RICH-61D0

NUC form factor board

Version 2.1

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Revision History

R1.0	Preliminary
R2.0	Add Power Button Function
R2.1	Update WIFI M.2 Key E

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Contents

1 Introduction 7
2 Specifications 8
2.1 Supported Operating Systems 10
2.2 Mechanical Dimensions 11
2.3 Power Consumption 12
2.4 Environmental Specifications 13
3 Block Diagram 14
4 Hardware Configuration 15
4.1 Connector Function 15
4.2 Jumper Settings 16
5 System Resources 23
5.1 Intel® Apollo Lake SoC 23
5.2 Main Memory 23
5.3 Installing the Single Board Computer 23
5.3.1 Chipset Component Driver 24
5.3.2 Intel® HD Graphics 50X 24
5.3.3 Intel LAN I210IT/I219LM Gigabit Ethernet Controller 25
6 BIOS Setup Items 26
6.1 Introduction 26
6.2 BIOS Setup 26
6.2.1 Main 28

6.2.2 Configuration 30
6.2.3 Security 53
6.2.4 Boot 55
6.2.5 Save & Exit 57
7 Troubleshooting 59
7.1 Hardware Quick Installation 59
7.2 BIOS Setting 60
7.3 FAQ 61
8 Portwell Software Service 63
9 Industry Specifications 64

Preface

This user's guide provides information about the components, features, connectors and BIOS Setup menus available on the RICH-61D0. This document should be referred to when designing 4" Embedded board application. The other reference documents that should be used include the following:

- ✧ Intel Apollo Lake Design Guide
- ✧ Intel Apollo Lake I Specification

Please contact PORTWELL Sales Representative for above documents.

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1 Introduction

PORTWELL, Inc., (http://www.Portwell.net) a world-leading innovator in the Medical Electronic market, today announces the release of the RICH-61D0 utilizing the Intel® NUC form factor based on the Intel Atom® processor E3900 series, includes integrated, enhanced graphics and memory controllers on 14nm process technology, delivering significant power reduction, performance improvements and smaller platform footprint over the previous Intel Atom® processor E3900 series. The RICH-61D0 can provide the low power consumption for low profile fan-less applications such as Medical, Panel PC, POS, Print Imaging, ATM, Kiosk, Digital Security and Digital Signage.

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2 Specifications

CPU	Intel Atom® Apollo Lake SOC, Pentium and Celeron Processor support Dual/Quad Core (up to 10W) With 2MB Cache
GPU	- Intel® Gen 9 Graphics supports DirectX 12, OpenGL 4.2 / OpenCL 2.0 - Video decode HW accelerator - support for H.264, H.265, MPEG2, VC-1/WMV9, JPEG, VP8 and VP9
BIOS	AMI uEFI BIOS 64MB
System Memory	Dual Channel DDR3L 1866/1600 Non-ECC SO-DIMM up to 8GB
Storage	- 1x SATA III port (SATA DOM) - 1x Micro-SD 3.0 socket - Support Onboard eMMC 5.0 (32G/64G)
Watchdog Timer	Programmable by SIO
H/W statue monitor	- Temperature (CPU & System) - Voltage (CPU Vcore,12V, 5V, 3.3V, 1.35V)
Expansion Interface	1x M.2 socket (E key) support WiFi, BT
Serial Port	1x RS-232 connector
USB	- 4x USB 3.0 ports support by stacked connector (Front + Left) - 2x USB 2.0 ports on board with pitch 2.0 header

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Audio	**- High Definition Audio integrated in Intel SoC** **- Realtek ALC255 HDA codec** **- Audio jack with Mic-In or Line-out**
Ethernet	**- High Definition Audio integrated in Intel® SoC** **- Realtek ALC255 HDA F23** **- Audio jack with MIC In orLine-out**
Display Interface	**- 1x HDMI (1.4b) port on board connector, up to 3840x2160@30 MHz** **- 1x DP(1.2) port on rear I/O, up to 4096x2160@60Mhz**

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2.1 Supported Operating Systems

The RICH-61D0 supports the following operating systems.

- ✧ Windows 10* (64 bit)
- ✧ Wind River* 8.0 Linux Distribution(64 bit)
- ✧ Yocto* Tool-based Embedded Linux Distribution (64 bit)
- ✧ Android* 6.0(64bit)
- ✧ VxWorks*7.0 (RTOS) (64 bit)

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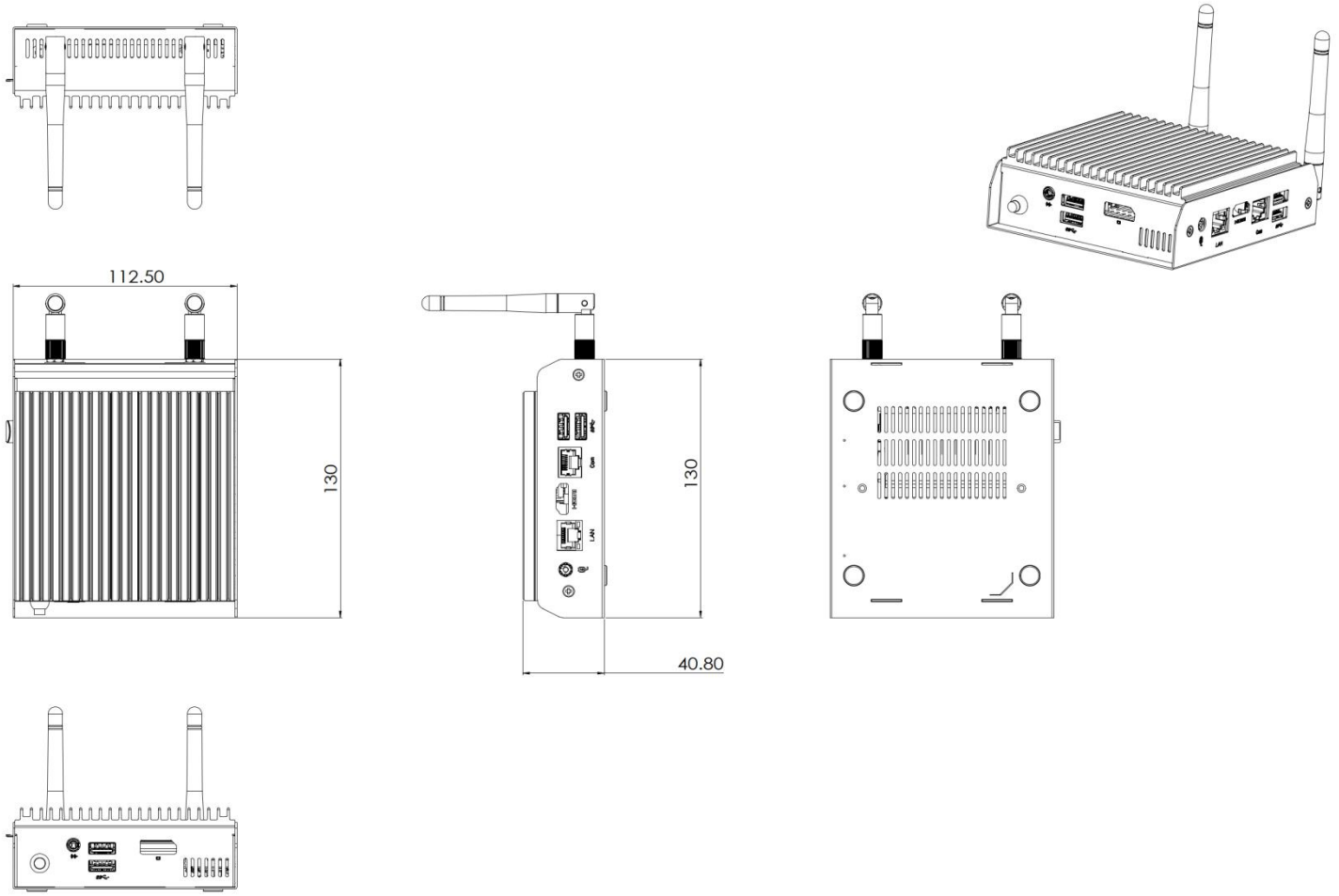
2.2 Mechanical Dimensions



2.3 Power Consumption

3 Test Configuration	
CPU Type	Intel Pentium® CPU N4200 @ 1.10GHz
SBC BIOS	Portwell,Inc. BIOS Version: 70908T00
Memory	DDR3L-1866 non-ECC up to 8GB
VGA Card	(DDI1, RTD2168) Resolution up to 1920 x 1200
VGA Driver	Intel Driver Version: 21.20.16.4590
LAN Card	RJ-45: Support 10/100/1000Mbps by RTL8111H Ethernet Controller (SoC PCIe port 0)
LAN Driver	REALTEK Driver Version: 1002.0715.2015
LAN Card	N/A
LAN Driver	N/A
Audio Card	Support ALC255
Audio Driver	REALTEK Driver Version: 6.0.1.7571
Chip Driver	Intel Driver includes WiX Toolset 3.7
USB3.0 Driver	Intel Driver includes WiX Toolset 3.7
EC Version	N/A
Power Supply	Support standard ATX or AT power up mode
Power Supply	N/A

Power consumption(24V)

ATX:

Item	Power ON	Full Loading 10Min	Full Loading 30Min
CPU +24V	N/A	N/A	N/A
Device+12V	N/A	N/A	N/A
Device +5V	N/A	N/A	N/A
CPU+ Device +24V+12V	N/A	N/A	N/A
USB3.0 Loading Test	4.94 V/ 860 mA		

2.4 Environmental Specifications

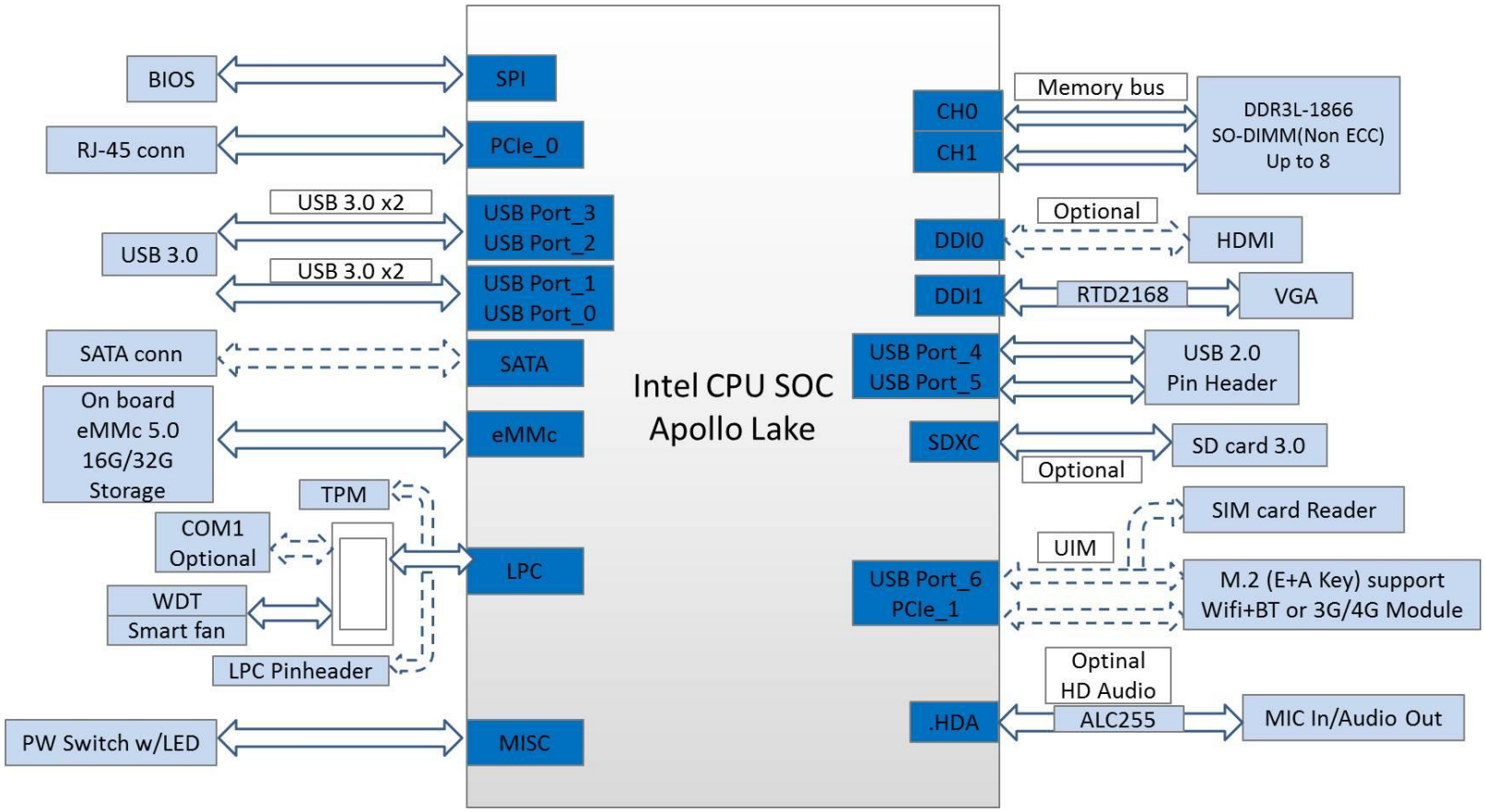
Storage Temperature : -40~85°C

Operation Temperature : 0~60°C

Storage Humidity : 5~90%

Operation Humidity: 10~90%

3 Block Diagram



4 Hardware Configuration

4.1 Connector Function

We have made a list of connector function. The following figure shows where the connectors are and what they are called in board file.

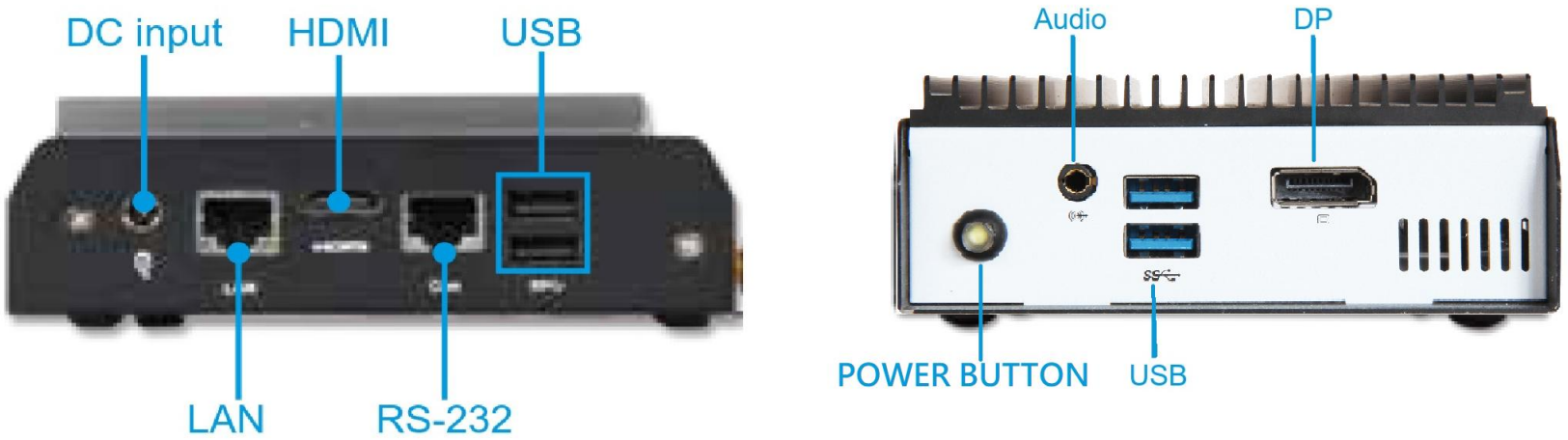


Figure1. RICH-61D0 System View

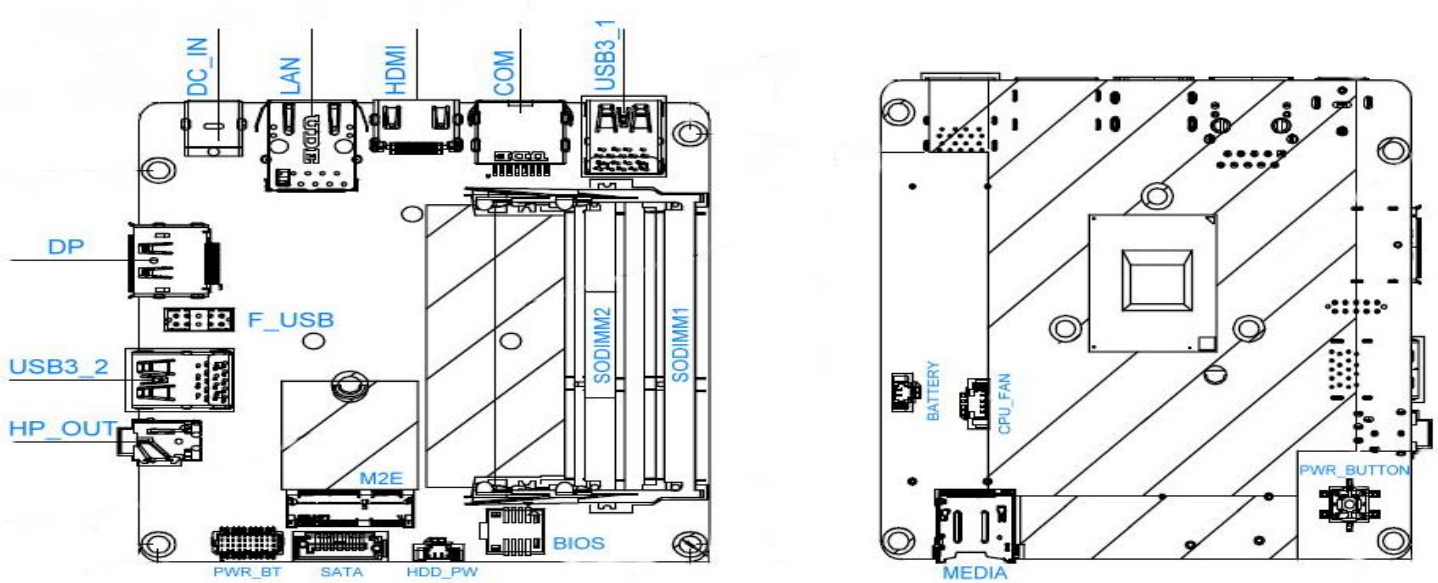


Figure2. RICH-61D0 Board View

4.2 Jumper Settings

For users to customize RICH-61D0's features. In the following sections, Users can refer to Figure 1& 2 for the Jumper allocations.

Jumper Table

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

Connector Function List:

Connector	Function	Remark
DC_IN	DC_IN	VIN=12/19V
LAN	LAN	GIGALAN
HDMI	HDMI	
COM	COM	RS232
USB3_1	USB 3.0 *2	
DP	DP	
F_USB	F_USB	
USB3_2	USB 3.0 *2	
HP_OUT	Global Headset + MIC-IN	
PWR_BT	PWRBTN/RSTBTN/LEDs	
SATA	SATA3	
M2E	WLAN SLOT	
HDD_PW	DEVSLP	
BIOS	BIOS SPI SOCKET	
SODIMM1	DDR3L SO-DIMM SOCKET	
SODIMM2	DDR3L SO-DIMM SOCKET	
BATTERY	CR2032/40mm/1.25	
MEDIA	Micro SD	
CPU_FAN	CPU_FAN	
PWR_BUTTON	SIO NCT5510Y PWR	

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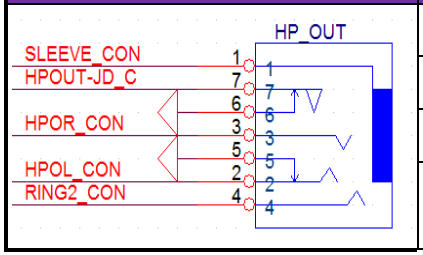
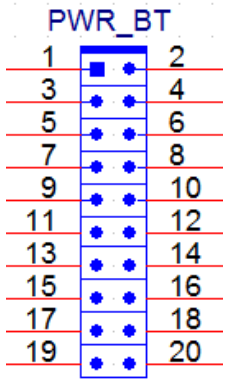
HP_OUT:

PCB Footprint	PIN No.	Signal Description	PIN No.	Signal Description
	1	SLEEVE_CON	2	HPOL_CON
	3	HPOR_CON	4	RING2_CON
	5	GND	6	GND
	7	HPOUT-JD_C		

PWR_BT:

PCB Footprint	PIN No.	Signal Description	PIN No.	Signal Description
	1	CLK_25M_80H	2	GND
	3	LFRAME#	4	LAD0
	5	PMU_PLTRST_N	6	LAD1
	7	LAD3	8	LAD2
	9	+V3.3S	10	SERIRQ_3V3
	11	-PANSHW	12	GND
	13	MPD_+	14	MPD-
	15	WDT#	16	SATA_LED_P
	17	GND	18	GND
	19	+V5S	20	+V5A

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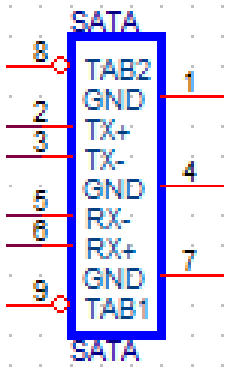
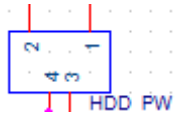
SATA:

PCB Footprint	Pin No	Signal Description
	1	GND
	2	TX+
	3	TX-
	4	GND
	5	RX-
	6	RX+
	7	GND
	8	TAB2
	9	TAB1

HDD_PW:

PCB Footprint	Pin No	Signal Description	Pin No	Signal Description
	1	+V5S	2	GND
	3	GND	4	GND

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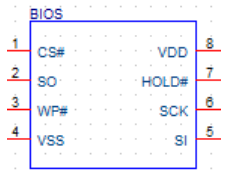
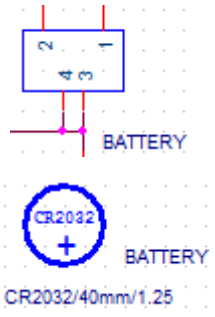
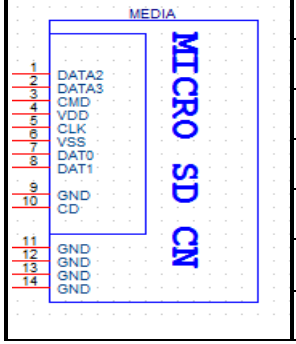
BIOS:

PCB Footprint	PIN No.	Signal Description	PIN No.	Signal Description
	1	CS#	2	SO
	3	WP#	4	VSS
	5	SI	6	SCK
	7	HOLD#	8	VDD

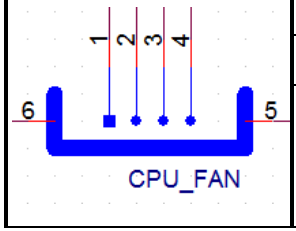
BATTERY:

	PIN No.	Signal Description	PIN No.	Signal Description
	1	BAT	2	GND
	3	GND	4	GND

Micro SD:

	PIN No.	Signal Description	PIN No.	Signal Description
	1	DAT2	2	DAT3
	3	CMD	4	VDD
	5	CLK	6	VSS
	7	DAT0	8	DAT1
	9	GND	10	CD
	11	GND	12	GND
	13	GND	14	GND

MEDIA:

	PIN No.	Signal Description	PIN No.	Signal Description
	1	CMD	2	FAN_VCC
	3	TACH_PWRFAN1	4	PWM_PWMFAN1
	5	CMD	6	CMD

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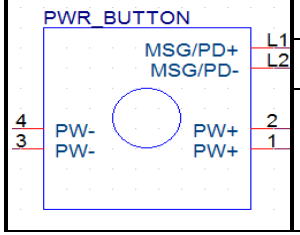
PWR_BUTTON:

	PIN No.	Signal Description	PIN No.	Signal Description
	1	PW+	2	PW+
	3	PW-	4	PW-
	L1	MSG/PD+	L2	MSG/PD-

5 System Resources

5.1 Intel® Apollo Lake SoC

Intel® Celeron® Processor J3455 (2M Cache, up to 2.30 GHz)
Intel® Celeron® Processor N3350 (2M Cache, up to 2.40 GHz)
Intel® Pentium® Processor N4200 (2M Cache, up to 2.50 GHz)

5.2 Main Memory

RICH-61D0 provides 1 x 204-pin SO-DIMM sockets which supports DDR3L non-ECC memory. The maximum memory can be up to 8GB. Memory clock and related settings can be detected by BIOS via SPD interface.

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

5.3 Installing the Single Board Computer

To install your RICH-61D0 into standard chassis or proprietary environment, please perform the following:
Step 1 : Check all jumpers setting on proper position
Step 2 : Install and configure memory module on right position
Step 3 : Place RICH-61D0 into the dedicated position in the system

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Step 4 : Attach cables to existing peripheral devices and secure it

WARNING

Please ensure that motherboard is properly inserted and fixed by mechanism.

Note:

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

5.3.1 Chipset Component Driver

The RICH-61D0 build with Intel® Pentium® Processor J/N Series including J3455 / N3350 / N4200 sku. It's a new chipset that some old operating systems might not be able to recognize. To overcome this compatibility issue, for Windows Operating Systems such as Windows 10, please install its INF before any of other Drivers are installed. You can find very easily this chipset component driver in RICH-61D0 CD-title

5.3.2 Intel® HD Graphics 50X

RICH-61D0 has integrated Intel® HD Graphics 50X(J3455 / N3350_ Intel® HD Graphics 500, N4200_ Intel® HD Graphics 505)
Processor Graphics indicates graphics processing circuitry integrated into the processor, providing the graphics, compute, media, and display capabilities. Intel® HD Graphics, Iris™ Graphics, Iris Plus Graphics, and Iris Pro Graphics deliver enhanced media conversion, fast frame rates, and 4K Ultra HD (UHD) video
RICH-61D0 supports DP, HDMI display output. This combination makes RICH-61D0 an excellent performance hardware.

Drivers Support

Please find the Graphic driver in the RICH-61D0 CD-title. The driver supports Windows 10.

5.3.3 Intel LAN I210IT/I219LM Gigabit Ethernet Controller

- RTL8111H Gigabit Ethernet controller and RJ45 connector on rear I/O

Drivers Support

Please find RTL8111H LAN driver in Ethernet directory of RICH-61D0 CD/DVD-title. The driver supports Windows 10.

6 BIOS Setup Items

6.1 Introduction

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

6.2 BIOS Setup

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

Press<Delete> or <ESC> to enter SETUP

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

Press <F1> to Run General Help or Resume

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

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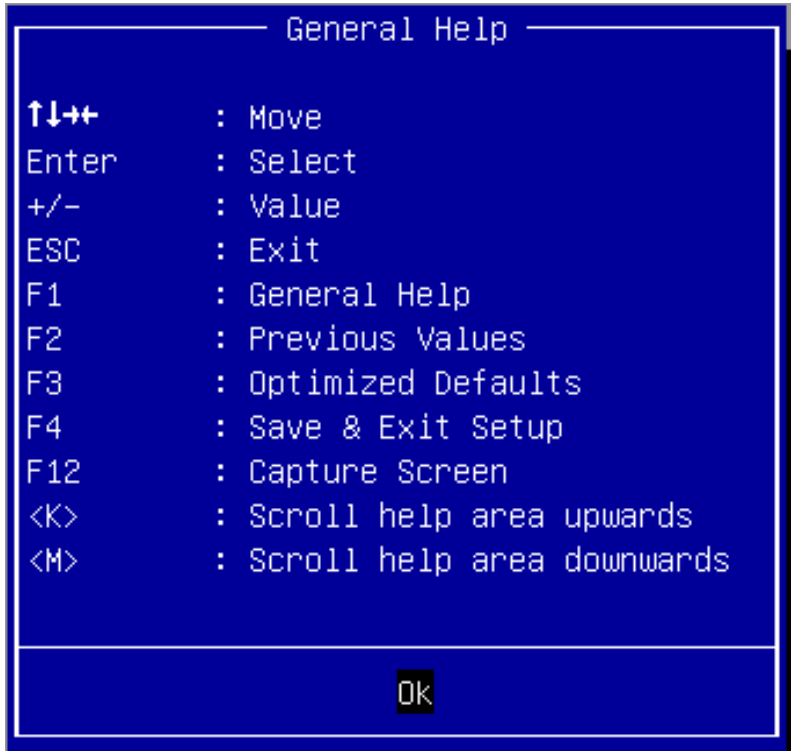

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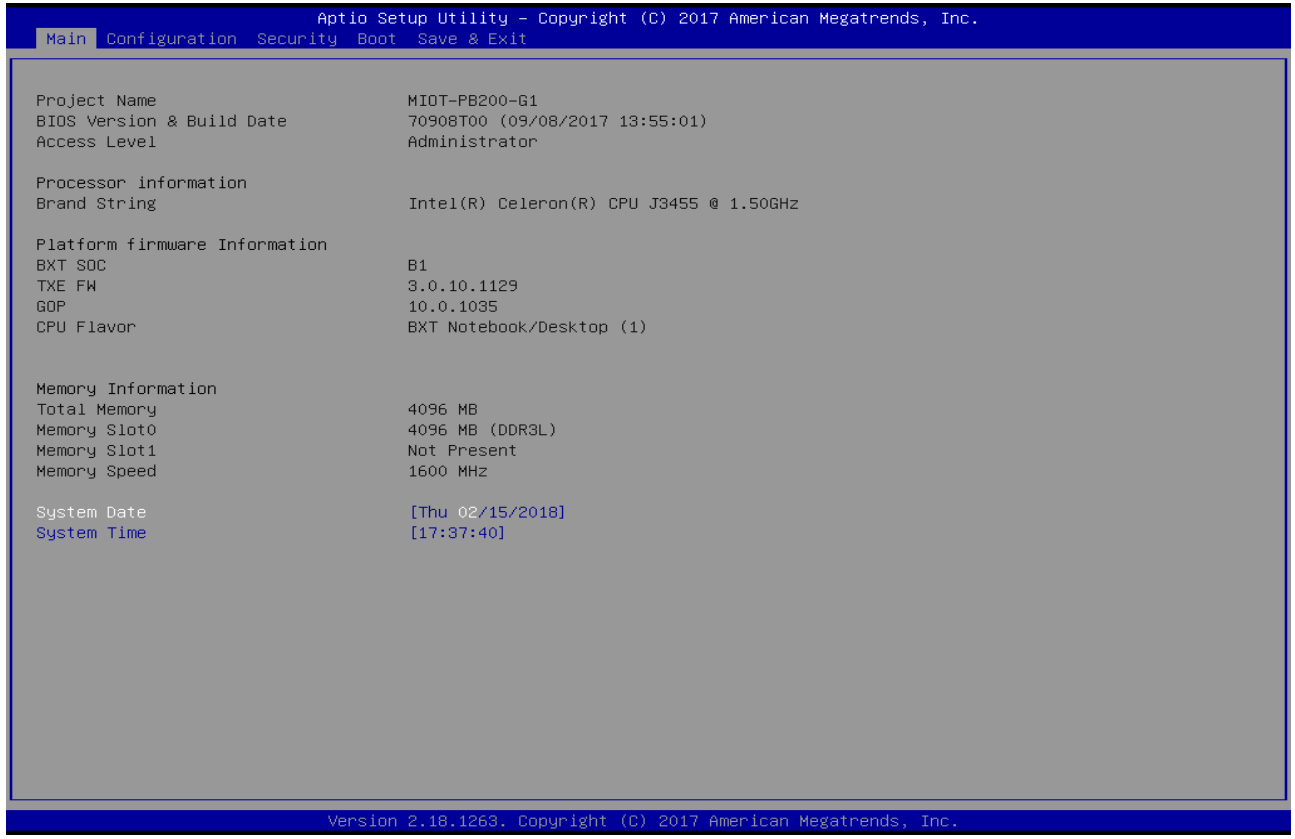
6.2.1 Main

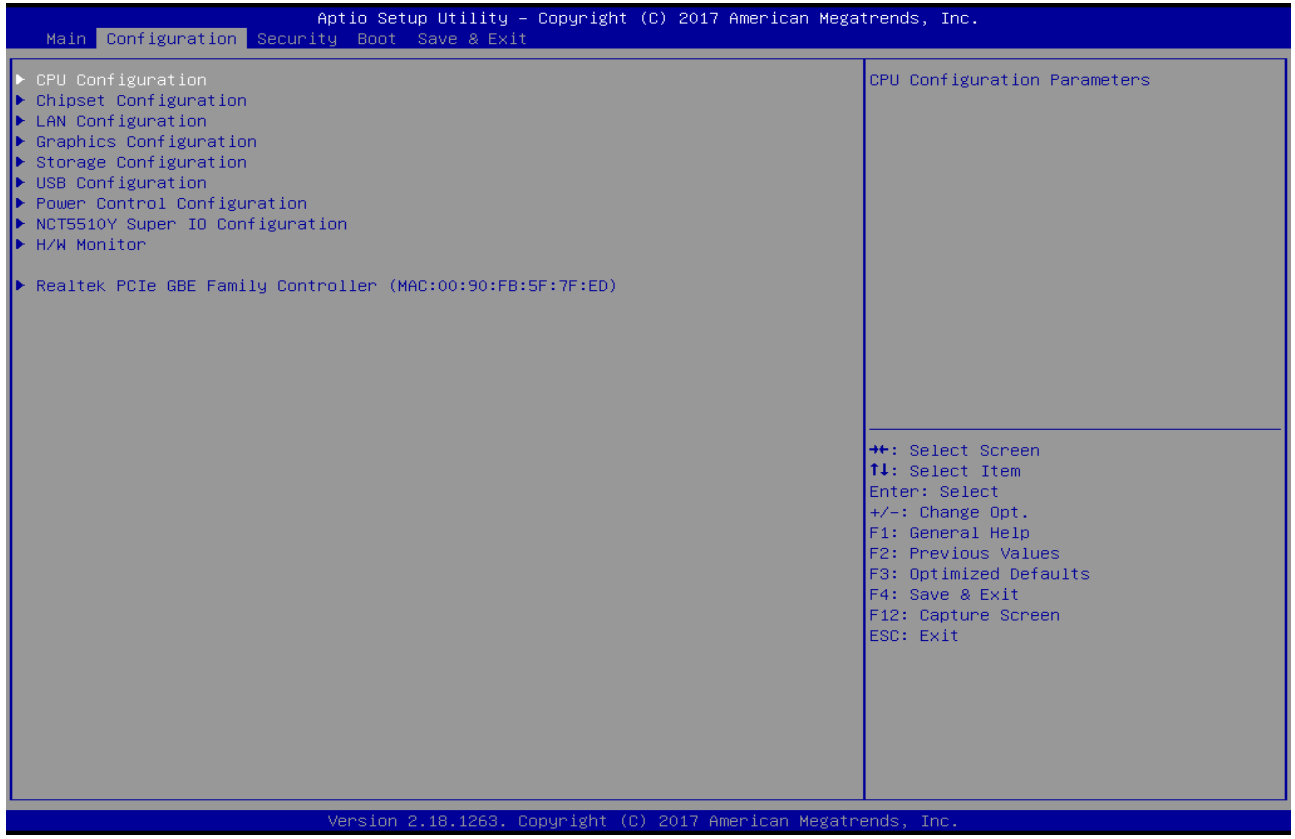
Use this menu for basic system configurations, such as time, date etc.



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

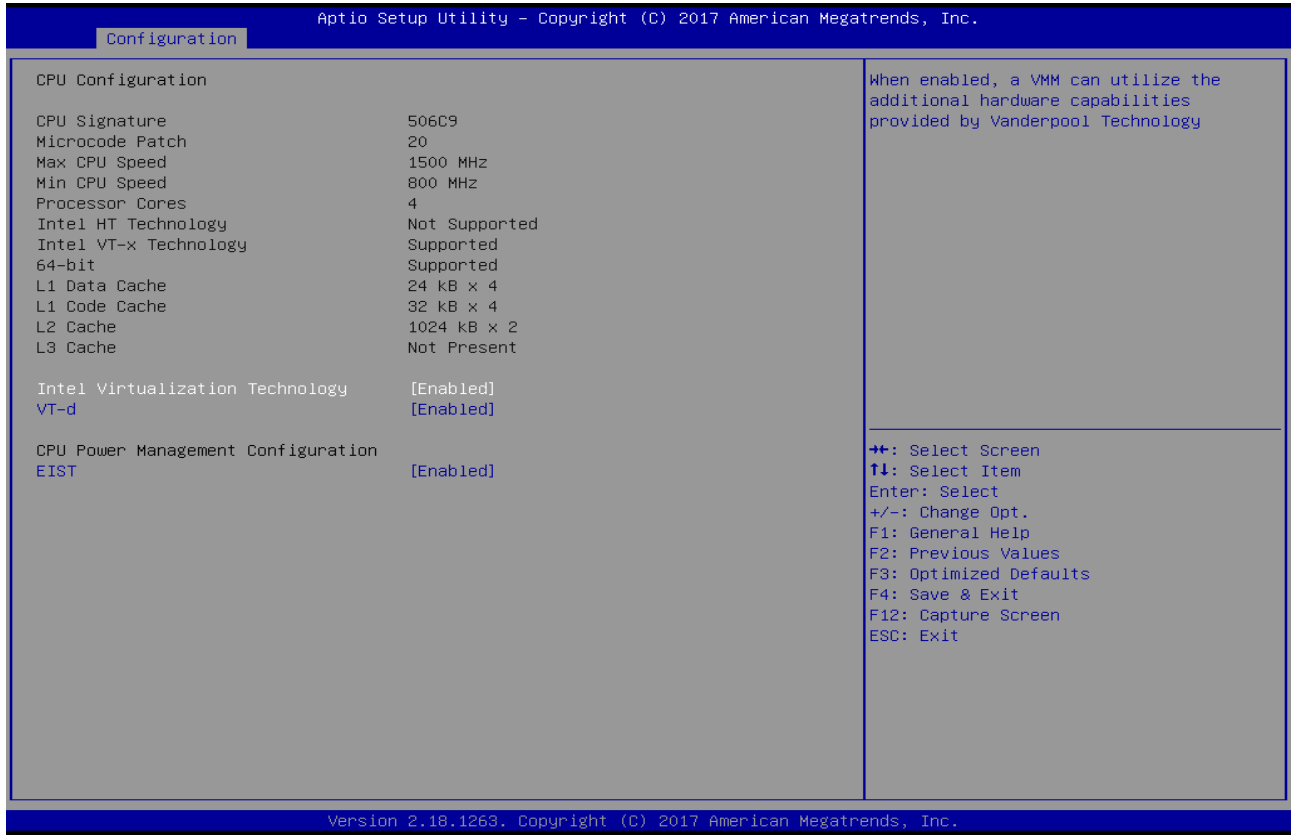
6.2.2 Configuration

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



CPU Configuration

CPU Configuration Parameters



Feature	Description	Options
Intel Virtualization Technology	When enabled, a VMM can utilize the additional hardware capabilities provided by Vanderpool Technology.	★Enabled, Disabled
VT-d	Enable/Disable CPU VT-d.	★Enabled, Disabled
EIST	Enable/Disable Intel SpeedStep.	★Enabled, Disabled

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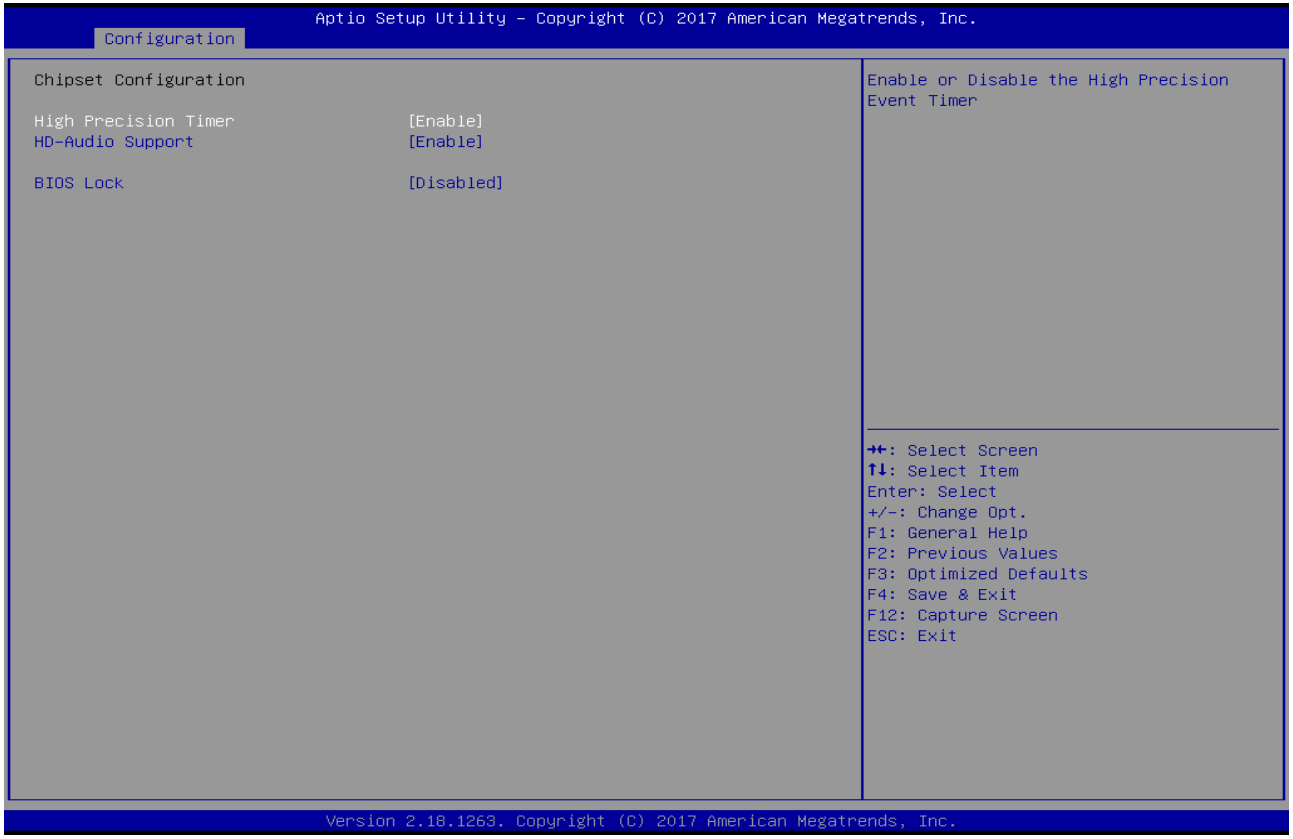
Chipset Configuration

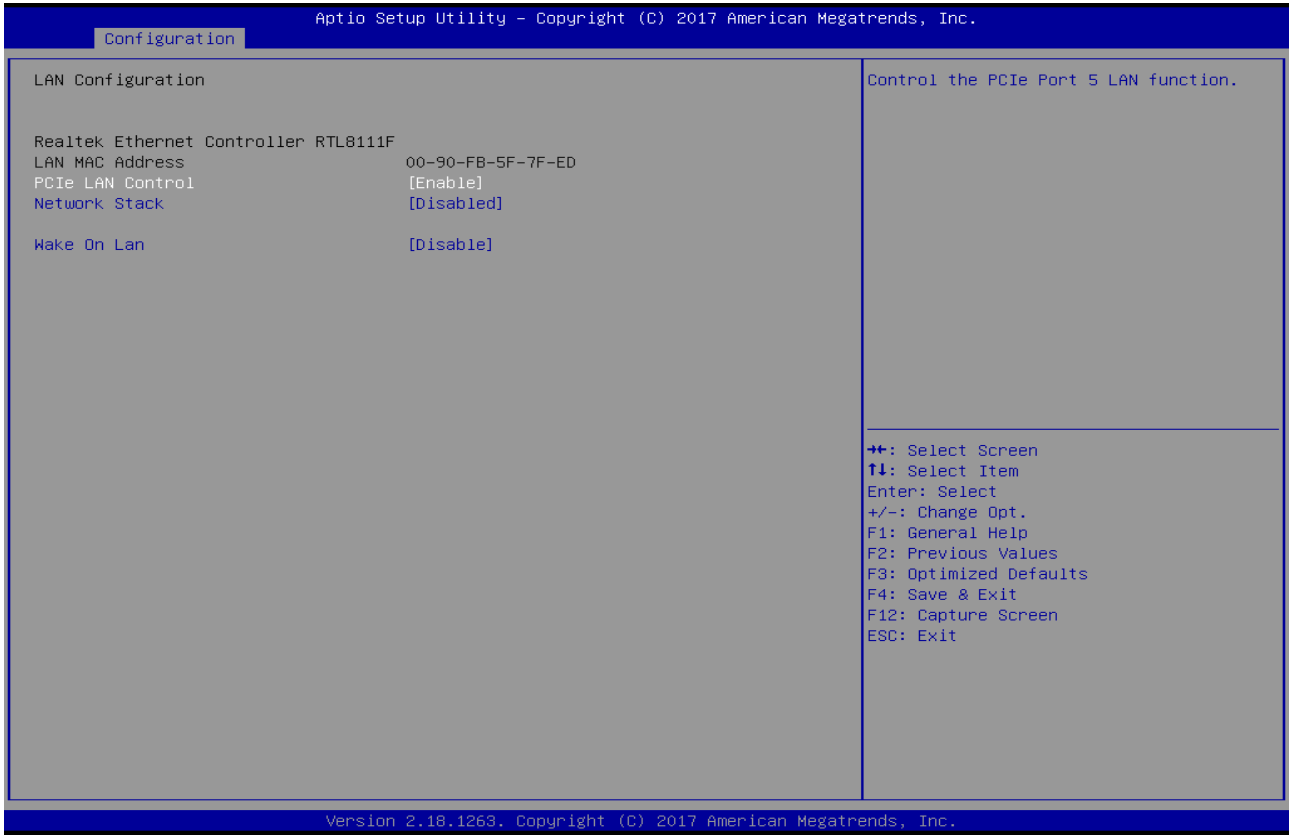
Configuration Chipset feature



Feature	Description	Options
High Precision Timer	Enable or Disable the High Precision Event Timer.	★Enable, Disable
HD-Audio Support	Enable or Disable HD-Audio Support.	★Enable, Disable
BIOS Lock	Enable or Disable BIOS Lock	★Disabled, Enabled

LAN Configuration

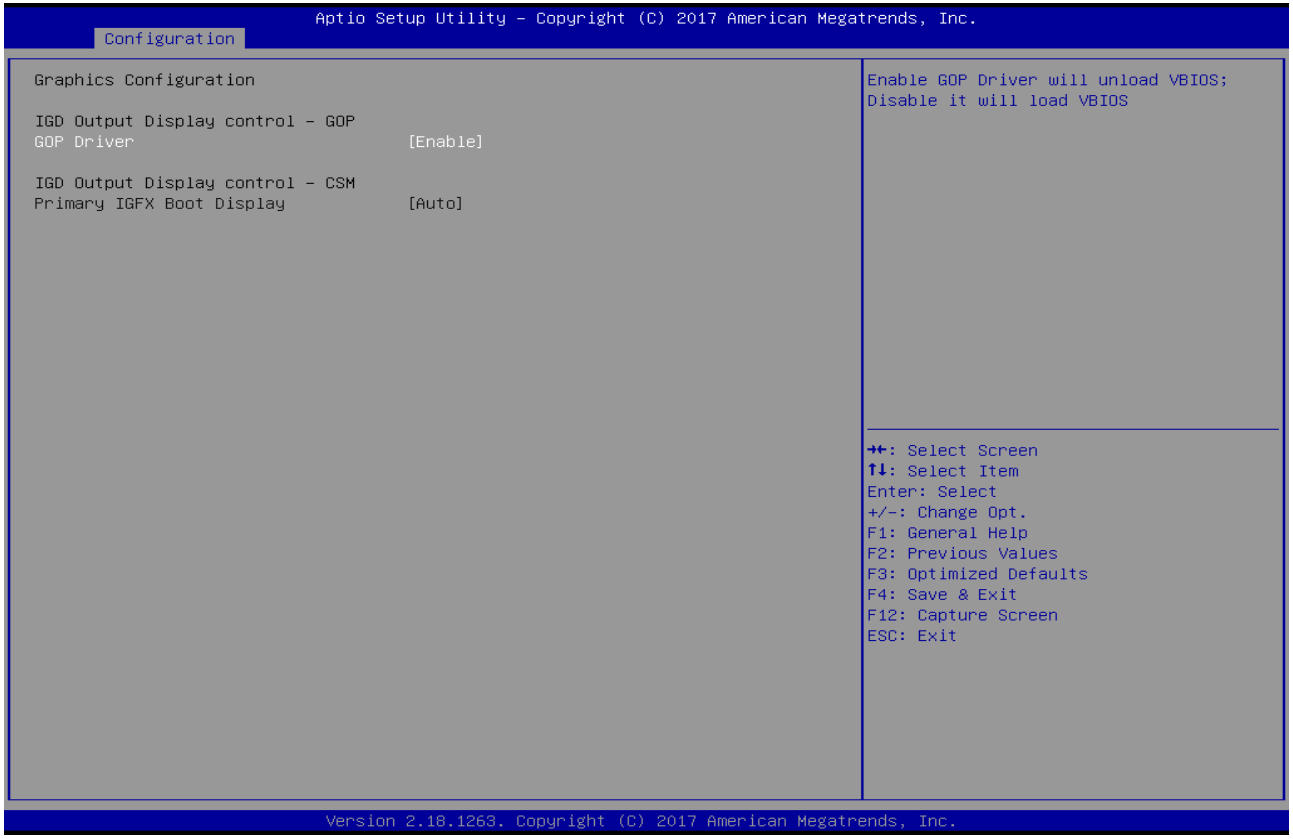
Configuration on Board LAN device.



Feature	Description	Options
PCIe LAN Control	Control the PCIe Port 5 LAN function.	★Enable, Disable
Network Stack	Enable or disable UEFI Network Stack.	★Disabled, Enabled
Network Stack[Enable]		
IPv4 PXE Support		★Disabled, Enabled
IPv6 PXE Support		★Disabled, Enabled
Wake on LAN	Enable or disable the Wake on LAN.	★Disable Enable

Graphics Configuration

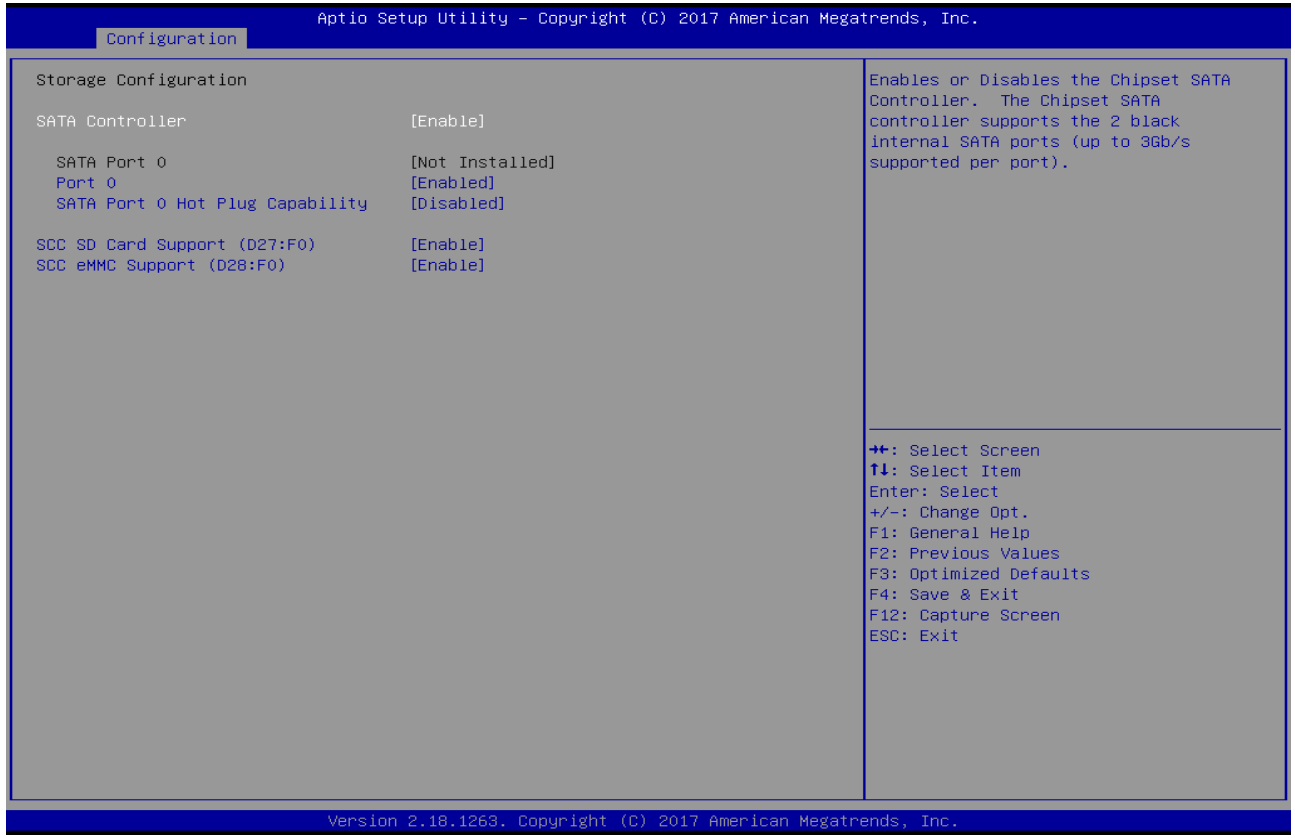
Configuration Graphics Settings



Feature	Description	Options
GOP Driver	Enable GOP Driver will unload VBIOS; Disable it will load VBIOS.	★Enable, Disable

Storage Configuration

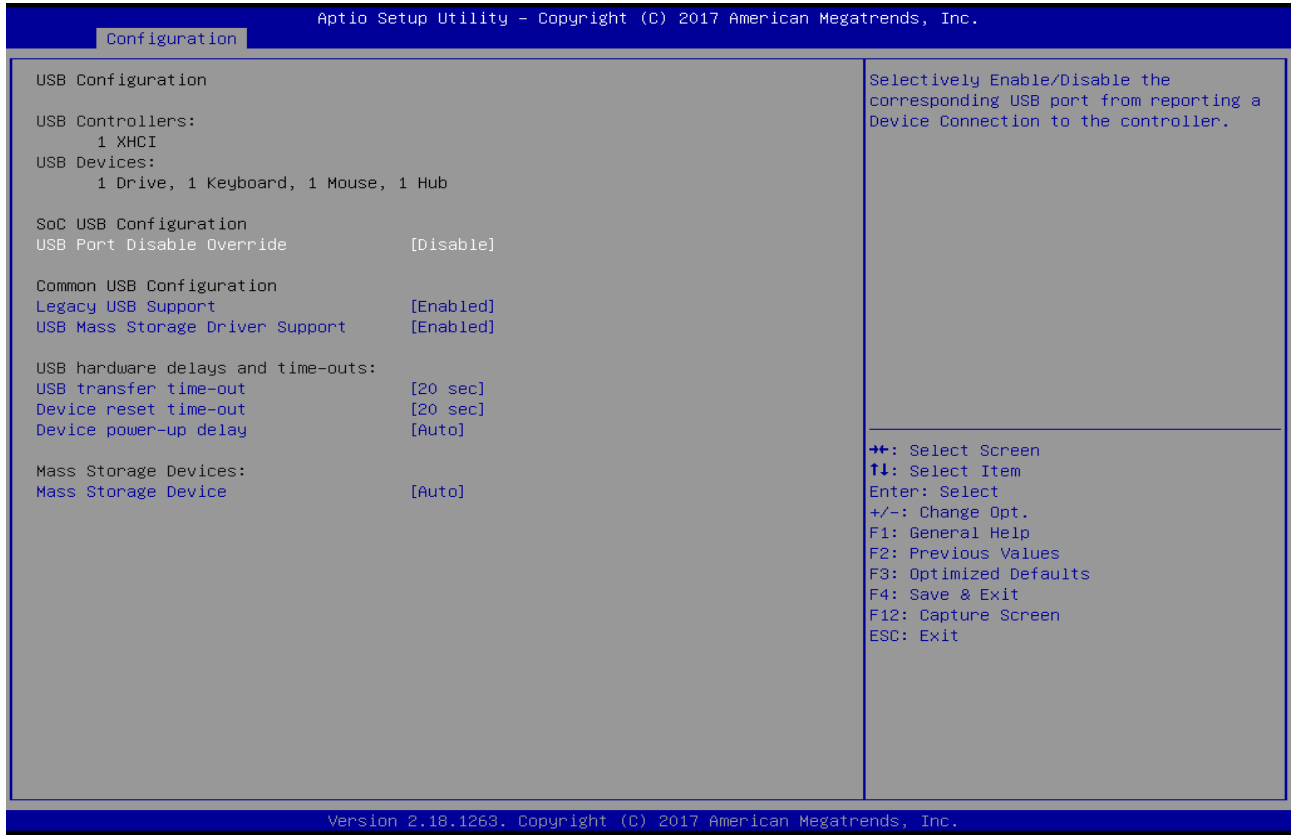
Storage Device Options Settings



Feature	Description	Options
SATA Controller	Enable or disable the chipset SATA Controller. The Chipset SATAs controller supports the 2 back internal SATA ports (up to 3Gb/s supported per port)	★Enable, Disable
SATA Port 0		
Port 0	Enable or Disable SATA Port.	★Enabled, Disabled
SATA Port 0 Hot Plug Capability	If enable, SATA port will be reported as hot Plug capable.	★Disabled, Enabled
SCC SD Card Support (D27:F0)	Enable/Disable SCC SD Card Support	★Enable, Disable
SCC eMMC Support (D28:F0)	Enable/Disable SCC eMMC Support	★Enable, Disable

USB Configuration

USB Configuration Parameters.



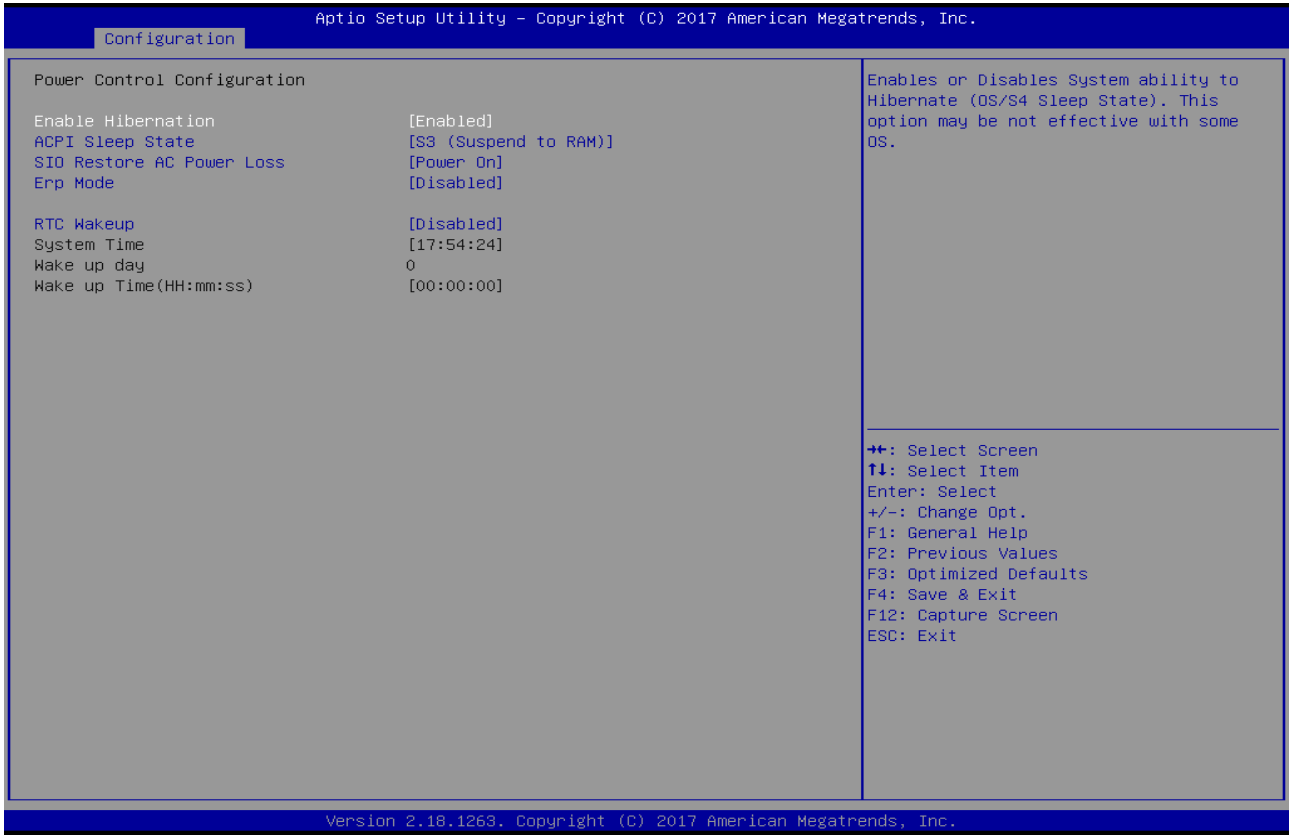
Feature	Description	Options
SoC USB Configuration		
USB Port Disable Override	Selectively Enables/Disable. The corresponding USB port from reporting a Device Connection to the controller.	★Disable, Enable
USB Port Disable Override [Enabled]		
USB Port #0	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
USB Port #1	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
USB Port#2	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
USB Port#3	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
USB Port#4	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
USB Port#5	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
USB Port#6	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
USB Port#7	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
USB 3 Port #0	Enable/Disable USB port. Once disabled, any USB devices plug into the connector	★Enabled, Disabled

	will not be detected by BIOS or OS.	
USB 3 Port #1	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
USB 3 Port #2	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
USB 3 Port #3	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
USB 3 Port #4	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
USB 3 Port #5	Enable/Disable USB port. Once disabled, any USB devices plug into the connector will not be detected by BIOS or OS.	★Enabled, Disabled
Common USB Configuration		
Legacy USB Support	Enables Legacy USB Support. Auto option disable legacy Support if no USB devices are connected. Disable option will keep USB device available only for EFI applications.	★Enabled, Disabled, Auto
USB Mass Storage Driver Support	Enable/Disable USB Mass Storage Driver Support.	★Enable, Disabled
USB Hardware delays and time-outs:		
USB transfer time-out	The time-out value for Control, Bulk, and Interrupt transfers.	★20 sec, 1 sec, 5 sec, 10 sec,
Device reset time-out	USB mass storage device Start Unit command time-out.	★20 sec, 10 sec, 30sec, 40 sec

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.	★Auto, Manual

Power Control Configuration

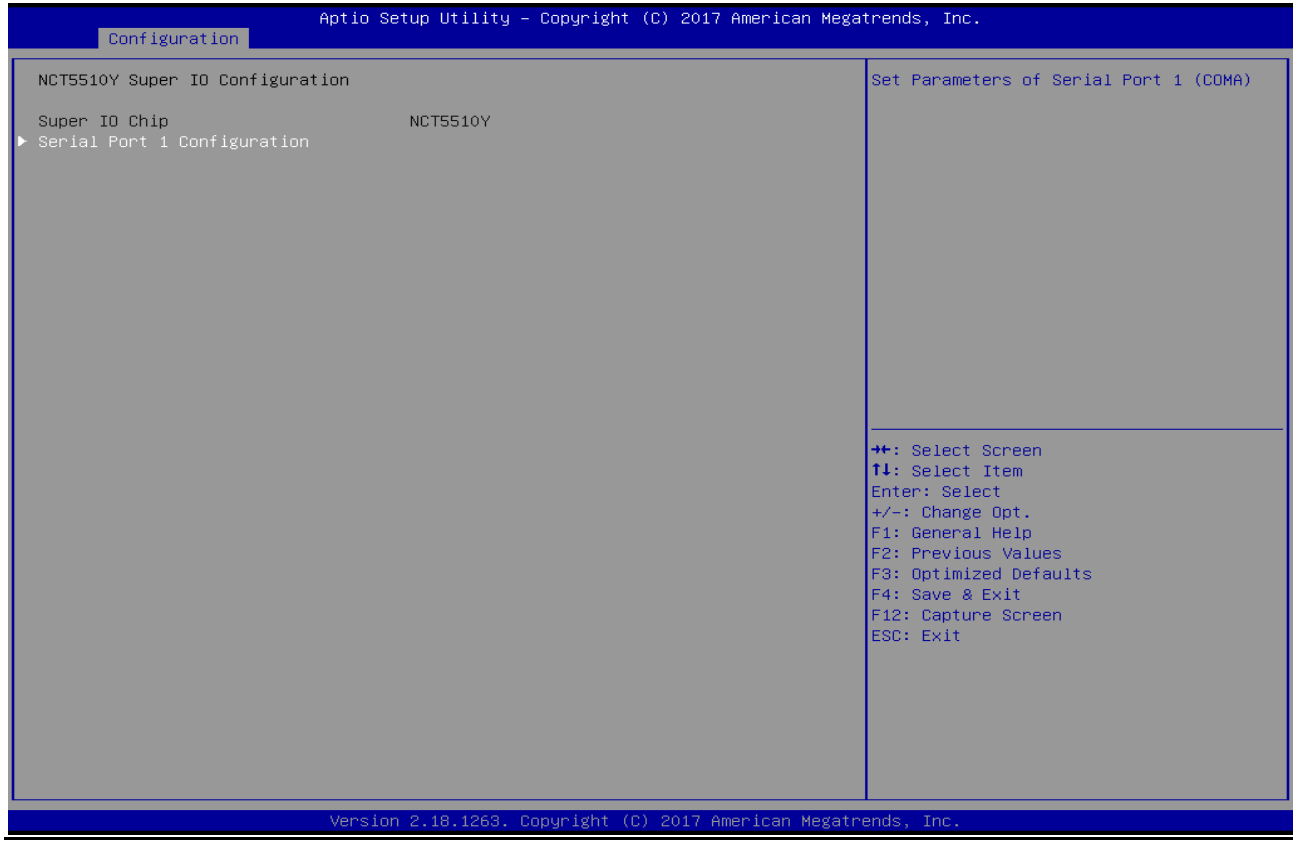
System Power Control Configuration Parameters



Feature	Description	Options
Enable Hibernation	Enables or Disables System ability to Hibernate (OS/S4 Sleep State). This option may be not effective with some OS.	★Enabled, Disabled
ACPI Sleep State	Select the highest ACPI sleep state the system will enter when the SUSPEND button is pressed.	★Suspend Disabled, S3 (Suspend to RAM), Suspend Disabled
SIO Restore AC Power Loss	Use SIO to specify what state to go to when power is re-applied after a power failure (G3 state). Power On: System will boot directly as soon as power applied. Power Off: state until power button is pressed.	★Power On, Power Off, Last State
Erp Mode	Enable/Disable Erp function in S4/S5.	★Disabled, Enabled
RTC Wake up	Enable or disable System wake on alarm event. [Enabled], system will wake up the Hour: Min: Sec specified. [Disabled] Turn off RTC Wakeup.	★Disabled, Enabled
RTC Wake up [Enabled]		
Wake up day	Select 0 for daily system wake up 1-31 for which day of the month that you would like the system to wake up	★0, 0-31
Wake up Time(HH: mm: ss)	Use [Enter], [TAB] to select field, HH: 0-23, mm: 0-59, ss: 0-59	HH: 0-23, mm: 0-59, ss: 0-59

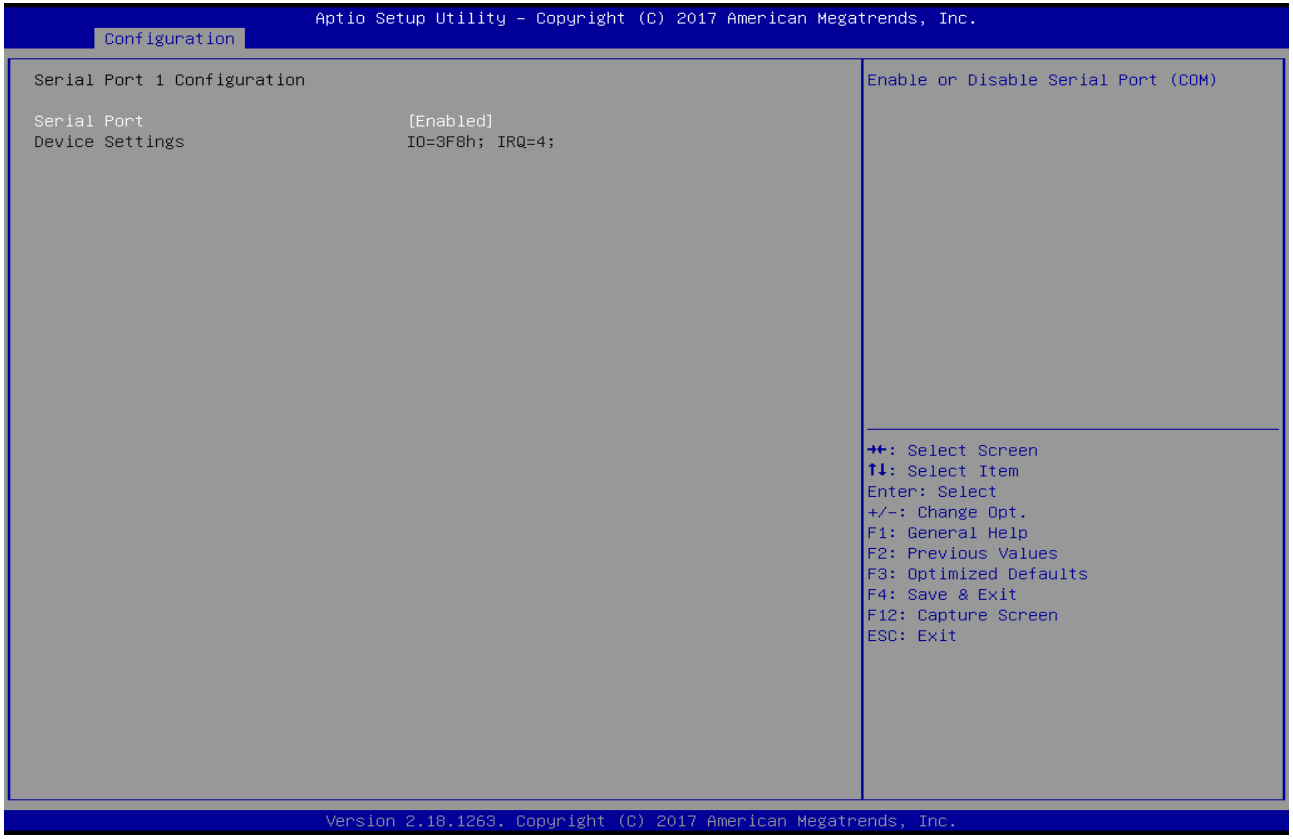
HCT5510Y Super IO Configuration

System Super IO Chip Parameters.



Serial Port 1 Configuration

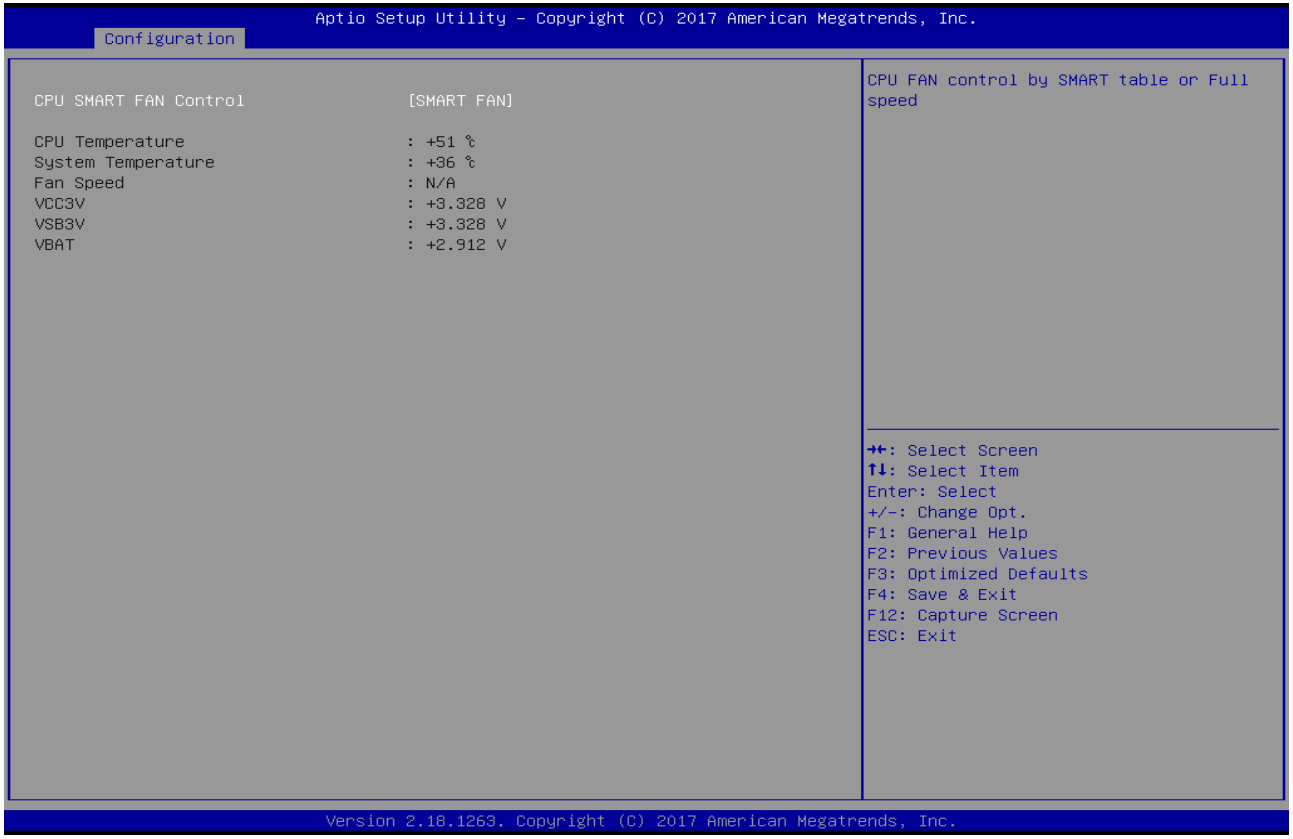
Set Parameters of Serial Port 1 (COMA)



Feature	Description	Options
Serial Port	Enable or Disable Serial Port (COM)	★Enabled, Disabled

H/W Monitor Configuration

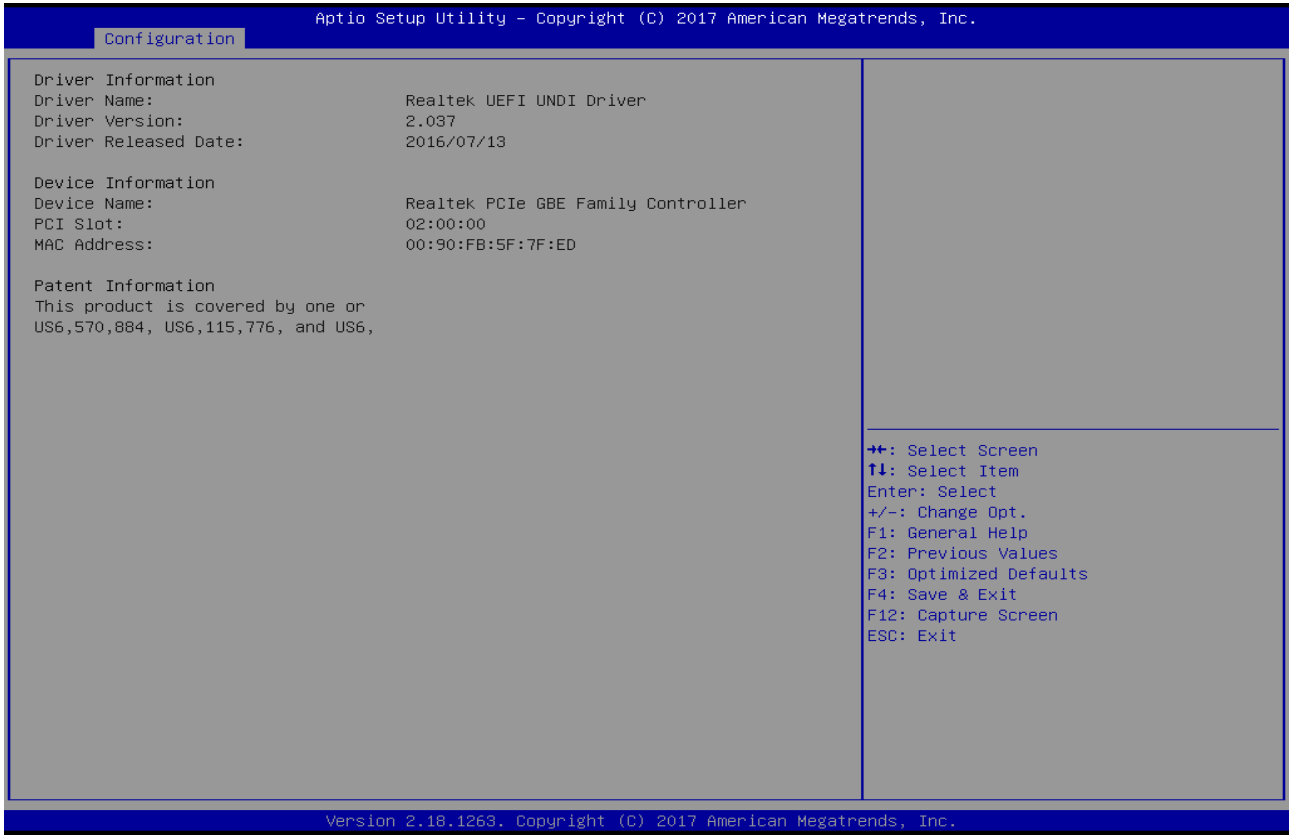
Monitor hardware status



Feature	Description	Options
CPU SMART FAN CONTROL	CPU FAN control by SMART table or FULL speed.	★SMART FAN, FULL Speed

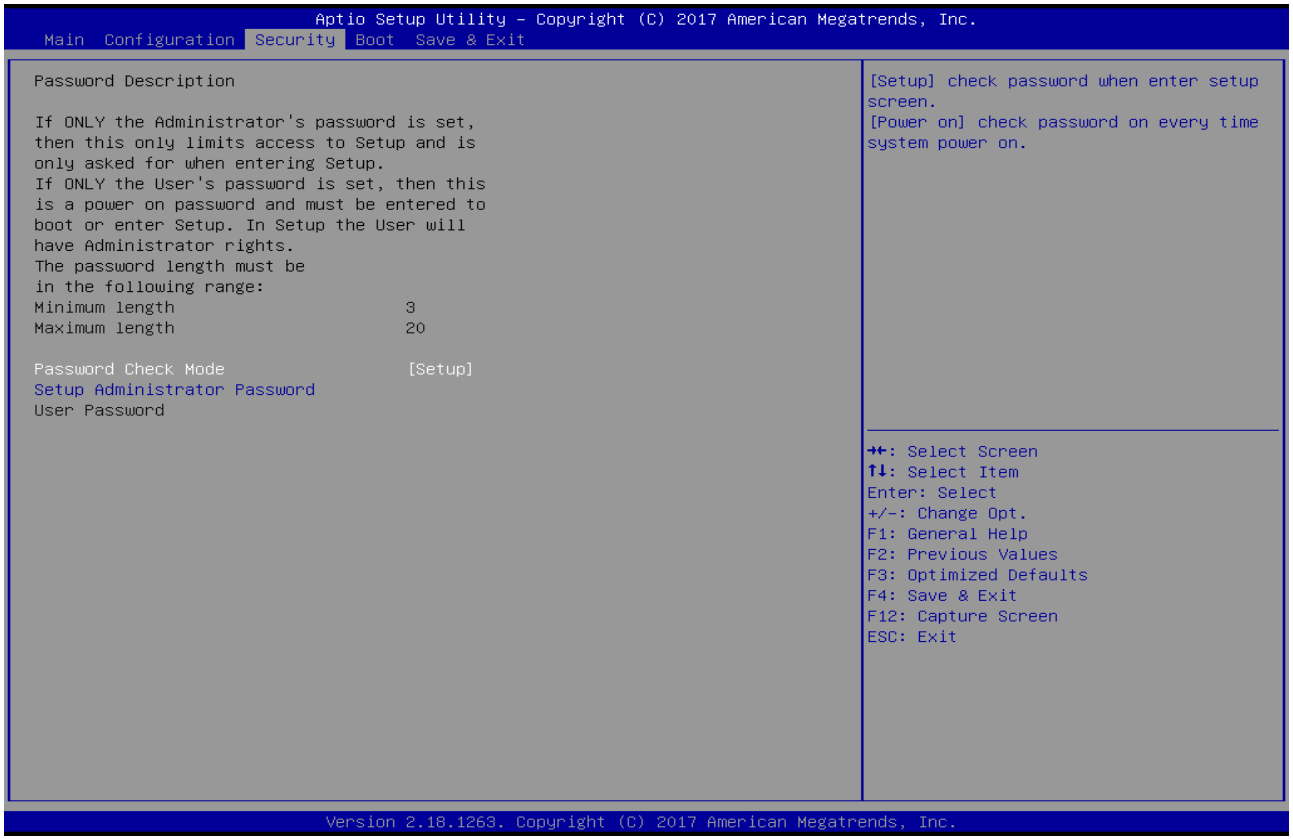
Realtek PCIe GBE Family Controller

Get driver information and configure Realtek ethernet controller parameter



6.2.3 Security

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



Feature	Description	Options
Password Check Mode	[Setup] check password when enter setup screen. [Power on] check password on every time system power on.	★Setup, Power on
Setup Administrator Password	Set Setup Administrator Password	★No default setting

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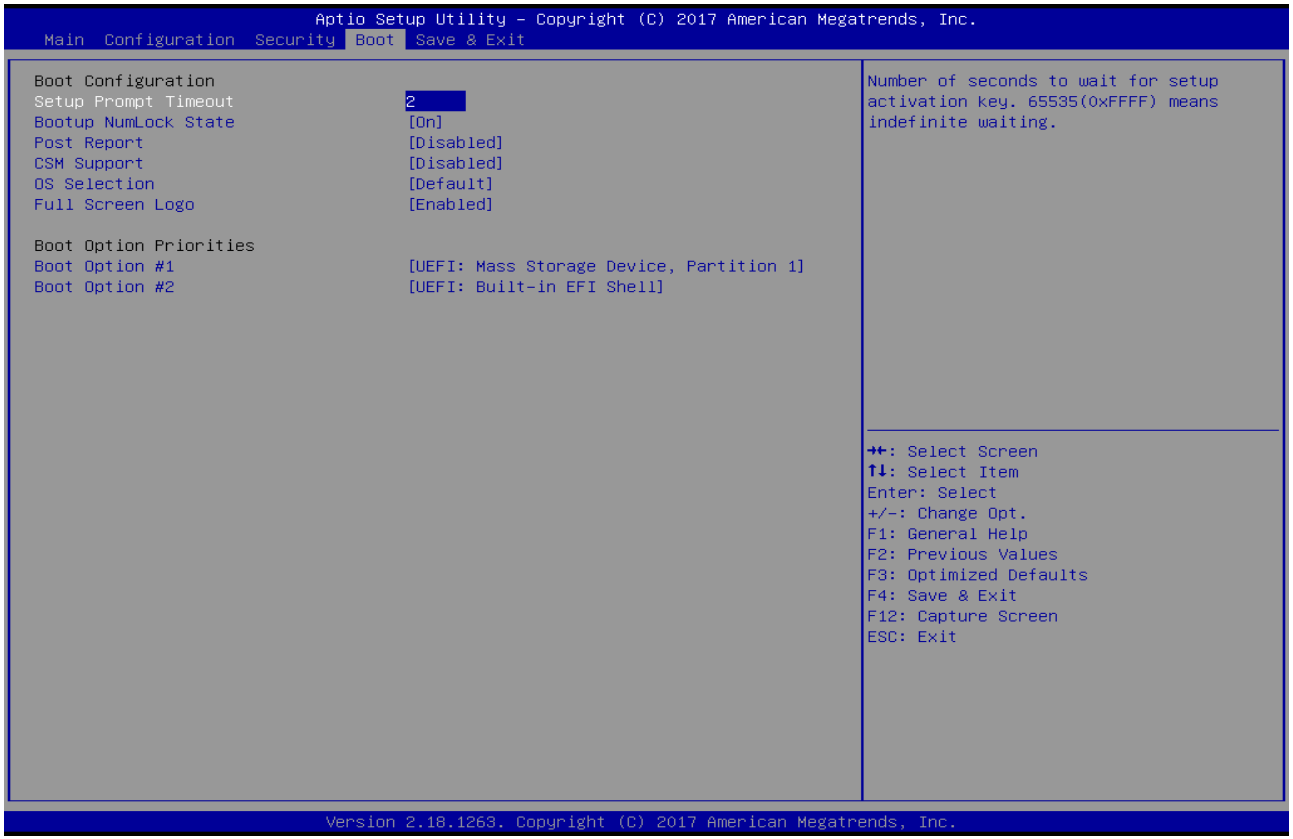
6.2.4 Boot

Use this menu to specify the priority of boot devices.



Feature	Description	Options
Setup Prompt Timeout	Number of seconds to wait for setup activation key. 65535 (0Xffff) means indefinite waiting.	★2, 1-65535
Bootup NumLock State	Select the keyboard NumLock state	★On, Off
Post Report	Post Report Support Enabled/Disabled	★Disabled, Enabled
CSM Support	Enable/Disable CSM Support	★Disabled, Enabled
CSM Support [Enabled]		
Network	Controls the execution of UEFI and Legacy PXE OpROM	★UEFI, Legacy, Do not launch
Launch Storage OPROM	Controls the execution of UEFI and Legacy Storage OpROM	★UEFI, Legacy, Do not launch
video	Controls the execution of UEFI and Legacy Video OpROM	★UEFI, Legacy, Do not launch
OS Selection	[Default] To Win8/8.1/10; [Other] Android / Linux; [Legacy System] Win7 / DOS; This item setting will effect LPSS & XHCI Hand-off item setting.	★Default, Others, Legacy System, MSDOS
Full screen Logo	Enables or disables Quiet Boot option and Full screen Logo.	★Enabled, Disabled
BOOT Option Priorities		
Boot Option #1	Sets the system boot order	★UEFI: Built-in EFI Shell, Disabled

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6.2.5 Save & Exit

Feature	Description	Options
Save Changes and Reset	Reset the system after saving the changes.	
Discard Changes and Reset	Reset system setup without saving any changes.	
Restore Defaults	Restore/Load Default values for all the setup options.	
UEFI: Built-in EFI Shell **(Boot option filter: UEFI only)**	Reset the system after saving the changes.	
Launch EFI Shell from filesystem device	Attempts to Launch EFI Shell application (Shell.efi) from one of the available filesystem devices.	

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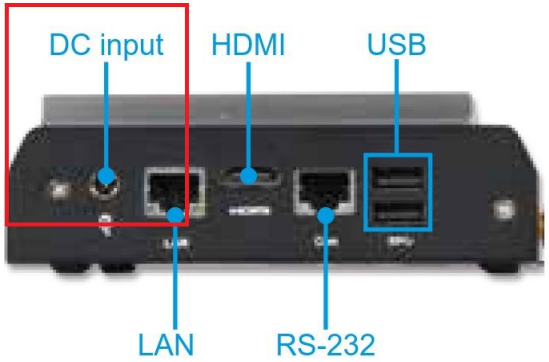
7 Troubleshooting

This chapter provides a few useful tips to quickly get RICH-61D0 running with success. As basic hardware installation has been addressed in Chapter 2, this chapter will focus on system integration issues, in terms of BIOS setting, and OS diagnostics.

7.1 Hardware Quick Installation

DC Jack Power

There is one method to connect the power of RICH-61D0 which is 12V DC Jack (DC-IN).



7.2 BIOS Setting

It is assumed that users have correctly adopted modules and connected all the devices cables required before turning on DC power. 204-pin DDR3L 1333/1600/1866 MH/z SO-DIMM Memory, keyboard, mouse, DP/HDMI connector, device power cables, DC power Jack are good examples that deserve attention. With no assurance of properly and correctly accommodating these modules and devices, it is very possible to encounter system failures that result in malfunction of any device.

To make sure that you have a successful start with RICH-61D0, it is recommended, when going with the boot-up sequence, to hit “Del” key And enter the BIOS setup menu to tune up a stable BIOS configuration so that you can wake up your system far well.

Loading the default optimal setting

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

7.3 FAQ

Information & Support

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

Answer: You can switch off your power supply then find the RTC battery on the RICH-61D0 to remove it and wait 10 seconds to clean your password then insert it back to connector and switch on your power supply.

Question: How to update the BIOS file of RICH-61D0?

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

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

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

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

2. Type in your User name and password and log in the download center.
3. Select **"Search download"** and type the keyword **"RICH-61D0"**.
4. Find the **"BIOS "**page and download the ROM file and flash utility.
5. Unzip file to bootable USB flash drive which can boot to dos mode. Then execute the **"update.efi "**. It will start to update BIOS.
   NOTE: Once you use "update.efi" to update BIOS, it must be get into the SHELL MODE to update BIOS
6. When you see the "FPT Operation Passed" message, which means the BIOS update processes finished. Please cut the AC power off and **wait for 10 seconds** before powering on.

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

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

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

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

8 Portwell Software Service

Portwell Evaluation Tool (PET)

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

Portwell BIOS web Tool (PBT)

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

Portwell EC Auto Test Tool (PECAT)

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

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9 Industry Specifications

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

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