 and LAN2. The Ethernet port provides a standard RJ45 jack connector with LED indicators on the front side to show its Active/Link status (Green LED) and Speed status (Yellow LED).

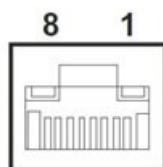


Figure 2.4 Ethernet Connector (LAN)

Table 2.2: Ethernet Connector (LAN) Pin Definition

Pin	10/100/1000 Mbps Signal Name
1	BI_DA+(GHz)
2	BI_DA-(GHz)
3	BI_DB+(GHz)
4	BI_DC+(GHz)
5	BI_DC-(GHz)
6	BI_DB-(GHz)
7	BI_DD+(GHz)
8	BI_DD-(GHz)
H3	GND
H4	GND

2.4.4 USB 3.1 Connector

ARK-1551 supports four USB 3.1 Gen. 2 interfaces, which support Plug-and-Play functionality and hot swapping for up to 127 external devices. The USB interfaces comply with USB UHCI, and Rev. 3.0.

USB 3.1 connectors contain legacy pins to interface to USB 2.0 and USB 3.0 devices and a new set of pins for USB 3.1 connectivity.

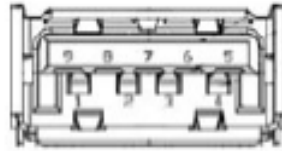


Figure 2.5 USB Connector

Table 2.3: USB Connector Pin Definition

Pin	Signal Name
1	+5V
2	D- _0
3	D+ _0
4	GND
5	USB0_SSRX-
6	USB0_SSRX+
7	GND
8	USB0_SSTX-
9	USB0_SSTX+

2.4.5 Audio Connector

ARK-1551 features one phone jack connector that supports stereo Line Out or Mic In audio ports. The audio chip is controlled by ALC892 and is compliant with Azalea standards.

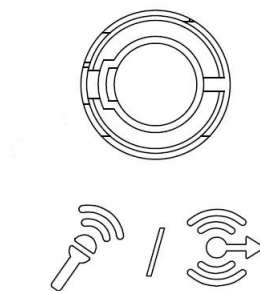


Figure 2.6 Audio Connector

2.4.6 COM Connector

ARK-1551 provides one 9-pin D-sub connector, which supports RS232/422/485 serial communication interface ports. Its default setting is RS-232, if you want to use RS-422/485, use the BIOS manual to change the settings.

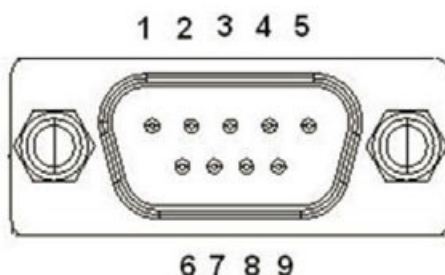


Figure 2.7 COM Connector

Table 2.4: COM Connector Pin Definition

Pin	RS-232	RS-422	RS-485
1	DCD	Tx-	DATA-
2	RxD	Tx+	DATA+
3	TxD	Rx+	NC
4	DTR	Rx-	NC
5	GND	GND	GND
6	DSR	NC	NC
7	RTS	NC	NC
8	CTS	NC	NC
9	RI	NC	NC

NC represents "No Connection".

2.4.7 HDMI Connector

ARK-1551 offers one integrated 19-pin receptacle connector HDMI 1.4b interfaces. The HDMI link supports resolutions of up to 4096x2160@30Hz.

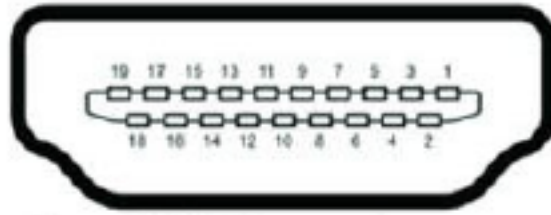


Figure 2.8 HDMI Connector

Table 2.5: HDMI Connector Pin Definition

Pin	Signal Name
1	HDMI_TX2+
2	GND
3	HDMI_TX2-
4	HDMI_TX1+
5	GND
6	HDMI_TX1-
7	HDMI_TX0+
8	GND
9	HDMI_TX0-
10	HDMI_CLK+
11	GND
12	HDMI_CLK-
13	NC
14	NC
15	HDMI_DCLK
16	HDMI_DDAT
17	GND
18	+V5_HDMI-HPD
19	DDP0_HPDP

NC represents "No Connection".

2.4.8 GPIO

ARK-1551 offers a 8-bit GPIO, please refer to the pin definition.

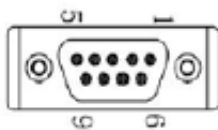


Table 2.6: GPIO Connector Pin Definition

Pin	Signal Name
1	DI/O bit 0
2	DI/O bit 1
3	DI/O bit 2
4	DI/O bit 3
5	DI/O bit 4
6	DI/O bit 5
7	DI/O bit 6
8	DI/O bit 7
9	GND

2.4.9 VGA Connector

ARK-1551 provides one an integrated 15-pin female VGA digital video interface, which supports up to 1920 x 1200 @ 60 Hz. Please refer to Table 2.8 for its pin assignments.

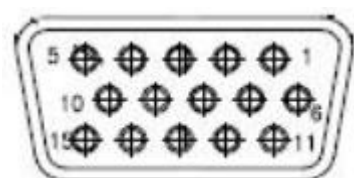


Figure 2.9 VGA Connector

Table 2.7: VGA Connector Pin Assignments

Pin	Signal Name	Pin	Signal Name
1	Red	2	Green
3	Blue	4	NC
5	GND	6	GND
7	GND	8	GND
9	5V	10	GND
11	NC	12	DDAT
13	H-SYNC	14	V-SYNC
15	DCLK		

2.4.10 Power Switch Connector

ARK-1551 provides one power switch connector for remote power switch device connection. It provides an additional interface for connecting cables to switch the power on/off.

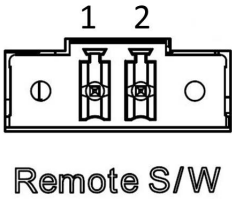


Figure 2.10 Power Switch Connector Pin Assignments

Table 2.8: Power Switch Connector Pin Assignments	
Pin	Signal Name
1	Power Button In
2	GND

2.4.11 LED Indicators

ARK-1551 provides one LED on the front panel that indicates the storage status and system power status.



Figure 2.11 LED Indicators

2.4.12 Antenna Socket

ARK-1551 reserves four antenna sockets for installing wireless device antennas. Each antenna socket is labeled “ANT” for easy identification.

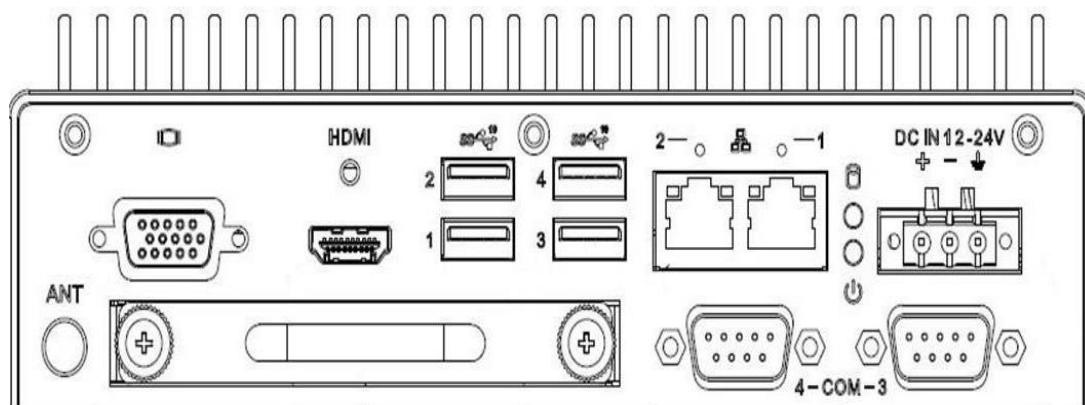


Figure 2.12 Front I/O ANT Placement

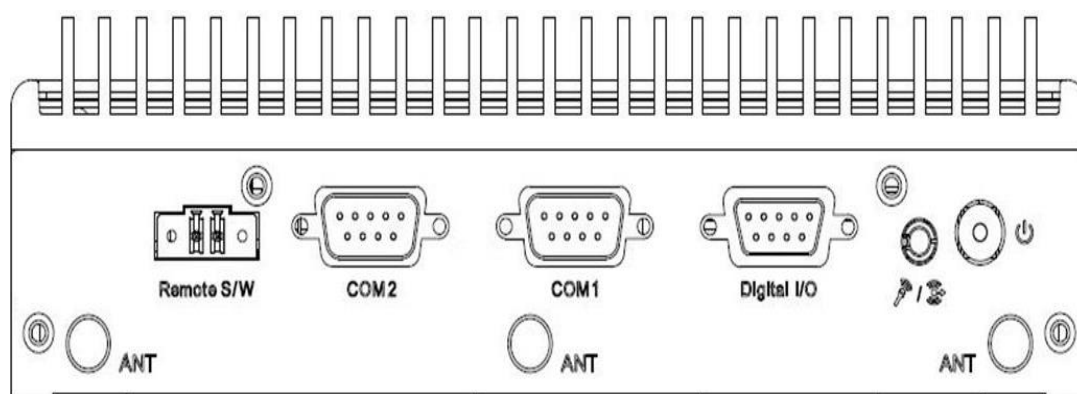


Figure 2.13 Rear I/O ANT Placement

2.5 Installation

2.5.1 2.5" HDD/SSD Installation

1. Loosen the screws marked in red and remove the hard drive tray.



2. Install the hard drive on the tray (screws are included in the accessory box).



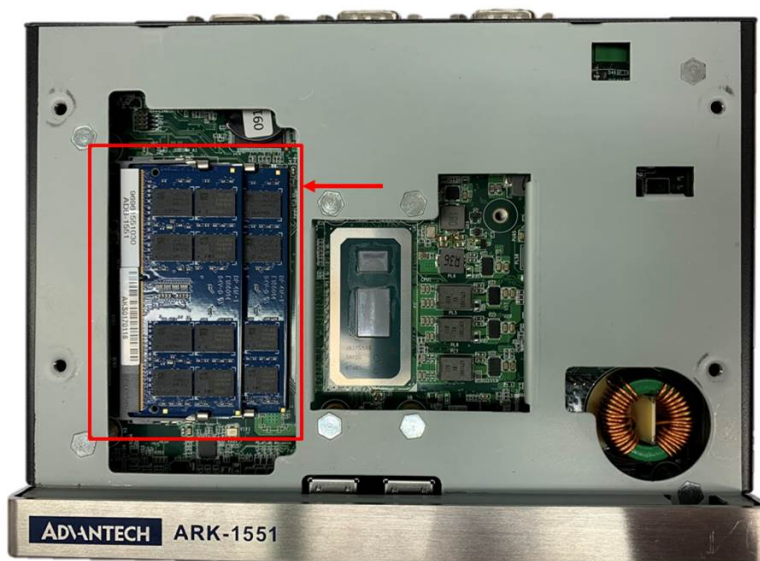
3. Secure the screws on the hard drive tray and put the tray back into the system unit.

2.5.2 RAM Installation

1. Remove the 4 top cover screws.



2. Remove the top cover and locate the memory socket.
3. Install the memory. (The memory is optional, and does not come standard in the shipment.)



2.5.3 miniPCle Module Installation

1. Unscrew the two screws from both sides of the ARK-1551.



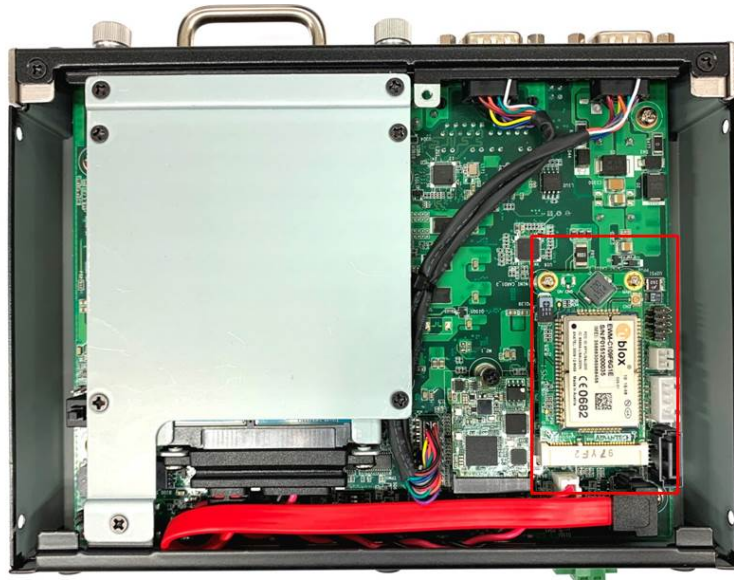
2. Unscrew the screw on the bottom cover of ARK-1551.



3. Open the bottom cover of the ARK-1551.



4. Insert the miniPCle module onto the miniPCle slot (MINI_CARD1). Next, return and fasten the two screws back into the miniPCle module. The miniPCle module should be either an mSATA, WLAN module, or other compatible module. Only one miniPCle module can be installed at a time.



5. Replace the bottom cover and secure it using the screws. Secure the screws on two sides of system.

2.5.4 M.2 Installation

1. Unscrew the two screws from both sides of the ARK-1551.



2. Unscrew the screw on the bottom cover of ARK-1551.



3. Open bottom the cover of ARK-1551.



4. Insert the M.2 module into the M.2 slot (M2). Next, return and fasten the single screw on the M.2 module. The M.2 module can be either a WWAN module or other compatible modules. Only one M.2 module can be installed at a time.



5. Replace bottom cover and secure the bottom cover screws. Next, secure the screws on two sides of the system.

2.5.5 Optional Adapter Installation

1. To install an optional adapter, connect the adapter wires to the 3-pin phoenix connector provided in the accessory box. Connect the wires to the correct +, -, and GND pins, then secure it using a screwdriver.



2. Connect the 3-pin phoenix connector to the DC In port.



2.5.6 Wall Mount Installation

1. Unscrew the 4 screws on both sides of ARK-1551.



2. Screw the wall mount brackets onto both sides of the ARK-1551.



Caution! 4 x M3 type 5 mm (0.19 in) screws are provided to secure the mounting kit and unit. Use a suitable mounting apparatus to avoid injury.



Attention! Vis de type M3, longueur 5 mm (0.19 in) x 4 fournies pour la fixation du kit de montage et de l'unité. Utilisez un appareil de montage approprié pour éviter tout risque de blessure.



Chapter 3

BIOS Settings

This chapter details BIOS configuration data set up.

3.1 Introduction

The AMI BIOS ROM has a built-in setup program — the BIOS Setup Utility — that allows users to modify the basic system configuration. All configuration data is stored in battery-backed CMOS to ensure the setup information is retained when the power is turned off.

This chapter describes the basic navigation of the ARK-1551 BIOS setup screens.



3.2 Entering BIOS Setup

Turn on the computer and then press <F2> or to enter the BIOS Setup menu.

3.2.1 Main Setup

Upon accessing the BIOS Setup Utility, users are presented with the Main setup page. Users can always return to the Main setup page by selecting the Main tab. The Main BIOS Setup page is shown below.



The Main BIOS setup page has two main frames. The left frame displays all the items accessible on the Main page. Items that are grayed out cannot be configured, whereas items presented in blue text can be configured. The right frame displays the key legend.

Located above the key legend is an area reserved for a text message. When an item is selected in the left frame, the item is presented in white text and often accompanied by a text message.

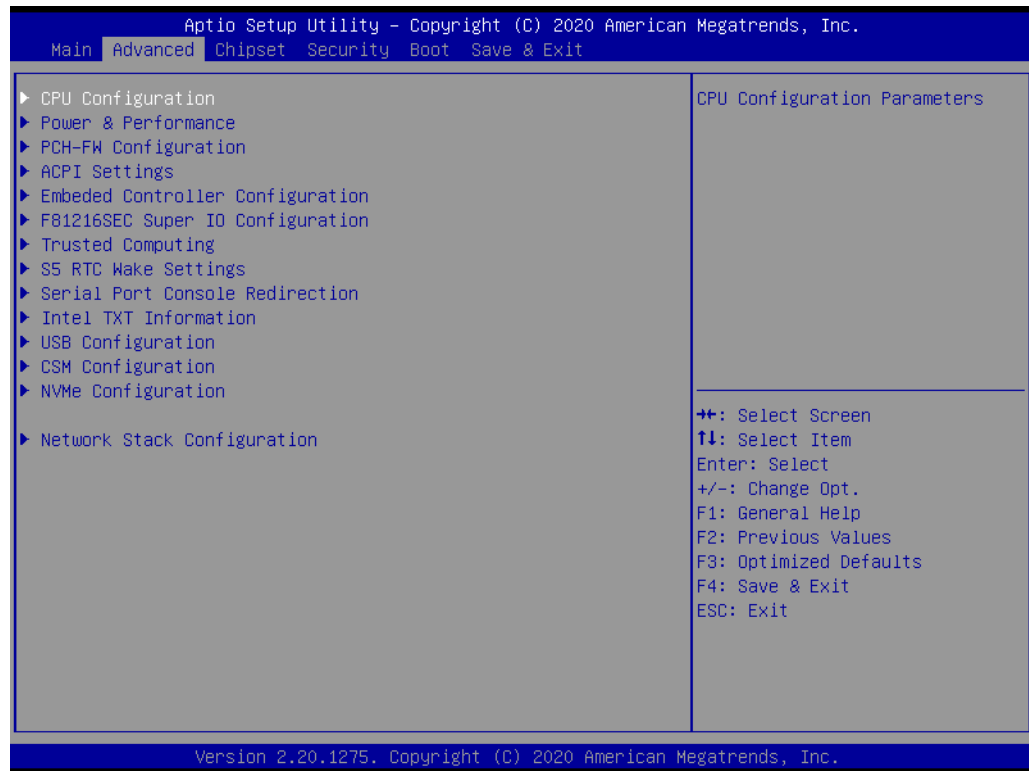
■ System Time/System Date

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

3.2.2 Advanced BIOS Setup

Select the Advanced tab from the BIOS Setup Utility to enter the Advanced BIOS Setup page. Select any of the items in the left frame of the screen, such as CPU Configuration, to access the sub menu for that item. The options for any of the Advanced BIOS Setup items can be displayed by highlighting the item using the <Arrow> keys.

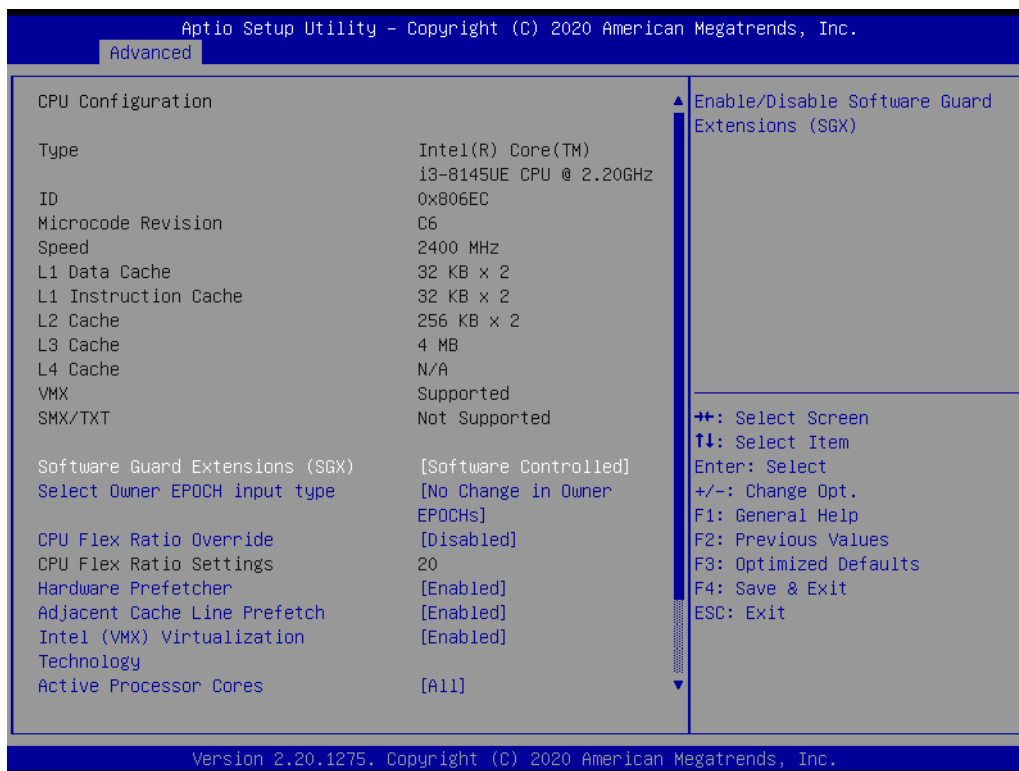
The Advanced BIOS Setup page is shown below:



3.2.2.1 CPU Information

■ CPU Information

This item allows users to view the CPU, speed, and core information.



■ SW Guard Extension (SGX)

Enable/Disable Software Guard Extensions (SGX).

■ Select Owner EPOCH input type

Choose Owner EPOCH modes.

■ CPU Flex Ratio Override

Enable/Disable CPU Flex Ratio Programming.

■ Hardware Prefetcher

This item allows users to enable or disable the hardware prefetcher feature.

■ Adjacent Cache Line Prefetch

This item allows users to enable or disable the adjacent cache line prefetch feature.

■ Intel® (VMX) Virtualization Technology

When Enabled, a VMM can utilize the additional hardware capability provided by Vanderpool Technology.

■ Active Processor Cores

This item allows users to set how many processor cores should be active.

■ AES

Enable/Disable AES (Advanced Encryption Standard).

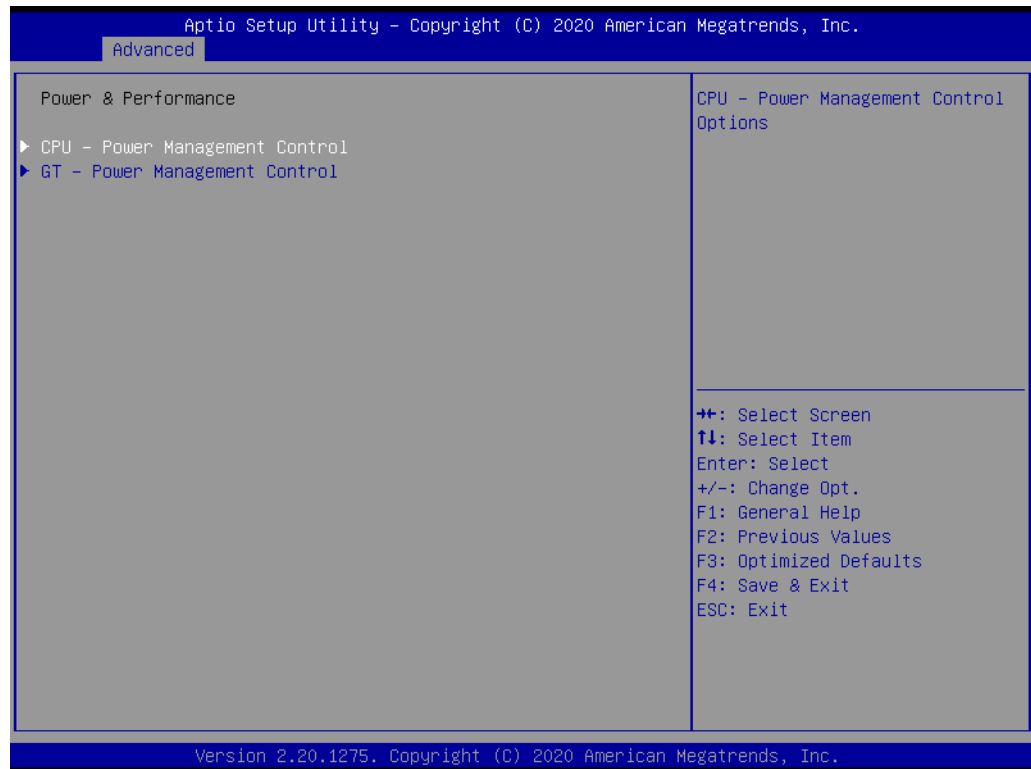
■ MachineCheck

Enable/Disable Machine Check.

■ MonitorMWait

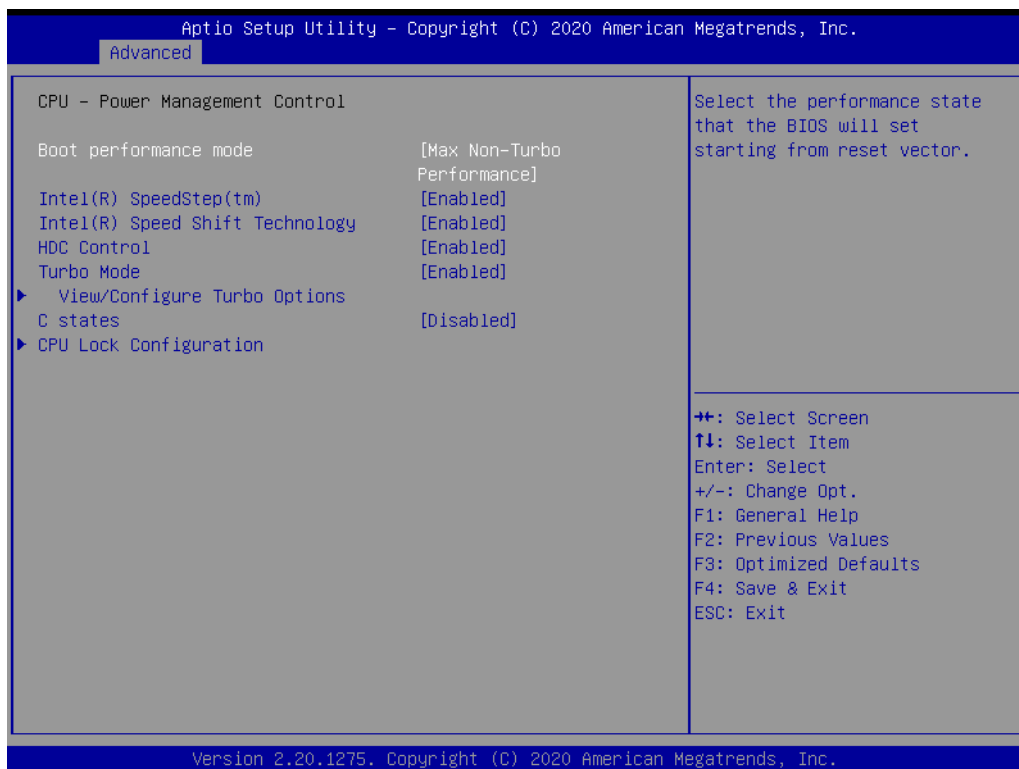
Enable/Disable MonitorMWait.

3.2.2.2 Power and Performance



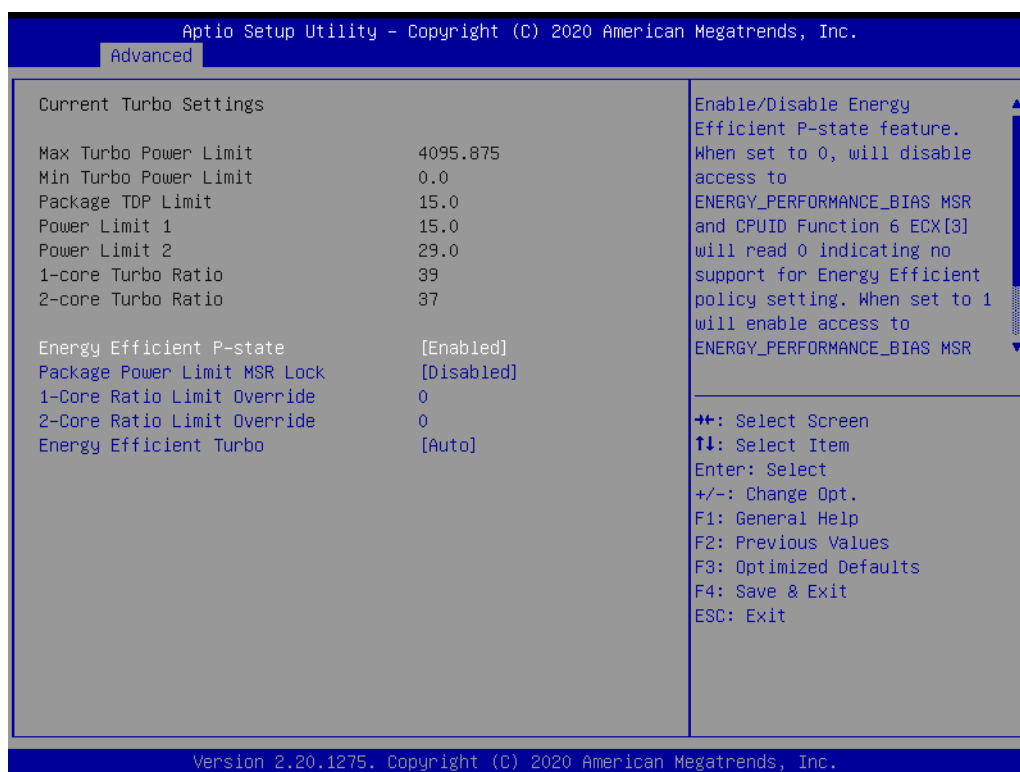
- **CPU - Power Management Control**
CPU - Power Management Control Options.
- **GT - Power Management Control**
GT - Power Management Control Options.

CPU - Power Management Control



- **Boot Performance mode**
Select the performance state that the BIOS will set before OS handoff.
- **Intel® SpeedStep™**
Allows more than two frequency ranges to be supported.
- **Intel® Speed Shift Technology**
Enable/Disable Intel® Speed Shift Technology support.
- **HDC Control**
Enable/Disable Intel® HDC.
- **Turbo Mode**
Enable/Disable processor turbo mode.
- **View/Configure Turbo Options**
View and Configure Turbo Options.
- **CPU Lock Configuration**
CPU Lock Configuration.

View/Configure Turbo Options



- **Energy Efficient P-state**
Enable/Disable Energy Efficient P-state feature.
- **Package Power Limit MSR Lock**
Enable/Disable locking of Package Power Limit settings.
- **Energy Efficient Turbo**
Enable/Disable Energy Efficient Turbo feature.

CPU Lock Configuration



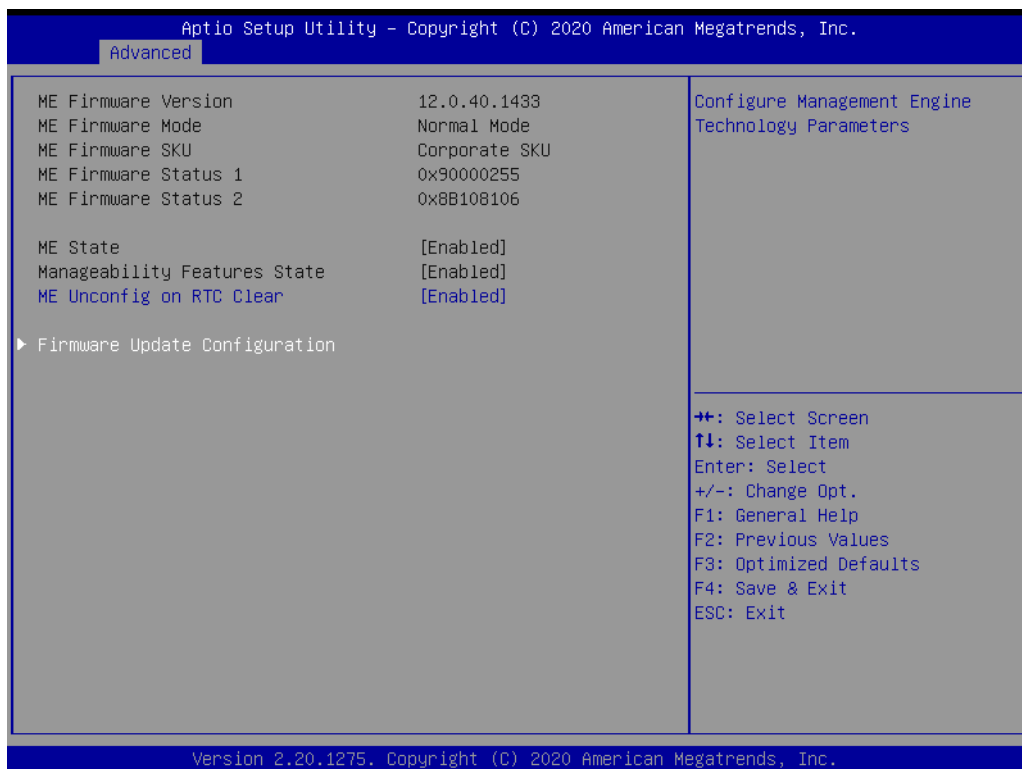
- **CFG Lock**
Configure MSR 0xE2[15], CFG Lock bit.
- **Overclocking Lock**
Enable/Disable Overclocking Lock (BIT 20) in FLEX_RATIO(194) MSR.

GT - Power Management Control



- **RC6(Render Standby)**
Check to enable render standby support.
- **Maximum GT frequency**
Maximum GT frequency limited by user.
- **Disable Turbo GT frequency**
Enabled/Disabled Turbo GT frequency.

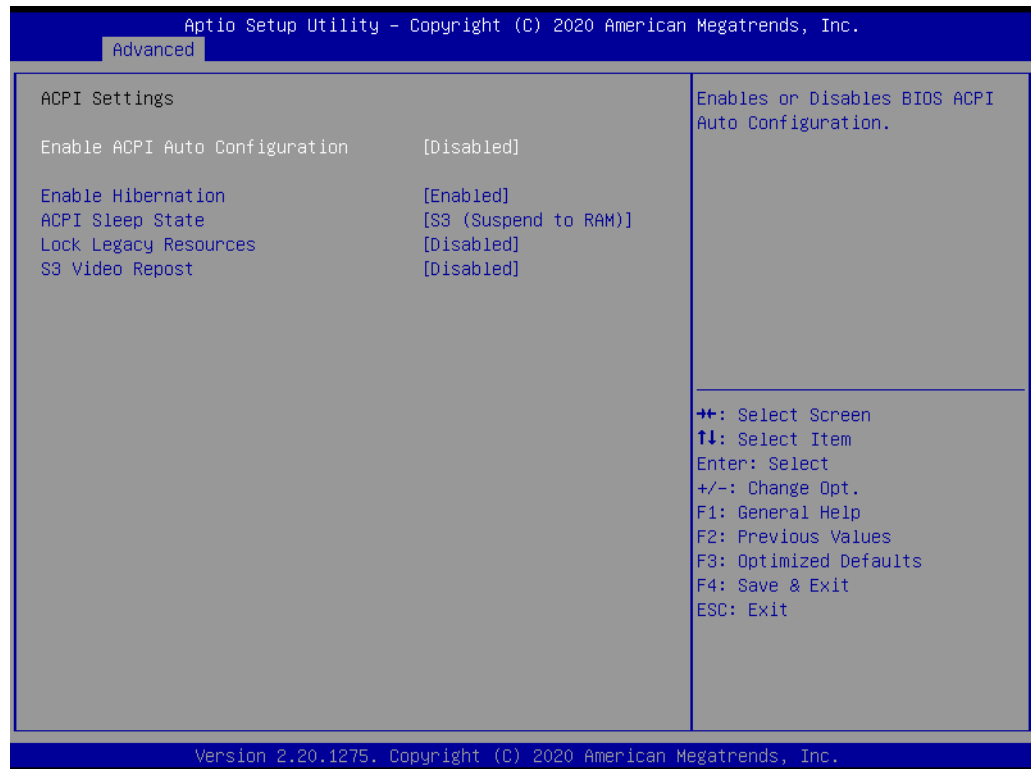
3.2.2.3 PCH-FW Configuration



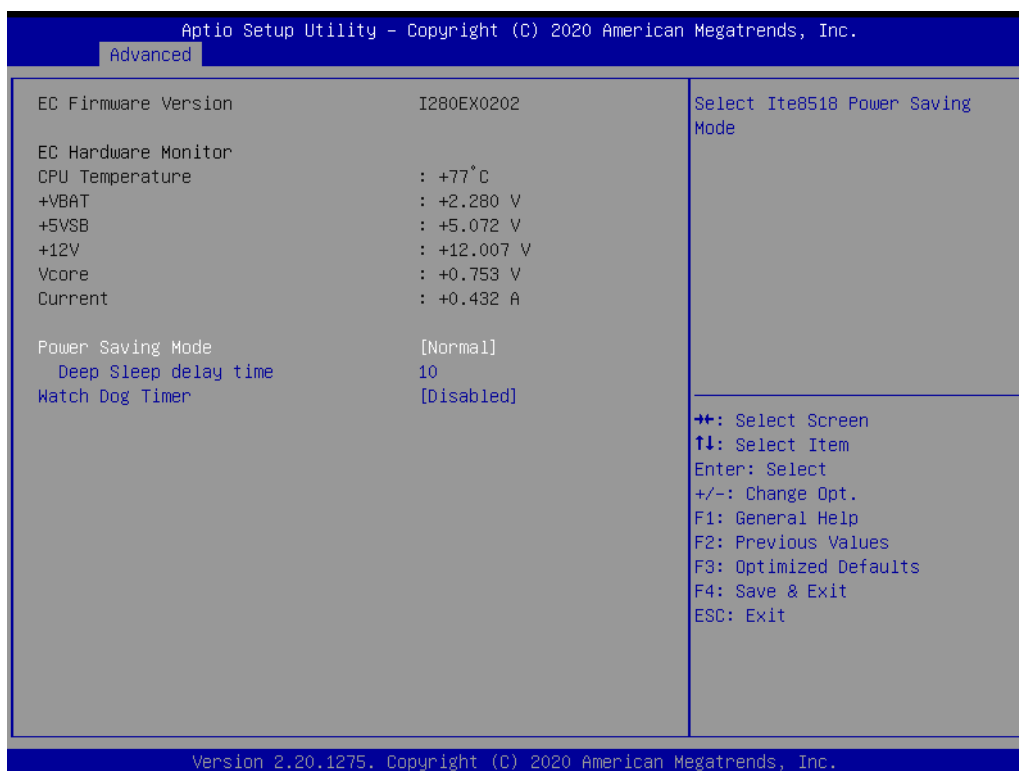
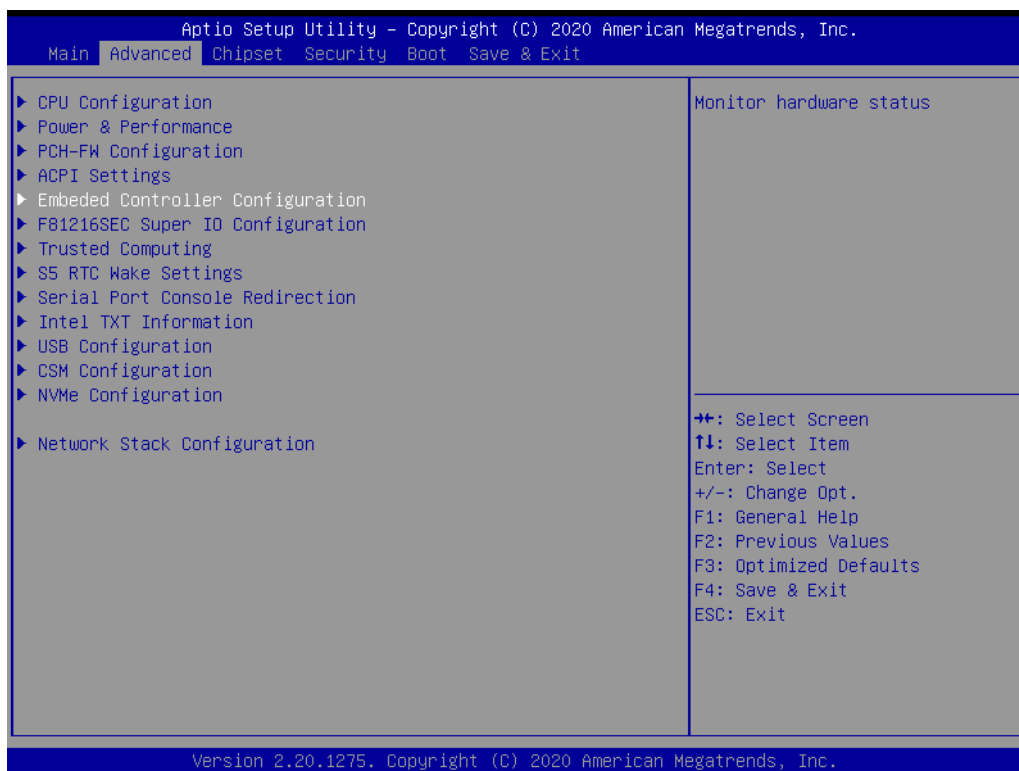
- **ME State**
When Disabled ME will be put ME into Temporarily Disabled Mode.
- **Manageability Features State**
Enable/Disable Intel® Manageability features.
- **ME Unconfig on RTC Clear**
When Disabled, ME will not be unconfigured on RTC Clear.
- **Firmware Update Configuration**
Configure Management Engine Technology Parameters.

3.2.2.4 ACPI Settings

- **Enable ACPI Auto Configuration**
This item allows users to enable or disable BIOS ACPI auto configuration.
- **Enable Hibernation**
This item allows users to enable or disable hibernation.
- **ACPI Sleep State**
This item allows users to set the ACPI sleep state.
- **Lock Legacy Resources**
This item allows users to lock legacy device resources.



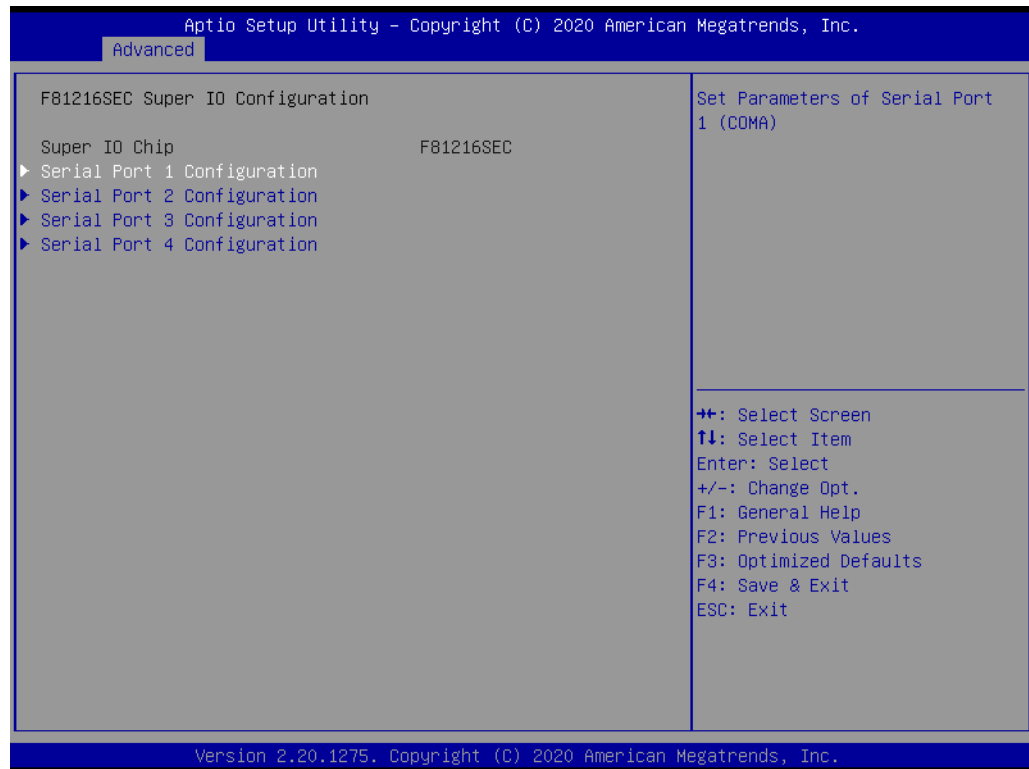
3.2.2.5 Embedded Controller Configuration



- **EC Hardware Monitor**
This section shows system health status.
- **Power Saving Mode**
This item allows users to set board's power saving mode when off.
- **Watchdog Timer**
This item allows users to select EC watchdog timer.

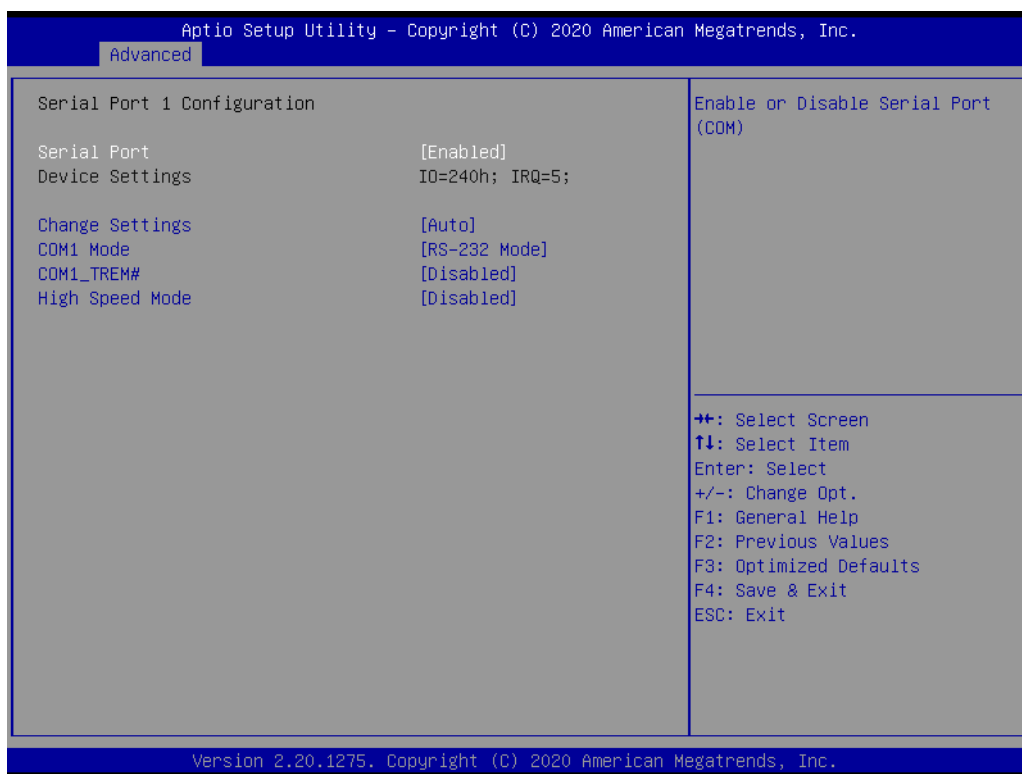
3.2.2.6 Super I/O Configuration

- **Set Parameters of Serial Port 1 (COM 1)**
This item allows users to configure Serial Port 1.
- **Set Parameters of Serial Port 2 (COM 2)**
This item allows users to configure Serial Port 2.
- **Set Parameters of Serial Port 2 (COM 3)**
This item allows users to configure Serial Port 3.
- **Set Parameters of Serial Port 2 (COM 4)**
This item allows users to configure Serial Port 4.



Serial Port 1 Configuration

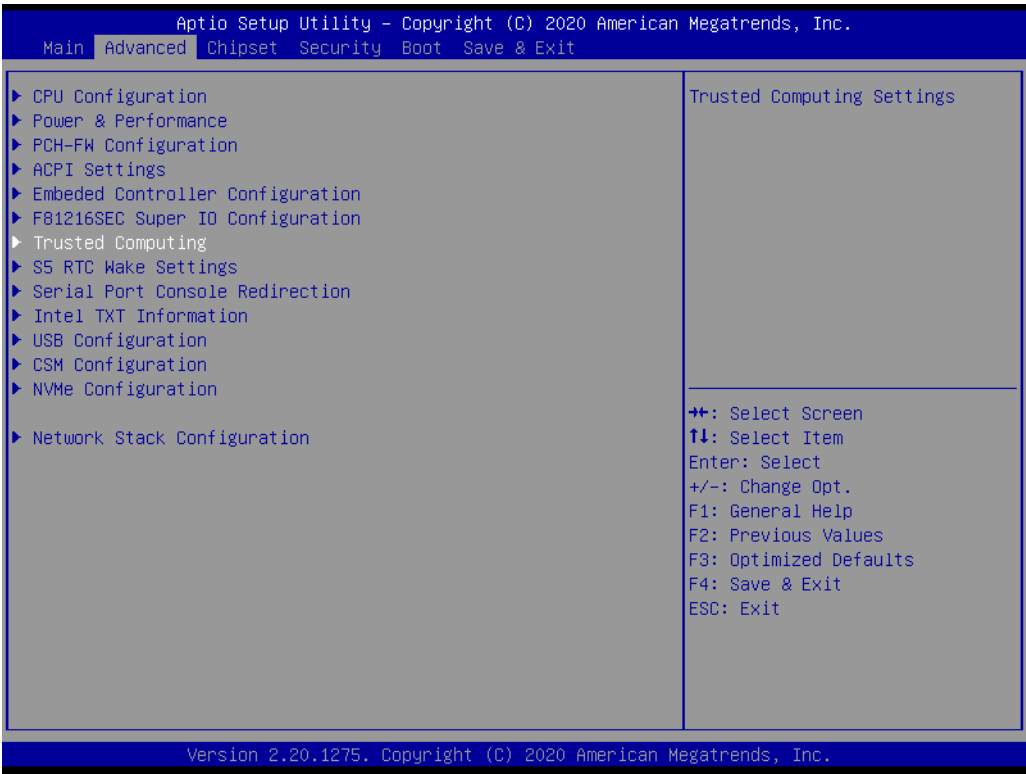
- **Serial Port**
This item allows users to enable or disable Serial Port 1 (COM).
- **Change Settings**
This item allows users to specify the settings for a super I/O device.
- **Choose Serial Port Mode**
This item allows users to change the serial port mode.
- **RS485 Auto Flow**
This item allows users to enable or disable RS485 auto flow.



The items and options for configuring Serial Port 2, Serial Port 3, and Serial Port 4 are the same as that for Serial Port 1.

3.2.2.7 Trusted Computing

Provides control options for TPM module device security.



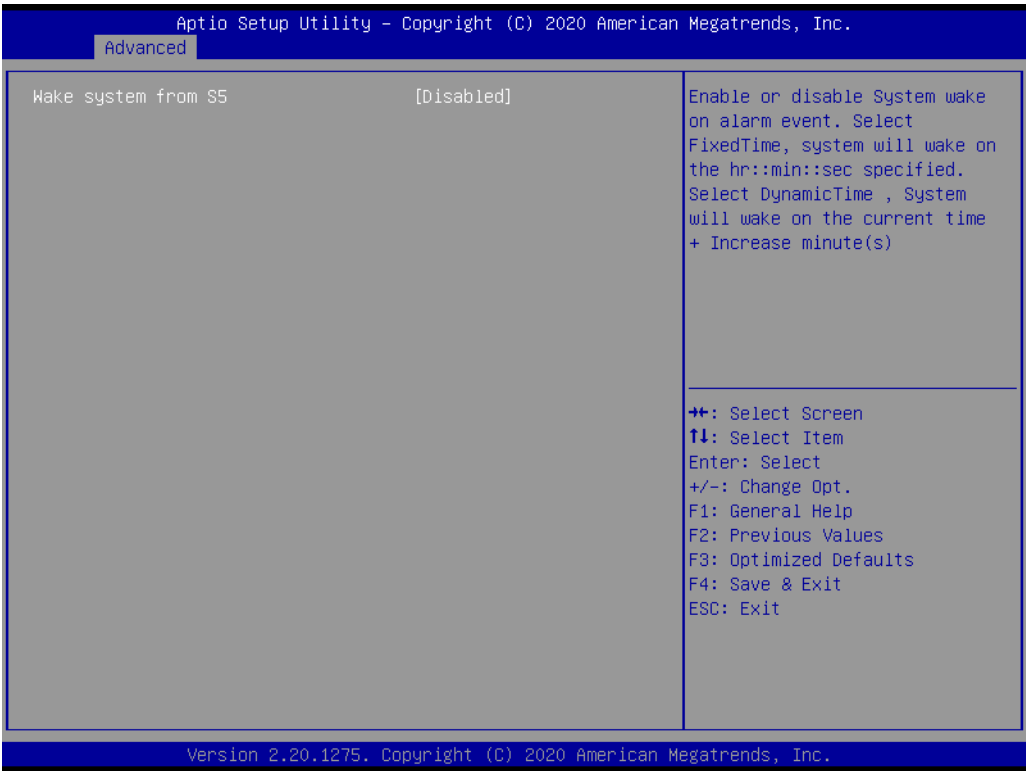
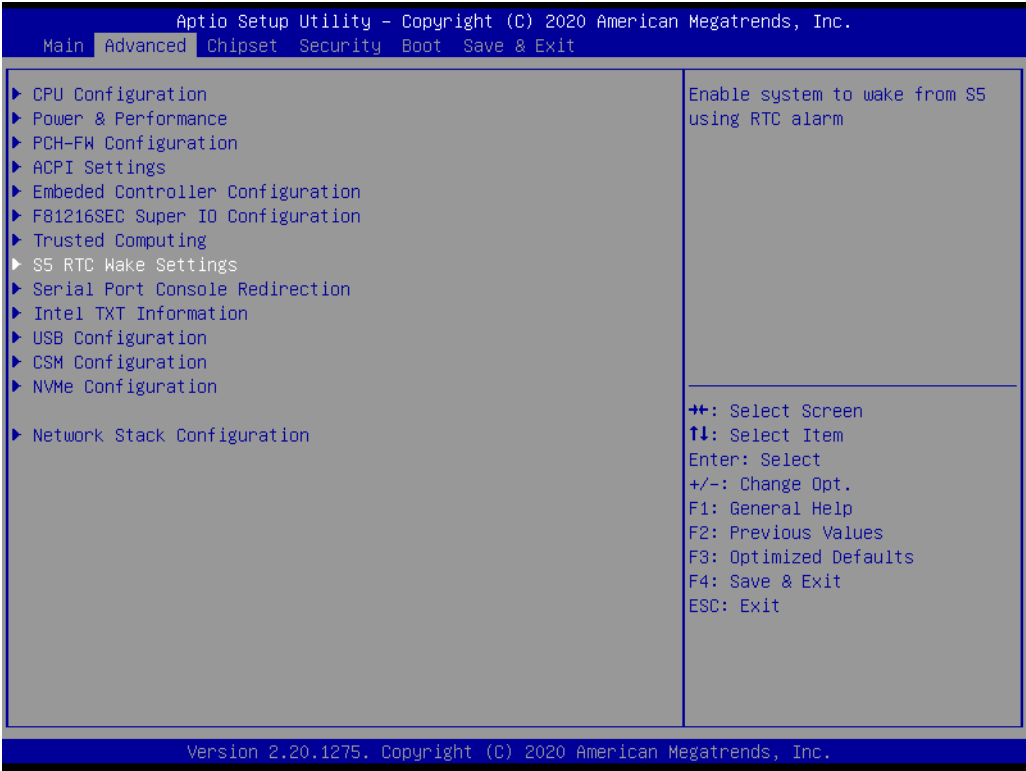
- **Security Device Support**
Enable or Disable BIOS support for security device.
- **SHA-1 PCR Bank**
Enable or Disable SHA-1 PCR Bank.
- **SHA256 PCR Bank**
Enable or Disable SHA256 PCR Bank.
- **Pending operation**
Schedule an Operation for the Security Device.
- **Platform Hierarchy**
Enable or Disable Platform Hierarchy.
- **Storage Hierarchy**
Enable or Disable Storage Hierarchy.
- **Endorsement Hierarchy**
Enable or Disable Endorsement Hierarchy.
- **TPM 2.0 UEFI Spec Version**
Select the TCG2 Spec Version Support.
- **Physical Presence Spec Version**
Select to Tell O.S. to support PPI Spec Version 1.2 or 1.3.
- **Device Select**
TPM 1.2 will restrict support to TPM 1.2 devices, TPM 2.0 will restrict support to TPM 2.0 devices.



3.2.2.8 S5 RTC Wake Settings

Wake System at Fixed Time

This item allows users to enable or disable Wake On Alarm Event. If the Fixed-Time option is selected for this item, the system will wake at the hr:min:sec specified. If the DynamicTime option is selected, the system will wake at the current time + specified minute(s).



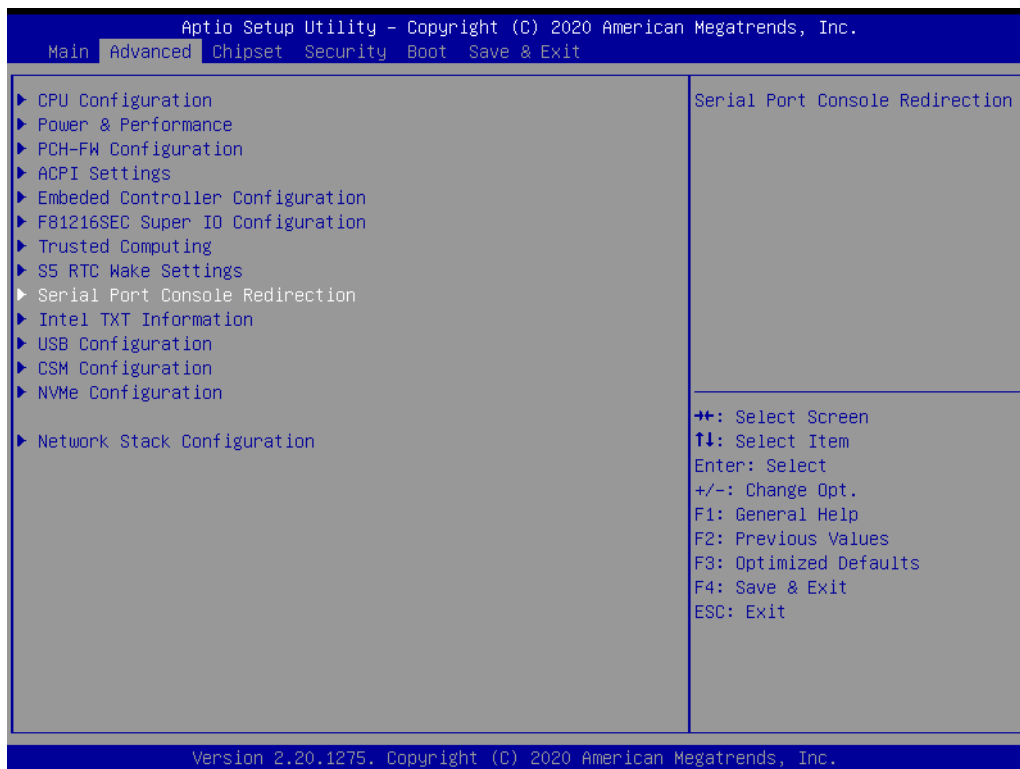
3.2.2.9 Serial Port Console Redirection

■ Console Redirection

This item allows users to enable or disable console redirection for Microsoft Windows Emergency Management Services (EMS).

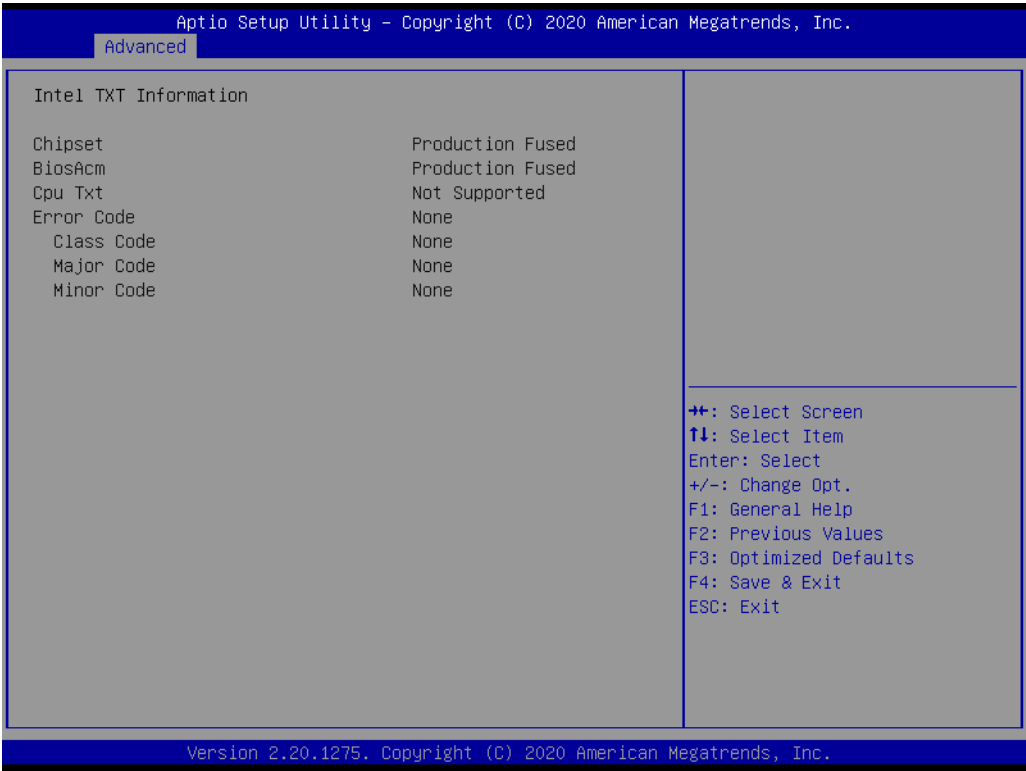
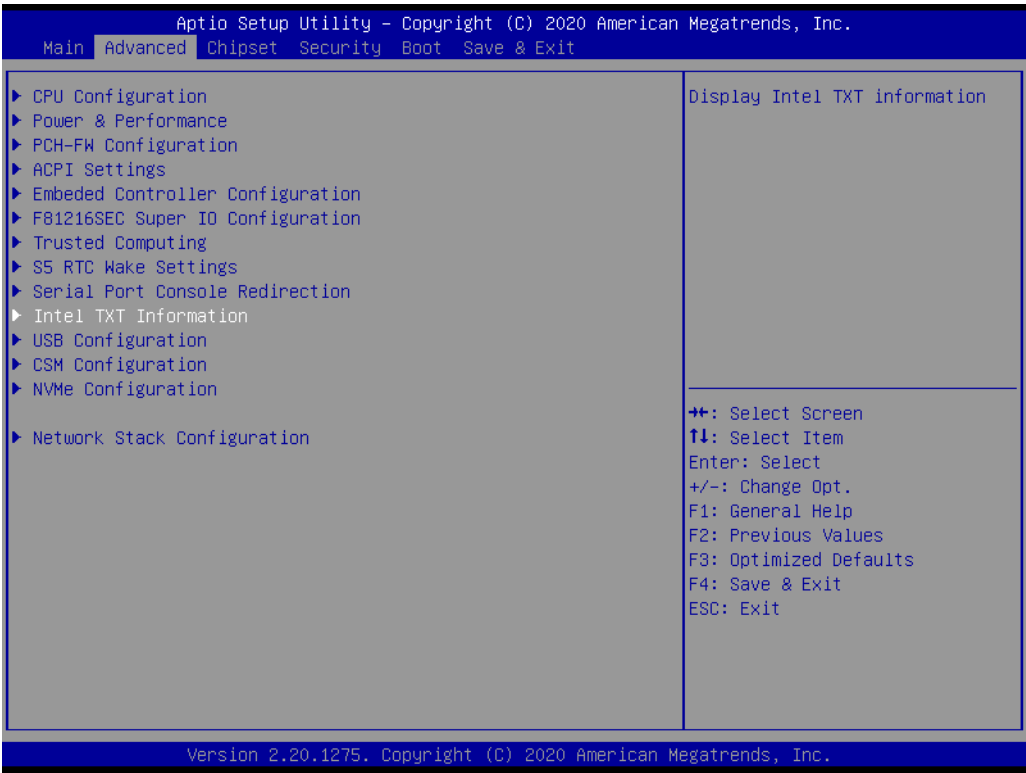
■ Console Redirection Settings

This item allows users to configure the console redirection settings.

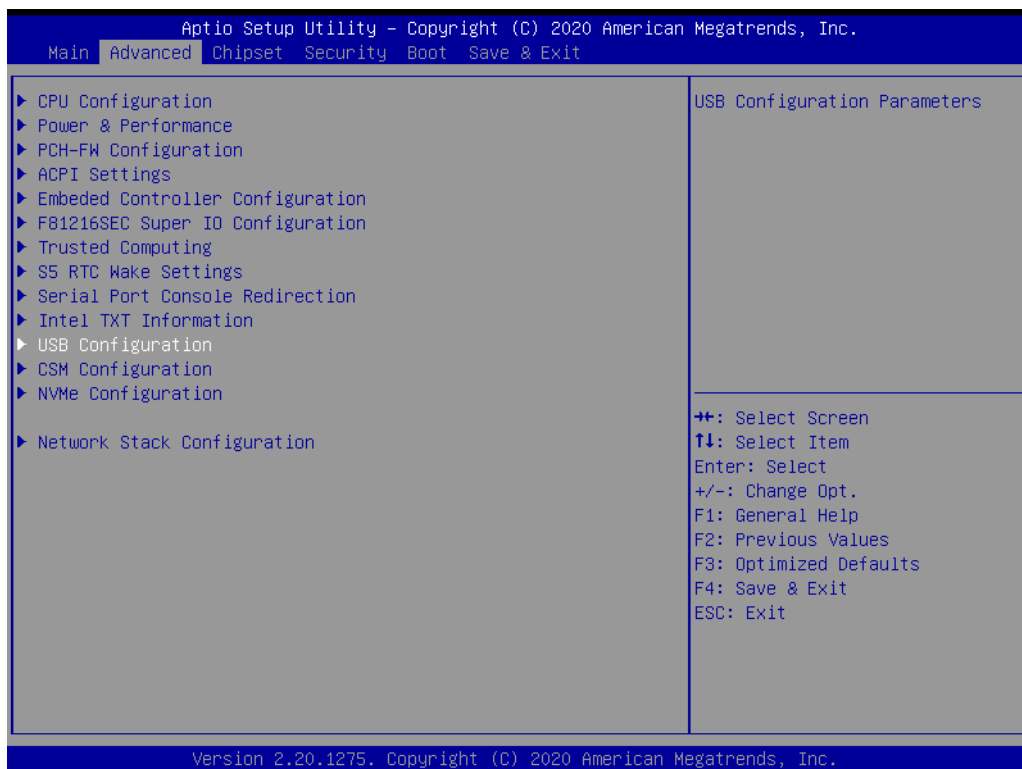


3.2.2.10 Intel® TXT Information

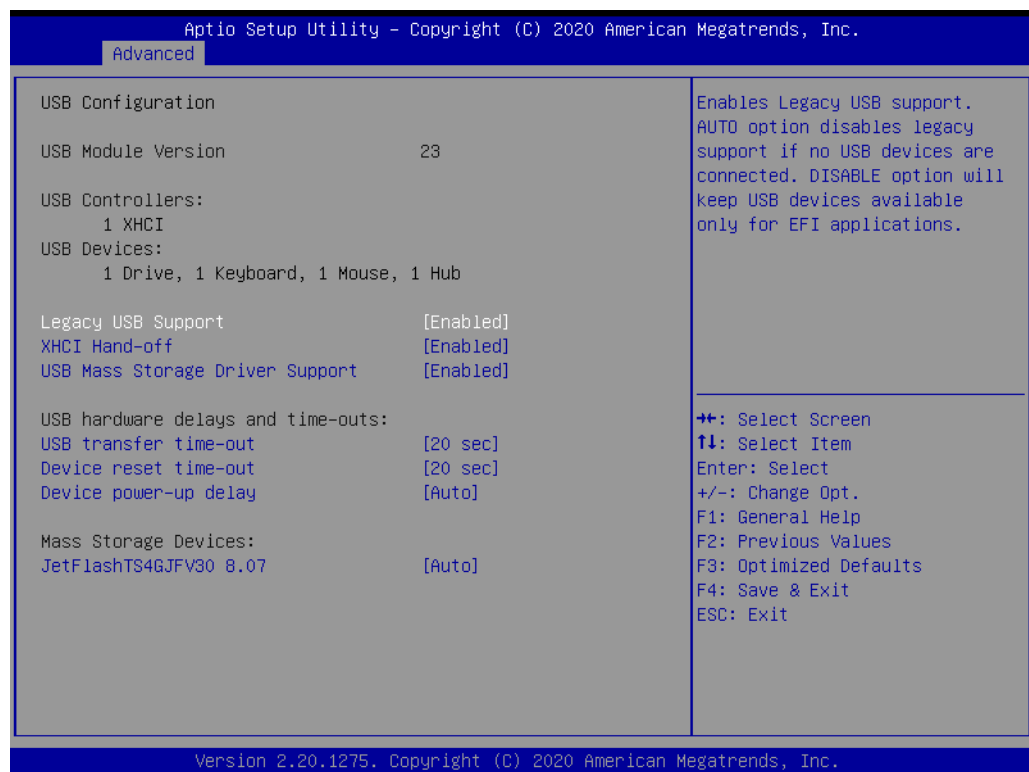
- **Intel® TXT Information**
Display Intel® TXT information.



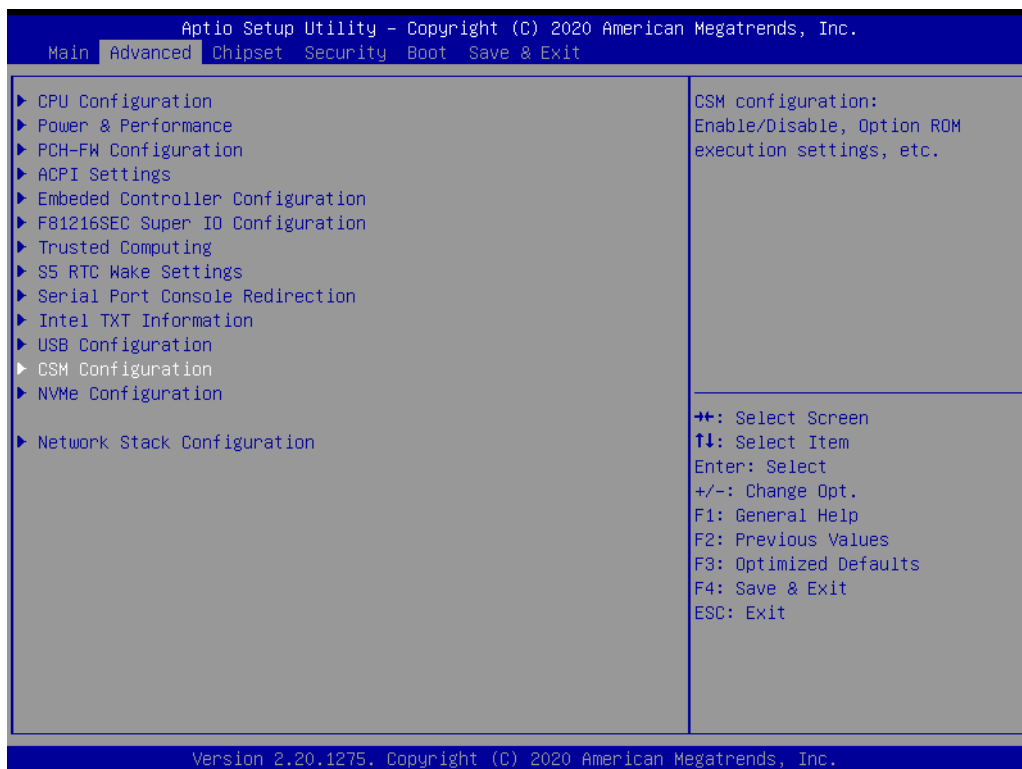
3.2.2.11 USB Configuration



- **Legacy USB Support**
Enables Legacy USB support. AUTO option disables legacy support if no US devices are connected. DISABLE option will keep USB devices available only for EFI applications.
- **XHCI Hand-off**
This is a workaround for operating systems without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.
- **USB Mass Storage Driver Support**
Enable/Disable USB Mass Storage Driver Support.
- **USB transfer time-out**
Time-out value for control, bulk, and interrupt transfers.
- **Device reset time-out**
USB mass storage device start unit command time-out.
- **Device power-up delay**
Maximum time the device will take before it properly reports itself to the Host Controller. 'Auto' uses default value: for a Root port it is 100 ms, for a Hub port the delay is taken from Hub descriptor.



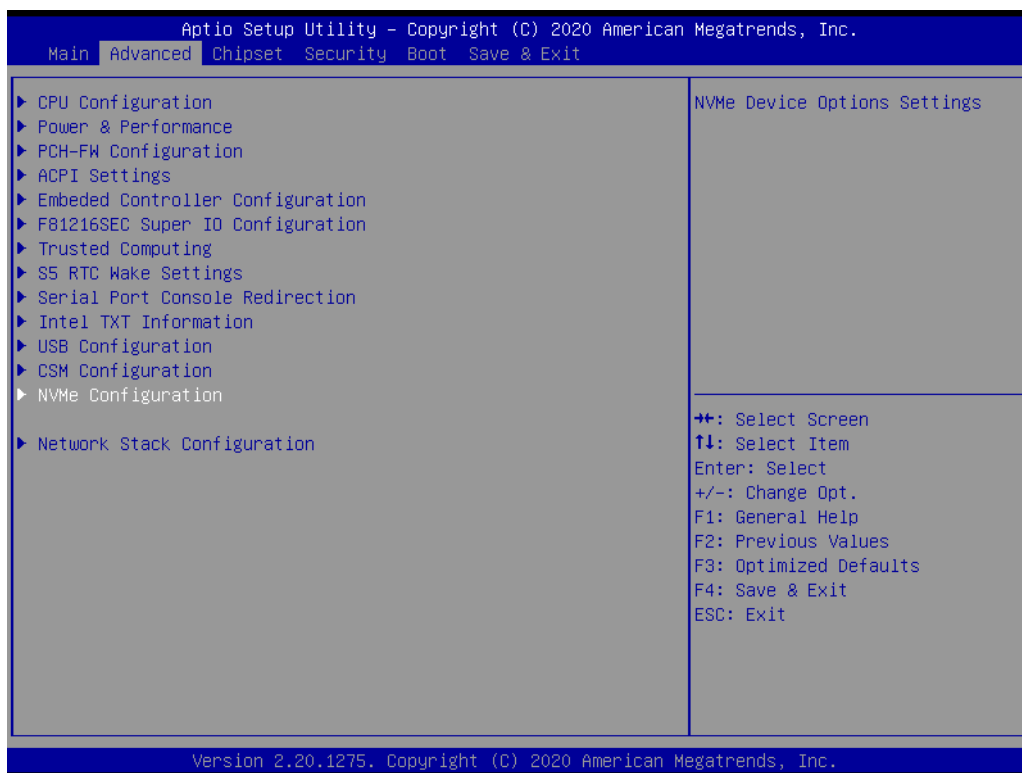
3.2.2.12 CSM Configuration



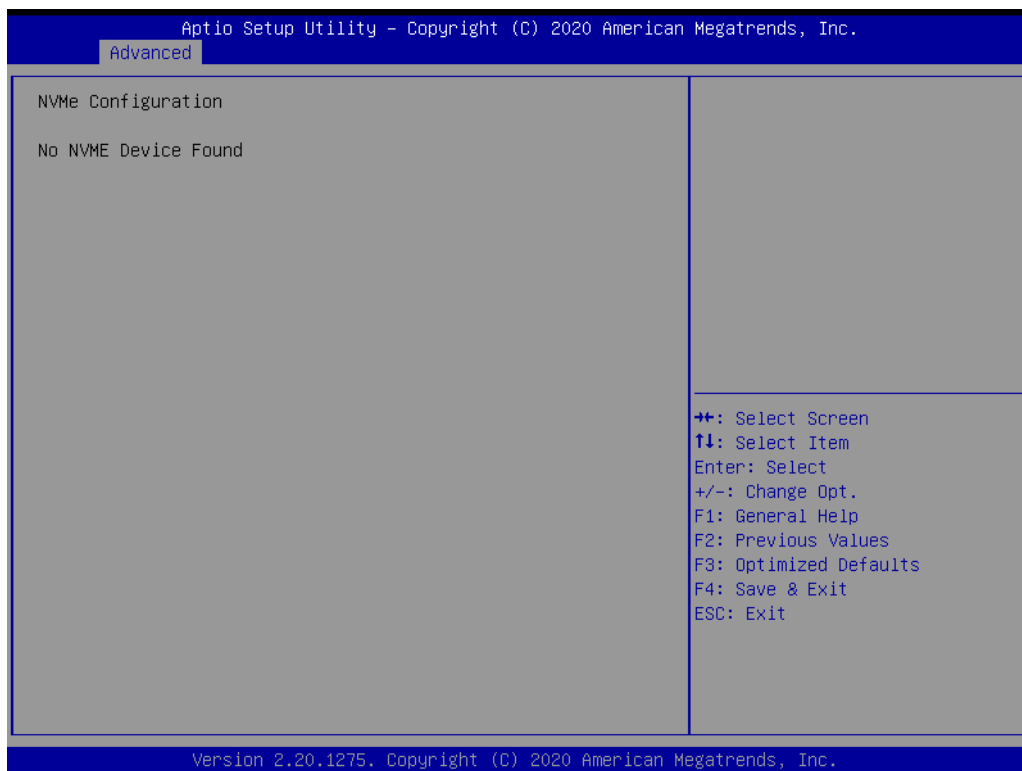
- **CSM Support**
Enable/Disable CSM Support.
- **GateA20 Active**
UPON REQUEST - GA20 can be disabled using BIOS services. ALWAYS – do not allow disabling GA20; this option is useful when any RT code is executed above 1MB.
- **INT19 Trap Response**
BIOS reaction on INT19 trapping by Option ROM: IMMEDIATE - execute the trap right away; POSTPONED - execute the trap during legacy boot.
- **Boot Option Filter**
This option controls Legacy/UEFI ROMs priority.
- **Network**
Controls the execution of UEFI and Legacy PXE OpROM.
- **Storage**
Controls the execution of UEFI and Legacy Storage OpROM.
- **Video**
Controls the execution of UEFI and Legacy Video OpROM.
- **Other PCI devices**
Determines OpROM execution policy for devices other than Network, Storage, or Video.



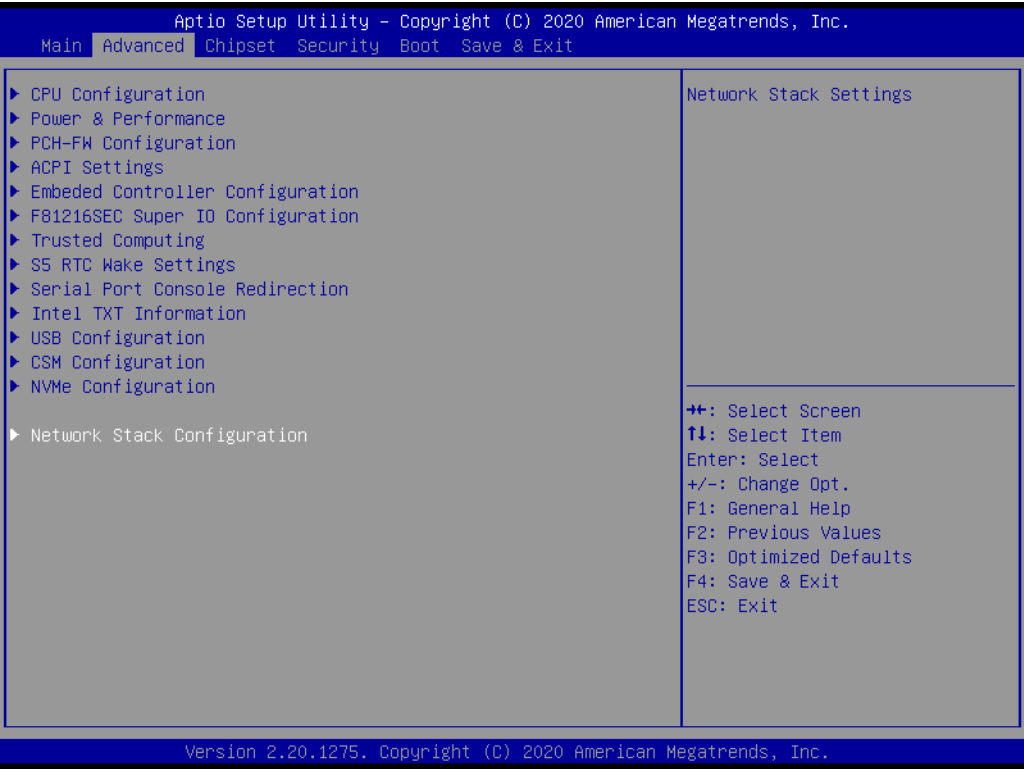
3.2.2.13 NVMe Configuration



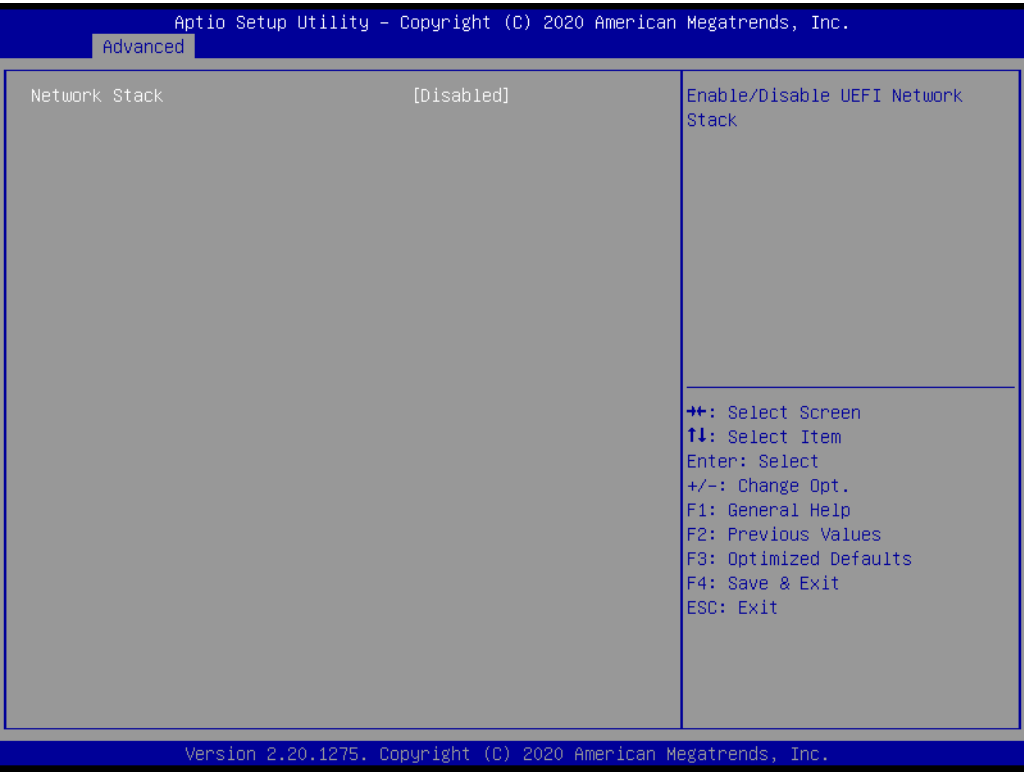
This item shows NVMe device information.

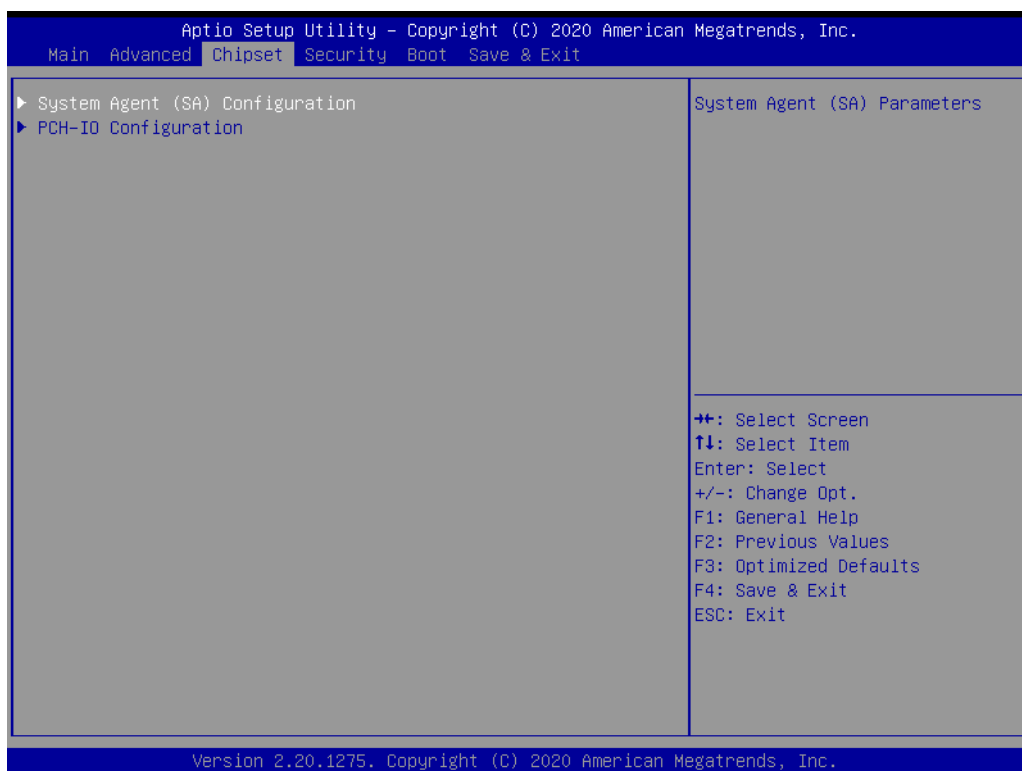


3.2.2.14 Network Stack Configuration



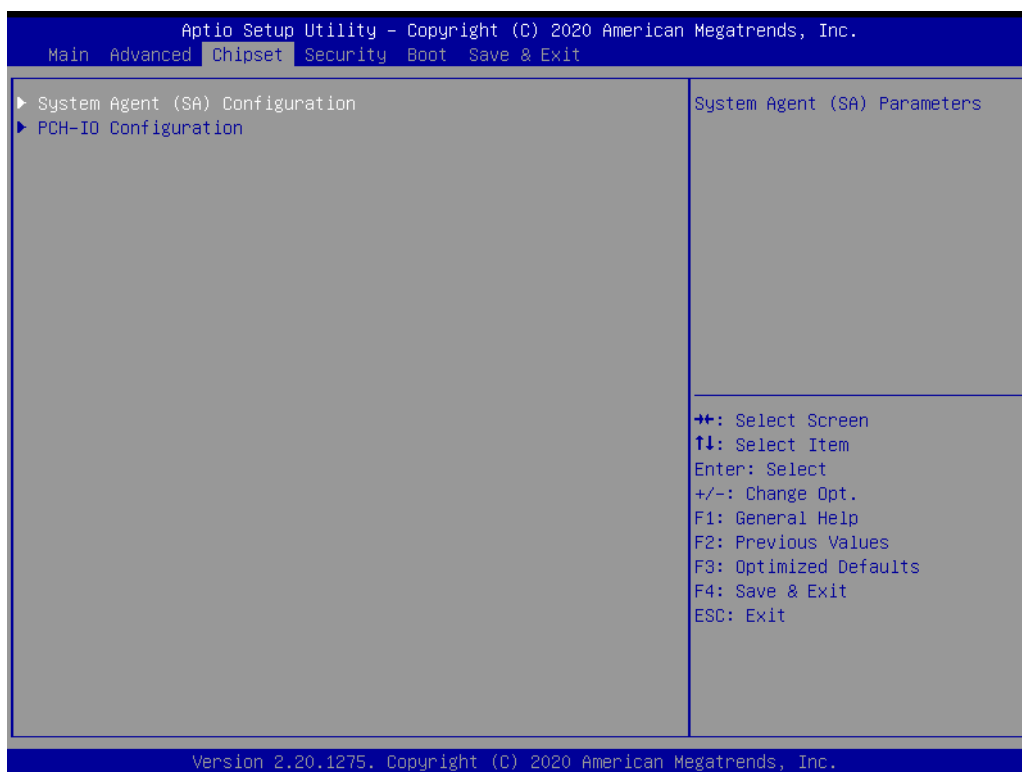
- **Network Stack**
Enable/Disable UEFI Network Stack.





3.2.3 Chipset Configuration

Select the Chipset tab from the ARK-1551 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.

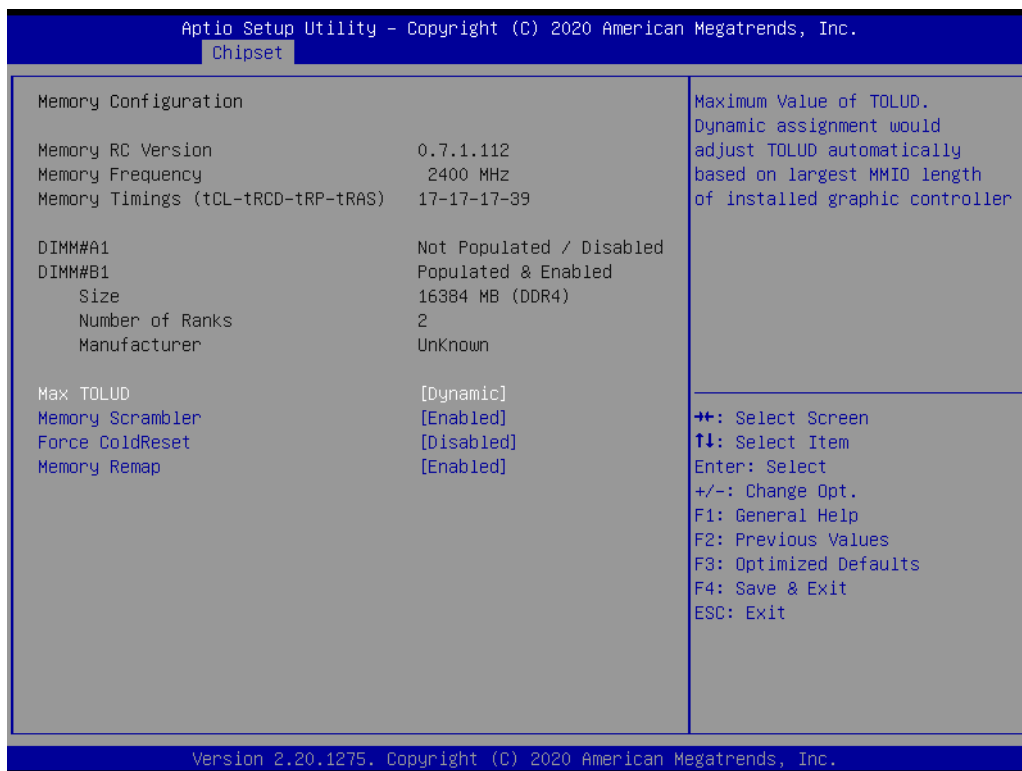


3.2.3.1 System Agent (SA) Configuration



- **Memory Configuration**
Memory Configuration Parameters.
- **Graphics Configuration**
Graphics Configuration Parameters.
- **VT-d**
VT-D capability.
- **Above 4GB MMIO BIOS assignment**
Enable/Disable above 4GB Memory Mapped IO BIOS assignment.
- **X2APIC Opt Out**
Enable/Disable X2APIC Opt Out Bit.

Memory Configuration

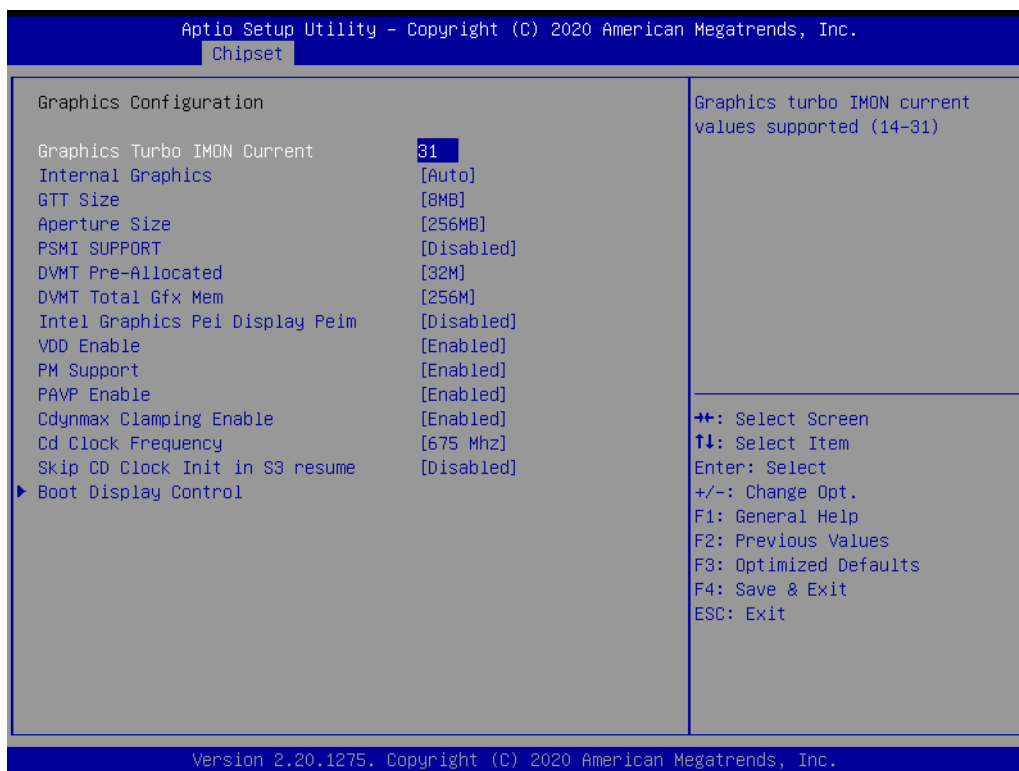


- **Max TOLUD**
Maximum Value of TOLUD.
- **Memory Scrambler**
Enable/Disable Memory Scrambler support.
- **Force ColdReset**
Force ColdReset OR Choose MrcColdBoot mode.
- **Memory Remap**
Enable/Disable Memory Remap above 4GB.

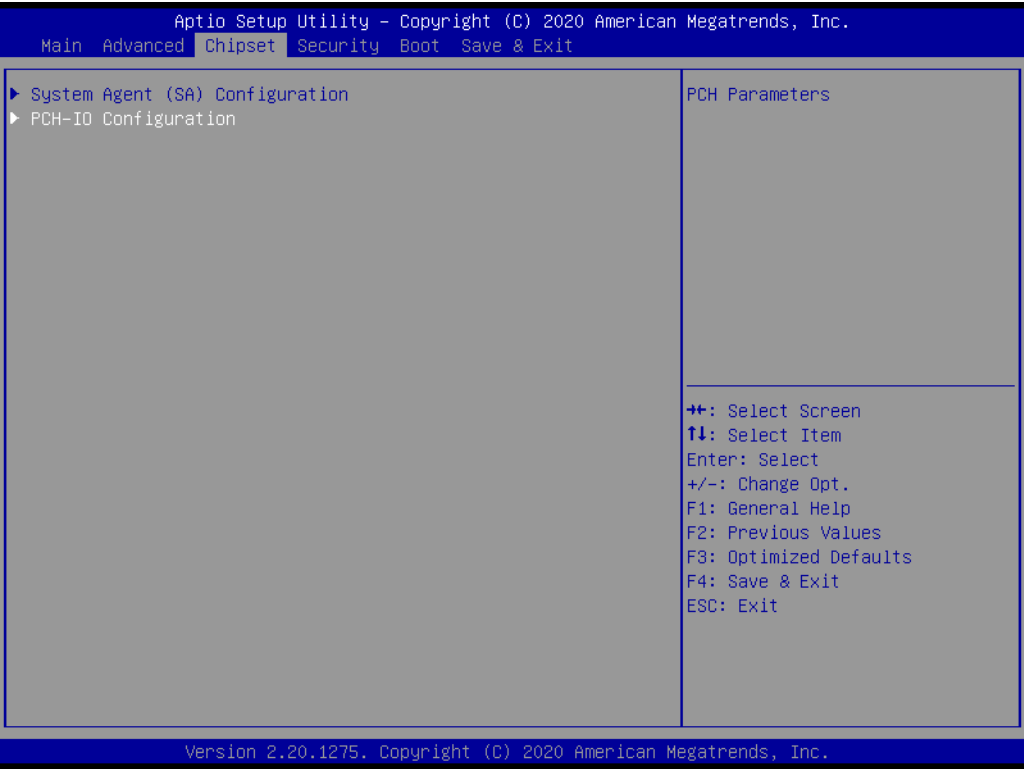
Graphics Configuration



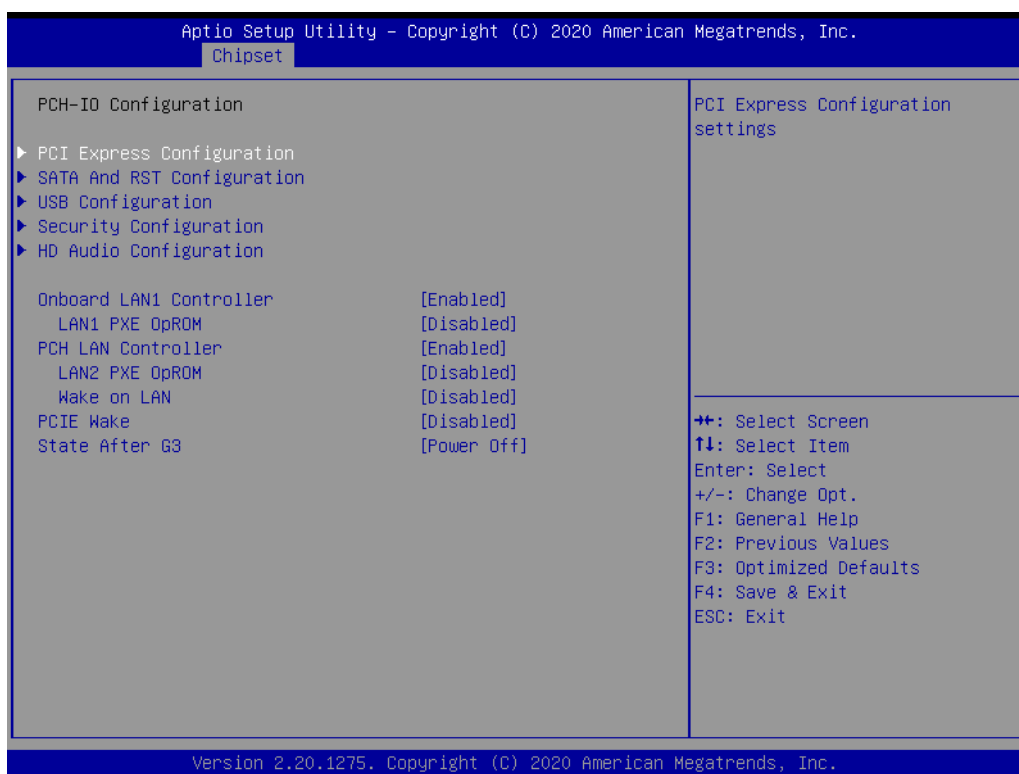
- **Graphics Turbo IMON Current**
Graphics Turbo IMON current values supported.
- **Internal Graphics Pei Display Peim**
Keep IGFX enabled based on the setup options.
- **GTT Size**
Select the GTT Size.
- **Aperture Size**
Select the Aperture Size.
- **DVMT Pre-Allocated**
Select DVMT 5.0 Pre-Allocated (Fixed) Graphics Memory size used by the Internal Graphics Device.
- **DVMT Total Gfx Mem**
Select DVMT 5.0 Total Graphic Memory size used by the Internal Graphics Device.
- **Gfx Low Power Mode|**
This option is applicable for SFF only.
- **VDD Enable**
Enable/Disable VDD.
- **PM Support**
Enable/Disable PM Support.
- **PAVP Enable**
Enable/Disable PAVP.
- **Cdynmax Clamping Enable**
Enable/Disable Cdynmax Clamping Enable.
- **Cd Clock Frequency**
Select the highest Cd clock frequency supported by this platform.



3.2.3.2 PCH-IO Configuration

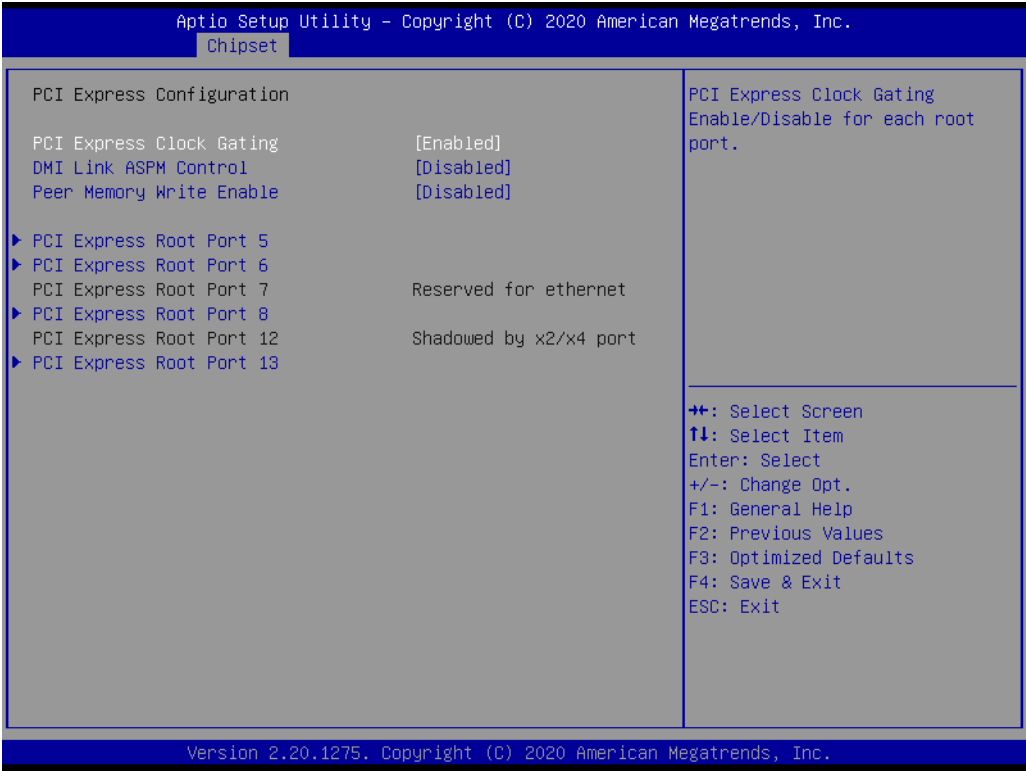


- **PCI Express Configuration**
PCI Express Configuration Settings.
- **SATA And RST Configuration**
SATA Device Options Settings.
- **USB Configuration**
USB Configuration Settings.
- **Security Configuration**
Security Configuration Settings.
- **HD Audio Configuration**
HD Audio Subsystem Configuration Settings.
- **Onboard LAN1 Controller**
Enable or Disable onboard NIC.
- **LAN1 PXE OpROM**
Enable or Disable onboard LAN's PXE option ROM.
- **PCH LAN Controller**
Enable or Disable onboard NIC.
- **LAN2 PXE OpROM**
Enable or Disable onboard LAN's PXE option OpROM.
- **PCIE Wake**
Enable or Disable PCIE to wake the system from S5.
- **State After S3**
Specify what state to go to when power is re-applied after a power failure (G3 state).



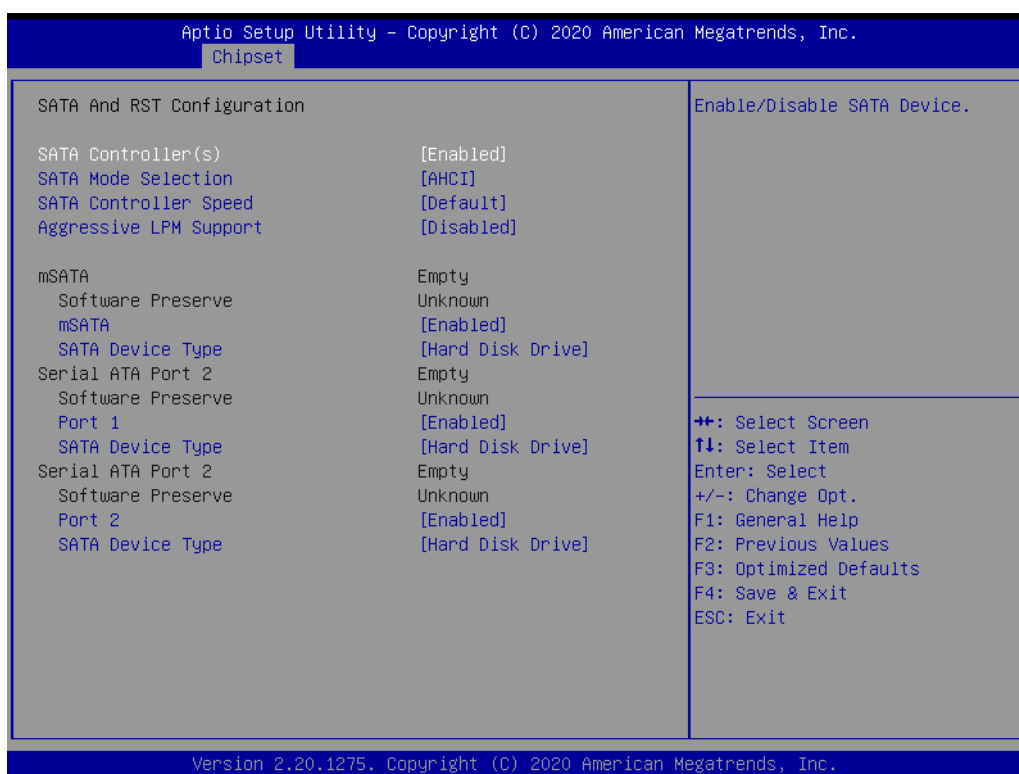
PCI Express Configuration

- **PCI Express Root Port 5/6/7/8/12/13**
PCI Express Port 5/6/7/8/12/13 settings.



SATA and RST Configuration

- **SATA Controller(s)**
Enable/Disable SATA Device.
- **SATA Mode Selection**
Determine how SATA controller operates.
- **SATA Controller Speed**
Indicates the maximum speed the SATA controller can support.
- **Software Feature Mask Configuration**
RST Legacy ROM/RST UEFI Driver will refer to the SWFM configuration to enable/disable the storage feature.
- **Aggressive LPM Support**
Enabled PCH to aggressively enter link power state.

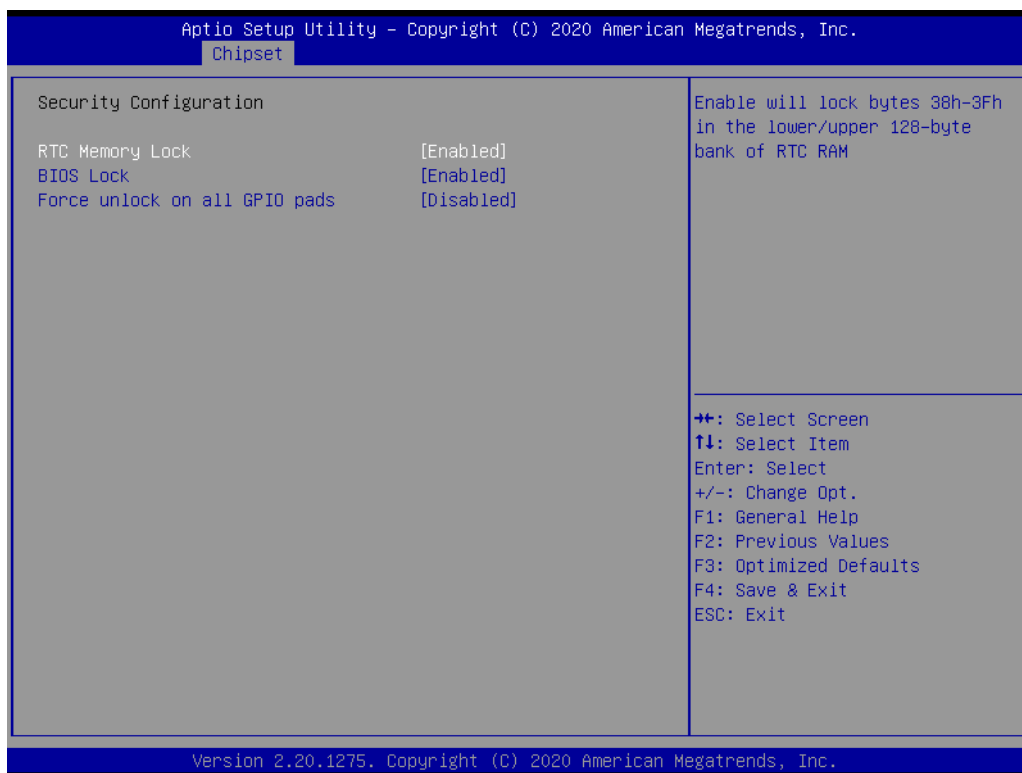


USB Configuration

- **XHCI Disable Compliance mode**
Option to disable Compliance Mode.
- **USB Port Disable Override**
Selectively Enable/Disable the corresponding USB Port from reporting a Device Connection to the Controller.

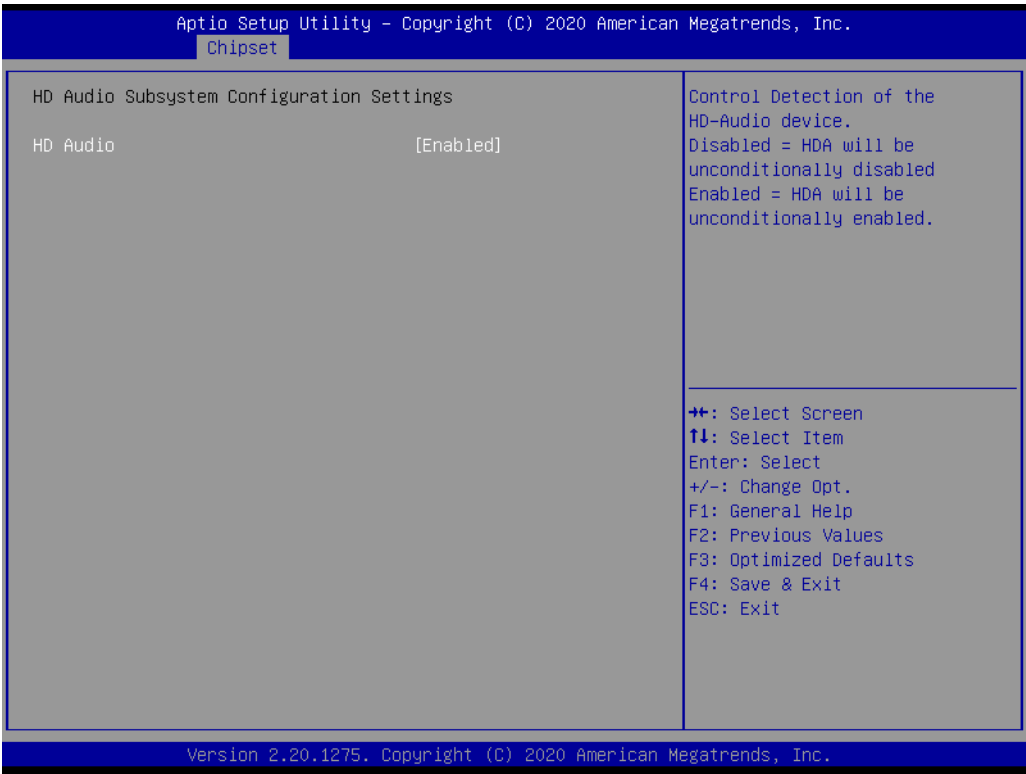


Security Configuration



- **RTC Lock**
Enable will lock bytes 38h-3Fh in the lower/upper 128-byte bank of RTC RAM.
- **BIOS Lock**
Enable or Disable the PCH BIOS Lock Enable feature.
- **Force Unlock on all GPIO pads**
Enable or Disable the Force Unlock on all GPIO pads feature.

HD Audio Configuration



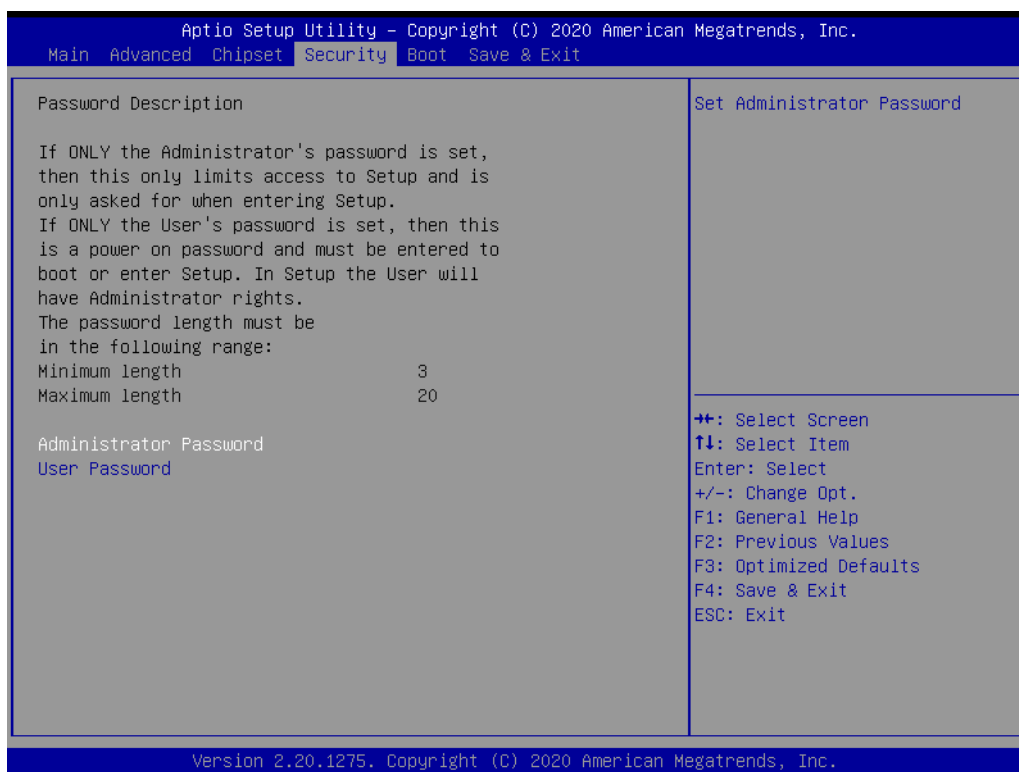
- **HD Audio**
Control Detection of the HD-Audio device. Disabled = HDA will be unconditionally disabled. Enabled = HDA will be unconditionally Enabled.

3.2.4 Security

Select Security Setup from the ARK-1551 Setup main BIOS setup menu. All Security Setup options, such as password protection and virus protection are described in this section. To access the sub menu for the following items, select the item and press <Enter>:

- **Change Administrator/User Password**

Select this option and press <ENTER> to access the sub menu, and then type in the password.



3.2.5 Boot

- **Setup Prompt Timeout**
Number of seconds that the firmware will wait before initiating the original default boot selection. A value of 0 indicates that the default boot selection is to be initiated immediately on boot. A value of 65535(0xFFFF) indicates that firmware will wait for user input before booting. This means the default boot selection is not automatically started by the firmware.
- **Bootup NumLock State**
Select the keyboard NumLock state.
- **Quiet Boot**
Enables or disables Quiet Boot option.
- **Boot Option #1**
Sets the system boot order.
- **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.



Appendix **A**

Watchdog Sample Code

A.1 Watchdog Timer Sample Code

```
EC_Command_Port = 0x29Ah
EC_Data_Port = 0x299h
Write EC HW ram = 0x89
Watch dog event flag = 0x57
Watchdog reset delay time = 0x5E
Reset event = 0x04
Start WDT function = 0x28
=====

.model small
.486p
.stack 256
.data
.code
org 100h
.STARTup
mov dx, EC_Command_Port
mov al,89h ; Write EC HW ram.
out dx,al
mov dx, EC_Data_Port
mov al, 5Fh ; Watchdog reset delay time low byte (5Eh is high
byte) index.
out dx,al
mov dx, EC_Data_Port
mov al, 30h ;Set 3 seconds delay time.
out dx,al
mov dx, EC_Command_Port
mov al,89h ; Write EC HW ram.
out dx,al
mov dx, EC_ EC_Data_Port
mov al, 57h ; Watch dog event flag.
out dx,al
mov dx, EC_Data_Port
mov al, 04h ; Reset event.
out dx,al
mov dx, EC_Command_Port
mov al,28h ; start WDT function.
out dx,al
.exit
```


Appendix **B**

SUSI API Introduction

B.1 SUSI API Introduction

To provide programmers with easier, more convenient access to hardware, Advantech has released a suite of application programming interfaces (APIs) in the form of a program library. This program library is known as the Secured and Unified Smart Interface, or SUSI for short.

SUSI provides a uniform API for application programmers to access the hardware functions in different OS and on different Advantech platforms. Application programmers can invoke the functions exported by SUSI instead of calling the drivers directly. The benefit of using SUSI is portability. The same set of APIs is defined for various Advantech platforms and implemented on different OS.

The hardware functions currently supported by SUSI are grouped into various categories and APIs, such as the Watchdog API and Hardware Monitor API. The most common of the SUSI APIs are briefly described below.

B.1.1 Watchdog API

A watchdog timer (abbreviated as WDT) is a hardware device that triggers an action, e.g., system reboot, if the system does not reset the timer within a specific period of time. The WDT API in SUSI provides developers with functions such as starting the timer, resetting the timer, and setting the timeout value if the hardware requires customized timeout values.

B.1.2 Hardware Monitor API

The hardware monitor (abbreviated as HWM) is a system health supervision capability achieved by placing certain I/O chips along with sensors for inspecting the target of interest for certain condition indexes, such as temperature and voltage.

However, due to the inaccuracy of many commercially available hardware monitoring chips, Advantech has developed a unique scheme for hardware monitoring that uses a dedicated micro-processor with algorithms specifically designed for providing accurate, reliable, real-time data.



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