USER GUIDE

COMe-cBW6

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COME-CBW6 - USER GUIDE

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Kontron Europe GmbH

Gutenbergstraße. 2
85737 Ismaning
Germany
www.kontron.com

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NOTICE

You find the most recent version of the “General Safety Instructions“ online in the download area of this product.

Revision History

Revision	Brief Description of Changes	Date of Issue
1.0	Initial Issue	2016-Apr-14
1.1	Updated the carries Accessories	2020-Jul-23
1.2	Ethernet controller i211AT replaced by i210AT	2022-April-25

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If you have any difficulties using this user guide, discover an error, or just want to provide some feedback, contact Kontron Support. Detail any errors you find. We will correct the errors or problems as soon as possible and post the revised user guide on our website.

Symbols

The following symbols may be used in this manual:

⚠DANGER	DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
⚠WARNING	WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
⚠CAUTION	CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
NOTICE	NOTICE indicates a property damage message.
	Electric Shock! This symbol and title warn of hazards due to electrical shocks (> 60 V) when touching products or parts of them. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material. Please refer also to the "High-Voltage Safety Instructions" portion below in this section.
	ESD Sensitive Device! This symbol and title inform that the electronic boards and their components are sensitive to static electricity. Care must therefore be taken during all handling operations and inspections of this product in order to ensure product integrity at all times.
	HOT Surface! Do NOT touch! Allow to cool before servicing.
	Laser! This symbol informs of the risk of exposure to laser beam and light emitting devices (LEDs) from an electrical device. Eye protection per manufacturer notice shall review before servicing.
	This symbol indicates general information about the product and the user manual. This symbol also indicates detail information about the specific product configuration.
	This symbol precedes helpful hints and tips for daily use.

For Your Safety

Your new Kontron product was developed and tested carefully to provide all features necessary to ensure its compliance with electrical safety requirements. It was also designed for a long fault-free life. However, the life expectancy of your product can be drastically reduced by improper treatment during unpacking and installation. Therefore, in the interest of your own safety and of the correct operation of your new Kontron product, you are requested to conform with the following guidelines.

High Voltage Safety Instructions

As a precaution and in case of danger, the power connector must be easily accessible. The power connector is the product's main disconnect device.

⚠CAUTION

Warning

All operations on this product must be carried out by sufficiently skilled personnel only.

⚠CAUTION

Electric Shock!

Before installing a non hot-swappable Kontron product into a system always ensure that your mains power is switched off. This also applies to the installation of piggybacks. Serious electrical shock hazards can exist during all installation, repair, and maintenance operations on this product. Therefore, always unplug the power cable and any other cables which provide external voltages before performing any work on this product.

Earth ground connection to vehicle's chassis or a central grounding point shall remain connected. The earth ground cable shall be the last cable to be disconnected or the first cable to be connected when performing installation or removal procedures on this product.

Special Handling and Unpacking Instruction

NOTICE

ESD Sensitive Device!

Electronic boards and their components are sensitive to static electricity. Therefore, care must be taken during all handling operations and inspections of this product, in order to ensure product integrity at all times.

⚠CAUTION

Handling and operation of the product is permitted only for trained personnel within a work place that is access controlled. Follow the "General Safety Instructions" supplied with the product.

Do not handle this product out of its protective enclosure while it is not used for operational purposes unless it is otherwise protected.

Whenever possible, unpack or pack this product only at EOS/ESD safe work stations. Where a safe work station is not guaranteed, it is important for the user to be electrically discharged before touching the product with his/her hands or tools. This is most easily done by touching a metal part of your system housing.

It is particularly important to observe standard anti-static precautions when changing piggybacks, ROM devices, jumper settings etc. If the product contains batteries for RTC or memory backup, ensure that the product is not placed on conductive surfaces, including anti-static plastics or sponges. They can cause short circuits and damage the batteries or conductive circuits on the product.

Lithium Battery Precautions

If your product is equipped with a lithium battery, take the following precautions when replacing the battery.

⚠CAUTION

Danger of explosion if the battery is replaced incorrectly.

- Replace only with same or equivalent battery type recommended by the manufacturer.
- Dispose of used batteries according to the manufacturer's instructions.

General Instructions on Usage

In order to maintain Kontron's product warranty, this product must not be altered or modified in any way. Changes or modifications to the product, that are not explicitly approved by Kontron and described in this user guide or received from Kontron Support as a special handling instruction, will void your warranty.

This product should only be installed in or connected to systems that fulfill all necessary technical and specific environmental requirements. This also applies to the operational temperature range of the specific board version that must not be exceeded. If batteries are present, their temperature restrictions must be taken into account.

In performing all necessary installation and application operations, only follow the instructions supplied by the present user guide.

Keep all the original packaging material for future storage or warranty shipments. If it is necessary to store or ship the product then re-pack it in the same manner as it was delivered.

Special care is necessary when handling or unpacking the product. See Special Handling and Unpacking Instruction.

Quality and Environmental Management

Kontron aims to deliver reliable high-end products designed and built for quality, and aims to complying with environmental laws, regulations, and other environmentally oriented requirements. For more information regarding Kontron's quality and environmental responsibilities, visit http://www.kontron.com/about-kontron/corporate-responsibility/quality-management.

Disposal and Recycling

Kontron's products are manufactured to satisfy environmental protection requirements where possible. Many of the components used are capable of being recycled. Final disposal of this product after its service life must be accomplished in accordance with applicable country, state, or local laws or regulations.

WEEE Compliance

The Waste Electrical and Electronic Equipment (WEEE) Directive aims to:

- Reduce waste arising from electrical and electronic equipment (EEE)
- Make producers of EEE responsible for the environmental impact of their products, especially when the product become waste
- Encourage separate collection and subsequent treatment, reuse, recovery, recycling and sound environmental disposal of EEE
- Improve the environmental performance of all those involved during the lifecycle of EEE

Environmental protection is a high priority with Kontron.

Kontron follows the WEEE directive

You are encouraged to return our products for proper disposal.

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1/ Introduction

1.1. Product Description

The standard design of the COM Express® compact modules – Kontron COMe-cBW6 – supports the entire portfolio of Intel® Pentium® and Celeron® Processor N3000 series. Integrated Intel® HD Graphic Gen 8 with 3 independent display support for general mobile embedded applications. The memory of up to 2x 4GB has been laid out as dual-channel DDR3L SODIMM. With onboard eMMC Flash option, SD card slot and 2x SATA3 ample storage options for OS and application software are available. Substantial USB support is also offered with 4x USB 3.0/2.0 and 4x USB 2.0.

1.2. Naming clarification

COM Express® defines a Computer-On-Module, or COM, with all components necessary for a bootable host computer, packaged as a super component.

- COMe-bXX# modules are Kontron's COM Express® modules in basic form factor (125mm x 95mm)
- COMe-cXX# modules are Kontron's COM Express® modules in compact form factor (95mm x 95mm)
- COMe-mXX# modules are Kontron's COM Express® modules in mini form factor (55mm x 84mm)

The product names for Kontron COM Express® Computer-on-Modules consist of a short form of the industry standard (**COMe**-), the form factor (**b**=basic, **c**=compact, **m**=mini), the capital letters for the CPU and Chipset Codenames (**XX**) and the pin-out type (**#**) followed by the CPU Name.

1.3. Understanding COM Express® Functionality

All Kontron COM Express® basic and compact modules contain two 220pin connectors; each of it has two rows called Row A & B on primary connector and Row C & D on secondary connector. COM Express® Computer-on-modules feature the following maximum amount of interfaces according to the PICMG module Pin-out type:

Feature	Pin-Out Type 1	Pin-Out Type 10	Pin-Out Type 2	Pin-Out Type 6
HD Audio	1x	1x	1x	1x
Gbit Ethernet	1x	1x	1x	1x
Serial ATA	4x	4x	4x	4x
Parallel ATA	-	-	1x	-
PCI	-	-	1x	-
PCI Express x1	6x	6x	6x	8x
PCI Express x16 (PEG)	-	-	1x	1x
USB Client	1x	1x	-	-
USB 2.0	8x	8x	8x	8x
USB 3.0	-	2x	-	4x
VGA	1x	-	1x	1x
LVDS	Dual Channel	Single Channel	Dual Channel	Dual Channel
DP++ (SDVO/DP/HDMI/DVI)	1x optional	1x	3x shared with PEG	3x
LPC	1x	1x	1x	1x
External SMB	1x	1x	1x	1x
External I2C	1x	1x	1x	1x
GPIO	8x	8x	8x	8x
SDIO shared w/GPIO	1x optional	1x optional	-	1x optional
UART (2-wire COM)	-	2x	-	2x
FAN PWM out	-	1x	-	1x

1.4. COM Express® Documentation

This product manual serves as one of three principal references for a COM Express® design. It documents the specifications and features of COMe-cBW6. Additional references are available at your Kontron Support or at PICMG®:

- The COM Express® Specification defines the COM Express® module form factor, pin-out, and signals. This document is available at the PICMG® website by filling out the order form.
- The COM Express® Design Guide by PICMG® serves as a general guide for baseboard design, with a focus on maximum flexibility to accommodate a wide range of COM Express® modules.

Some of the information contained within this product manual applies only to certain product revisions (CE: xxx). If certain information applies to specific product revisions (CE: xxx) it will be stated. Please check the product revision of your module to see if this information is applicable.

1.5. COM Express® Benefits

COM Express® modules are very compact, highly integrated computers. All Kontron COM Express® modules feature a standardized form factor and a standardized connector layout which carry a specified set of signals. Each COM is based on the COM Express® specification. This standardization allows designers to create a single-system baseboard that can accept present and future COM Express® modules.

The baseboard designer can optimize exactly how each of these functions implements physically. Designers can place connectors precisely where needed for the application on a baseboard designed to optimally fit a system's packaging.

A single baseboard design can use a range of COM Express® modules with different sizes and pin-outs. This flexibility can differentiate products at various price/performance points, or when designing future proof systems that have a built-in upgrade path. The modularity of a COM Express® solution also ensures against obsolescence when computer technology evolves. A properly designed COM Express® baseboard can work with several successive generations of COM Express® modules.

A COM Express® baseboard design has many advantages of a customized computer-board design and, additionally, delivers better obsolescence protection, heavily reduced engineering effort, and faster time to market.

2/ Product Specification

2.1. Module definition

The COM Express® compact sized Computer-on-Module COMe-cBW6 (CBW6) follows pin-out Type 6 and is compatible to PICMG specification COM.0 Rev 2.1. The COMe-cBW6 based on latest platform is available in different variants to cover the demand of different performance, price and power:

Commercial grade modules (0°c to 60°c operating)

Part Number	Product Name	Processor	Memory	eMMC	TPM	mSD Socket	VGA analog	USB 2.0	USB 3.0
36020-0000-17-8	COMe-cBW6 N3710	N3710	2x DDR3L SODIMM	-	No	Yes	No	4	4
36020-0000-17-4	COMe-cBW6 N3160	N3160	2x DDR3L SODIMM	-	No	Yes	No	4	4
36020-0000-11-2	COMe-cBW6 N3010	N3010	1x DDR3L SODIMM	-	No	Yes	No	4	4

2.2. Functional Specification

2.2.1. Processor

The 14nm Intel@ Atom Celeron embedded (Braswell) CPU family with 25x27mm package size (FCBGA1170) supports:

- Intel® 64
- Intel® Virtualization Technology (VT-x)
- Enhanced Intel SpeedStep® Technology
- Idle States (C-States)
- Thermal Monitoring Technologies

Optional available (with customized BIOS):

- Advanced Encryption Standard Instructions (AES-NI)

The integrated Intel® HD Graphics supports:

- GraphicsTechnology with 12 Execution Units
- DirectX Support
- OpenGL Support
- # of Displays Suported: 3

Intel® -	Pentium® N3710	Celeron® N3160	Celeron® N3010
# of Cores	4	4	2
# of Threads	4	4	2
TDP Core Frequency (HFM)	1.6 GHz	1.6 GHz	1.04 GHz
Max Turbo Frequency 1 core	2.4 GHz (2.56 Ghz)	2.08 GHz (2.24GHz)	2.08 GHz (2.24 GHz)
Max Turbo Frequency 2 cores	2.4 GHz (2.56 Ghz)	2.08 GHz (2.24 GHz)	2.08 GHz (2.24 GHz)
Scenario Design Power (SDP)	4W	4W	3W
TjMax	90°C	90°C	90°C

Intel® -	Pentium® N3710	Celeron® N3160	Celeron® N3010
Thermal Design Power (TDP)	6W	6W	4W
cTDP-Down	-	-	-
cTDP-Up	-	-	-
Power Limit 2 (PL2 max)	-	-	-
Smart Cache	-	-	-
Min Memory Type	DDR3L 1333	DDR3L 1333	DDR3L 1333
Max Memory Type	DDR3L 1600	DDR3L 1600	DDR3L 1600
Supported Memory Size SODIMM	8GB	8GB	8GB
Supported Size Memory down	-	-	-
# of Memory Channels	2	2	2
Graphics Model	Intel® HD Graphics	Intel® HD Graphics	Intel® HD Graphics
GFX Base Frequency	400 MHz	320 MHz	320 MHz
GFX Max Dynamic Frequ.	700 MHz	640 MHz	600 MHz
GFX Technology	Gen8LP 16EQ	Gen8LP 12EQ	Gen8LP 12EQ
# of Displays Supported	3	3	3
Quick Sync Video	Yes	Yes	Yes
InTru™ 3D	No	No	No
Wireless Display	Yes	Yes	Yes
Clear Video HD	Yes	Yes	Yes
vPRO™ (optional)	No	No	No
TXT (optional)	No	No	No
AES-NI (optional)	Yes	Yes	Yes
VT-x	Yes	Yes	Yes
VT-d	No	No	No
PCI Express Graphics x16	-	-	-

2.2.2. Memory

Sockets	Up to 2x DDR3L SO-DIMM (depending on variant)
Memory Type	DDR3L-1333/1600
Maximum Size	2x4GB
Technology	Dual Channel

2.2.3. Graphics Core

The integrated Intel® HD Graphics (Gen 8LP) supports:

Graphics Core Render Clock	Intel® HD Graphics (Gen 8LP)
Execution Units / Pixel Pipelines	GT1 16EU
Max Graphics Memory	tbd
GFX Memory Bandwidth (GB/s)	tbd
GFX Memory Technology	DVMT
API (DirectX/OpenGL)	11.1
Shader Model	3.0
Hardware accelerated Video	H.264 / MPEG2 / VC1 / VP8
Independent/Simultaneous Displays	3
Display Port	tbd
HDCP support	HDCP / PAVP 2 (optional)

2.2.4. Monitor Output

CRT max Resolution	1920x1200@60Hz
TV out:	-

2.2.5. LVDS

LVDS Bits/Pixel	1x18/24, 2x18/24 with DP2LVDS
LVDS Bits/Pixel with dithering	-
LVDS max Resolution:	1920x1200
PWM Backlight Control:	YES
Supported Panel Data:	EDID/DID

2.2.6. Display Interfaces

Discrete Graphics	-
Digital Display Interface DDI1	DP++
Digital Display Interface DDI2	DP++ (optional VGA)
Digital Display Interface DDI3	-
Maximum Resolution on DDI	HDMI: 3840x2160 @30Hz, DP: 3840x2160 @ 30Hz

2.2.7. Storage

onboard SSD	2-64GB eMMC
SD Card support	1x mSD Socket onboard
IDE Interface	-
Serial-ATA	2x SATA 6Gb/s
SATA AHCI	AHCI
SATA RAID	-

2.2.8. Connectivity

USB 2.0	8x USB 2.0, no legacy EHCI controller (may cause installation problems under some OS, Win7)
USB 3.0	4x USB 3.0
USB Client	-
PCI	-
PCI External Masters	-
PCI Express	3x PCIe x1 Gen2, no hot plug (Express Card) supported
Max PCI Express	4x PCIe x1 without LAN
PCI Express x2/x4 configuration	YES
Ethernet	10/100/1000 Mbit
Ethernet controller	Intel® i211AT

2.2.9. Ethernet

The Intel® i210AT Ethernet supports:

- Jumbo Frames - 9K
- MACsec IEEE 802.1 AE
- Time Sync Protocol Indicator
- WOL (Wake On LAN)
- PXE (Preboot eXecution Environment)
- IEEE1588

2.2.10. Misc. Interfaces and Features

Supported BIOS Size/Type	8MB SPI
Audio	HD Audio
Onboard Hardware Monitor	Nuvoton NCT7802Y
Miscellaneous	2x UART / PWM FAN

2.2.11. Kontron Features

External I2C Bus	Fast I2C, MultiMaster capable
Smart Battery (M.A.R.S.) support	YES
Embedded API	KEAPI3
Custom BIOS Settings / Flash Backup	YES
Watchdog support	Dual Staged

2.2.12. Additional Features

- All solid capacitors (POSCAP). No tantalum capacitors used.
- Optimized RTC Battery monitoring to secure highest longevity
- Real fast I2C with transfer rates up to 40kB/s.

2.2.13. Power Features

Singly Supply Support	YES
Supply Voltage	8.5V - 20V
ACPI	ACPI 3.0
S-States	S0, S3, S4, S5
S5 Eco Mode	YES
Misc Power Management	DPST 4.0, iFFS

2.2.14. Power Consumption and Performance

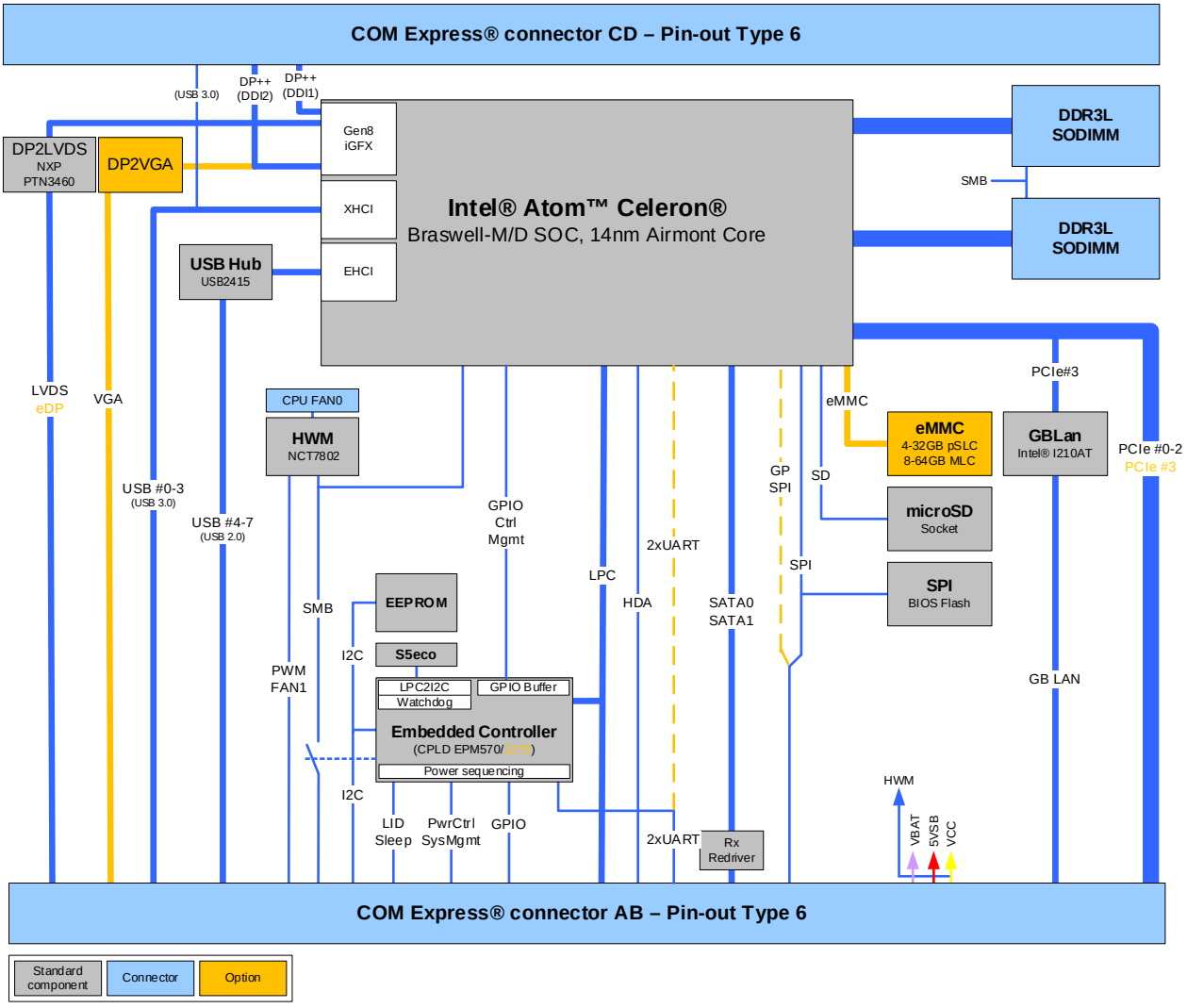
Full Load Power Consumption	tbd
Kontron Performance Index	tbd
Kontron Performance/Watt	tbd

*Measured Values. Please note the maximum Power Consumption with activated Turbo Mode in chapter Turbo 2.0

Detailed Power Consumption measurements in all states and benchmarks for CPU, Graphics and Memory performance are available in Application Note KEMAP054 at Kontron's Customer Section.

2.3. Block Diagram

Figure 1: Block Diagram of COMe-cBW6



2.4. Accessories

2.4.1. Product Specific Accessories

Product Number	Heatspreader and Cooling Solutions	Comment
36020-0000-99-0	HSP COMe-cBW6 thread	For all CPUs and temperature grades
36020-0000-99-1	HSP COMe-cBW6 through	For all CPUs and temperature grades

2.4.2. General Accessories

Part Number	COMe pin-out Type 6 compatible	Project Code	Comment
38116-0000-00-5	COM Express® Eval Carrier2 Type 6	ADT6	ATX Carrier with 5mm COMe connector
96007-0000-00-3	ADA-PCIe-DP	APDP	PCIe x16 to DP Adapter for Evaluation Carrier
96007-0000-00-7	ADA-Type6-DP3	DVO6	(sandwich) Adapter Card for 3x DisplayPort
96006-0000-00-2	COMe POST T6	NFCB	POST Code / Debug Card
38019-0000-00-0	ADA-COMe-Height-dual	EERC	Height Adapter

Part Number	Mounting	Comment
38017-0000-00-5	COMe Mount KIT 5mm 1set	Mounting Kit for 1 module including screws for 5mm connectors
38017-0100-00-5	COMe Mount KIT 5mm 100sets	Mounting Kit for 100 modules including screws for 5mm connectors
38017-0000-00-0	COMe Mount KIT 8mm 1set	Mounting Kit for 1 module including screws for 8mm connectors
38017-0100-00-0	COMe Mount Kit 8mm 100sets	Mounting Kit for 100 modules including screws for 8mm connectors

Part Number	Cooling Solutions	Comment
36099-0000-99-0	COMe Active Uni Cooler	for CPUs up to 20W TDP, to be mounted on HSP
36099-0000-99-1	COMe Passive Uni Cooler	for CPUs up to 10W TDP, to be mounted on HSP

Part Number	Display Adapter	Comment
9-5000-0352	ADA-LVDS-DVI 18bit	LVDS to DVI converter
9-5000-0353	ADA-LVDS-DVI 24bit	LVDS to DVI converter
96006-0000-00-8	ADA-DP-LVDS	DP to LVDS adapter
96082-0000-00-0	KAB-ADAPT-DP-DVI	DP to DVI adapter cable
96083-0000-00-0	KAB-ADAPT-DP-VGA	DP to VGA adapter cable
96084-0000-00-0	KAB-ADAPT-DP-HDMI	DP to HDMI adapter cable

Part Number	Cables	Comment
96079-0000-00-0	KAB-HSP 200mm	Cable adapter to connect FAN to module (COMe basic/compact)
96079-0000-00-2	KAB-HSP 40mm	Cable adapter to connect FAN to module (COMe basic/compact)

Part Number	Miscellaneous	Comment
18029-0000-00-0	MARS Smart Battery Kit	Starterkit Kontron Mobile Application platform for Rechargeable Systems

Part Number	DDR3L SODIMM, commercial temperature grade
97015-2048-16-1	DDR3L-1600 SODIMM 2GB
97015-4096-16-1	DDR3L-1600 SODIMM 4GB
97015-8192-16-1	DDR3L-1600 SODIMM 8GB

2.5. Electrical Specifications

2.5.1. Supply Voltage

Following supply voltage is specified at the COM Express® connector:

VCC	8.5 - 20V
Standby	5V DC +/- 5%
RTC	2.5V - 3.47V

⚠CAUTION

Only connect to an external power supply delivering the specified input rating and complying with the requirements of Safety Extra Low Voltage (SELV) and Limited Power Source (LPS) of UL/IEC 60950-1 or (PS2) of UL/IEC 62368-1.

NOTICE

To protect external power lines of peripheral devices, make sure that the wires have the right diameter to withstand the maximum available current and the enclosure of the peripheral device fulfils the fire-protection requirements of IEC/EN 62368-1.

NOTICE

If any of the supply voltages drops below the allowed operating level longer than the specified hold-up time, all the supply voltages should be shut down and left OFF for a time long enough to allow the internal board voltages to discharge sufficiently.

If the OFF time is not observed, parts of the board or attached peripherals may work incorrectly or even suffer a reduction of MTBF. The minimum OFF time depends on the implemented PSU model and other electrical factors and must be measured individually for each case.

- 5V Standby voltage is not mandatory for operation.
- Extended Temperature (E1) variants are validated for 12V supply only

2.5.2. Power Supply Rise Time

- The input voltages shall rise from ≤10% of nominal to within the regulation ranges within 0.1ms to 20ms.
- There must be a smooth and continuous ramp of each DC input voltage from 10% to 90% of its final set-point following the ATX specification

2.5.3. Supply Voltage Ripple

- Maximum 100 mV peak to peak 0 – 20 MHz

2.5.4. Power Consumption

The maximum Power Consumption of the different COMe-cBW6 variants is tbd (100% CPU load on all cores; 90°C CPU temperature). Further information with detailed measurements are available in Application Note KEMAP054 available on Kontron's Customer Section. Information there is available after registration.

2.5.5. Power Supply Modes

2.5.5.1. ATX Mode

By connecting an ATX power supply with VCC and 5VSB, PWR_OK is set to low level and VCC is off. Press the Power Button to enable the ATX PSU setting PWR_OK to high level and powering on VCC. The ATX PSU is controlled by the PS_ON# signal which is generated by SUS_S3# via inversion. VCC can be 8.5 - 20V in ATX Mode. On Computer-on-Modules supporting a wide range input down to 4.75V the input voltage shall always be higher than 5V Standby (VCC > 5VSB).

State	PWRBTN#	PWR_OK	V5_StdBy	PS_ON#	VCC
G3	x	x	0V	x	0V
S5	high	low	5V	high	0V
S5 → S0	PWRBTN Event	low → high	5V	high → low	0 V→ VCC
S0	high	high	5V	low	VCC

2.5.6. Single Supply Mode

In single supply mode (or automatic power on after power loss) without 5V Standby the module will start automatically when VCC power is connected and Power Good input is open or at high level (internal PU to 3.3V). PS_ON# is not used in this mode and VCC can be 8.5 - 20V.

To power on the module from S5 state press the power button or reconnect VCC. Suspend/Standby States are not supported in Single Supply Mode.

State	PWRBTN#	PWR_OK	V5_StdBy	VCC
G3	x	x	x	0
G3 → S0	high	open / high	x	connecting VCC
S5	high	open / high	x	VCC
S5 → S0	PWRBTN Event	open / high	x	reconnecting VCC

Signals marked with “x” are not important for the specific power state. There is no difference if connected or open.

All ground pins have to be tied to the ground plane of the carrier board.

2.6. Power Control

2.6.1. Power Supply

The COMe-cBW6 supports a power input from 8.5 - 20V. The supply voltage is applied through the VCC pins (VCC) of the module connector.

2.6.2. Power Button (PWRBTN#)

The power button (Pin B12) is available through the module connector described in the pinout list. To start the module via Power Button the PWRBTN# signal must be at least 50ms (50ms ≤ t < 4s, typical 400ms) at low level (Power Button Event).

Pressing the power button for at least 4seconds will turn off power to the module (Power Button Override).

2.6.3. Power Good (PWR_OK)

The COMe-cBW6 provides an external input for a power-good signal (Pin B24). The implementation of this subsystem complies with the COM Express® Specification. PWR_OK is internally pulled up to 3.3V and must be high level to power on the module.

2.6.4. Reset Button (SYS_RESET#)

The reset button (Pin B49) is available through the module connector described in the pinout list. The module will stay in reset as long as SYS_RESET# is grounded. If available, the BIOS setting for "Reset Behavior" must be set to "Power Cycle".

Modules with Intel® Chipset and active Management Engine do not allow to hold the module in Reset out of S0 for a long time. At about 10s holding the reset button the ME will reboot the module automatically

2.6.5. SM-Bus Alert (SMB_ALERT#)

With an external battery manager present and SMB_ALERT# (Pin B15) connected the module always powers on even if BIOS switch "After Power Fail" is set to "Stay Off".

2.7. Environmental Specification

2.7.1. Temperature Specification

Kontron defines following temperature grades for Computer-on-Modules in general. Please see chapter 'Product Specification' for available temperature grades for the COMe-cBW6

Temperature Specification	Operating	Non-operating	Validated Input Voltage
Commercial grade	0°C to +60°C	-30°C to +85°C	VCC: 8.5 - 20V
Extended Temperature (E1)	-25°C to +75°C	-30°C to +85°C	VCC: 12V
Industrial grade by **Screening** (XT)	-40°C to +85°C	-40°C to +85°C	VCC: 12V
Industrial grade by **Design** (E2)	-40°C to +85°C	-40°C to +85°C	VCC: 8.5 - 20V

Operating with Kontron heat spreader plate assembly

The operating temperature defines two requirements:

- the maximum ambient temperature with ambient being the air surrounding the module.
- the maximum measurable temperature on any spot on the heatspreader's surface

Test specification:

Temperature Grade	Validation requirements
Commercial grade	at 60°C HSP temperature the CPU @ 100% load needs to run at nominal frequency
Extended Temperature (E1)	at 75°C HSP temperature the CPU @ 75% load is allowed to start speedstepping for thermal protection
Industrial grade by **Screening** (XT)	at 85°C HSP temperature the CPU @ 50% load is allowed to start throttling for thermal protection
Industrial grade by **Design** (E2)	at 85°C HSP temperature the CPU @ 50% load is allowed to start throttling for thermal protection

Operating without Kontron heat spreader plate assembly

The operating temperature is the maximum measurable temperature on any spot on the module's surface.

2.7.2. Humidity

- 93% relative Humidity at 40°C, non-condensing (according to IEC 60068-2-78)

2.8. Standards and Certifications

2.8.1. RoHS II

The **COMe-cBW6** is compliant to the directive 2011/65/EU on the Restriction of the use of certain Hazardous Substances (RoHS II) in electrical and electronic equipment

Figure 2: ROHS II symbol

2.8.2. Component Recognition UL 60950-1

The **COM Express® compact** form factor Computer-on-Modules are Recognized by Underwriters Laboratories Inc. Representative samples of this component have been evaluated by UL and meet applicable UL requirements.

UL Listings:

- NWGQ2.E304278
- NWGQ8.E304278

Figure 3: UL symbol

2.8.3. WEEE Directive

WEEE Directive 2002/96/EC is not applicable for Computer-on-Modules.

2.8.4. Conformal Coating

Conformal Coating is available for Kontron Computer-on-Modules and for validated SO-DIMM memory modules. Please contact your local sales or support for further details.

2.8.5. Shock & Vibration

The **COM Express® compact** form factor Computer-on-Modules successfully passed shock and vibration tests according to

- IEC/EN 60068-2-6 (Non operating Vibration, sinusoidal, 10Hz-4000Hz, +/-0.15mm, 2g)
- IEC/EN 60068-2-27 (Non operating Shock Test, half-sinusoidal, 11ms, 15g)

2.8.6. EMC

Validated in Kontron reference housing for EMC the **COMe-cBW6** follows the requirements for electromagnetic compatibility standards

- EN55022

2.9. MTBF

The following MTBF (Mean Time Before Failure) values were calculated using a combination of manufacturer's test data, if the data was available, and the Telcordia (Bellcore) issue 2 calculation for the remaining parts.
The calculation method used is "Telcordia Issue 2 Method 1 Case 3" in a ground benign, controlled environment (GB, GC). This particular method takes into account varying temperature and stress data and the system is assumed to have not been burned in.
Other environmental stresses (extreme altitude, vibration, salt water exposure, etc) lower MTBF values.

System MTBF (hours): tbd

Fans usually shipped with Kontron products have 50,000-hour typical operating life. The above estimates assume no fan, but a passive heat sinking arrangement Estimated RTC battery life (as opposed to battery failures) is not accounted for in the above figures and need to be considered separately. Battery life depends on both temperature and operating conditions. When the Kontron unit has external power; the only battery drain is from leakage paths.

2.10. Mechanical Specification

2.10.1. Dimension

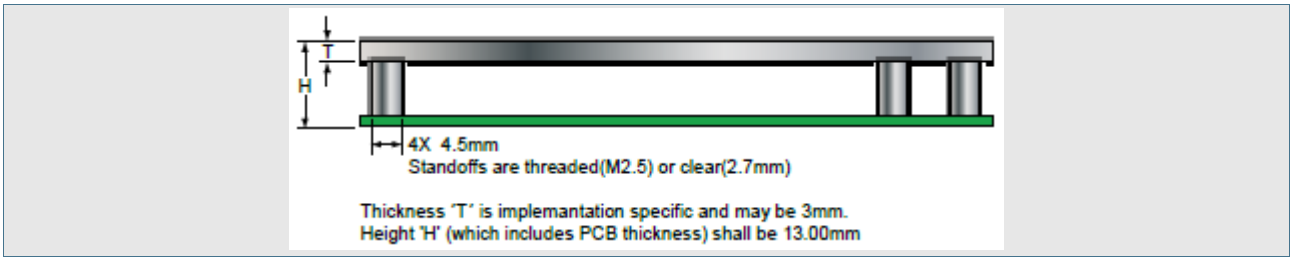
- 95.0 mm x 95.0 mm (3.75" x 3.75")
- Height approx. 13mm (0.4")

CAD drawings are available at Kontron's CustomerSection

2.10.2. Height

The COM Express® specification defines a module height of 13mm from bottom to heatspreader top:

Figure 4: Height of the COMe-cBW6 module



Cooling solutions provided from Kontron for compact sized Computer-on-Modules are 27mm in height from module bottom to Heatsink top. Universal Cooling solutions to be mounted on the HSP (36099-0000-00-x) are 14.3mm in height for an overall height of 27.3mm from module bottom to Heatsink top.

2.11. Module Dimensions

- Form Factor: COM Express® compact, pin-out Type 6
- Mechanical Size: 95x95mm

All dimensions in mm

2.12. Thermal Management, Heatspreader and Cooling Solutions

A heatspreader plate assembly is available from Kontron for the COMe-cBW6. The heatspreader plate on top of this assembly is NOT a heat sink. It works as a COM Express®-standard thermal interface to use with a heat sink or external cooling devices.

External cooling must be provided to maintain the heatspreader plate at proper operating temperatures. Under worst-case conditions, the cooling mechanism must maintain an ambient air and heatspreader plate temperature on any spot of the heatspreader's surface according the module specifications:

- 60°C for commercial grade modules
- 75°C for extended temperature grade modules (E1)
- 85°C for industrial temperature grade modules (E2/XT)

The aluminum slugs and thermal pads or the heat-pipe on the underside of the heatspreader assembly implement thermal interfaces between the heatspreader plate and the major heat-generating components on the COMe-cBW6. About 80 percent of the power dissipated within the module is conducted to the heatspreader plate and can be removed by the cooling solution.

You can use many thermal-management solutions with the heatspreader plates, including active and passive approaches. The optimum cooling solution varies, depending on the COM Express® application and environmental conditions. Active or passive cooling solutions provided from Kontron for the COMe-cBW6 are usually designed to cover the power and thermal dissipation for a commercial grade temperature range used in a housing with proper air flow.

Documentation and CAD drawings of COMe-cBW6 heatspreader and cooling solutions are provided at http://customersection.kontron.com.

3/ Features and Interfaces

3.1. Onboard eMMC Flash

The COMe-cBW6 features a 14x18mm onboard Micron NAND Flash drive with capacities of 2-64GB eMMC. The Flash drive includes a Phison PS8200 micro controller and supports:

- JEDEC/MMC standard version 5.0 compliant
- class 0 (basic); class 2 (block, read); class 4 (block write); class 5 (erase); class 6 (write protect); class 7 (lock card)
- MMCplus™ and MMCmobile™ protocols
- HS200/HS400 modes
- 52 MHz clock speed (MAX)
- Boot operation (high-speed boot)
- Sleep mode
- Replay-protected memory block (RPMB)
- Secure erase and secure trim
- Permanent and power-on write protection
- Double data rate (DDR) function
- Wear Leveling, ECC and block management
- -40°C to +85°C industrial temperature range
- Multi-Level-Cell (MLC) technology
- Single-Level-Cell (SLC) technology optional by firmware re-configuration during COMe-cBW6 manufacturing

Flash Part No.	MTFC4GACAAAM-4M IT	MTFC8GACAAAM-4M IT	MTFC16GAKAECN-4M IT	MTFC32GAKAECN-4M IT	MTFC64GAKAEEY-4M IT
Nominal Flash Size MLC	4GByte	8GByte	16GByte	32GByte	64GByte
Nominal Flash Size pSLC	2GByte	4GByte	8GByte	16GByte	32GByte
Seq. MLC read speed/MB200	80 MB/s	120 MB/s	250 MB/s/160MB/s	250 MB/s/160MB/s	280 MB/s/160MB(s
Seq. MLC write speed/MB200	11 MB/s	24 MB/s	30 MB/s	40MB/s	50 MB/s / 40MB/s
I/O Performance read/write	4000 / 1000 IOPS	4000 / 1000 IOPS	4700 / 1200 IOPS	4700 / 1300 IOPS	4700 / 1300 IOPS
Endurance (# of P/E cycles)	MLC: 3k SLC: 40k	MLC: 3k SLC: 40k	MLC: 3k SLC: 40k	MLC: 3k SLC: 40k	MLC: 3k SLC: 40k

Notes:

- Random access of 4KB chunk, sequential read access of 1MB chunk
- Data based on Datasheet Micron eMMC Rev. E 6/14 E
- ~10% of the nominal flash size are reserved for Firmware and Block Management

Note: the onboard eMMC Flash requires pre-configuration via EFI Shell before OS installation (e.g. diskpart utility).

3.2. Secure Digital Card

The COMe-cBW6 supports an mSD card into the onboard micro SD Card socket as mass storage device, no boot device. Following SD cards are validated from Kontron and recommended for use:

3.3. S5 Eco Mode

Kontron's new high-efficient power-off state S5 Eco enables lowest power-consumption in soft-off state – less than 1 mA compared to the regular S5 state this means a reduction by at least factor 200!

In the "normal" S5 mode the board is supplied by 5V_Stb and needs usually up to 300mA just to stay off. This mode allows to be switched on by power button, RTC event and WakeOnLan, even when it is not necessary. The new S5 Eco mode reduces the current enormous.

The S5 Eco Mode can be enabled in BIOS Setup, when the BIOS supports this feature.

Following prerequisites and consequences occur when S5 Eco Mode is enabled:

- The power button must be pressed at least for 200ms to switch on.
- Wake via Power button only.
- "Power On After Power Fail"/"State after G3": only "stay off" is possible

3.4. LPC

The Low Pin Count (LPC) Interface signals are connected to the LPC Bus bridge located in the CPU or chipset. The LPC low speed interface can be used for peripheral circuits such as an external Super I/O Controller, which typically combines legacy-device support into a single IC. The implementation of this subsystem complies with the COM Express® Specification. Implementation information is provided in the COM Express® Design Guide maintained by PICMG. Please refer to the official PICMG documentation for additional information.

The LPC bus does not support DMA (Direct Memory Access) and a clock buffer is required when more than one device is used on LPC. This leads to limitations for ISA bus and SIO (standard I/O´s like Floppy or LPT interfaces) implementations.

All Kontron COM Express® Computer-on-Modules imply BIOS support for following external baseboard LPC Super I/O controller features for the **Winbond/Nuvoton 5V 83627HF/G and 3.3V 83627DHG-P:**

83627HF/G	Phoenix BIOS	AMI CORE8	AMI / Phoenix EFI
PS/2	YES	YES	YES
COM1/COM2	YES	YES	YES
LPT	YES	YES	YES
HWM	YES	YES	NO
Floppy	NO	NO	NO
GPIO	NO	NO	NO
83627DHG-P	**Phoenix BIOS**	**AMI CORE8**	**AMI / Phoenix EFI**
PS/2	YES	YES	YES
COM1/COM2	YES	YES	YES
LPT	YES	YES	YES
HWM	NO	NO	NO
Floppy	NO	NO	NO
GPIO	NO	NO	NO

Features marked as not supported do not exclude OS support (e.g. HWM can be accessed via SMB). For any other LPC Super I/O additional BIOS implementations are necessary. Please contact your local sales or support for further details.

3.5. Serial Peripheral Interface (SPI)

The Serial Peripheral Interface Bus or SPI bus is a synchronous serial data link standard named by Motorola that operates in full duplex mode. Devices communicate in master/slave mode where the master device initiates the data frame. Multiple slave devices are allowed with individual slave select (chip select) lines. Sometimes SPI is called a "four wire" serial bus, contrasting with three, two, and one wire serial buses.

NOTICE

The SPI interface can only be used with a SPI flash device to boot from external BIOS on the baseboard

3.6. SPI boot

The COMe-cBW6 supports boot from an external SPI Flash. It can be configured by pin A34 (BIOS_DIS#0) and pin B88 (BIOS_DIS1#) in following configuration:

BIOS_DIS0#	BIOS_DIS1#	Function
open	open	Boot on-module BIOS
GND	open	Boot baseboard LPC FWH
open	GND	Baseboard SPI = Boot Device 1, on-module SPI = Boot Device 2
GND	GND	Baseboard SPI = Boot Device 2, on-module SPI = Boot Device 1

By default only SPI Boot Device 1 is used in configuration 3 & 4. Both SPI Boot Devices are used by splitting the BIOS with modified descriptor table in customized versions only.

3.6.1. Recommended SPI boot flash types for 8-SOIC package

Size	Manufacturer	Part Number	Device ID
16Mbit	Atmel	AT26DF161	0x1F4600
16Mbit	Atmel	AT26DF161A	0x1F4601
16Mbit	Atmel	AT25DF161	0x1F4602
16Mbit	Atmel	AT25DQ161	0x1F8600
16Mbit	Macronix	MX25L1605A(D)(36E)(06E)	0xC22015
16Mbit	Macronix	MX25L1635D	0xC22415
16Mbit	SST/Microchip	SST25VF016B	0xBF2541
16Mbit	Winbond	W25X16BV	0xEF3015
16Mbit	Winbond	W25Q16BV(CV)	0xEF4015
Size	**Manufacturer**	**Part Number**	**Device ID**
32Mbit	Atmel	AT25/26DF321	0x1F4700
32Mbit	Atmel	AT25DF321A	0x1F4701
32Mbit	Macronix	MX25L3205A(D)(06E)	0xC22016
32Mbit	Macronix	MX25L3225D(35D)(36D)	0xC25E16
32Mbit	SST/Microchip	SST25VF032B	0XBF254A
32Mbit	Winbond	W25X32BV	0xEF3016
32Mbit	Winbond	W25Q32BV,	0xEF4016
Size	**Manufacturer**	**Part Number**	**Device ID**
64Mbit	Atmel	AT25DF641(A)	0x1F4800
64Mbit	Atmel	AT25DQ641	0x1F8800
64Mbit	Macronix	MX25L6405D(45E)(36E)(06E)(73E)	0xC22017
64Mbit	Macronix	MX25L6455E	0xC22617
64Mbit	Macronix	MX25U6435F	0xC22537
64Mbit	SST/Microchip	SST25VF064C	0xBF254B
64Mbit	Winbond	W25X64BV	0xEF3017
64Mbit	Winbond	W25Q64BV(CV)(FV)	0xEF4017
64Mbit	Winbond	W25Q64DW	0XEF6017
64Mbit	Winbond	W25Q64FW	0XEF6017

3.6.2. Using an external SPI flash

- To program an external SPI flash follow these steps:
- Connect a SPI flash with correct size (similar to BIOS ROM file size) to the module SPI interface
- Open pin A34 and B88 to boot from the module BIOS
- Enter setup and prepare flash area to be overwritten by changing these parameters:
- Chipset->South Bridge->Security-> BIOS Lock -> disable
    - Advanced->Security Configuration->TXE HMRFPO -> enable
- Save and reboot
- Boot the module to DOS/EFI-Shell with access to the BIOS image and Firmware Update Utility provided on Kontron's Customer Section
- Connect pin B88 (BIOS_DIS1#) to ground to enable the external SPI flash
- Execute Flash.bat/Flash.efi to program the complete BIOS image to the external SPI flash
- Reboot

Your module will now boot from the external SPI flash when BIOS_DIS1# is grounded.

3.6.3. External SPI flash on Modules with Intel® ME

If booting from the external (baseboard mounted) SPI flash then exchanging the COM Express® module for another one of the same type will cause the Intel® Management Engine to fail during next start. This is by design of the ME because it bounds itself to the very module it has been flashed to. In the case of an external SPI flash this is the module present at flash time.

To avoid this issue please make sure to conduct a complete flash of the external SPI flash device after changing the COMexpress module for another one. If disconnecting and reconnecting the same module again this step is not necessary.

3.7. M.A.R.S.

The Smart Battery implementation for Kontron Computer-on-Modules called **M**obile **A**pplication for **R**echargeable **S**ystems is a BIOS extension for external Smart Battery Manager or Charger. It includes support for SMBus charger/selector (e.g. Linear Technology LTC1760 Dual Smart Battery System Manager) and provides ACPI compatibility to report battery information to the Operating System.

Reserved SM-Bus addresses for Smart Battery Solutions on the carrier:

8-bit Address	7-bit Address	Device
12h	0x09	SMART_CHARGER
14h	0x0A	SMART_SELECTOR
16h	0x0B	SMART_BATTERY

3.8. UART

The COMe-cBW6 supports up to two Serial RX/TX only Ports defined in COM Express® specification on Pins A98/A99 for UART0 and Pins A101/A102 for UART1. The implementation of the UART is compatible to 16450 and is supported by default from most operating systems. Resources are subordinated to other UARTS e.g. from external LPC Super I/O.

UART Features:

- 450 to 115.2k Baud (except 56000)
- 5, 6, 7 or 8bit characters
- 1 or 2 Stop bit generation

- Even, odd or no-parity generation/detection
- Complete status reporting capabilities
- Line break generation and detection
- Full prioritized interrupt system control
- No FIFO
- One additional shift register for transmit and one for receive
- No Flow Control
- No FCR register due to unavailability of FIFO
- MCR and MSR registers only implemented in loopback mode for compatibility with existing drivers and APIs
- Initialized per default to COM1 3F8h/IRQ4 and COM2 2F8/IRQ3 regardless of presence of an external SIO

The UART clock is generated by the 25MHz LPC clock which results in an accuracy of 0.5% on all UART timings

- Due to the protection circuitry required according COM Express® specification the transfer speed can only be guaranteed for 9600 Baud. Please contact your local sales or Kontron support for customized versions without protection circuitry.

- Legacy console redirection via onboard serial ports may be restricted in terms of serial input stream. Since they're only emulating a 16450 device (w/o FIFO) an input stream generated by a program may lose characters. Inputs from a keyboard via terminal program will be safe.

3.9. Fast I2C

The COMe-cBW6 supports a CPLD implemented LPC to I2C bridge using the WISHBONE I2C Master Core provided from opencores.org. The I2C Interface supports transfer rates up to 40kB/s and can be configured in Setup.

Specification for external I2C:

- Speed up to 400kHz
- Compatible to Philips I2C bus standard
- Multi-Master capable
- Clock stretching support and wait state generation
- Interrupt or bit-polling driven byte-by-byte data-transfers
- Arbitration lost interrupt with automatic transfer cancellation
- Start/Stop signal generation/detection
- Bus busy detection
- 7bit and 10bit addressing

3.10. Dual Staged Watchdog Timer

3.10.1. Basics

A watchdog timer (or computer operating properly (COP) timer) is a computer hardware or software timer that triggers a system reset or other corrective action if the main program, due to some fault condition, such as a hang, neglects to regularly service the watchdog (writing a “service pulse” to it, also referred to as “kicking the dog”, “petting the dog”, “feeding the watchdog” or “triggering the watchdog”). The intention is to bring the system back from the nonresponsive state into normal operation.

The COMe-cBW6 offers a watchdog which works with two stages that can be programmed independently and used one by one.

3.10.2. Time-out events

Reset	A reset will restart the module and starts POST and operating system new.
NMI	A non-maskable interrupt (NMI) is a computer processor interrupt that cannot be ignored by standard interrupt masking techniques in the system. It is typically used to signal attention for non-recoverable hardware errors.
SCI	A system control interrupt (SCI) is a OS-visible interrupt to be handled by the OS using AML code
Delay	Might be necessary when an operating system must be started and the time for the first trigger pulse must extended. (Only available in the first stage)
WDT Signal only	This setting triggers the WDT Pin on baseboard connector (COM Express® Pin B27) only
Cascade:	Does nothing, but enables the 2nd stage after the entered time-out.

3.10.3. WDT Signal

B27 on COM Express® Connector offers a signal that can be asserted when a watchdog timer has not been triggered within time. It can be configured to any of the 2 stages. Deassertion of the signal is automatically done after reset. If deassertion during runtime is necessary please ask your Kontron technical support for further help.

3.11. Speedstep Technology

The Intel® processors offer the Intel® Enhanced SpeedStep™ technology that automatically switches between maximum performance mode and battery-optimized mode, depending on the needs of the application being run. It enables you to adapt high performance computing on your applications. When powered by a battery or running in idle mode, the processor drops to lower frequencies (by changing the CPU ratios) and voltage, conserving battery life while maintaining a high level of performance. The frequency is set back automatically to the high frequency, allowing you to customize performance.

In order to use the Intel® Enhanced SpeedStep™ technology the operating system must support SpeedStep™ technology.

By deactivating the SpeedStep feature in the BIOS, manual control/modification of CPU performance is possible. Setup the CPU Performance State in the BIOS Setup or use 3rd party software to control CPU Performance States.

3.12. C-States

New generation platforms include power saving features like SuperLFM, EIST (P-States) or C-States in O/S idle mode.

Activated C-States are able to dramatically decrease power consumption in idle mode by reducing the Core Voltage or switching of parts of the CPU Core, the Core Clocks or the CPU Cache.

Following C-States are defined:

C-State	Description	Function
C0	Operating	CPU fully turned on
C1	Halt State	Stops CPU main internal clocks via software
C1E	Enhanced Halt	Similar to C1, additionally reduces CPU voltage
C2	Stop Grant	Stops CPU internal and external clocks via hardware
C2E	Extended Stop Grant	Similar to C2, additionally reduces CPU voltage
C3	Deep Sleep	Stops all CPU internal and external clocks
C3E	Extended Stop Grant	Similar to C3, additionally reduces CPU voltage
C4	Deeper Sleep	Reduces CPU voltage
C4E	Enhanced Deeper Sleep	Reduces CPU voltage even more and turns off the memory cache
C6	Deep Power Down	Reduces the CPU internal voltage to any value, including 0V
C7	Deep Power Down	Similar to C6, additionally LLC (LastLevelCache) is switched off

C-States are usually enabled by default for low power consumption, but active C-States my influence performance sensitive applications or real-time systems.

- Active C6-State may influence data transfer on external Serial Ports
- Active C7-State may cause lower CPU and Graphics performance

It's recommended to disable C-States / Enhanced C-States in BIOS Setup if any problems occur.

3.13. ACPI Suspend Modes and Resume Events

The COMe-cBW6 supports the S-states S0, S3, S4, S5. S5eco Support: YES

The following events resume the system from S3:

- USB Keyboard (1)
- USB Mouse (1)
- Power Button
- WakeOnLan (2)

The following events resume the system from S4:

- Power Button
- WakeOnLan (2)

The following events resume the system from S5:

- Power Button
- WakeOnLan (2)

The following events resume the system from S5Eco:

- Power Button

(1) OS must support wake up via USB devices and baseboard must power the USB Port with StBy-Voltage
(2) Depending on the Used Ethernet MAC/Phy WakeOnLan must be enabled in BIOS setup and driver options

4/ Pinout List

4.1. General Signal Description

Type	Description
I/O-3,3	Bi-directional 3,3 V IO-Signal
I/O-5T	Bi-dir. 3,3V I/O (5V Tolerance)
I/O-5	Bi-directional 5V I/O-Signal
I-3,3	3,3V Input
I/OD	Bi-directional Input/Output Open Drain
I-5T	3,3V Input (5V Tolerance)
OA	Output Analog
OD	Output Open Drain
O-1,8	1,8V Output
O-3,3	3,3V Output
O-5	5V Output
DP-I/O	Differential Pair Input/Output
DP-I	Differential Pair Input
DP-O	Differential Pair Output
PU	Pull-Up Resistor
PD	Pull-Down Resistor
PWR	Power Connection

To protect external power lines of peripheral devices, make sure that: the wires have the right diameter to withstand the maximum available current the enclosure of the peripheral device fulfills the fire-protection requirements of IEC/EN60950

4.2. Connector X1A Row A

Pin	Signal	Description	Type	Termination	Comment
A1	GND	Power Ground	PWR GND	-	-
A2	GBE0_MDI3 -	Ethernet Media Dependent Interface 3 -	DP-I/O	-	-
A3	GBE0_MDI3 +	Ethernet Media Dependent Interface 3 +	DP-I/O	-	-
A4	GBE0_LINK100#	Ethernet Speed LED	OD	-	-
A5	GBE0_LINK1000#	Ethernet Speed LED	OD	-	-
A6	GBE0_MDI2 -	Ethernet Media Dependent Interface 2 -	DP-I/O	-	-
A7	GBE0_MDI2 +	Ethernet Media Dependent Interface 2 +	DP-I/O	-	-
A8	GBE0_LINK #	LAN Link LED	OD	-	-
A9	GBE0_MDI1 -	Ethernet Media Dependent Interface 1 -	DP-I/O	-	-
A10	GBE0_MDI1 +	Ethernet Media Dependent Interface 1 +	DP-I/O	-	-
A11	GND	Power Ground	PWR GND	-	-
A12	GBE0_MDI0 -	Ethernet Media Dependent Interface 0 -	DP-I/O	-	-
A13	GBE0_MDI0 +	Ethernet Media Dependent Interface 0 +	DP-I/O	-	-
A14	GBE0_CTREF	Center Tab Reference Voltage	O	-	100nF capacitor to GND
A15	SUS_S3#	Suspend To RAM (or deeper) Indicator	O-3.3	PD 10k	-
A16	SATA0_TX+	SATA Transmit Pair 0 +	DP-O	-	-
A17	SATA0_TX-	SATA Transmit Pair 0 -	DP-O	-	-
A18	SUS_S4#	Suspend To Disk (or deeper) Indicator	O-3.3	PD 10k	-
A19	SATA0_RX+	SATA Receive Pair 0 +	DP-I	-	-
A20	SATA0_RX-	SATA Receive Pair 0 -	DP-I	-	-
A21	GND	Power Ground	PWR GND	-	-
A22	SATA2_TX+	USB 3.0 Receive Pair 0 -	DP-I	-	-
A23	SATA2_TX-	USB 3.0 Receive Pair 0 +	DP-I	-	-
A24	SUS_S5#	Soft Off Indicator	O-3.3	-	-
A25	SATA2_RX+	USB 3.0 Receive Pair 1 -	DP-I	-	-
A26	SATA2_RX-	USB 3.0 Receive Pair 1 +	DP-I	-	-
A27	BATLOW#	Battery Low	I-3.3	PU 10k 3.3V (S5)	assertion will prevent wake from S3-S5 state
A28	ATA_ACT#	Serial ATA activity LED	OD-3.3	PU 10k 3.3V (S0)	can sink 15mA
A29	HDA_SYNC	HD Audio Sync	O-3.3	-	-
A30	HDA_RST#	HD Audio Reset	O-3.3	-	-
A31	GND	Power Ground	PWR GND	-	-
A32	HDA_CLK	HD Audio Bit Clock Output	O-3.3	-	-
A33	HDA_SDOUT	HD Audio Serial Data Out	O-3.3	-	-
A34	BIOS_DIS0#	BIOS Selection Strap 0	I-3.3	PU 10k 3.3V (S0)	-
A35	THRMTRIP#	Thermal Trip	O-3.3	PU 10k 3.3V (S0)	do not use as this signal does not differ between regular and over-temperature shutdown
A36	USB6-	USB 2.0 Data Pair Port 6 –	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
A37	USB6+	USB 2.0 Data Pair Port 6 +	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
A38	USB_6_7_OC#	USB Overcurrent Indicator Port 6/7	I-3.3	PU 10k 3.3V (S5)	-
A39	USB4-	USB 2.0 Data Pair Port 4 -	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
A40	USB4+	USB 2.0 Data Pair Port 4 +	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
A41	GND	Power Ground	PWR GND	-	-
A42	USB2-	USB 2.0 Data Pair Port 2 –	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
A43	USB2+	USB 2.0 Data Pair Port 2 +	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
A44	USB_2_3_OC#	USB Overcurrent Indicator Port 2/3	I-3.3	PU 15k in CPLD (S5)	resistor value can range from 5kOhm to 25kOhm

A45	USB0-	USB 2.0 Data Pair Port 0 –	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
A46	USB0+	USB 2.0 Data Pair Port 0 +	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
A47	VCC_RTC	Real-Time Clock Circuit Power Input	PWR 3V	-	voltage range 2.8-3.47V
A48	EXCD0_PERST#	Express Card Reset Port 0	O-3.3	-	-
A49	EXCD0_CPPE#	Express Card Capable Card Request Port 0	I-3.3	PU 10k 3.3V (S0)	-
A50	LPC_SERIRQ	Serial Interrupt Request	I/O-3.3	PU 220k 3.3V (S0)	-
A51	GND	Power Ground	PWR GND	-	-
A52	PCIE_TX5+	Not Connected	nc	-	-
A53	PCIE_TX5-	Not Connected	nc	-	-
A54	GPI0	General Purpose Input 0	I-3.3	PU 100k 3.3V (S0)	-
A55	PCIE_TX4+	Not Connected	nc	-	-
A56	PCIE_TX4-	Not Connected	nc	-	-
A57	GND	Power Ground	PWR GND	-	-
A58	PCIE_TX3+	PCI Express Lane 3 Transmit +	DP-O	-	only available on no-LAN var.
A59	PCIE_TX3-	PCI Express Lane 3 Transmit -	DP-O	-	only available on no-LAN var.
A60	GND	Power Ground	PWR GND	-	-
A61	PCIE_TX2+	PCI Express Lane 2 Transmit +	DP-O	-	-
A62	PCIE_TX2-	PCI Express Lane 2 Transmit -	DP-O	-	-
A63	GPI1	General Purpose Input 1	I-3.3	PU 100k 3.3V (S0)	-
A64	PCIE_TX1+	PCI Express Lane 1 Transmit +	DP-O	-	-
A65	PCIE_TX1-	PCI Express Lane 1 Transmit -	DP-O	-	-
A66	GND	Power Ground	PWR GND	-	-
A67	GPI2	General Purpose Input 2	I-3.3	PU 100k 3.3V (S0)	-
A68	PCIE_TX0+	PCI Express Lane 0 Transmit +	DP-O	-	-
A69	PCIE_TX0-	PCI Express Lane 0 Transmit -	DP-O	-	-
A70	GND	Power Ground	PWR GND	-	-
A71	LVDS_A0+	LVDS Channel A DAT0+	DP-O	-	-
A72	LVDS_A0-	LVDS Channel A DAT0-	DP-O	-	-
A73	LVDS_A1+	LVDS Channel A DAT1+	DP-O	-	-
A74	LVDS_A1-	LVDS Channel A DAT1-	DP-O	-	-
A75	LVDS_A2+	LVDS Channel A DAT2+	DP-O	-	-
A76	LVDS_A2-	LVDS Channel A DAT2-	DP-O	-	-
A77	LVDS_VDD_EN	LVDS Panel Power Control	O-3.3	PD 100k	-
A78	LVDS_A3+	LVDS Channel A DAT3+	DP-O	-	-
A79	LVDS_A3-	LVDS Channel A DAT3+	DP-O	-	-
A80	GND	Power Ground	PWR GND	-	-
A81	LVDS_A_CK+	LVDS Channel A Clock+	DP-O	-	20-80MHz
A82	LVDS_A_CK-	LVDS Channel A Clock-	DP-O	-	20-80MHz
A83	LVDS_I2C_CK	LVDS I2C Clock (DDC)	IO-3.3	PU 2k21 3.3V (S0)	-
A84	LVDS_I2C_DAT	LVDS I2C Data (DDC)	IO-3.3	PU 2k21 3.3V (S0)	-
A85	GPI3	General Purpose Input 3	I-3.3	PU 100k 3.3V (S0)	-
A86	RSVD	Reserved for future use	nc	-	-
A87	RSVD/eDP_HPD	Reserved for future use	I-3.3	PD 100k	only available on no-LVDS var.
A88	PCIE0_CK_REF+	Reference PCI Express Clock +	DP-O	-	100MHz
A89	PCIE0_CK_REF-	Reference PCI Express Clock -	DP-O	-	100MHz
A90	GND	Power Ground	PWR GND	-	-
A91	SPI_POWER	3.3V Power Output Pin for external SPI flash	O-3.3	-	100mA (max.)
A92	SPI_MISO	SPI Master IN Slave OUT	I-3.3	PU 20k in CPU (S5)	All SPI signals are tri-stated with 20k ohm CPU internal weak pull-up until reset is deasserted
A93	GPO0	General Purpose Output 0	O-3.3	PD 100k	-
A94	SPI_CLK	SPI Clock	O-3.3	PU 20k in CPU (S5)	All SPI signals are tri-stated with 20k ohm CPU internal weak pull-up until reset is deasserted
A95	SPI_MOSI	SPI Master Out Slave In	O-3.3	PU 20k in CPU (S5)	All SPI signals are tri-stated with 20k ohm CPU internal weak pull-up until reset is deasserted

A96	TPM_PP	TPM Physical Presence	nc	-	
A97	TYPE10#	Indicates TYPE10# to carrier board	nc	-	-
A98	SER0_TX	Serial Port 0 TXD	O-3.3	-	20V protection circuit implemented on module, PD on carrier board needed for proper operation
A99	SER0_RX	Serial Port 0 RXD	I-5T	PU 47k 3.3V (S0)	20V protection circuit implemented on module
A100	GND	Power Ground	PWR GND	-	-
A101	SER1_TX	Serial Port 1 TXD	O-3.3	-	20V protection circuit implemented on module, PD on carrier board needed for proper operation
A102	SER1_RX	Serial Port 1 RXD	I-5T	PU 47k 3.3V (S0)	20V protection circuit implemented on module
A103	LID#	LID Switch Input	I-3.3	PU 47k 3.3V (S5)	20V protection circuit implemented on module
A104	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
A105	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
A106	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
A107	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
A108	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
A109	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
A110	GND	Power Ground	PWR GND	-	-

4.3. Connector X1A Row B

Pin	Signal	Description	Type	Termination	Comment
B1	GND	Power Ground	PWR GND	-	-
B2	GBE0_ACT#	Ethernet Activity LED	OD	-	-
B3	LPC_FRAME#	LPC Frame Indicator	O-3.3	PU 20k in CPU (S5)	-
B4	LPC_AD0	LPC Multiplexed Command, Address & Data 0	I/O-3.3	PU 20k in CPU (S5)	-
B5	LPC_AD1	LPC Multiplexed Command, Address & Data 1	I/O-3.3	PU 20k in CPU (S5)	-
B6	LPC_AD2	LPC Multiplexed Command, Address & Data 2	I/O-3.3	PU 20k in CPU (S5)	-
B7	LPC_AD3	LPC Multiplexed Command, Address & Data 3	I/O-3.3	PU 20k in CPU (S5)	-
B8	LPC_DRQ0#	LPC Serial DMA/Master Request 0	I-3.3	PU 15k in CPLD (S5)	resistor value can range from 5kOhm to 25kOhm
B9	LPC_DRQ1#	LPC Serial DMA/Master Request 1	I-3.3	PU 15k in CPLD (S5)	resistor value can range from 5kOhm to 25kOhm
B10	LPC_CLK	33MHz LPC clock	O-3.3	PD 20k in CPU	25MHz
B11	GND	Power Ground	PWR GND	-	-
B12	PWRBTN#	Power Button	I-3.3	PU 10k 3.3V (S5eco)	-
B13	SMB_CLK	SMBUS Clock	O-3.3	PU 2k9 3.3V (S5)	-
B14	SMB_DAT	SMBUS Data	I/O-3.3	PU 2k9 3.3V (S5)	-
B15	SMB_ALERT#	SMBUS Alert	I/O-3.3	PU 10k 3.3V (S5)	-
B16	SATA1_TX+	SATA 1 Transmit Pair +	DP-O	-	-
B17	SATA1_TX-	SATA 1 Transmit Pair -	DP-O	-	-
B18	SUS_STAT#	Suspend Status	O-3.3	-	-
B19	SATA1_RX+	SATA 1 Receive Pair +	DP-I	-	-
B20	SATA1_RX-	SATA 1 Receive Pair -	DP-I	-	-
B21	GND	Power Ground	PWR GND	-	-
B22	SATA3_TX+	Not Connected	nc	-	-
B23	SATA3_TX-	Not Connected	nc	-	-
B24	PWR_OK	Power OK	I-5T	PU 61k 3.3V	pullup voltage is S0 in ATX mode/ S5 in single supply mode / 5V tolerant
B25	SATA3_RX+	Not Connected	nc	-	-
B26	SATA3_RX-	Not Connected	nc	-	-
B27	WDT	Watch Dog Time-Out event	O-3.3	-	-
B28	HDA_SDIN2	Not Connected	nc	-	not supported
B29	HDA_SDIN1	Audio Codec Serial Data in 1	I-3.3	-	-
B30	HDA_SDIN0	Audio Codec Serial Data in 0	I-3.3	-	-
B31	GND	Power Ground	PWR GND	-	-
B32	SPKR	Speaker	O-3.3	PU 20k in CPU (S0)	-
B33	I2C_CK	I2C Clock	O-3.3	PU 2k21 3.3V (S5)	-
B34	I2C_DAT	I2C Data	I/O-3.3	PU 2k21 3.3V (S5)	-
B35	THRM#	Over Temperature Input	I-3.3	PU 10k 3.3V (S0)	no function implemented
B36	USB7-	USB 2.0 Data Pair Port 7 –	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
B37	USB7+	USB 2.0 Data Pair Port 7 +	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
B38	USB_4_5_OC #	USB Overcurrent Indicator Port 4/5	I-3.3	PU 10k 3.3V (S5)	-
B39	USB5-	USB 2.0 Data Pair Port 5 –	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
B40	USB5+	USB 2.0 Data Pair Port 5 +	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
B41	GND	Power Ground	PWR GND	-	-
B42	USB3-	USB 2.0 Data Pair Port 3 –	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
B43	USB3+	USB 2.0 Data Pair Port 3 +	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
B44	USB_0_1_OC #	USB Overcurrent Indicator Port 0/1	I-3.3	PU 15k in CPLD (S5)	resistor value can range from 5kOhm to 25kOhm
B45	USB1-	USB 2.0 Data Pair Port 1 –	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port

B46	USB1+	USB 2.0 Data Pair Port 1 +	DP-I/O	PD/PU in CPU	PD 15kOhm +/-5% on Downstream Facing Port; PU 1.5kOhm +/-5% on Upstream Facing Port
B47	EXCD1_PERST#	Express Card Reset Port 1	O-3.3	-	-
B48	EXCD1_CPPE#	Express Card Capable Card Request Port 1	I-3.3	PU 10k 3.3V (S0)	-
B49	SYS_RESET#	Reset Button Input	I-3.3	PU 10k 3.3V (S5)	-
B50	CB_RESET#	Carrier Board Reset	O-3.3		-
B51	GND	Power Ground	PWR GND	-	-
B52	PCIE_RX5+	Not Connected	nc	-	-
B53	PCIE_RX5-	Not Connected	nc	-	-
B54	GPO1	General Purpose Output 1	O-3.3	PD 100k	-
B55	PCIE_RX4+	Not Connected	nc	-	-
B56	PCIE_RX4-	Not Connected	nc	-	-
B57	GPO2	General Purpose Output 2	O-3.3	PD 100k	-
B58	PCIE_RX3+	PCI Express Lane 3 Receive +	DP-I	-	only available on no-LAN var.
B59	PCIE_RX3-	PCI Express Lane 3 Receive -	DP-I	-	only available on no-LAN var.
B60	GND	Power Ground	PWR GND	-	-
B61	PCIE_RX2+	PCI Express Lane 2 Receive +	DP-I	-	-
B62	PCIE_RX2-	PCI Express Lane 2 Receive -	DP-I	-	-
B63	GPO3	General Purpose Output 3	O-3.3	PD 100k	-
B64	PCIE_RX1+	PCI Express Lane 1 Receive +	DP-I	-	-
B65	PCIE_RX1-	PCI Express Lane 1 Receive -	DP-I	-	-
B66	WAKE0#	PCI Express Wake Event	I-3.3	PU 10k 3.3V (S5)	-
B67	WAKE1#	General Purpose Wake Event	I-3.3	PU 10k 3.3V (S5)	-
B68	PCIE_RX0+	PCI Express Lane 0 Receive +	DP-I	-	-
B69	PCIE_RX0-	PCI Express Lane 0 Receive -	DP-I	-	-
B70	GND	Power Ground	PWR GND	-	-
B71	LVDS_B0+	LVDS Channel B DAT0+	DP-O	-	-
B72	LVDS_B0-	LVDS Channel B DAT0-	DP-O	-	-
B73	LVDS_B1+	LVDS Channel B DAT1+	DP-O	-	-
B74	LVDS_B1-	LVDS Channel B DAT1-	DP-O	-	-
B75	LVDS_B2+	LVDS Channel B DAT2+	DP-O	-	-
B76	LVDS_B2-	LVDS Channel B DAT2-	DP-O	-	-
B77	LVDS_B3+	LVDS Channel B DAT3+	DP-O	-	-
B78	LVDS_B3-	LVDS Channel B DAT3-	DP-O	-	-
B79	LVDS_BKLT_EN	Panel Backlight On	O-3.3	PD 100k	-
B80	GND	Power Ground	PWR GND	-	-
B81	LVDS_B_CK+	LVDS Channel B Clock+	DP-O	-	20-80MHz
B82	LVDS_B_CK-	LVDS Channel B Clock-	DP-O	-	20-80MHz
B83	LVDS_BKLT_CTRL	Backlight Brightness Control	O-3.3	-	-
B84	VCC_5V_SBY	5V Standby	PWR 5V (S5)	-	optional (not neccessary in single supply mode)
B85	VCC_5V_SBY	5V Standby	PWR 5V (S5)	-	optional (not neccessary in single supply mode)
B86	VCC_5V_SBY	5V Standby	PWR 5V (S5)	-	optional (not neccessary in single supply mode)
B87	VCC_5V_SBY	5V Standby	PWR 5V (S5)	-	optional (not neccessary in single supply mode)
B88	BIOS_DIS1#	BIOS Selection Strap 1	I-3.3	PU 10k 3.3V (S0)	PU might be powered during suspend
B89	VGA_RED	CRT_RED / Analog Video RGB-RED	OA	PD 150R	-
B90	GND	Power Ground	PWR GND	-	-
B91	VGA_GREEN	VGA_GREEN / Analog Video RGB-GREEN	OA	PD 150R	-
B92	VGA_BLUE	VGA_BLUE / Analog Video RGB-BLUE	OA	PD 150R	-
B93	VGA_HSYNC	VGA_HSYNC / Analog Video H-Sync	O-3.3	-	-
B94	VGA_VSYNC	VGA_VSYNC / Analog Video V-Sync	O-3.3	-	-
B95	VGA_DDC_CLK	VGA_DDC_CLK / Display Data Channel Clock	I/O-5	PU 2k4 3.3 (S0)	-
B96	VGA_DDC_DATA	VGA_DDC_DATA / Display Data Channel Data	I/O-5	PU 2k4 3.3 (S0)	-
B97	SPI_CS#	SPI Chip Select	O-3.3	-	-
B98	RSVD	Reserved for future use	nc	-	-
B99	RSVD	Reserved for future use	nc	-	-
B100	GND	Power Ground	PWR GND	-	-
B101	FAN_PWMOUT	Fan PWM Output	O-3.3	-	20V protection circuit implemented on module, PD on carrier board needed for proper operation
B102	FAN_TACHIN	Fan Tach Input	I-3.3	PU 47k 3.3V (S0)	20V protection circuit implemented on module
B103	SLEEP#	Sleep Button Input	I-3.3	PU 47k 3.3V (S5)	20V protection circuit implemented on module

B104	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
B105	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
B106	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
B107	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
B108	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
B109	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
B110	GND	Power Ground	PWR GND	-	-

4.4. Connector X1B Row C

Pin	Signal	Description	Type	Termination	Comment
C1	GND	Power Ground	PWR GND	-	-
C2	GND	Power Ground	PWR GND	-	-
C3	USB_SSRX0-	USB Super Speed Receive - (0)	DP-I	-	-
C4	USB_SSRX0+	USB Super Speed Receive + (0)	DP-I	-	-
C5	GND	Power Ground	PWR GND	-	-
C6	USB_SSRX1-	USB Super Speed Receive - (1)	DP-I	-	-
C7	USB_SSRX1+	USB Super Speed Receive + (1)	DP-I	-	-
C8	GND	Power Ground	PWR GND	-	-
C9	USB_SSRX2-	USB Super Speed Receive - (2)	DP-I	-	-
C10	USB_SSRX2+	USB Super Speed Receive + (2)	DP-I	-	-
C11	GND	Power Ground	PWR GND	-	-
C12	USB_SSRX3-	USB Super Speed Receive - (3)	DP-I	-	-
C13	USB_SSRX3+	USB Super Speed Receive + (3)	DP-I	-	-
C14	GND	Power Ground	PWR GND	-	-
C15	DDI1_PAIR6+	Not Connected	nc	-	-
C16	DDI1_PAIR6-	Not Connected	nc	-	-
C17	RSVD	Reserved for future use	nc	-	-
C18	RSVD	Reserved for future use	nc	-	-
C19	PCIE_RX6+	Not Connected	nc	-	-
C20	PCIE_RX6-	Not Connected	nc	-	-
C21	GND	Power Ground	PWR GND	-	-
C22	PCIE_RX7+	Not Connected	nc	-	-
C23	PCIE_RX7-	Not Connected	nc	-	-
C24	DDI1_HPD	DDI1 Hotplug Detect	I-3.3	PD 100k	-
C25	DDI1_PAIR4+	Not Connected	nc	-	-
C26	DDI1_PAIR4-	Not Connected	nc	-	-
C27	RSVD	Reserved for future use	nc	-	-
C28	RSVD	Reserved for future use	nc	-	-
C29	DDI1_PAIR5+	Not Connected	nc	-	-
C30	DDI1_PAIR5-	Not Connected	nc	-	-
C31	GND	Power Ground	PWR GND	-	-
C32	DDI2_CTRLCLK_AUX+	DDI2 CTRLCLK/AUX+	I/O-3.3	PD 100k	-
C33	DDI2_CTRLDATA_AUX-	DDI2 CTRLDATA/AUX-	I/O-3.3	PU 100k 3.3V (S0)	-
C34	DDI2_DDC_AUX_SEL	DDI2 DDC/AUX select	I-3.3	PD 1M	-
C35	RSVD	Reserved for future use	nc	-	-
C36	DDI3_CTRLCLK_AUX+	Not Connected	nc	-	-
C37	DDI3_CTRLDATA_AUX-	Not Connected	nc	-	-
C38	DDI3_DDC_AUX_SEL	Not Connected	nc	-	-
C39	DDI3_PAIR0+	Not Connected	nc	-	-
C40	DDI3_PAIR0-	Not Connected	nc	-	-
C41	GND	Power Ground	PWR GND	-	-
C42	DDI3_PAIR1+	Not Connected	nc	-	-
C43	DDI3_PAIR1-	Not Connected	nc	-	-
C44	DDI3_HPD	Not Connected	nc	-	-
C45	RSVD	Reserved for future use	nc	-	-
C46	DDI3_PAIR2+	Not Connected	nc	-	-
C47	DDI3_PAIR2-	Not Connected	nc	-	-
C48	RSVD	Reserved for future use	nc	-	-
C49	DDI3_PAIR3+	Not Connected	nc	-	-
C50	DDI3_PAIR3-	Not Connected	nc	-	-
C51	GND	Power Ground	PWR GND	-	-
C52	PEG_RX0+	Not Connected	nc	-	-
C53	PEG_RX0-	Not Connected	nc	-	-
C54	TYPE0#	n.c. for type 6 module	nc	-	-
C55	PEG_RX1+	Not Connected	nc	-	-
C56	PEG_RX1-	Not Connected	nc	-	-
C57	TYPE1#	n.c. for type 6 module	nc	-	-
C58	PEG_RX2+	Not Connected	nc	-	-
C59	PEG_RX2-	Not Connected	nc	-	-
C60	GND	Power Ground	PWR GND	-	-
C61	PEG_RX3+	Not Connected	nc	-	-
C62	PEG_RX3-	Not Connected	nc	-	-
C63	RSVD	Reserved for future use	nc	-	-
C64	RSVD	Reserved for future use	nc	-	-
C65	PEG_RX4+	Not Connected	nc	-	-
C66	PEG_RX4-	Not Connected	nc	-	-

C67	RSVD	Reserved for future use	nc	-	-
C68	PEG_RX5+	Not Connected	nc	-	-
C69	PEG_RX5-	Not Connected	nc	-	-
C70	GND	Power Ground	PWR GND	-	-
C71	PEG_RX6+	Not Connected	nc	-	-
C72	PEG_RX6-	Not Connected	nc	-	-
C73	GND	Power Ground	PWR GND	-	-
C74	PEG_RX7+	Not Connected	nc	-	-
C75	PEG_RX7-	Not Connected	nc	-	-
C76	GND	Power Ground	PWR GND	-	-
C77	RSVD	Reserved for future use	nc	-	-
C78	PEG_RX8+	Not Connected	nc	-	-
C79	PEG_RX8-	Not Connected	nc	-	-
C80	GND	Power Ground	PWR GND	-	-
C81	PEG_RX9+	Not Connected	nc	-	-
C82	PEG_RX9-	Not Connected	nc	-	-
C83	RSVD	Reserved for future use	nc	-	-
C84	GND	Power Ground	PWR GND	-	-
C85	PEG_RX10+	Not Connected	nc	-	-
C86	PEG_RX10-	Not Connected	nc	-	-
C87	GND	Power Ground	PWR GND	-	-
C88	PEG_RX11+	Not Connected	nc	-	-
C89	PEG_RX11-	Not Connected	nc	-	-
C90	GND	Power Ground	PWR GND	-	-
C91	PEG_RX12+	Not Connected	nc	-	-
C92	PEG_RX12-	Not Connected	nc	-	-
C93	GND	Power Ground	PWR GND	-	-
C94	PEG_RX13+	Not Connected	nc	-	-
C95	PEG_RX13-	Not Connected	nc	-	-
C96	GND	Power Ground	PWR GND	-	-
C97	RSVD	Reserved for future use	nc	-	-
C98	PEG_RX14+	Not Connected	nc	-	-
C99	PEG_RX14-	Not Connected	nc	-	-
C100	GND	Power Ground	PWR GND	-	-
C101	PEG_RX15+	Not Connected	nc	-	-
C102	PEG_RX15-	Not Connected	nc	-	-
C103	GND	Power Ground	PWR GND	-	-
C104	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
C105	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
C106	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
C107	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
C108	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
C109	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
C110	GND	Power Ground	PWR GND	-	-

4.5. Connector X1B Row D

Pin	Signal	Description	Type	Termination	Comment
D1	GND	Power Ground	PWR GND	-	-
D2	GND	Power Ground	PWR GND	-	-
D3	USB_SSTX0-	USB Super Speed Transmit - (0)	DP-O	-	-
D4	USB_SSTX0+	USB Super Speed Transmit + (0)	DP-O	-	-
D5	GND	Power Ground	PWR GND	-	-
D6	USB_SSTX1-	USB Super Speed Transmit - (1)	DP-O	-	-
D7	USB_SSTX1+	USB Super Speed Transmit + (1)	DP-O	-	-
D8	GND	Power Ground	PWR GND	-	-
D9	USB_SSTX2-	USB Super Speed Transmit - (2)	DP-O	-	-
D10	USB_SSTX2+	USB Super Speed Transmit + (2)	DP-O	-	-
D11	GND	Power Ground	PWR GND	-	-
D12	USB_SSTX3-	USB Super Speed Transmit - (3)	DP-O	-	-
D13	USB_SSTX3+	USB Super Speed Transmit + (3)	DP-O	-	-
D14	GND	Power Ground	PWR GND	-	-
D15	DDI1_CTRLCLK_AUX+	DDI1 CTRLCLK/AUX+	I/O-3.3	PD 100k	-
D16	DDI1_CTRLDATA_AUX-	DDI1 CTRLDATA/AUX-	I/O-3.3	PU 100k 3.3V (S0)	-
D17	RSVD	Reserved for future use	nc	-	-
D18	RSVD	Reserved for future use	nc	-	-
D19	PCIE_TX6+	Not Connected	nc	-	-
D20	PCIE_TX6-	Not Connected	nc	-	-
D21	GND	Power Ground	PWR GND	-	-
D22	PCIE_TX7+	Not Connected	nc	-	-
D23	PCIE_TX7-	Not Connected	nc	-	-
D24	RSVD	Reserved for future use	nc	-	-
D25	RSVD	Reserved for future use	nc	-	-
D26	DDI1_PAIR0+	DDI1 Pair 0 +	DP-O	-	-
D27	DDI1_PAIR0-	DDI1 Pair 0 -	DP-O	-	-
D28	RSVD	Reserved for future use	nc	-	-
D29	DDI1_PAIR1+	DDI1 Pair 1 +	DP-O	-	-
D30	DDI1_PAIR1-	DDI1 Pair 1 -	DP-O	-	-
D31	GND	Power Ground	PWR GND	-	-
D32	DDI1_PAIR2+	DDI1 Pair 2 +	DP-O	-	-
D33	DDI1_PAIR2-	DDI1 Pair 2 -	DP-O	-	-
D34	DDI1_DDC_AUX_SEL	DDI1 DDC/AUX select	I-3.3	PD 1M	-
D35	RSVD	Reserved for future use	nc	-	-
D36	DDI1_PAIR3+	DDI1 Pair 3 +	DP-O	-	-
D37	DDI1_PAIR3-	DDI1 Pair 3 -	DP-O	-	-
D38	RSVD	Reserved for future use	nc	-	-
D39	DDI2_PAIR0+	DDI2 Pair 0 +	DP-O	-	-
D40	DDI2_PAIR0-	DDI2 Pair 0 -	DP-O	-	-
D41	GND	Power Ground	PWR GND	-	-
D42	DDI2_PAIR1+	DDI2 Pair 1 +	DP-O	-	-
D43	DDI2_PAIR1-	DDI2 Pair 1 -	DP-O	-	-
D44	DDI2_HPD	DDI2 Hotplug Detect	I-3.3	PD 100k	-
D45	RSVD	Reserved for future use	nc	-	-
D46	DDI2_PAIR2+	DDI2 Pair 2 +	DP-O	-	-
D47	DDI2_PAIR2-	DDI2 Pair 2 -	DP-O	-	-
D48	RSVD	Reserved for future use	nc	-	-
D49	DDI2_PAIR3+	DDI2 Pair 3 +	DP-O	-	-
D50	DDI2_PAIR3-	DDI2 Pair 3 -	DP-O	-	-
D51	GND	Power Ground	PWR GND	-	-
D52	PEG_TX0+	Not Connected	nc	-	-
D53	PEG_TX0-	Not Connected	nc	-	-
D54	PEG_LANE_RV#	Not Connected	nc	-	-
D55	PEG_TX1+	Not Connected	nc	-	-
D56	PEG_TX1-	Not Connected	nc	-	-
D57	TYPE2#	GND for type 6 module	PWR	-	-
D58	PEG_TX2+	Not Connected	nc	-	-
D59	PEG_TX2-	Not Connected	nc	-	-
D60	GND	Power Ground	PWR GND	-	-
D61	PEG_TX3+	Not Connected	nc	-	-
D62	PEG_TX3-	Not Connected	nc	-	-
D63	RSVD	Reserved for future use	nc	-	-
D64	RSVD	Reserved for future use	nc	-	-
D65	PEG_TX4+	Not Connected	nc	-	-
D66	PEG_TX4-	Not Connected	nc	-	-

D67	GND	Power Ground	PWR GND	-	-
D68	PEG_TX5+	Not Connected	nc	-	-
D69	PEG_TX5-	Not Connected	nc	-	-
D70	GND	Power Ground	PWR GND	-	-
D71	PEG_TX6+	Not Connected	nc	-	-
D72	PEG_TX6-	Not Connected	nc	-	-
D73	GND	Power Ground	PWR GND	-	-
D74	PEG_TX7+	Not Connected	nc	-	-
D75	PEG_TX7-	Not Connected	nc	-	-
D76	GND	Power Ground	PWR GND	-	-
D77	RSVD	Reserved for future use	nc	-	-
D78	PEG_TX8+	Not Connected	nc	-	-
D79	PEG_TX8-	Not Connected	nc	-	-
D80	GND	Power Ground	PWR GND	-	-
D81	PEG_TX9+	Not Connected	nc	-	-
D82	PEG_TX9-	Not Connected	nc	-	-
D83	RSVD	Reserved for future use	nc	-	-
D84	GND	Power Ground	PWR GND	-	-
D85	PEG_TX10+	Not Connected	nc	-	-
D86	PEG_TX10-	Not Connected	nc	-	-
D87	GND	Power Ground	PWR GND	-	-
D88	PEG_TX11+	Not Connected	nc	-	-
D89	PEG_TX11-	Not Connected	nc	-	-
D90	GND	Power Ground	PWR GND	-	-
D91	PEG_TX12+	Not Connected	nc	-	-
D92	PEG_TX12-	Not Connected	nc	-	-
D93	GND	Power Ground	PWR GND	-	-
D94	PEG_TX13+	Not Connected	nc	-	-
D95	PEG_TX13-	Not Connected	nc	-	-
D96	GND	Power Ground	PWR GND	-	-
D97	RSVD	Reserved for future use	nc	-	-
D98	PEG_TX14+	Not Connected	nc	-	-
D99	PEG_TX14-	Not Connected	nc	-	-
D100	GND	Power Ground	PWR GND	-	-
D101	PEG_TX15+	Not Connected	nc	-	-
D102	PEG_TX15-	Not Connected	nc	-	-
D103	GND	Power Ground	PWR GND	-	-
D104	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
D105	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
D106	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
D107	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
D108	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
D109	VCC_12V	Main Input Voltage (8.5-20V)	PWR 8.5-20V	-	-
D110	GND	Power Ground	PWR GND	-	-

The termination resistors in these tables are already mounted on the module. Refer to the design guide for information about additional termination resistors.

5/ BIOS Operation

The BIOS (Basic Input and Output System) or UEFI (Unified Extensible Firmware Interface) records hardware parameters of the system in the CMOS on the Computer-on-Module. It's major functions include execution of the POST(Power-On-Self-Test) during system start-up, saving system parameters and loading the operating system. The BIOS includes a BIOS Setup programm that allows to modify system configuration settings. The module is equipped with AMI© Aptio, which is located in an onboard SPI serial flash memory.

5.1. Determining the BIOS Version

To determine the BIOS version currently used on the Computer-on-Modules please check System Information Page inside Setup.

5.2. BIOS Update

Kontron provides continuous BIOS updates for Computer-on-Modules. The updates are provided for download on http://customersection.kontron.com with detailed change descriptions within the according Product Change Notification (PCN). Please register for Kontron's Customer Section to get access to BIOS downloads and PCN service.

Modules with BIOS Region/Setup only inside the flash can be updated with AFU utilities (usually 1-3MB BIOS binary file size) directly. Modules with Intel® Management Engine, Ethernet, Flash Descriptor and other options additionally to the BIOS Region (usually 4-16MB BIOS binary file size) requires a different update process with Intel Flash Utility FPT and a wrapper to backup and restore configurations and the MAC address. Therefore it is strongly recommended to use the batch file inside the BIOS download package available on Kontron's Customer Section.

- Boot the module to DOS/EFI Shell with access to the BIOS image and Firmware Update Utility provided on Kontron's Customer Section
- Execute Flash.bat in DOS or Flash.nsh in EFI Shell

NOTICE Any modification of the update process may damage your module!

5.3. POST Codes

Important POST codes during boot-up

Key	Function
AB	BIOS Setup
AD	EFI Shell
AE	Windows

5.4. Setup Guide

The Setup Utility changes system behavior by modifying the Firmware configuration. The setup program uses a number of menus to make changes and turn features on or off.

Functional keystrokes in POST:

Key	Function
DEL	Enter Setup
ESC	Enter Setup
F7	Boot Menu

Functional keystrokes in Setup:

[F1]	Help
[F3]	Load default settings
[F4]	Save and Exit

5.4.1. Menu Bar

The menu bar at the top of the window lists different menus. Use the left/right arrow keys to make a selection.

5.4.2. Legend Bar

Use the keys listed in the legend bar on the bottom to make your selections or exit the current menu. The table below describes the legend keys and their alternates.

Key	Function
← or → Arrow key	Select a menu.
↑ or ↓ Arrow key	Select fields in current menu.
<Home> or <End>	Move cursor to top or bottom of current window.
<PgUp> or <PgDn>	Move cursor to next or previous page.
+/-	Change Option
<Enter>	Execute command or select submenu.
<F1>	General Help window.
<F2>	Previous Values
<F3>	Load the optimized default configuration.
<F4>	Save and exit.
<Esc>	Exit menu.

5.4.3. Selecting an Item

Use the ↑ or ↓ key to move the cursor to the field you want. Then use the + and – keys to select a value for that field. The Save Value commands in the Exit menu save the values displayed in all the menus.

5.4.4. Displaying Submenus

Use the ← or → key to move the cursor to the submenu you want. Then press <Enter>. A pointer (►) marks all submenus.

5.4.5. Item Specific Help Window

The Help window on the right side of each menu displays the Help text for the selected item. It updates as you move the cursor to each field.

5.4.6. General Help Window

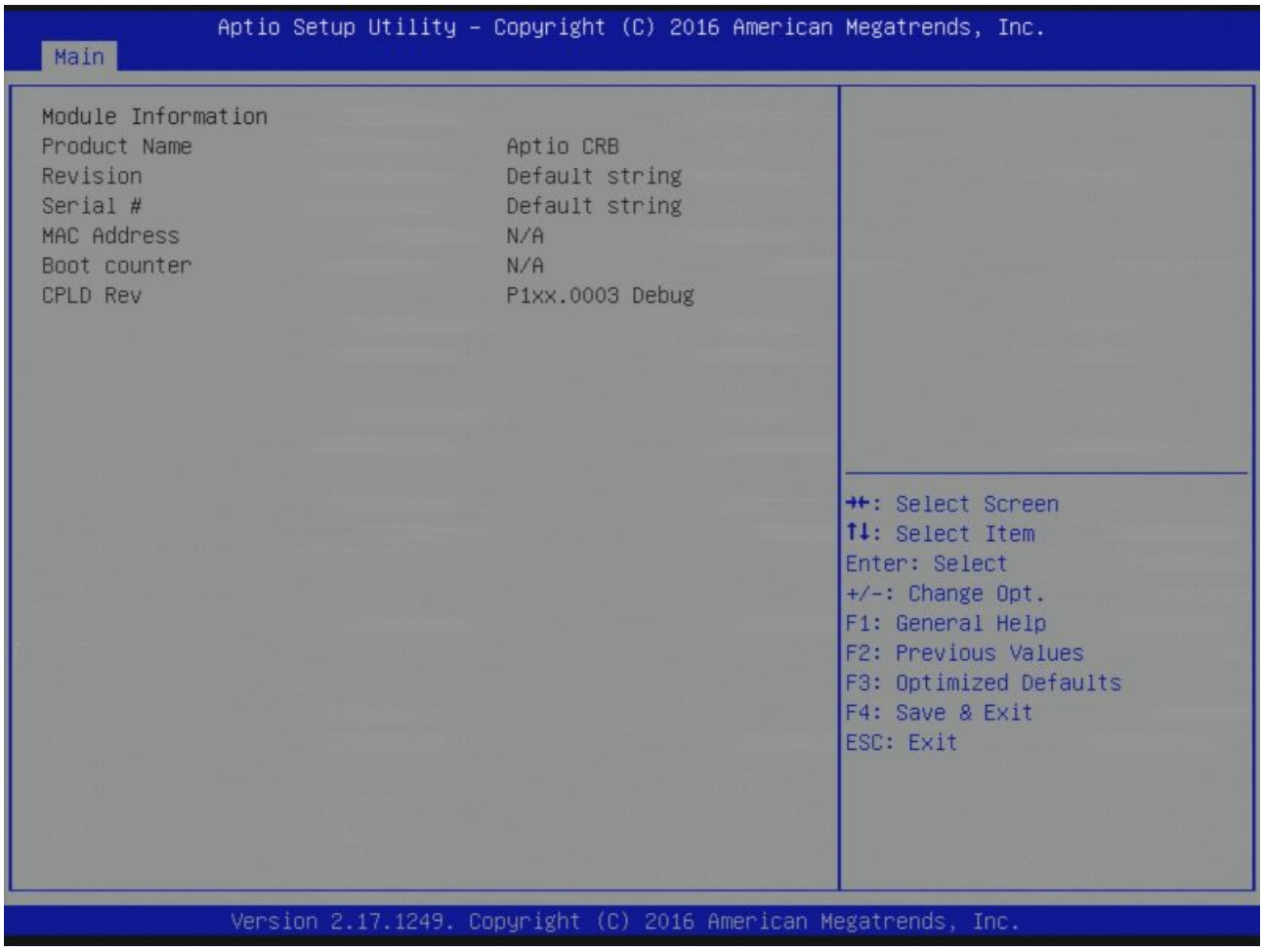
Pressing <F1> on a menu brings up the General Help window that describes the legend keys and their alternates. Press <Esc> to exit the General Help window.

5.5. BIOS Setup

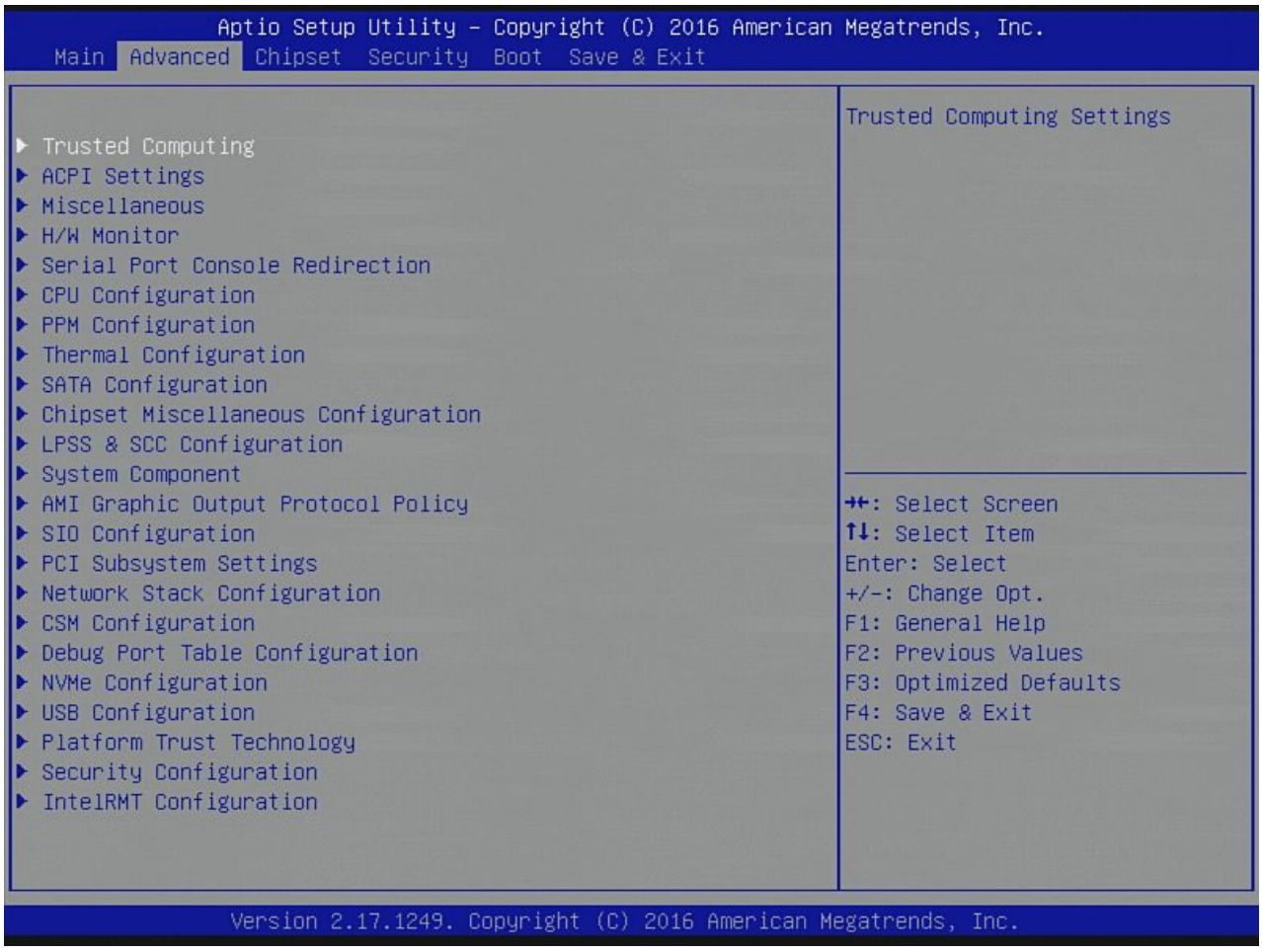
5.5.1. Main

Feature	Options	Description
System Language	[English]	Choose the system default language
System Date		Set the Date. Use the Tab to switch between Date elements.
System Time		Set the Date. Use the Tab to switch between Date elements.

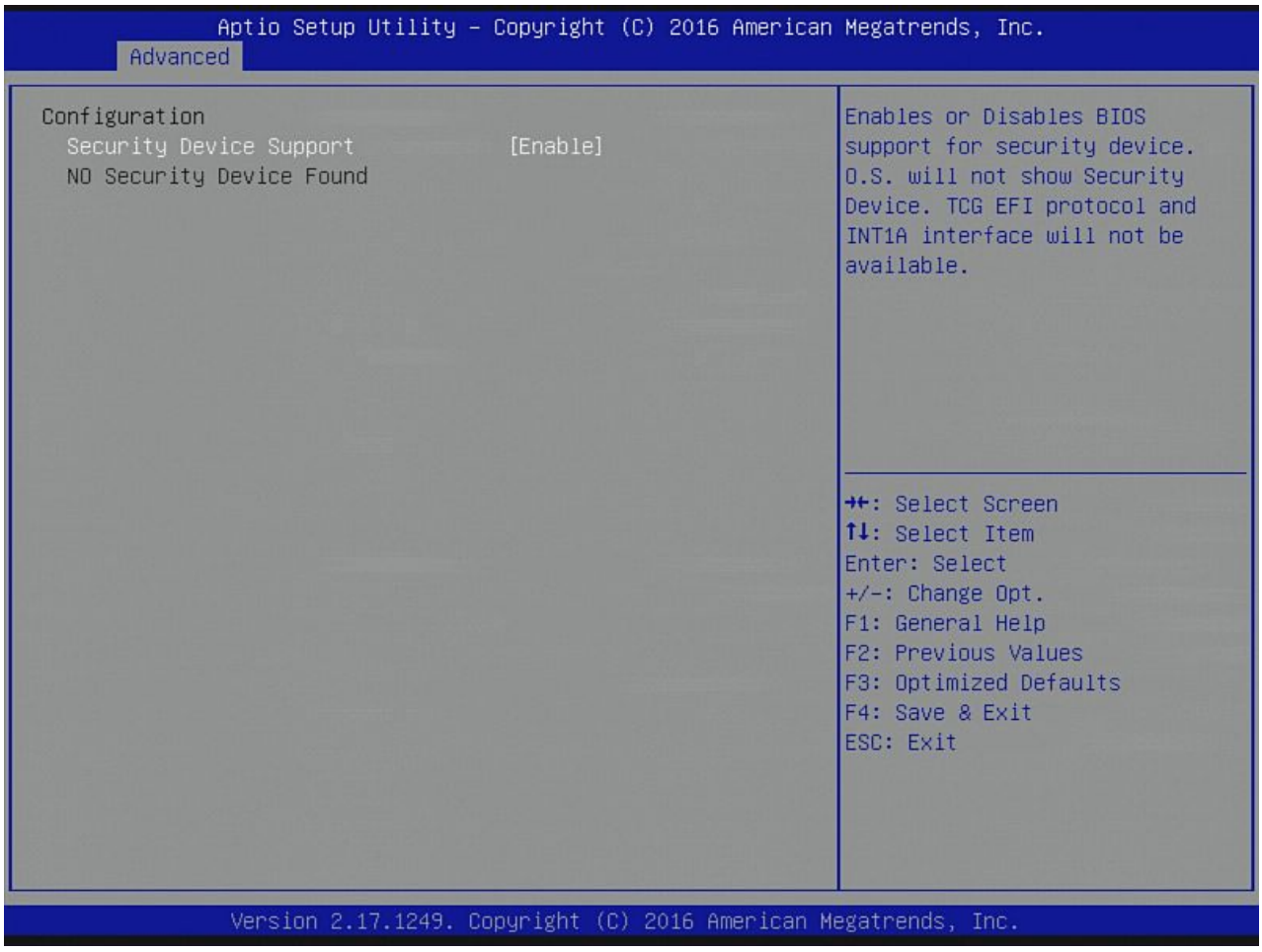
5.5.1.1. Platform Information



5.5.2. Advanced

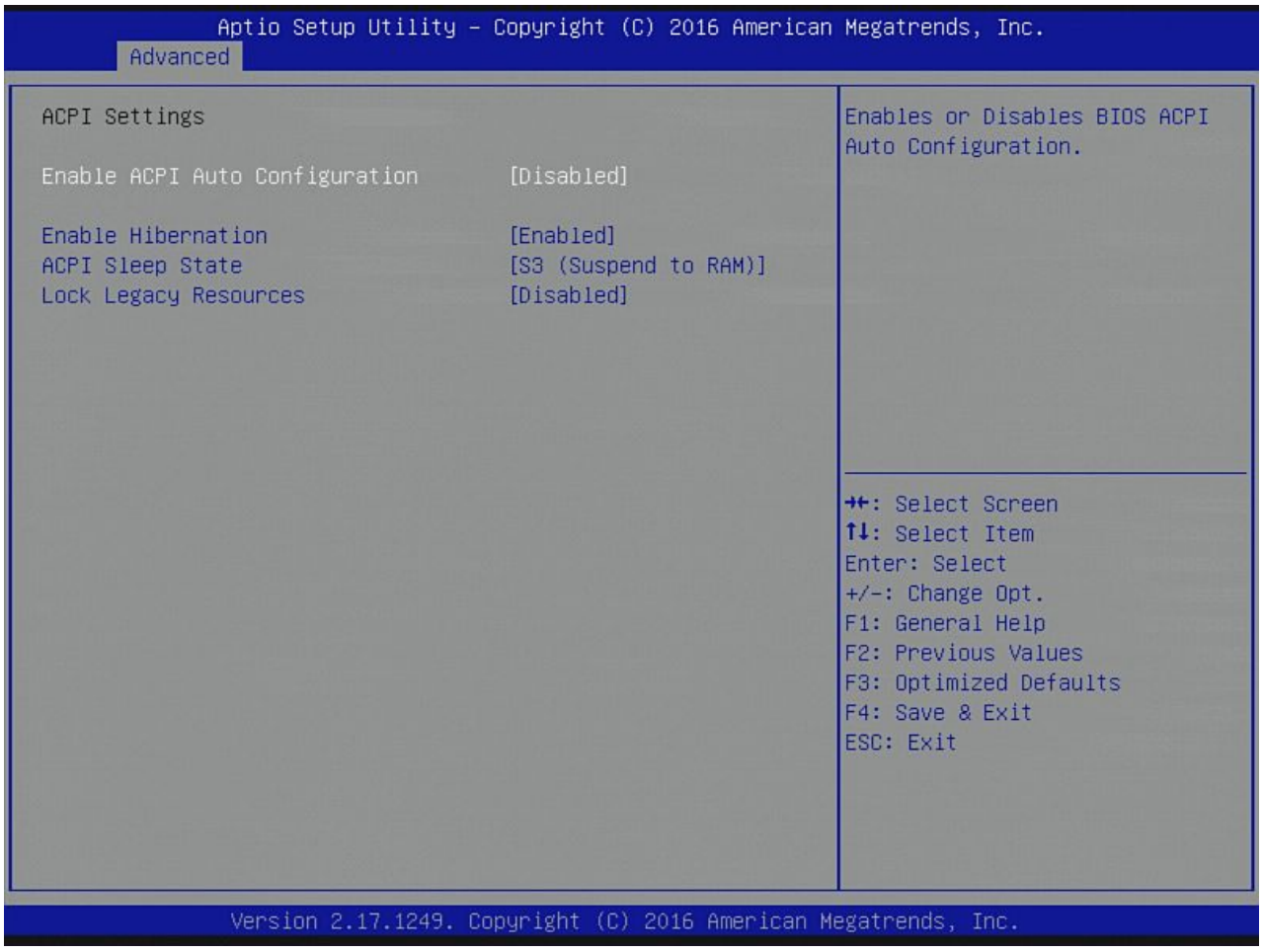


5.5.2.1. Trusted Computing



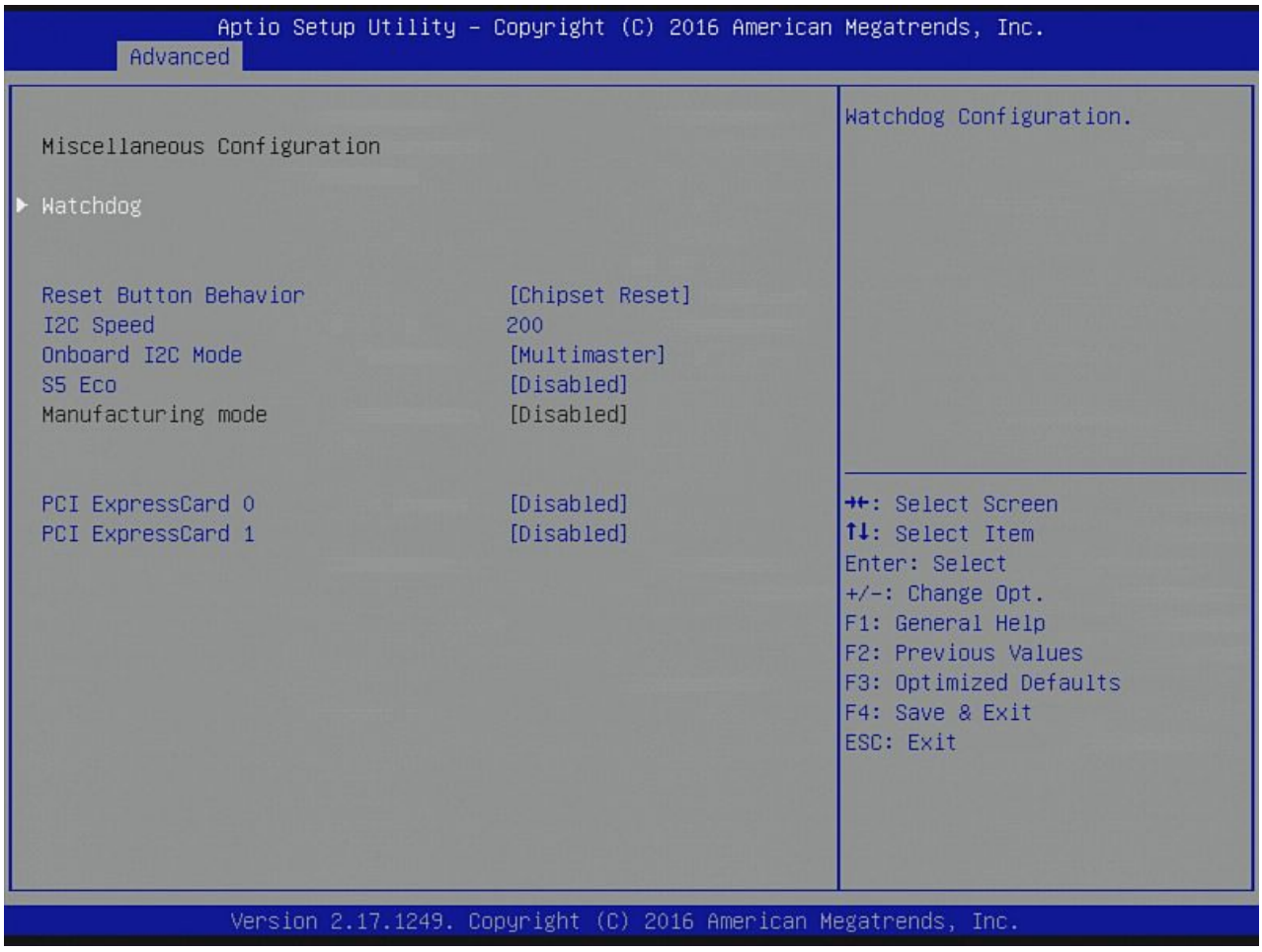
Feature	Options	Description
Security Device Support	Disable **Enable**	Enables or Disables BIOS support for security device. O.S. will not show Security Device. TCG EFI protocol and INT1A interface will not be available.

5.5.2.2. ACPI Settings



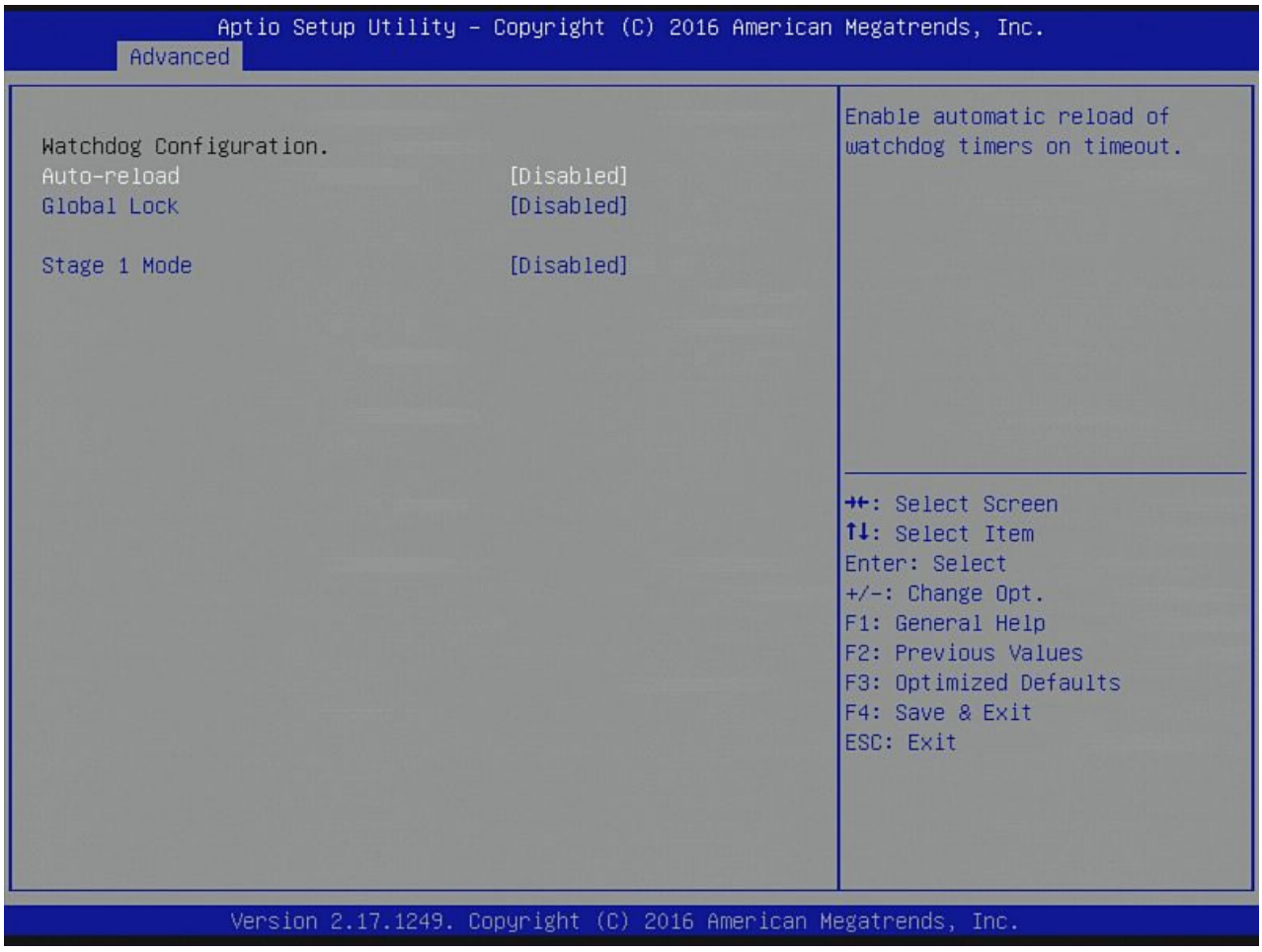
Feature	Options	Description
Enable ACPI Auto Configuration	**Disabled** Enabled	Enables or Disables BIOS ACPI Auto Configuration.
Enable Hibernation	Disabled **Enabled**	Enables or Disables System ability to Hibernate (OS/S4 Sleep State). This option may be not effective with some OS.
ACPI Sleep State	Suspend Disabled **S3 (Suspend to RAM)**	Select the highest ACPI sleep state the system will enter when the SUSPEND button is pressed.
Lock Legacy Resources	**Disabled** Enabled	Enables or Disables Lock of Legacy Resources

5.5.2.3. Miscellaneous



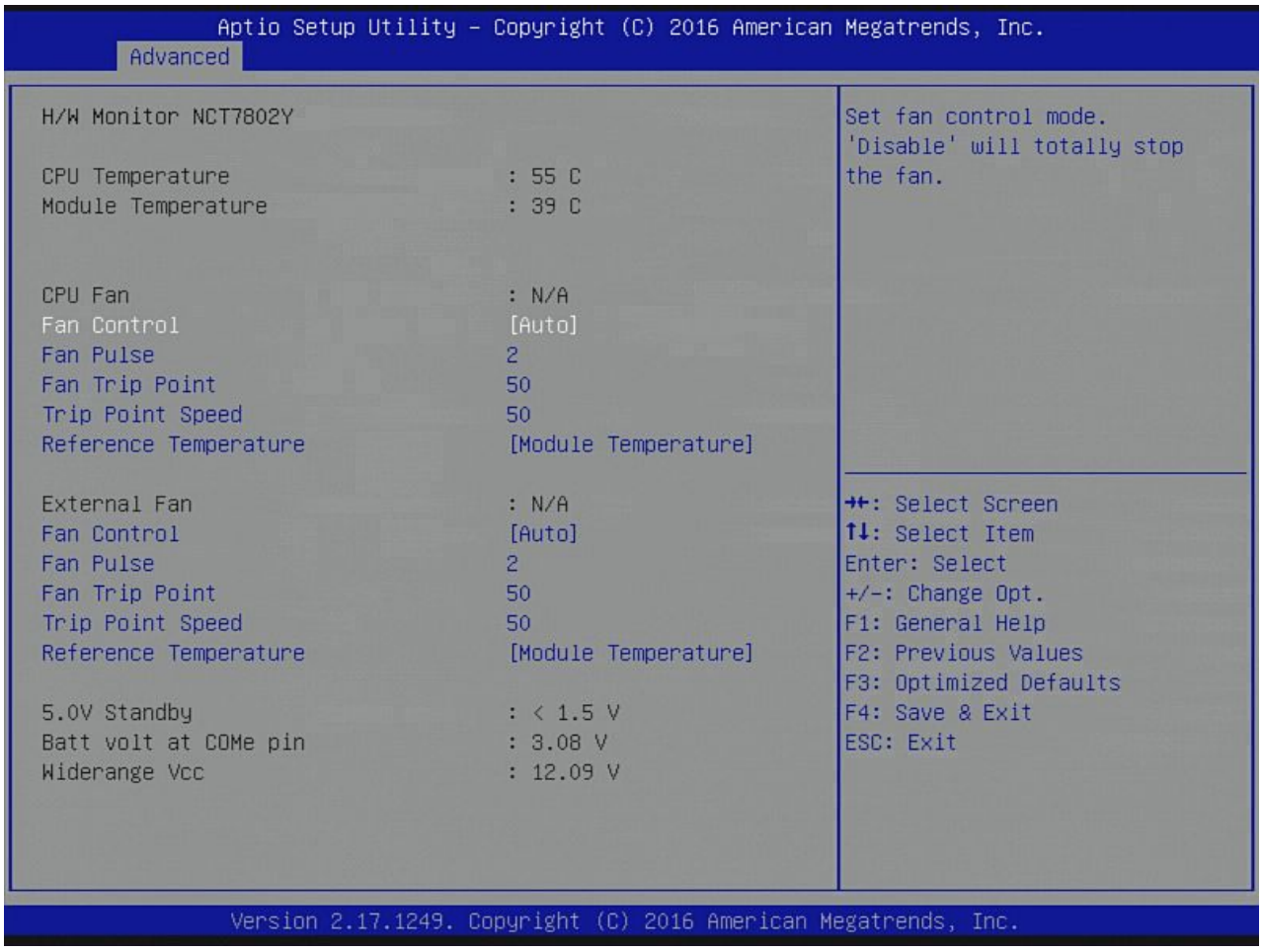
Feature	Options	Description
Reset Button Behavior	**Chipset Reset** Power Cycle	Reset Button Behavior: Chipset Reset, Power Cycle
I2C Speed	**200**	Select I2C Bus Speed in kHz, min. 1kHz, max. 400kHz. For a default system 200kHz should be an appropriate value.
IOnboard I2C Mode	**Multimaster** Busclear	Multimaster / BusClear
S5 Eco	**Disabled** Enabled	Reduce supply current in Soft Off (S5) to less than 1mA. If enabled, power button is the only wakeup source in S5! See manual for restrictions in S5 Eco.
PCI Expresscard 0	Port 1, 2, 3, 4 **Disabled**	Controls PCIe port for ExpressCard support.
PCI Expresscard 1	Port 1, 2, 3, 4 **Disabled**	Controls PCIe port for ExpressCard support.

5.5.2.4. Watchdog



Feature	Options	Description
Auto-reload	**Disabled** Enabled	Enable automatic reload of watchdog timers on timeout.
Global Lock	**Disabled** Enabled	If set to enabled, all Watchdog registers (except WD_KICK) become read only until the board is reset.
Stage 1 Mode	**Disabled** Reset NMI SMI SCI Delay WDT Signal only	Select Action for this Watchdog stage

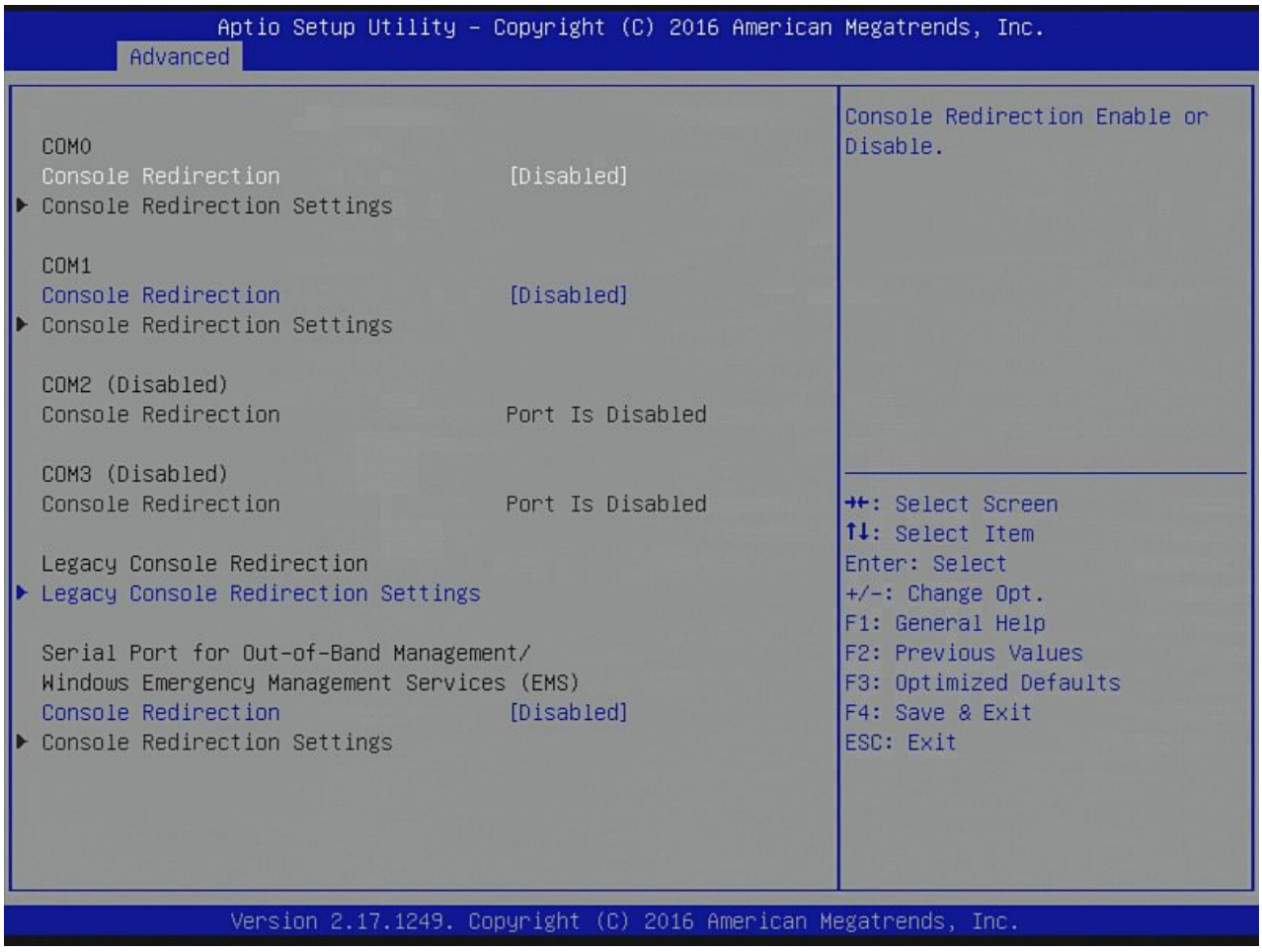
5.5.2.5. H/W Monitor



Feature	Options	Description
CPU Temperature	xx°C	Shows the measured temperature of the CPU Diode with onboard HWM.
Module Temperature	xx°C	Shows the internal hardware monitor temperature.
CPU FAN	xxxx rpm	Shows the fan speed of onboard FAN connector.
Fan Control	Disabled Manual **Auto**	Set fan control mode. 'Disable' will totally stop the fan.
Fan Pulse	**2**	Number of Pulses the fan produces during one revolution. Range: 1-4
Fan Trip Point	**50**	Temperature where fan accelerates. Range: 20 – 80 C
Trip Point Speed	**50**	Fan speed at trip point in %. Minimum value is 30. Fan always runs at 100% at TJmax – 10 C
Reference Temperature	CPU Temperature **Module Temperature**	Determines the temperature source which is used for automatic fan control
External FAN	xxxx rpm	Shows the fan speed of external COMe FAN.
FAN Control	Disabled Manual **Auto**	Set fan control mode. 'Disable' will totally stop the fan.

Fan Pulse	**2**	Number of pulses the fan produces during one revolution. Range 1-4
Fan Trip Point	**50**	Temperature where fan accelerates. Range 20 – 80 C
Trip Point Speed	**50**	Fan speed at trip point in %. Minimum value is 30. Fan always runs at 100% at TJmax – 10 C.
Reference Temperature	PCH Temperature **Module Temperature** CPU Temperature	Determines the temperature source which is used for automatic fan control.
5.0V Standby	x.xx V	Shows the 5V Standby Voltage input.
Batt volt at COMe pin	x.xx V	Shows the RTC Battery Voltage input measured at COMe connector.
Widerange Vcc	x.xx V	Shows the Module Main Input Voltage.
External FAN	xxxx rpm	Shows the fan speed of external COMe FAN.

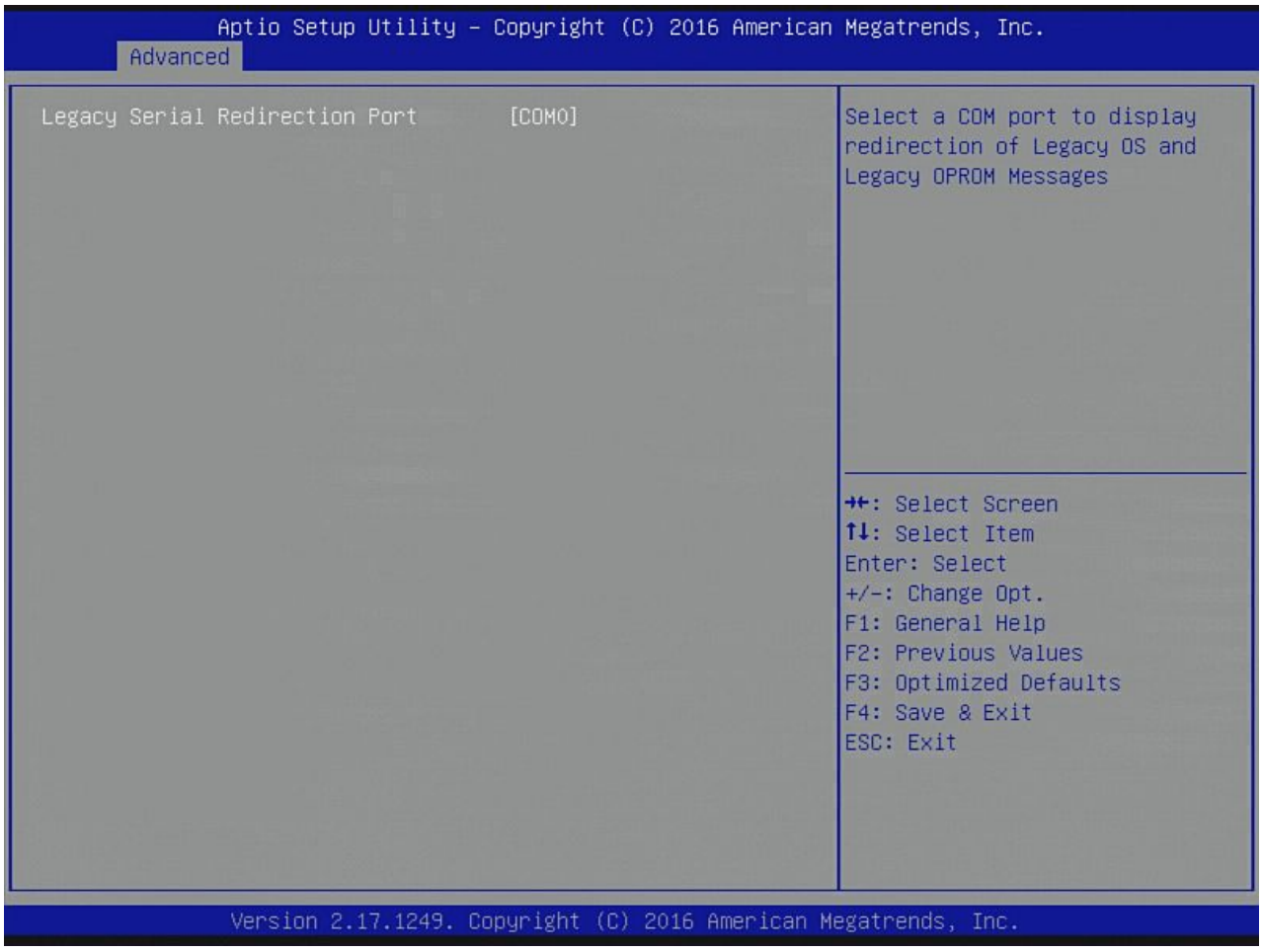
5.5.2.6. Serial Port Console Redirection



Feature	Options	Description
COM0 Console Redirection	**Disabled** Enabled	Console Redirection Enable or Disable.
COM1 Console Redirection	**Disabled** Enabled	Console Redirection Enable or Disable.
COM2 Console Redirection	**Port Is Disabled**	
COM3 Console Redirection	**Port Is Disabled**	
Serial Port for Out-of-Band Management/Windows Emergency Management Services (EMS) Console Redirection	**Disabled** Enabled	Console Redirection Enable or Disable.

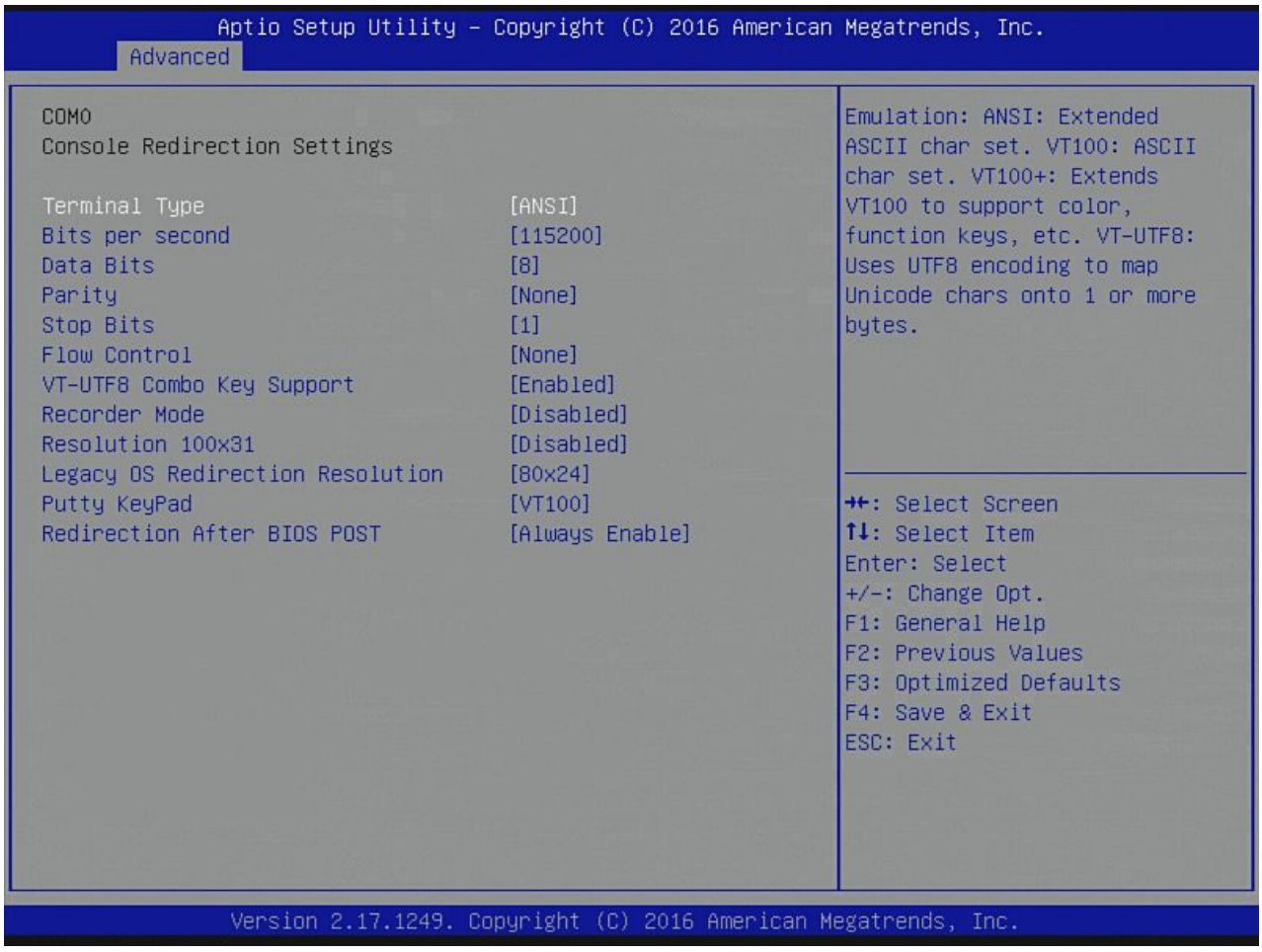
COM0 and COM1 are always available.
COM2 and COM3 can only be selected if an optional Winbond SuperIO is available in the system.

5.5.2.7. Legacy Console Redirection Settings



Feature	Options	Description
Legacy Serial Redirection Port	COM0 COM1 COM2 (Disabled) COM3 (Disabled)	Select a COM port to display redirection of Legacy OS and Legacy OPROM Messages

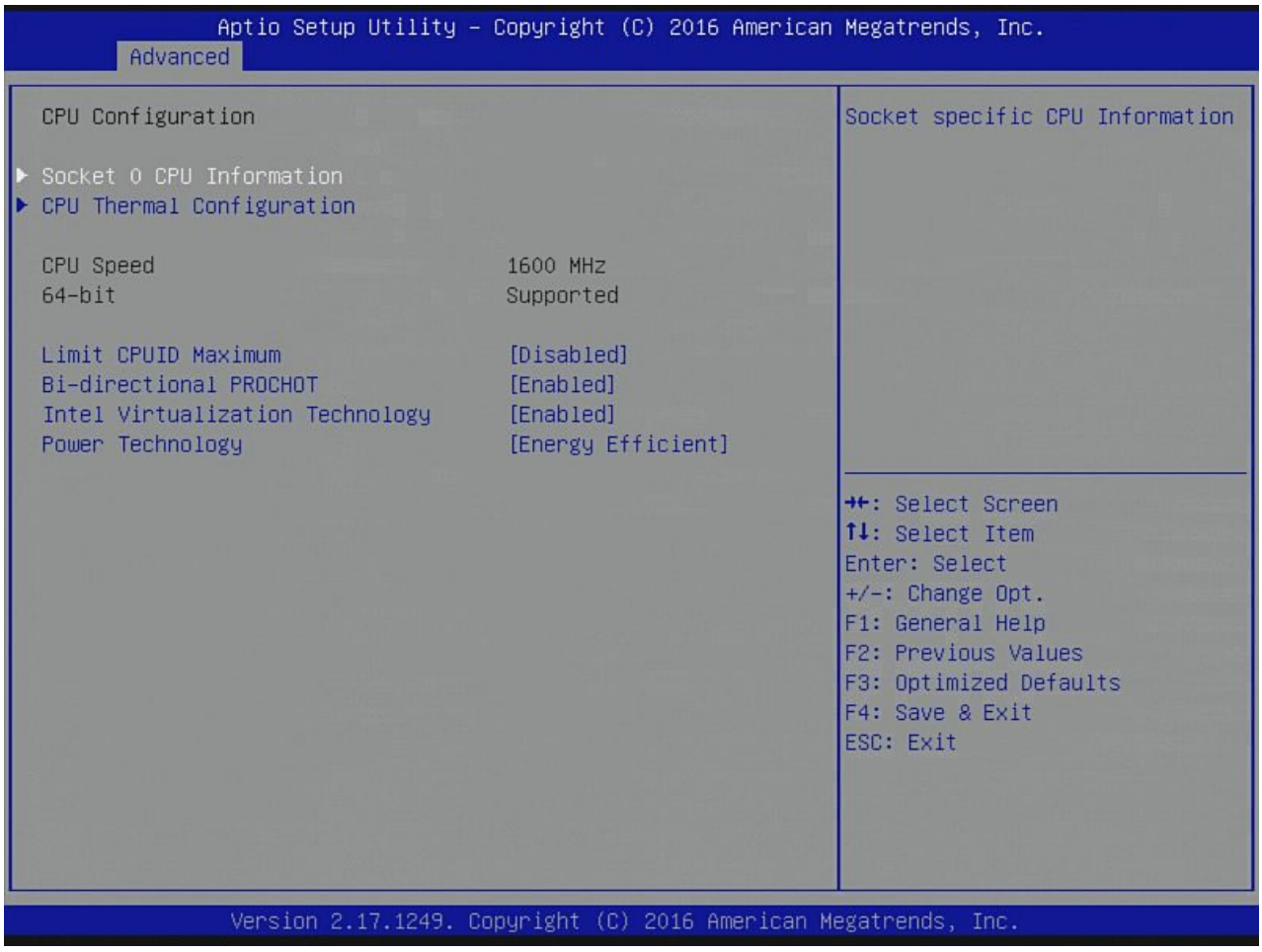
5.5.2.8. Con sole Redirection Settings (Disabled)



Feature	Options	Description
Terminal Type	VT100 VT100+ VT-UTF8 **ANSI**	Emulation: ANSI: Extended ASCII char set. VT100: ASCII char set. VT100+: Extends VT100 to support color, function keys, etc. VT-UTF8: Uses UTF8 encoding to map Unicode chars onto 1 or more bytes.
Bits per second	9600 19200 38400 57600 **115200**	Selects serial port transmission speed. The speed must be matched on the other side. Long or noisy lines may require lower speeds.
Data Bits	7 **8**	Data Bits
Parity	**None** Even Odd Mark Space	A parity bit can be sent with the data bits to detect some transmission errors. Even: parity bit is 0 if the num of 1's in the data bits is even. Odd: parity bit is 0 if num of 1's in the data bits is odd. Mark: parity bit is always 1. Space: Parity bit is always 0. Mark and Space Parity do not allow for error detection.
Stop Bits	**1** 2	Stop bits indicate the end of a serial data packet. (A.start bit indicates the beginning). The standard setting is 1 stop bit. Communication with slow devices may require more than 1 stop bit.

Flow Control	**None** Hardware RTS/CTS	Flow control can prevent data loss from buffer overflow. When sending data, if the receiving buffers are full, a 'stop' signal can be sent to stop the data flow. Once the buffers are empty, a 'start' signal can be sent to restart the flow. Hardware flow control uses two wires to send start/stop signals.
VT-UTF8 Combo Key Sup	Disabled **Enabled**	Enable VT-UTF8 Combination Key Support for ANSI/VT100 terminals
Recorder Mode	**Disabled** Enabled	With this mode enabled only text will be sent. This is to capture Terminal data.
Resolution 100﹨31	**Disabled** Enabled	Enables or disables extended terminal resolution
Legacy OS Redirection Resolution	**80x24** 80x25	On Legacy OS, the Number of Rows and Columns supported redirection
Putty KeyPad	**VT100** LINUX XTERMR6 SCO ESCN VT400	Select FunctionKey and KeyPad on Putty.
Redirection After BIO	**Always Enable** BootLoader	The Settings specify if Bootloader is selected then legacy console redirection is disabled before booting to legacy OS. Default value is Always Enable which means Legacy console Redirection is enabled for Legacy OS.

5.5.2.9. CPU Configuration

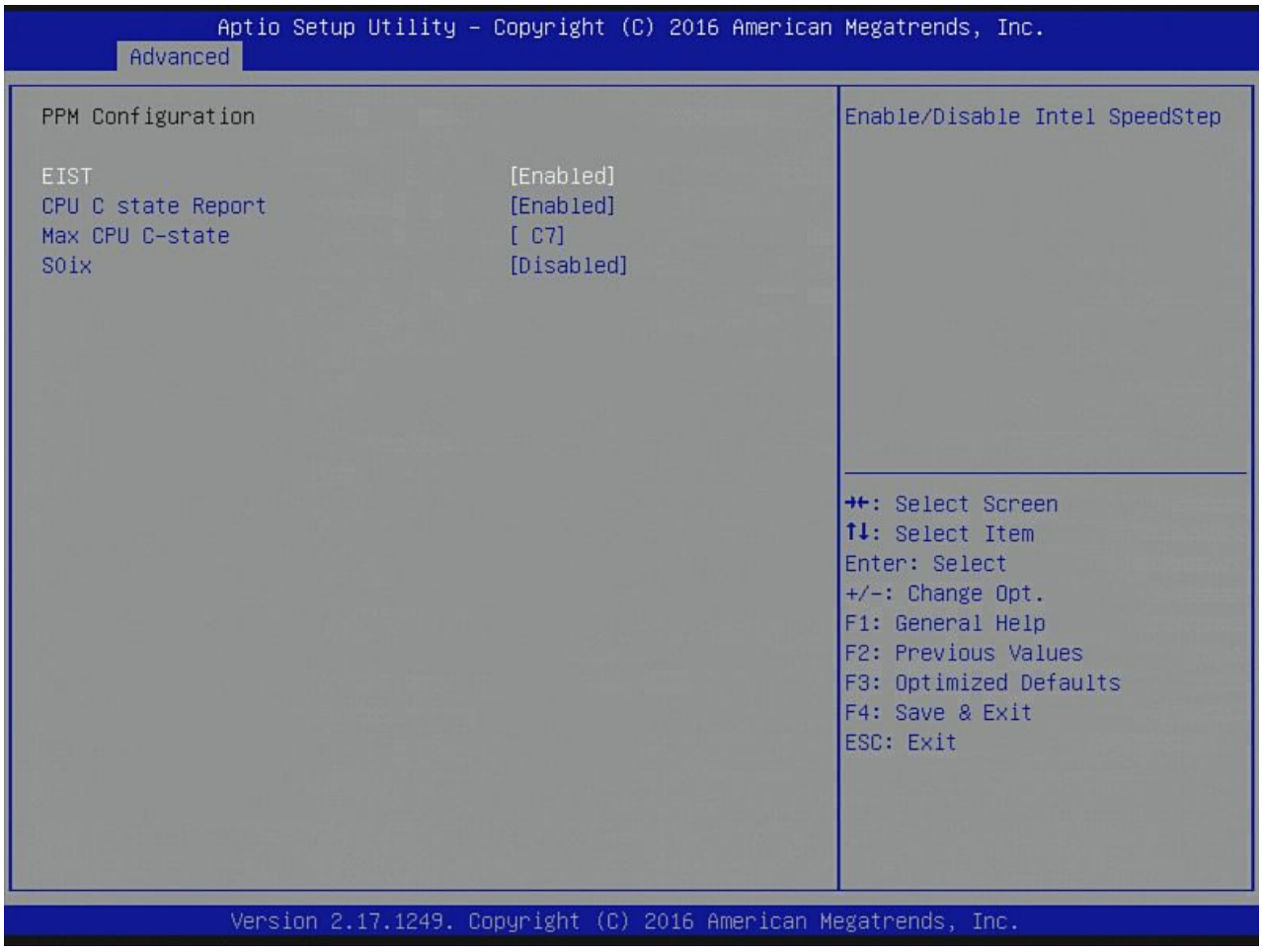


Feature	Options	Description
Socket 0 CPU Configuration	-	Socket specific CPU Information
Limit CPUID Maximum	**Disabled** Enabled	Disabled for Windows XP
Bi-directional PROCHOT	Disabled **Enabled**	When a processor thermal sensor trips (either core), the PROCHOT# will be driven. If bi-direction is enabled, external agents can drive PROCHOT# to throttle the processor.
Intel Virtualization Technology	Disabled **Enabled**	When enabled, a VMM can utilize the additional hardware capabilities provided by Vanderpool Technology.
Power Technology	Disable **Energy Efficient** Custom	Enable the power management features.

5.5.2.10. CPU Thermal Configuration

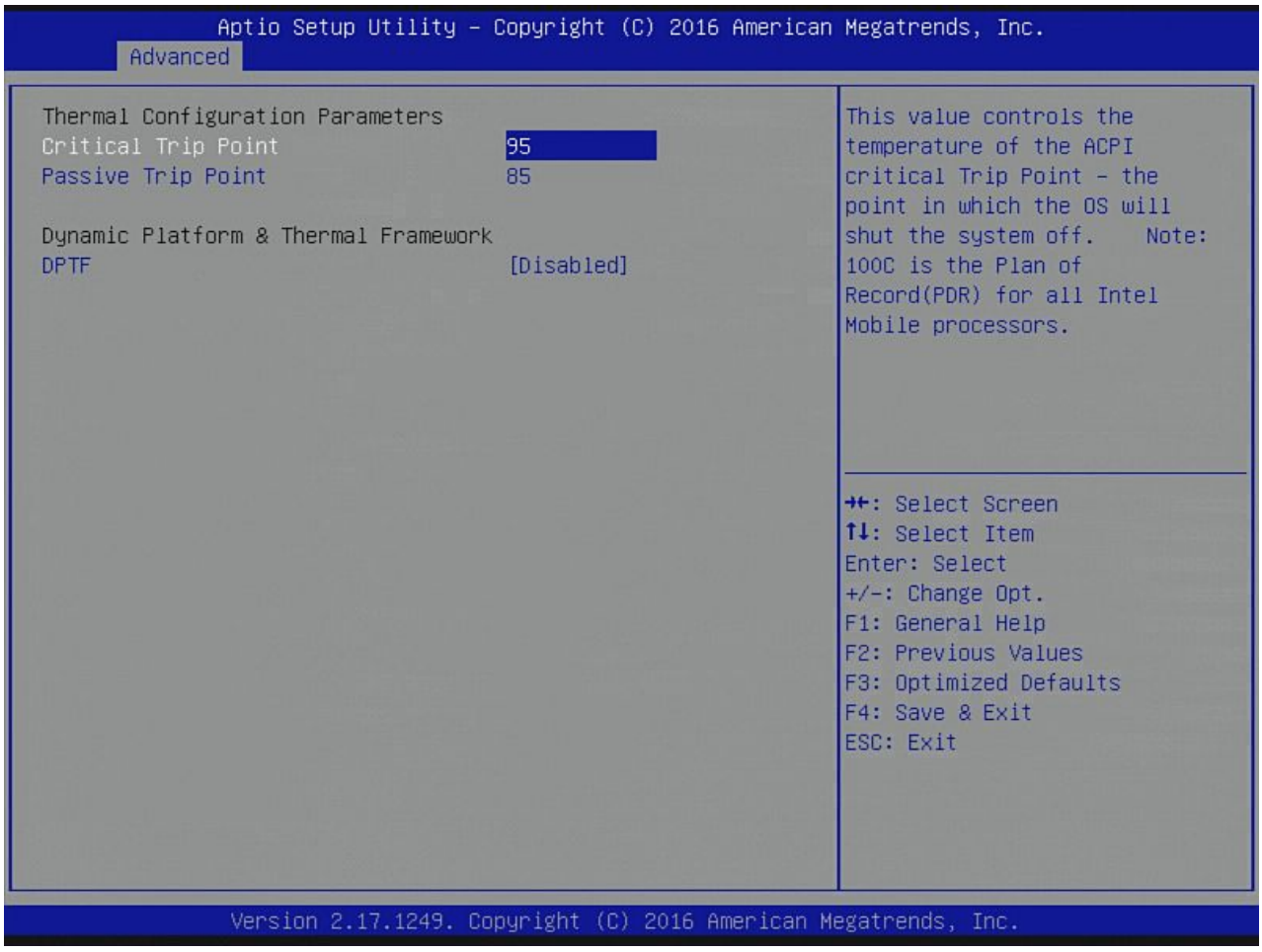
Feature	Options	Description
DTS	**Disabled** Enabled	Enabled/Disable Digital Thermal Sensor.

5.5.2.11. PPM Configuration



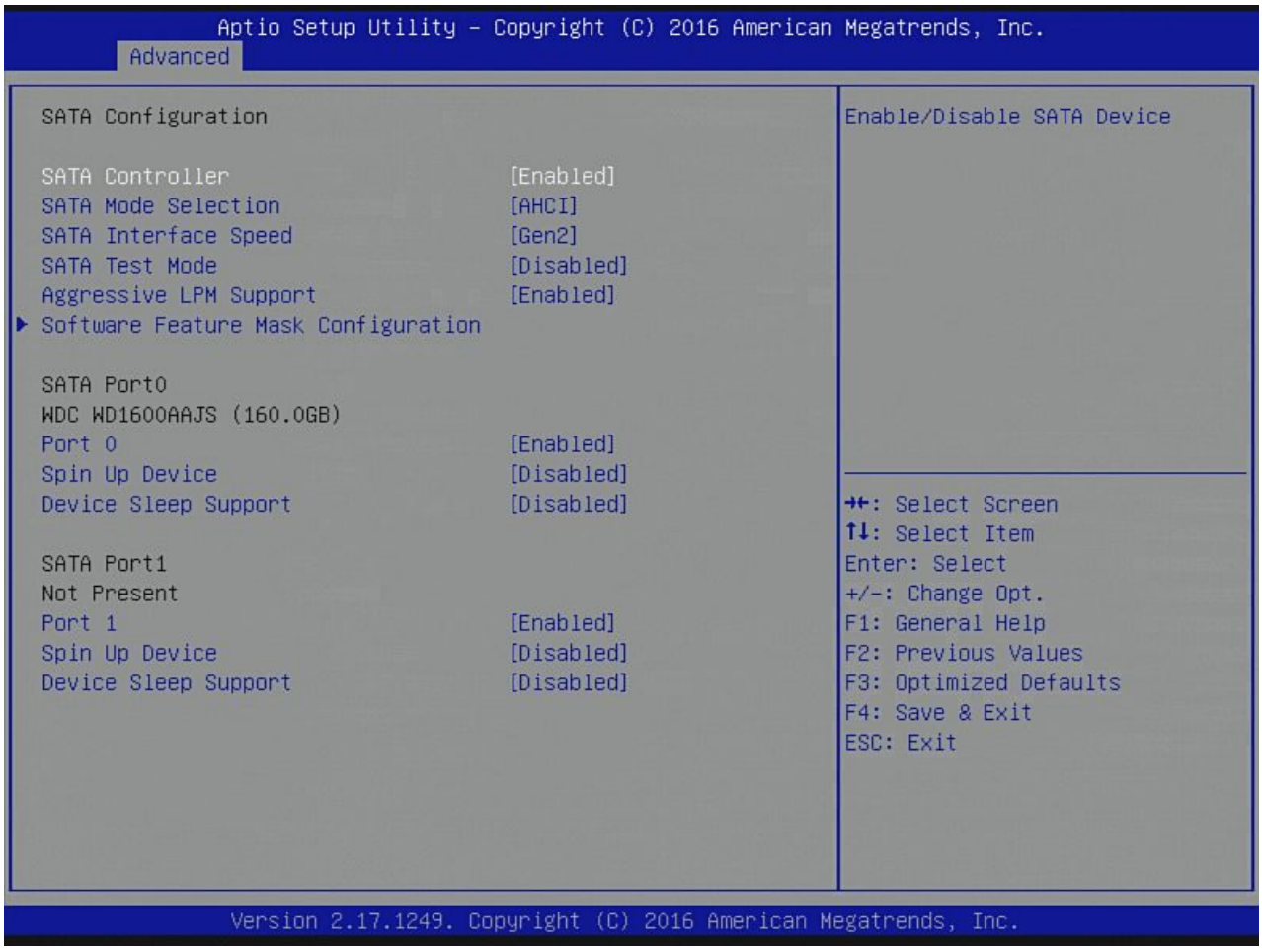
Feature	Options	Description
EIST	Disabled **Enabled**	Enable/Disable Intel SpeedStep
CPU C state Report	Disabled **Enabled**	Enable/Disable CPU C state report to OS
Max CPU C-state	**C7** C6 C1	This option controls Max C state that the processor will support
S0ix	**Disabled** Enabled	Enable/Disable CPU S0ix state

5.5.2.12. Thermal Configuration



Feature	Options	Description
Critical Trip Point	**95**	This value controls the temperature of the ACPI critical Trip Point – the point in which the OS will shut the system off. Note: 100C is the Plan of Record (PDR) for all Intel mobile processors.
Passive Trip Point	**85**	This value controls the temperature of the ACPI critical Trip Point – the point in which the OS will begin throttling the processor.
DPTF	**Disabled** Enabled	Enable/Disable DPTF

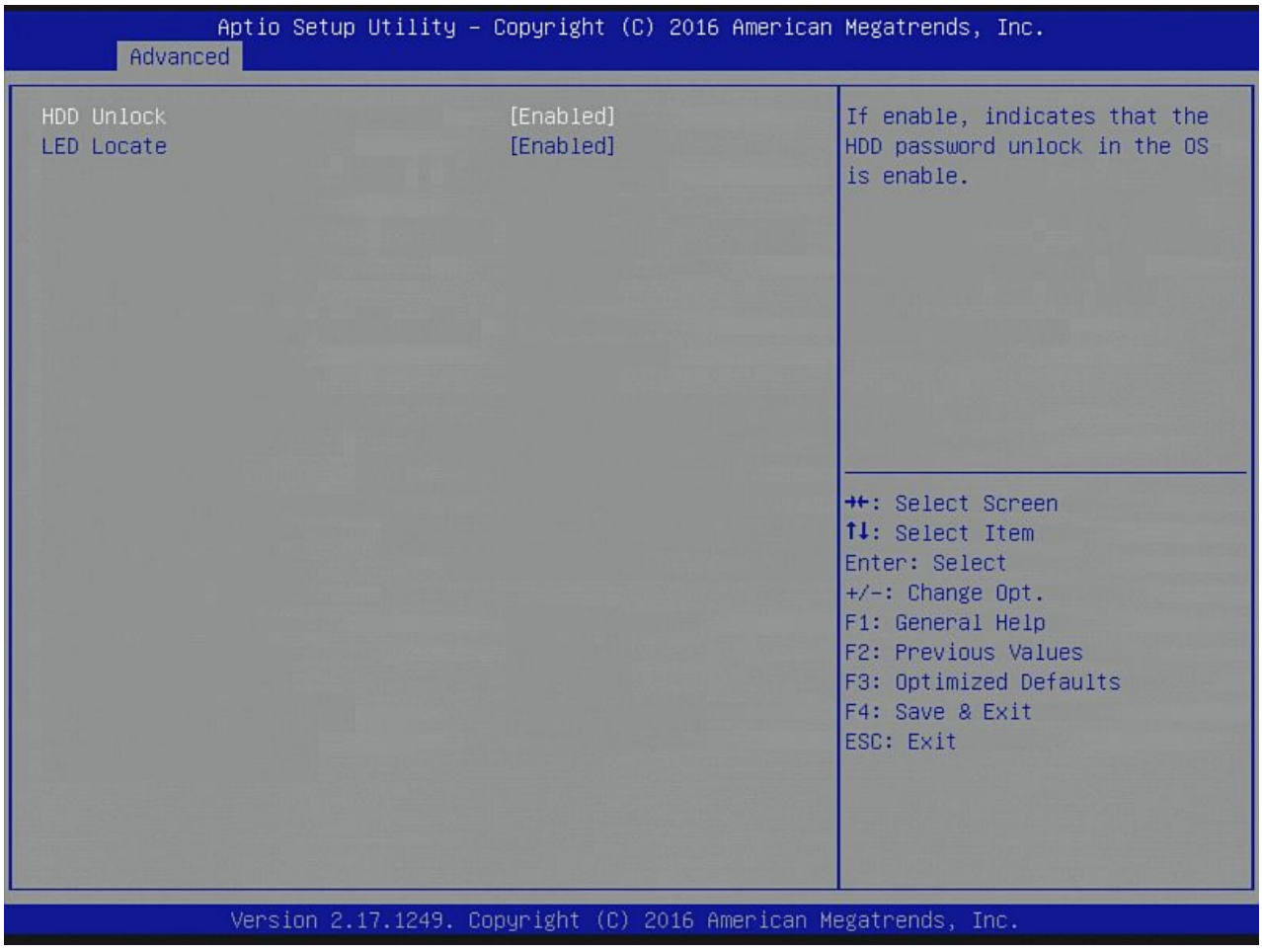
5.5.2.13. SATA Configuration



Feature	Options	Description
SATA Controller	Disabled **Enabled**	Enable/Disable SATA Device
SATA Mode Selection	**AHCI**	Determine SATA controller operation.
SATA Interface Speed	Gen1 **Gen2** Gen3	Select SATA Interface Speed, CHV A1 always with Gen1 Speed.
SATA Test Mode	**Disabled** Enabled	Test Mode enable / disabale.
Aggressive LPM Support	Disabled **Enabled**	Enable PCH to aggressively enter link power state.
Software Feature Mask Configuration	-	RAID OPOM/RST driver will refer to the SWFM configuration to enable/disable the storage features.
Port 0	**Enabled** Disabled	Enable / Diable SATA Port.
Spin Up Device	Enabled **Disabled**	If enable for any of ports Staggered Spin Up will be performed and only the drives which have this option enabled will spin up at boot. Otherwise all drives spin up at boot.

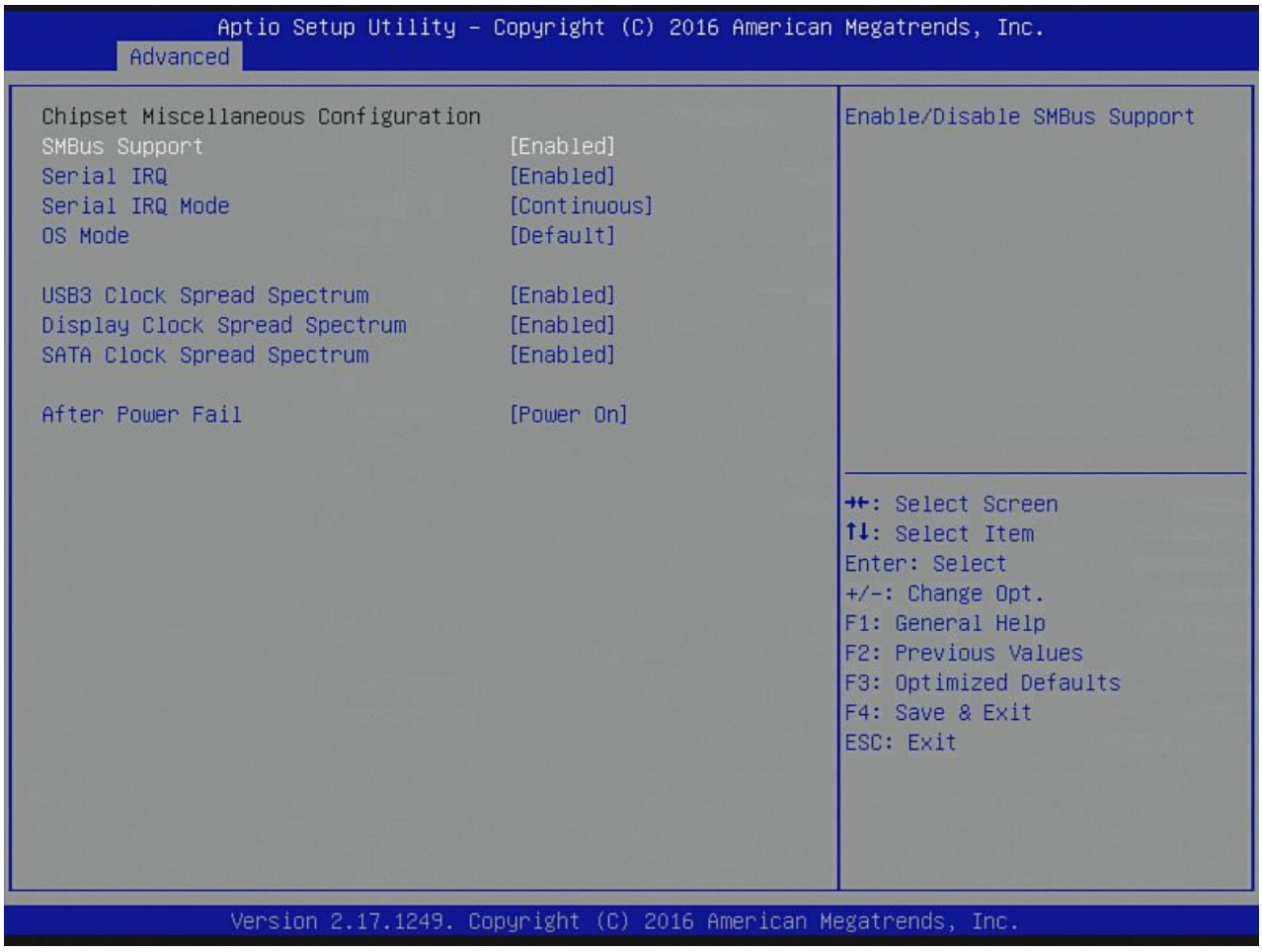
Device Sleep Support	Enabled **Disabled**	Enable/Disable Device Sleep Support on that port.
Port 1	**Enabled** Disabled	Enable / Diable SATA Port.
Spin Up Device	Enabled **Disabled**	If enable for any of ports Staggered Spin Up will be performed and only the drives which have this option enabled will spin up at boot. Otherwise all drives spin up at boot.
Device Sleep Support	Enabled **Disabled**	Enable/Disable Device Sleep Support on that port.

5.5.2.14. Software Feature Mask Configuration



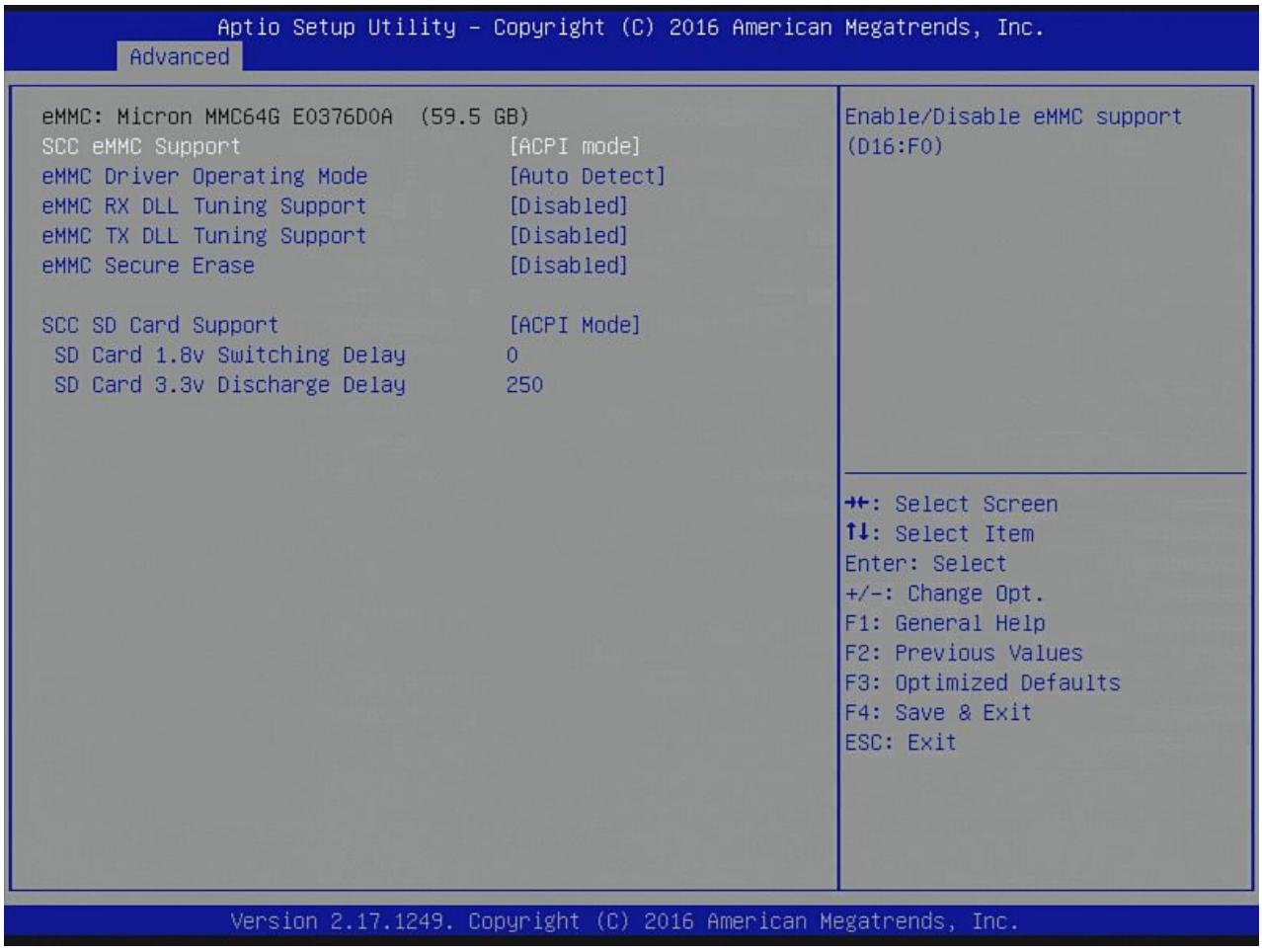
Feature	Options	Description
HDD Unlock	**Enabled** Disabled	If enable, indicates that the HDD password unlock in the OS is enable.
LED Locate	**Enabled** Disabled	If enabled indicates that the LEG/SGPIO hardware is attached and ping to locate if feature is enabled on the OS.

5.5.2.15. Chipset Miscellaneous Configuration



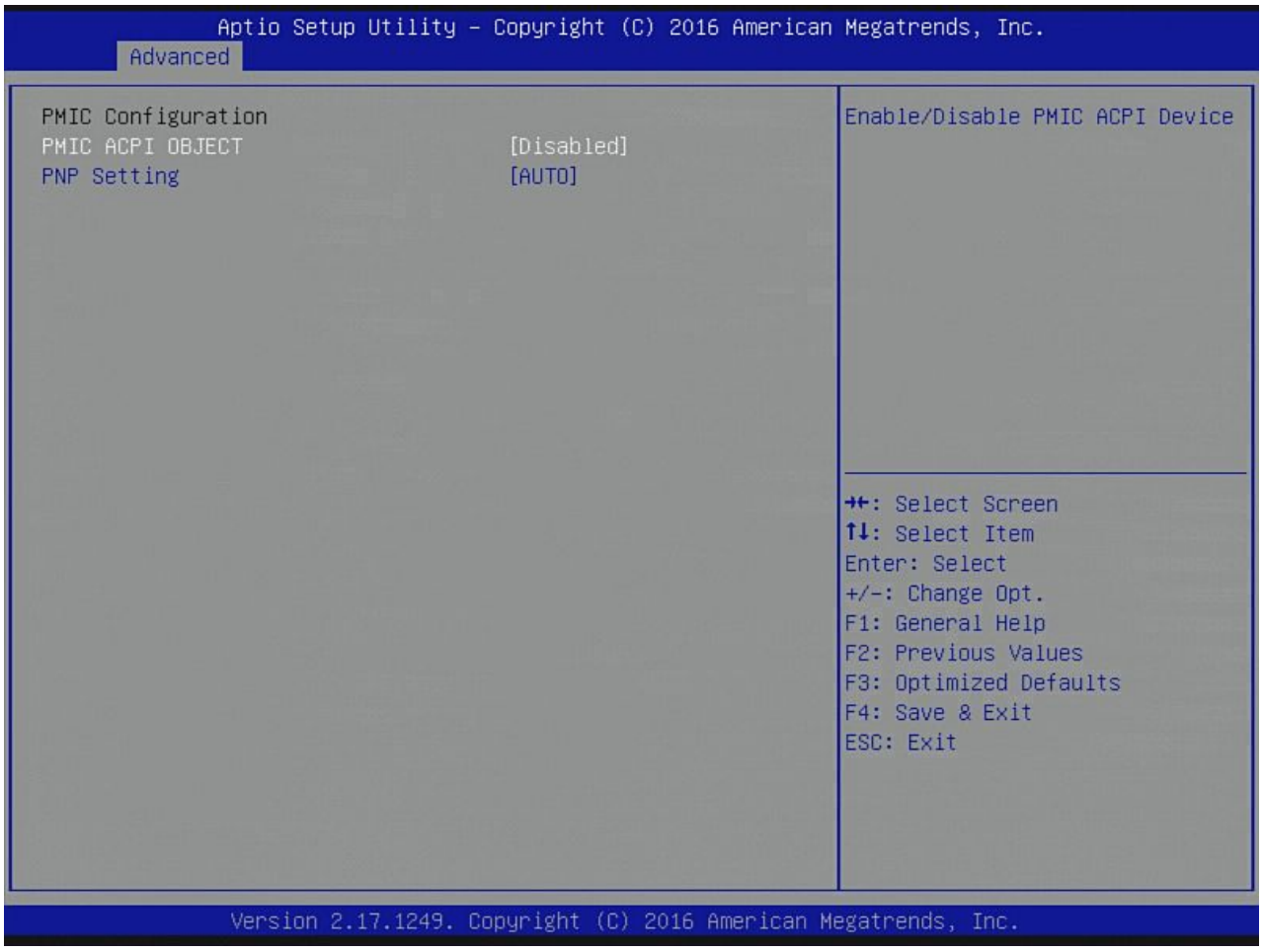
Feature	Options	Description
SMBus Support	**Enabled** Disabled	Enable/Disable SMBus Support
Serial IRQ	**Enabled** Disabled	Enable/Disable SIRQ logic
Serial IRQ Mode	Quiet **Continuous**	Configure serial IRQ mode.
OS Mode Mode	**Default** Legacy System Yocto Linux	Allows to preset chipset devices for the needs of certain Operating Systems
USB3 Clock Spread Spectrum	**Enabled** Disabled	Enable USB3 clock Spread Spectrum feature.
Display Clock Spread Spectrum	**Enabled** Disabled	Enable Display clock spread spectrum feature.
SATA Clock Spread Spectrum	Enabled **Disabled**	Enable SATA clock spread spectrum feature.
After Power fail	Power Off **Power On**	Select AC power state when power is re-applied after a power failure.

5.5.2.16. LPSS & SCC Configuration



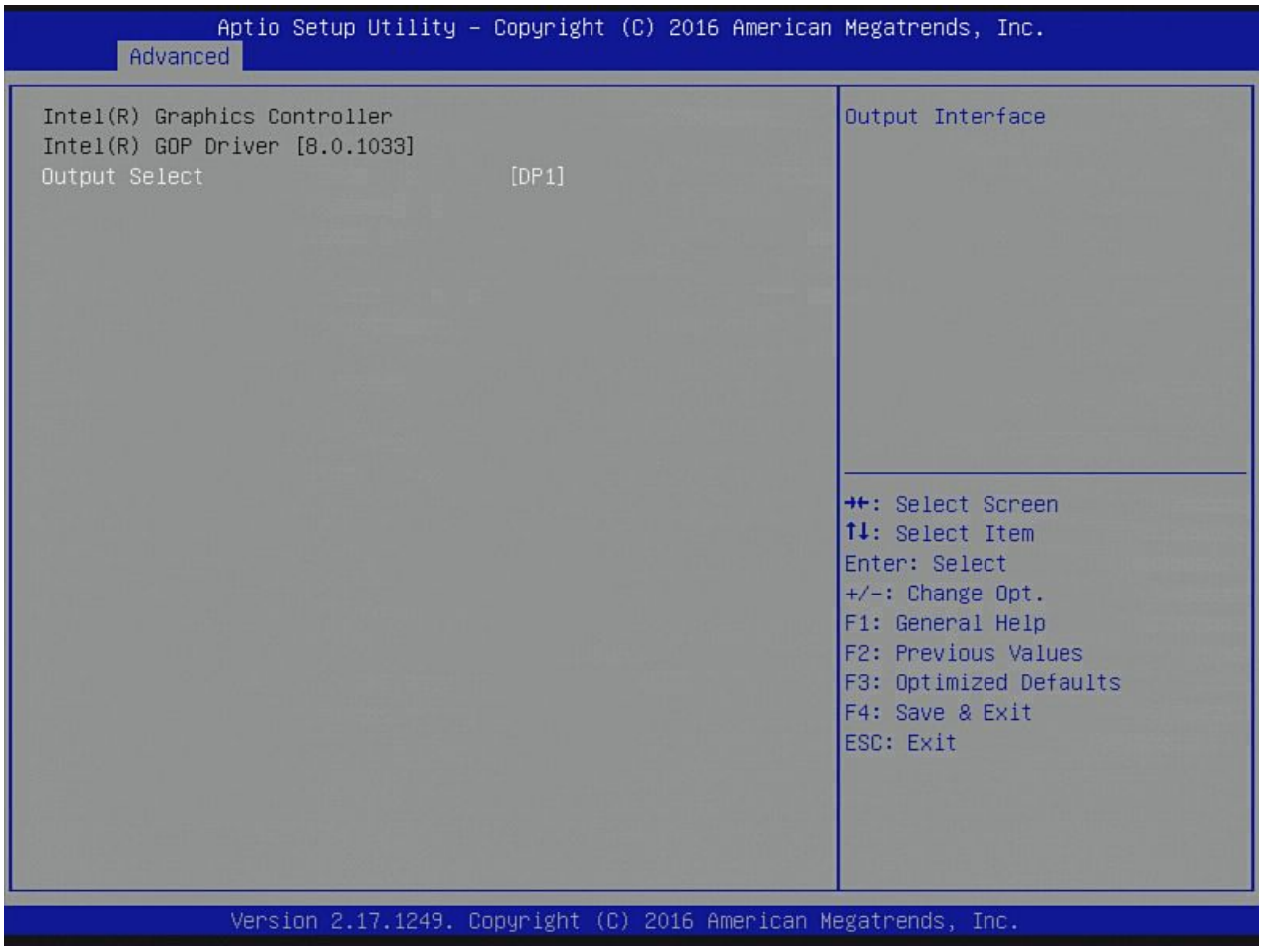
Feature	Options	Description
SCC eMMC Support	**ACPI mode** PCi mode Disabled	Enable/Disable eMMC Support (D16:F0)
eMMC Driver operating Mode	**Auto Detect** Basic Frequency Up to 26MHz Up to 52MHz	Select the operating frequency in eMMC driver
eMMC RX DLL Tuning Support	Enabled, **Disabled**	Enable/Disable eMMC RX DLL Tuning Support
eMMC TX DLL Tuning Support	Enabled **Disabled**	Enable/Disable eMMC TX DLL Tuning Support
eMMC Secure Erase	Enabled **Disabled**	Enable/Disable eMMC Secure Erase. When enabled, all the data on eMMC will be erased.
SCC SD Card Support	**ACPI Mode** PCI Mode Disabled	Enable/Disable SD Card Support (D18:F0)
SD Card 1.8v Switching Delay	**0**	Set SD Card 1.8v Switching Delay From 0 to 999 ms
SD Card 3.3v Switching Delay	**250**	Set SD Card 3.3v Discharge Delay From 0 to 999 ms

5.5.2.17. System Component



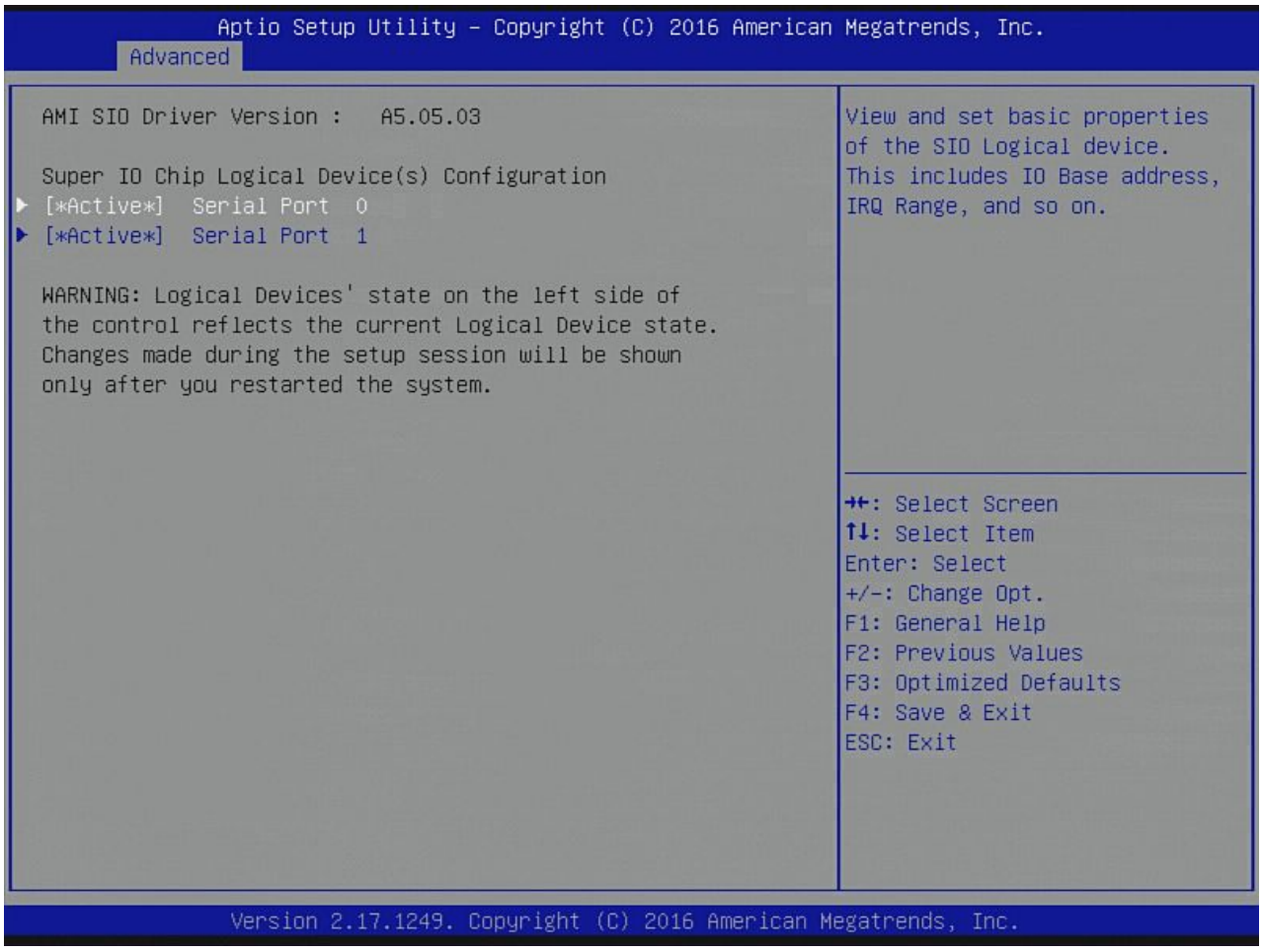
Feature	Options	Description
PMIC ACPI OBJECT	Enabled **Disabled**	Enable/Disable PMIC ACPI Device (D16:F0)
PNP Setting	Disabled **Auto** AX STEEPING BX STEEPING	Select PNP Setting mode. Disable, Performance, Power or Power&Performance mode

5.5.2.18. AMI Graphic Output Protocol Policy



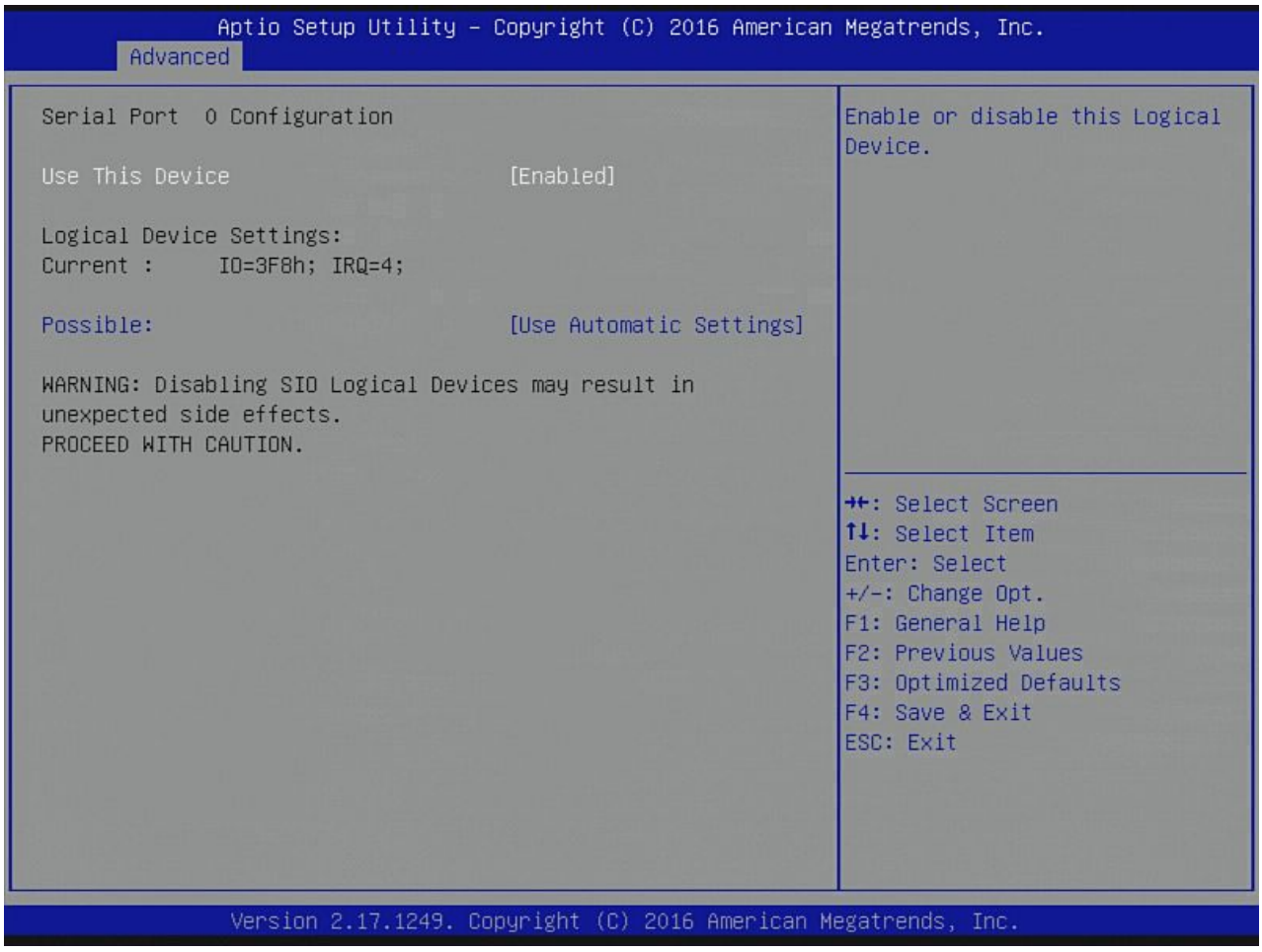
Feature	Options	Description
Output Select	**DP1**	Output Interface

5.5.2.19. SIO Configuration



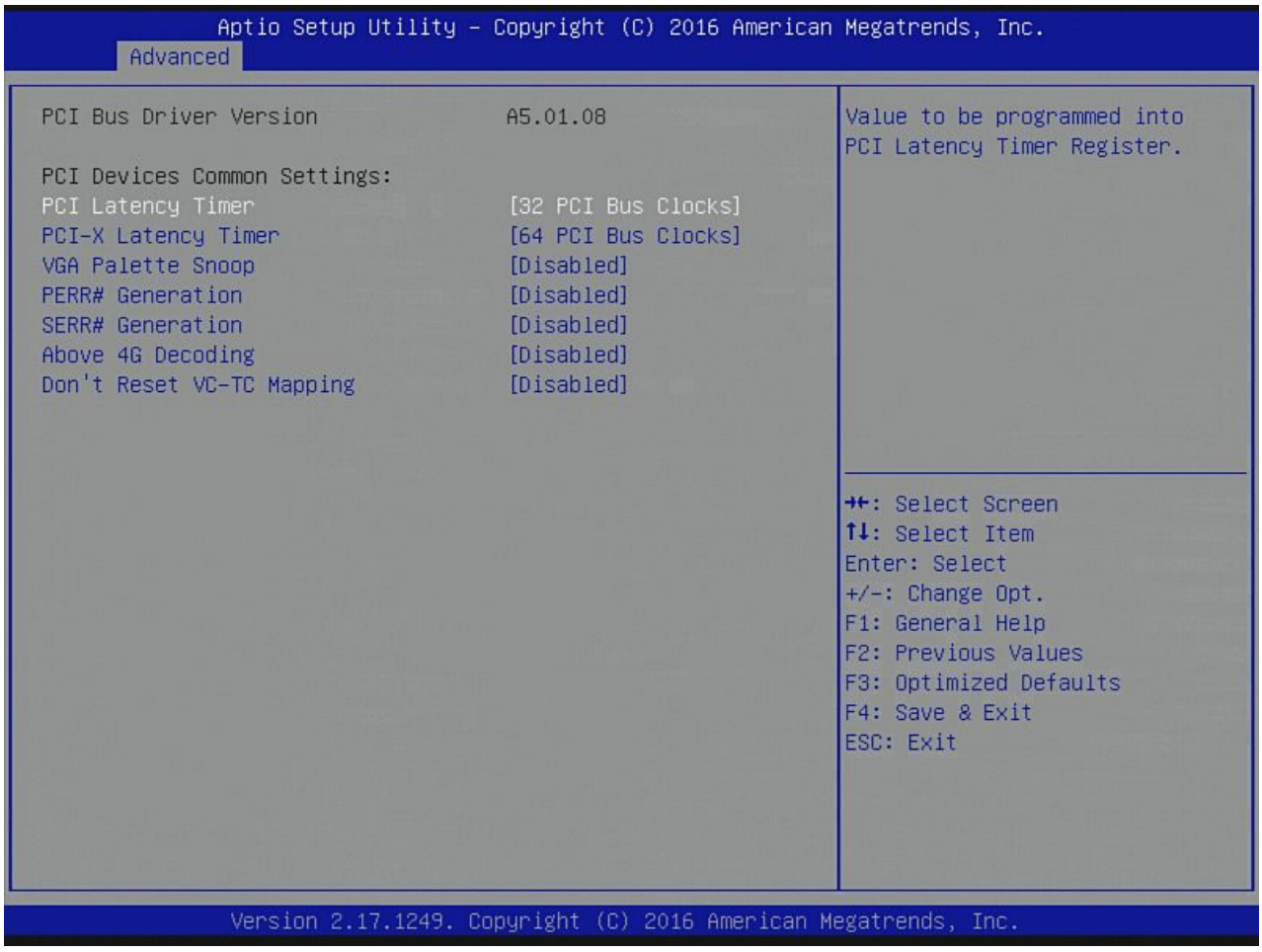
Feature	Options	Description
[*Active*] Serial Port 0	**DP1**	View and set basic

5.5.2.20. Serial Port 0/1 Configuration



Feature	Options	Description
Use This Device	Disabled **Enabled**	Enable or disable this Logical Device.
Possible:	**Use Automatic Settings** IO=3F8h; IRQ=4; IO=3F8h; IRQ=3,4,5,7,9,10,11,12; IO=2F8h; IRQ=3,4,5,7,9,10,11,12; IO=3E8h; IRQ=3,4,5,7,9,10,11,12; IO=2E8h; IRQ=3,4,5,7,9,10,11,12;	Allows user to change device's resource settings. New settings will be reflected on this setup page after system restarts.

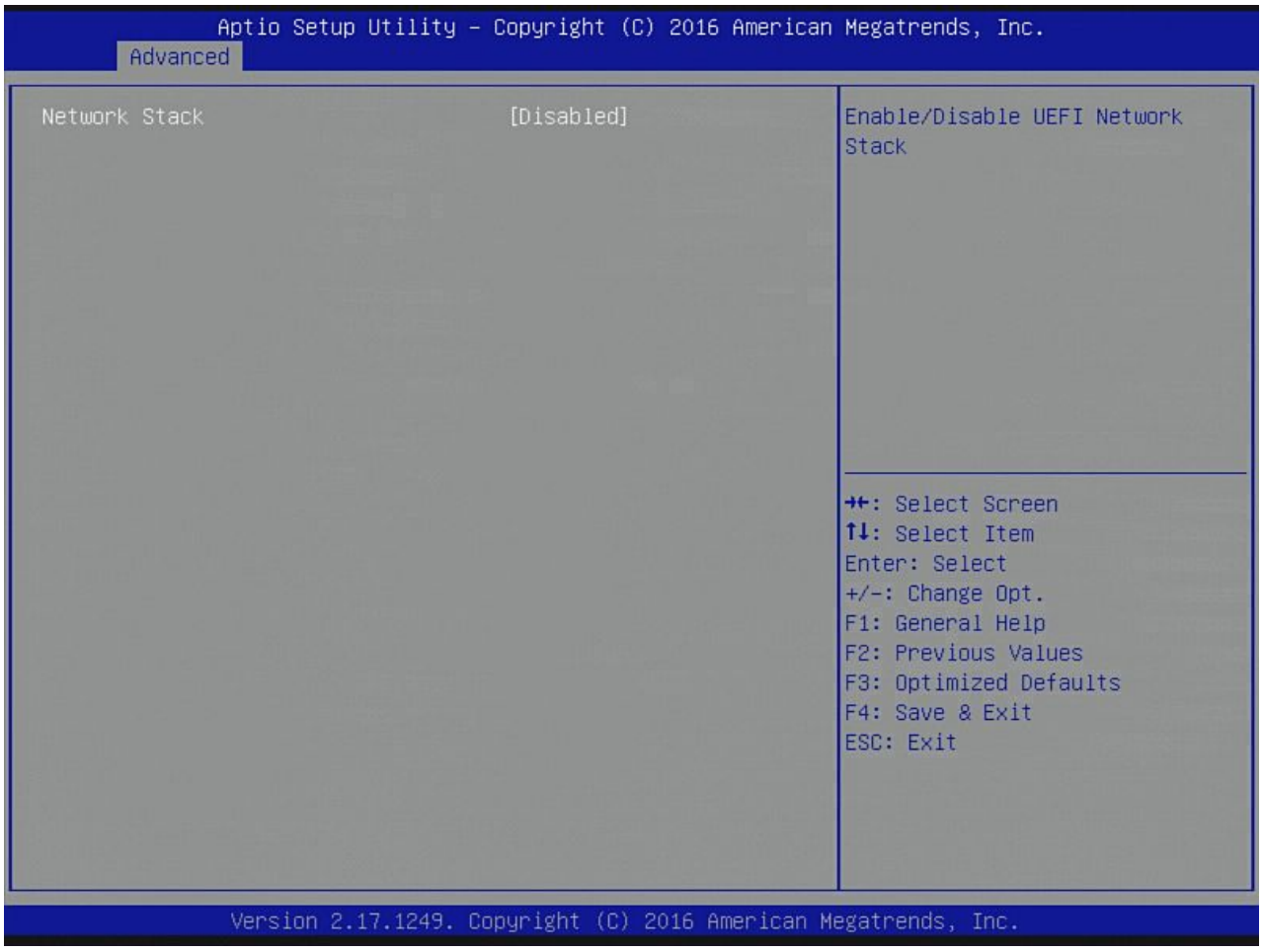
5.5.2.21. PCI Subsystem Settings



Feature	Options	Description
PCI Latency Timer	**32 PCI Bus Clocks** 64 PCI Bus Clocks 96 PCI Bus Clocks 128 PCI Bus Clocks 160 PCI Bus Clocks 192 PCI Bus Clocks 224 PCI Bus Clocks 248 PCI Bus Clocks	Value to be programmed into PCI Latency timer Register.
PCI-X Latency Timer	32 PCI Bus Clocks **64 PCI Bus Clocks** 96 PCI Bus Clocks 128 PCI Bus Clocks 160 PCI Bus Clocks 192 PCI Bus Clocks 224 PCI Bus Clocks 248 PCI Bus Clocks	Value to be programmed into PCI Latency timer Register.
VGA Palette Snoop	**Disabled** Enabled	Enables or Disables VGA Palette Registers Snooping.
PERR# Generation	**Disabled** Enabled	Enables or Disables PCI Device to Generate PERR#.

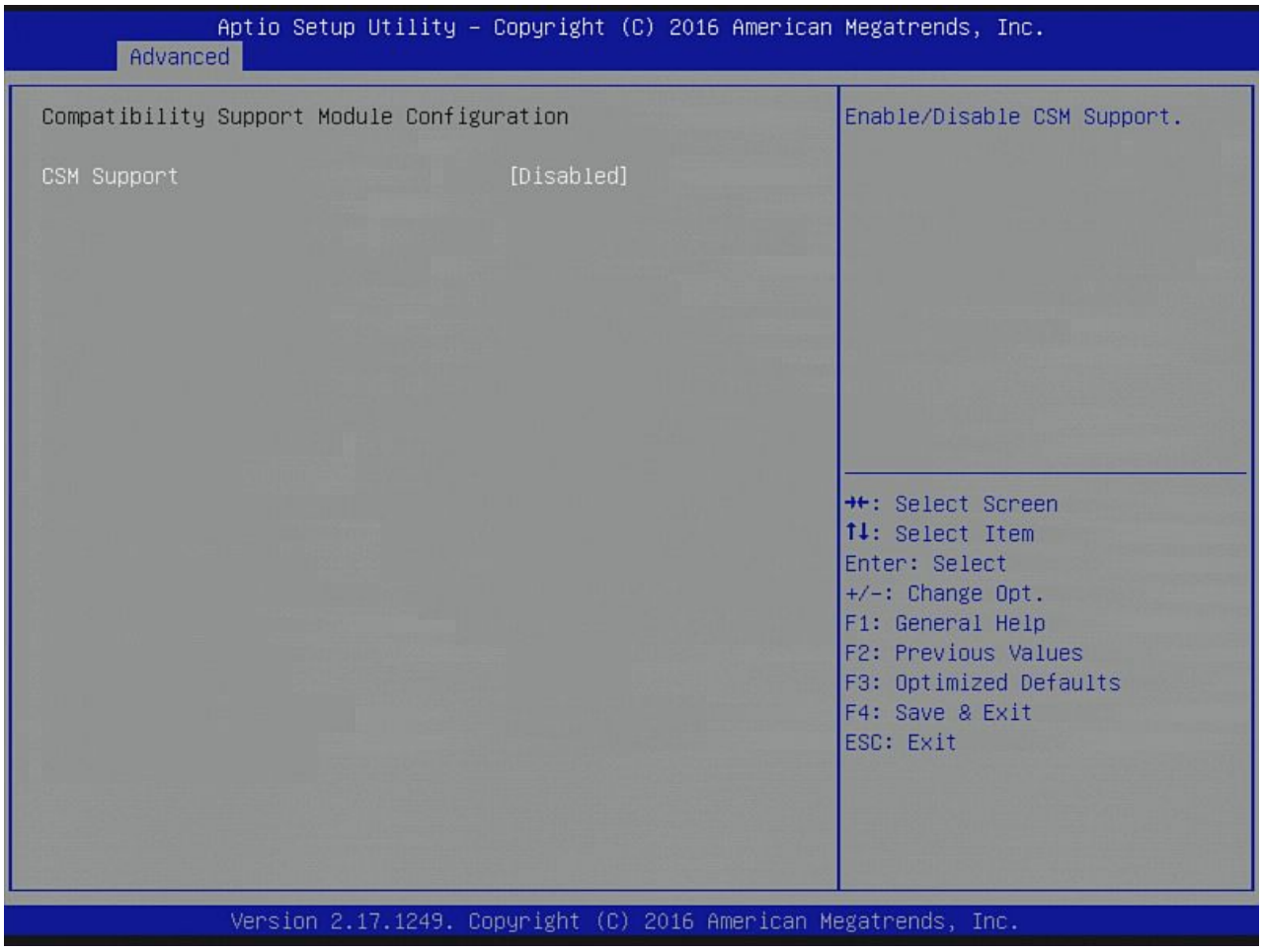
SERR# Generation	**Disabled** Enabled	Enables or Disables PCI Device to Generate SERR#.
Above 4G Decoding	**Disabled** Enabled	Enables or Disables 64bit capable Devices to be Decoded in Above 4G Address Space (Only if System Supports 64 bit PCI decoding).
Don't Reset VC-TC Mapping	**Disabled** Enabled	If system has Virtual Channels, Software can reset traffic Class mapping through Virtual Channels, to its default state. Setting this option to Enabled will not modify VC Resources.

5.5.2.22. Network Stack Configuration



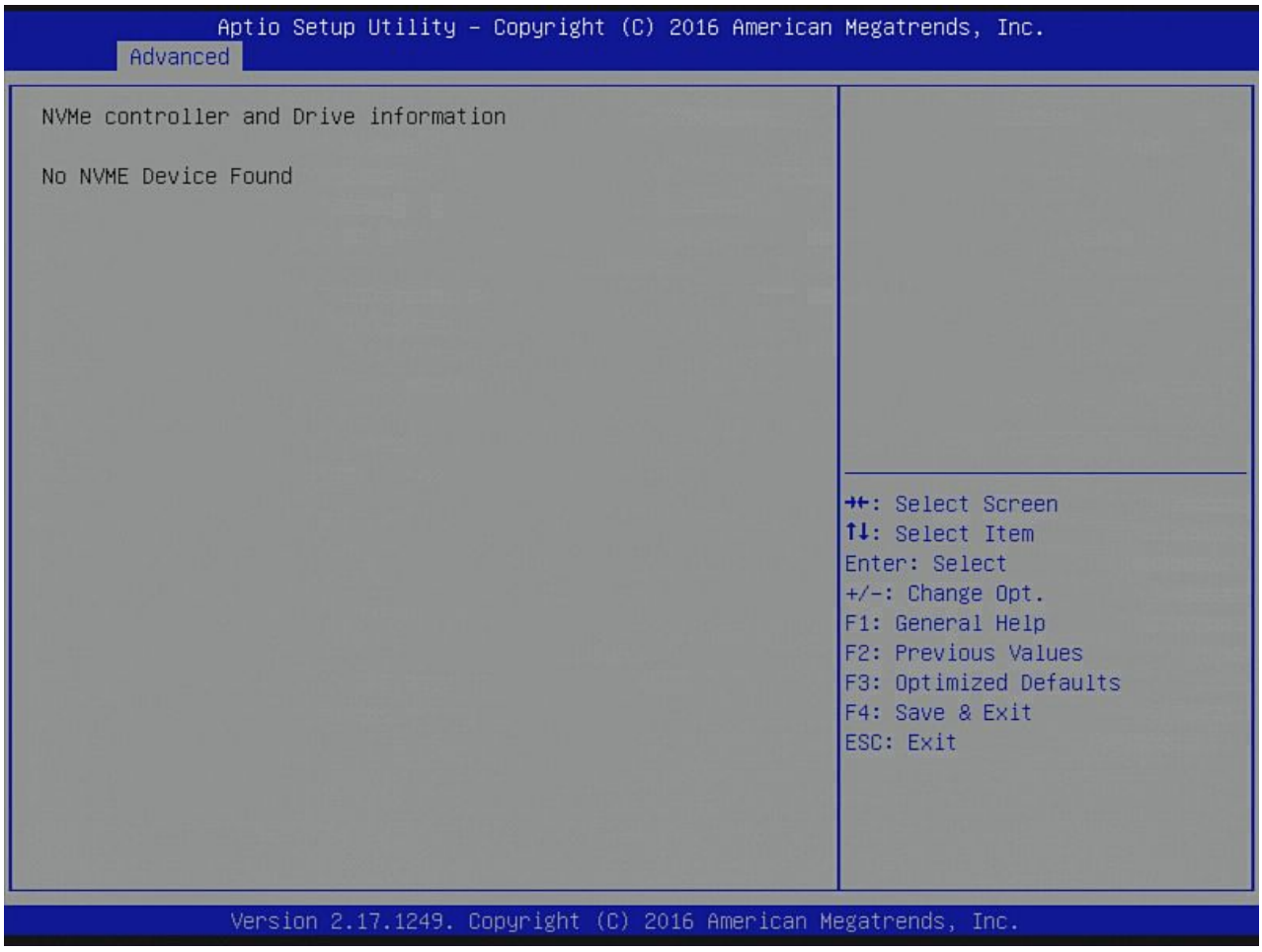
Feature	Options	Description
Network Stack	**Disabled** Enabled	Enable/Disable UEFI network Stack

5.5.2.23. CSM Configuration



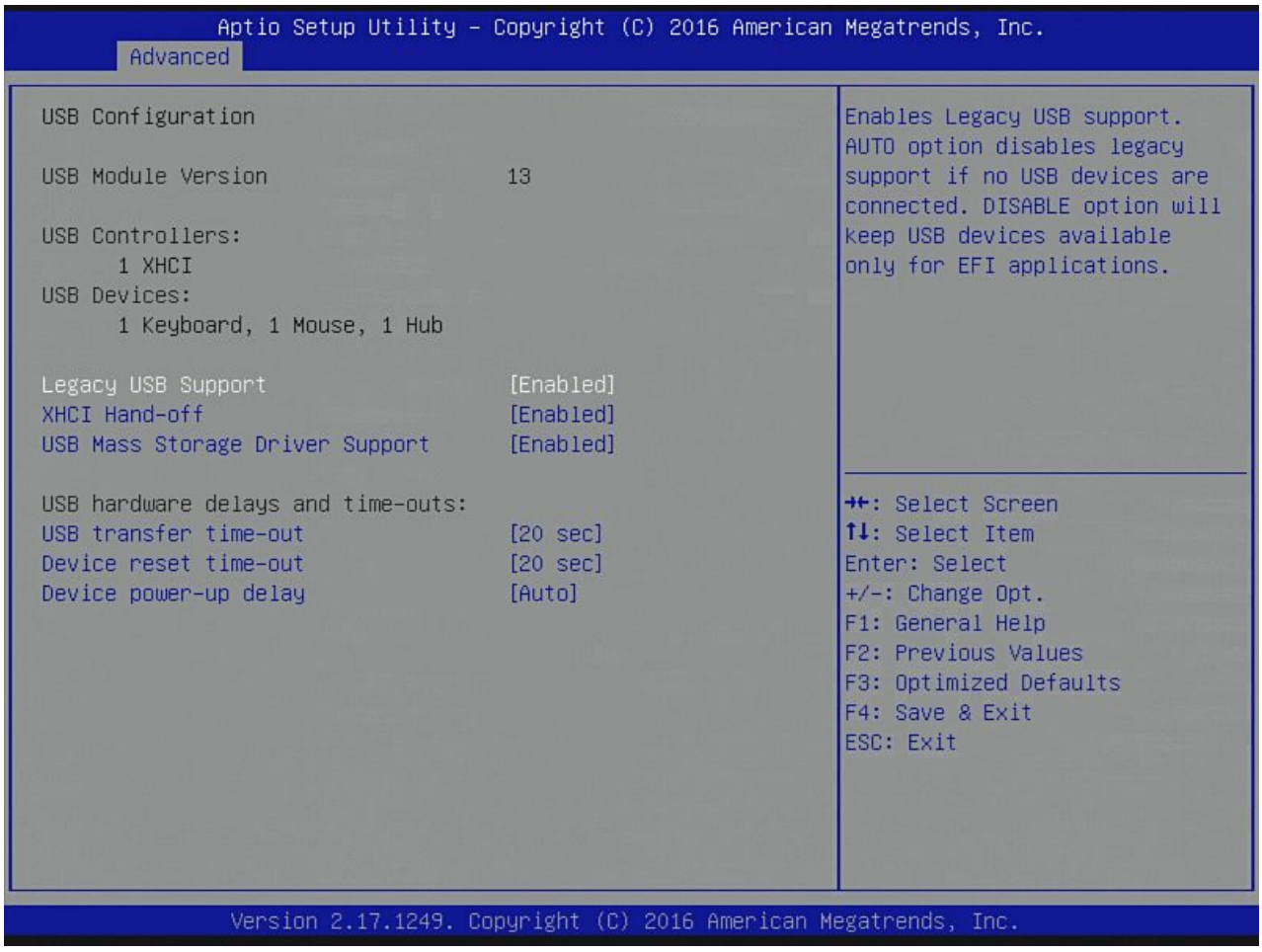
Feature	Options	Description
CSM Support	**Disabled** Enabled	Enable/Disable CSM Support.

5.5.2.24. NVMe Configuration



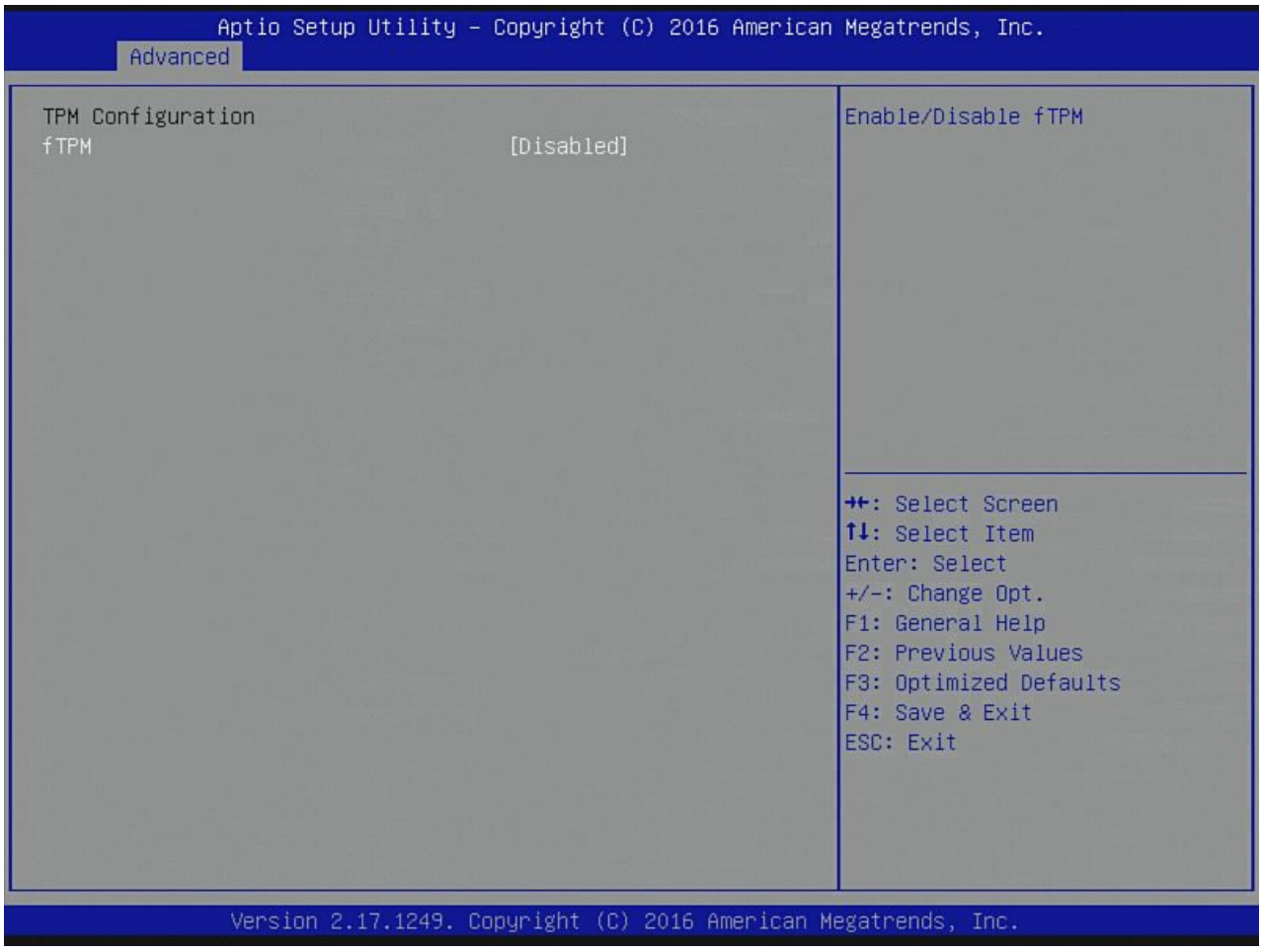
Feature	Options	Description
No NVME Device Found	-	-

5.5.2.25. USB Configuration



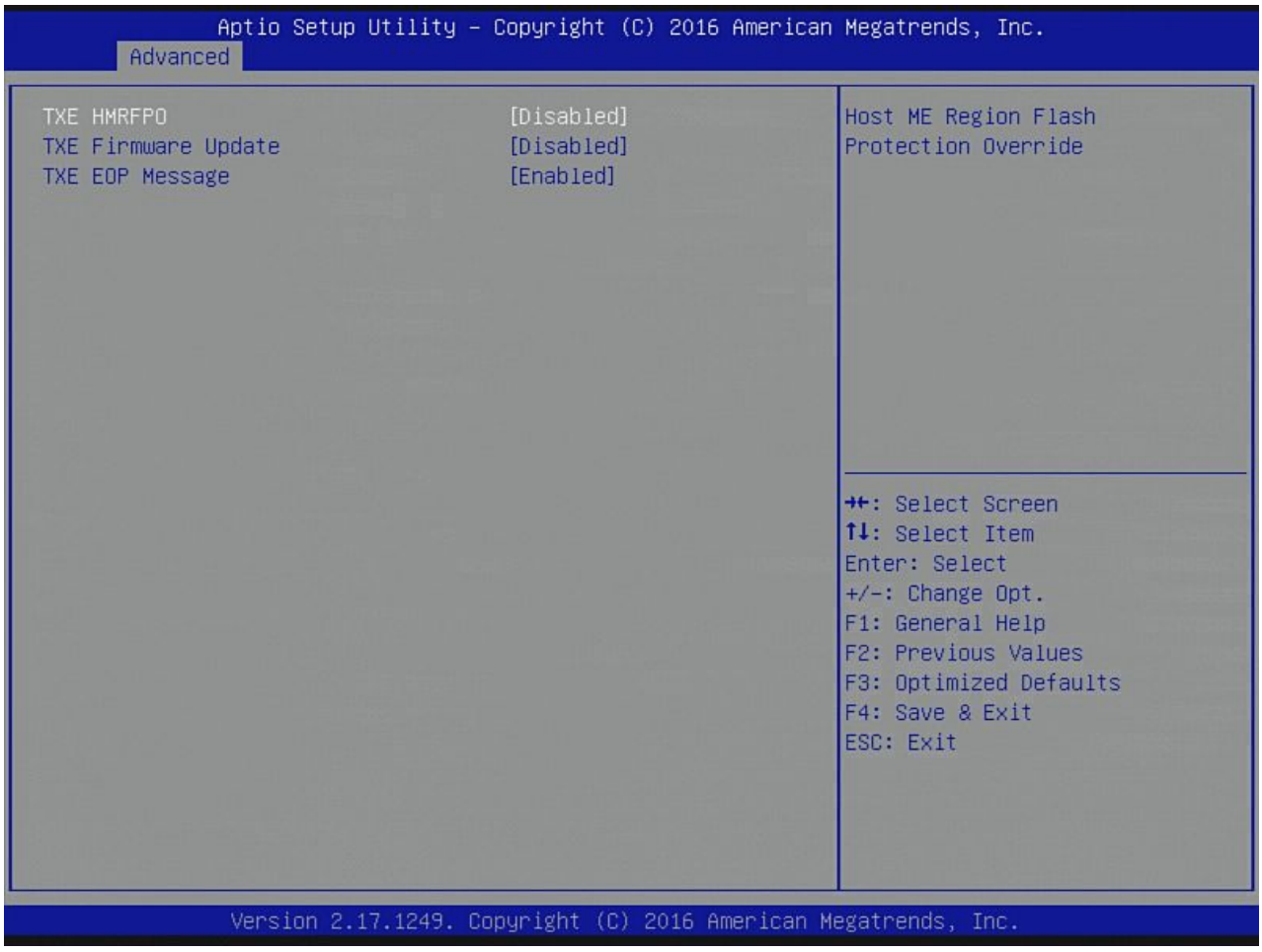
Feature	Options	Description
Legacy USB Support	**Enabled** Disabled Auto	Enables Legacy USB support. AUTO option disables legacy support if no USB devices are connected. DISABLE option will keep USB devices available only for EFI applications.
XHCI Hand-off	**Enabled** Disabled	This is a workaround for OSes without XHCI ownership change should be claimed by XHCI driver.
USB Mass Storage Driver Support	**Enabled** Disabled	Enable/Disable USB Mass Storage Driver Support.
USB transfer time-out	1 sec 5 sec 10 sec **20 sec**	The time-out value for Control, Bulk, and Interrupt transfers.
Device reset time-out	10 sec **20 sec** 30 sec 40 sec	USB mass storage device Start Unit command time-out.
Device power-up delay	**Auto** Manual	Maximum time the device will take before it properly reports itself to the Host Controller. 'Auto' uses default value: for a root port it is 100 ms, for a hub port the delay is taken from hub descriptor.

5.5.2.26. Platform Trust Technology



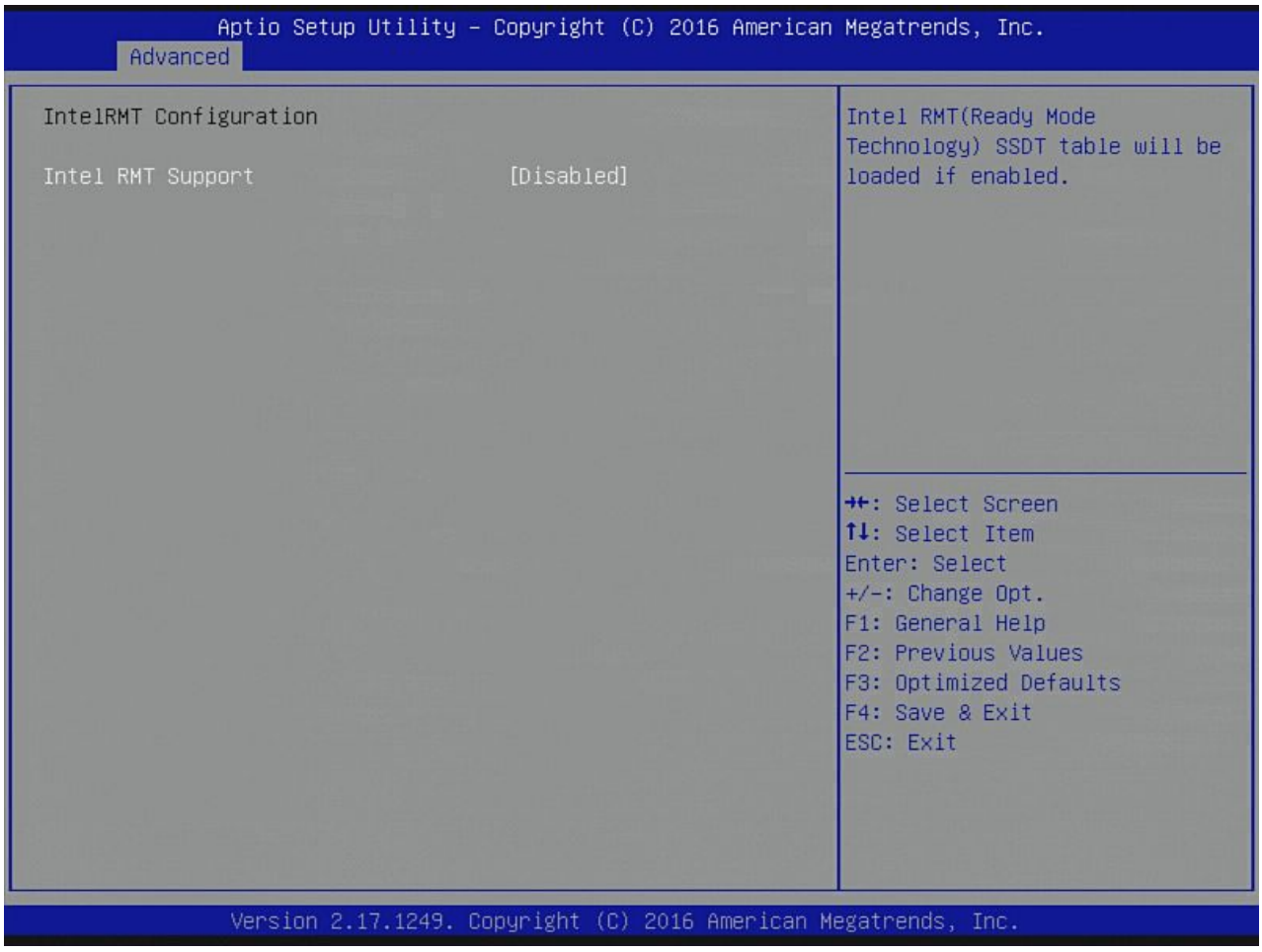
Feature	Options	Description
fTPM	Enabled **Disabled**	Enable/disable fTPM

5.5.2.27. Security Configuration



Feature	Options	Description
TXE HMRFPO	Enabled **Disabled**	Host ME Region flash Protection Override
TXE Firmware update	Enabled **Disabled**	
TXE EOP Message	**Enabled** Disabled	Send EOP Message before Enter OS

5.5.2.28. IntelRMT Configuration

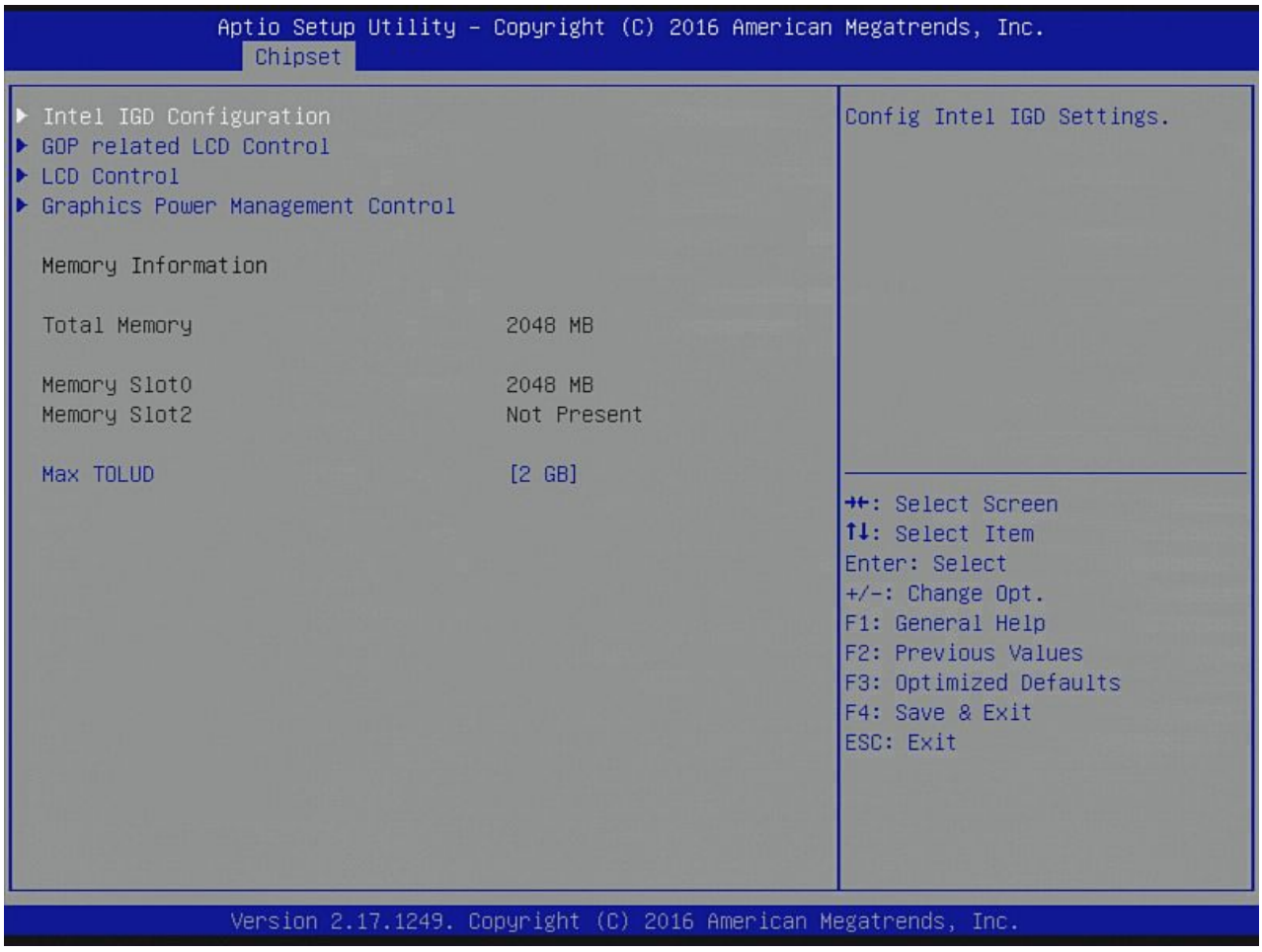


Feature	Options	Description
Intel RMT Support	**Disabled** Enabled	Intel RMT (Ready Mode Technology) SSDT table will be loaded if enabled.

5.5.3. Chipset

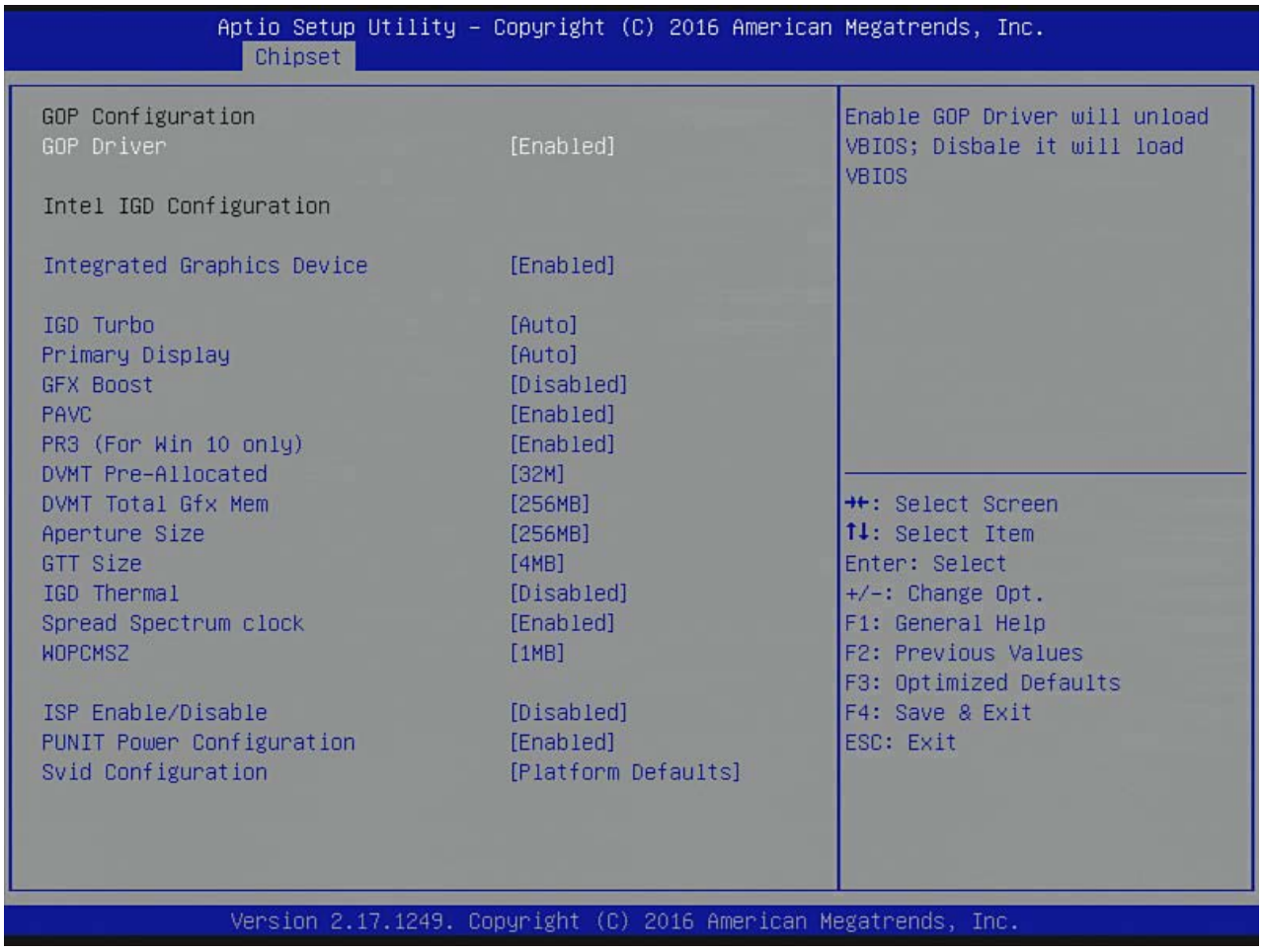
Aptio Setup Utility – Copyright (C) 2016 American Megatrends, Inc.
Main Advanced Chipset Security Boot Save & Exit
North Bridge
South Bridge
North Bridge Parameters
→←: Select Screen
↑↓: Select Item
Enter: Select
+/-: Change Opt.
F1: General Help
F2: Previous Values
F3: Optimized Defaults
F4: Save & Exit
ESC: Exit
Version 2.17.1249. Copyright (C) 2016 American Megatrends, Inc.

5.5.3.1. North Bridge



Feature	Options	Description
Max TOLUD	**2 GB** 2.25 GB 2.5 GB 2.75 GB 3 GB	Maximum Value of TOLUD.

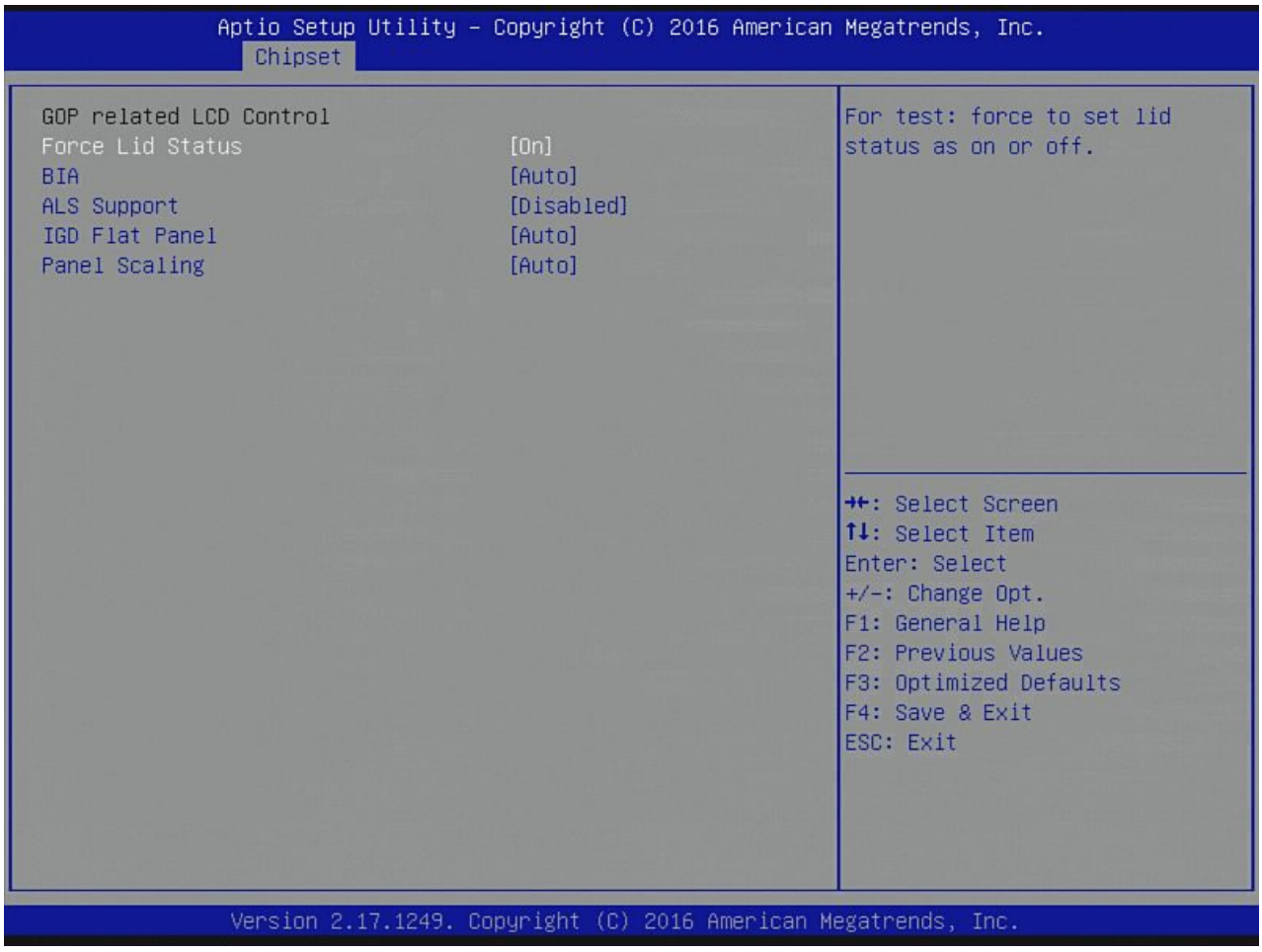
5.5.3.2. Intel IGD Configuration



Feature	Options	Description
GOP Driver	**Enabled** Disabled	Enable GOP Driver will unload VBIOS; Disable it will load VBIOS
Integrated Graphics Device	**Enabled** Disabled	Enable: Enable Integrated Graphics Device (IGD) when selected as the Primary Video Adaptor. Disable: Always disable IGD
IGD Turbo	**Auto** Enabled Disabled	Select the IGD Turbo feature, if Auto selected, IGD Turbo will only be enabled when SOC steeping is B0 or above.
Primary Display	**Auto** IGD PCIe	Select which of IGD/PCI graphics device should be Primary Display.
GFX Boost	Enabled **Disabled**	Enable/Disable GFX Boost
PAVC	**Enabled** Disabled	Enable/Disable Protected Audio Video Control
PR3 (For Win 10 only)	**Enabled** Disabled	Enable/Disable PR3 (For Win 10 only)

DVMT Pre-Allocated	**32M** 64M 96M 128M 160M 192M 224M 256M 288M 320M 352M 384M 416M 448M 480M 512M	Select DVMT 5.0 Pre-Allocated (Fixed) Graphics Memory size used by the Internal Graphics Device.
DVMT Total Gfx Mem	128MB **256MB** Max	Select DVMT 5.0 Total Graphic Memory size used by the Internal graphics Device.
Aperture Size	128MB **256MB** Max	Select the Aperture Size
GTT Size	2MB **4MB** 8MB	Select the GTT Size
IGD Thermal	**Disabled** Enabled	Enable/Disable IGD Thermal
Spread Spectrum clock	Disabled **Enabled**	Enable/Disable Spread Spectrum clock
WOPCMSZ	**1MB** 2MB 4MB 8MB	Select a size for WOPCMSZ.
ISP Enable/Disable	**Disabled** Enabled	Enable/Disable ISP PCI Device Selection
PUNIT Power Configuration	Disabled **Enabled**	Enable or Disable Punit Power configuration.
Svid Configuration	Platform Defaults Svid Config 0 Svid Config 1 Svid Config 3 Svid Config 4 BSW I2C PMIC Config	Choose The Right SVID Config

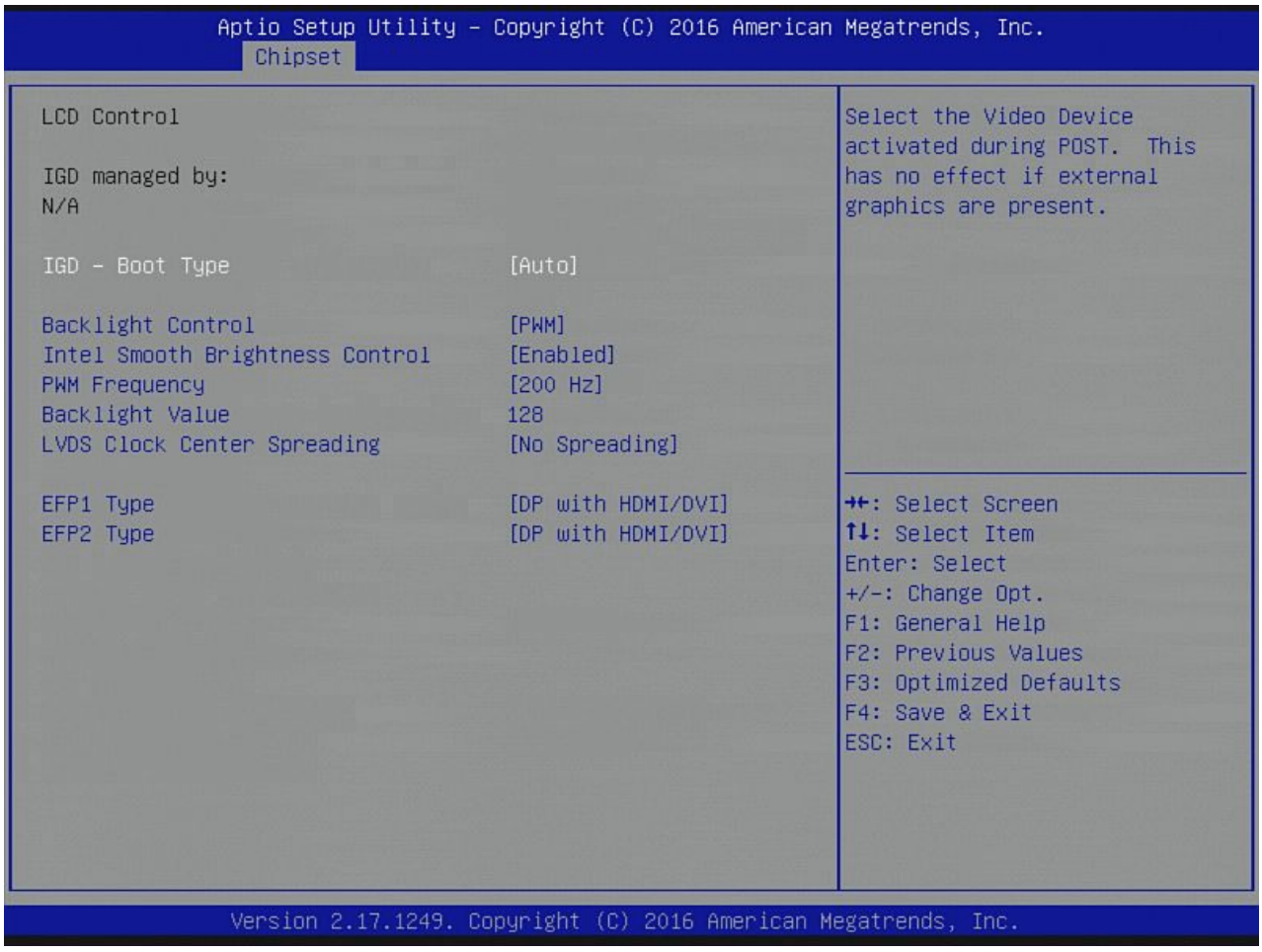
5.5.3.3. GOP Related LCD Control



Feature	Options	Description
Force Lid Status	**On** Off	For test: force to set lid status as on or off.
BIA	**Auto** Level1 Level2 Level3 Level4 Level5 Disabled	Auto: GMCH Use VBIOS Default; Level n: Enabled with Selected Aggressiveness Level
ALS Support	**Disabled,** Enabled	Valid only for ACPI
IGD Flat Panel	**Auto** 640+480 800*600 1024*768 1280*1024 1366*768 1680*1050 1600*1200 1280*800	SIGD Flat Panel Options

Panel Scaling	**Auto** Centering Stretching	Select the LCD panel scaling option used by internal Graphics Device.

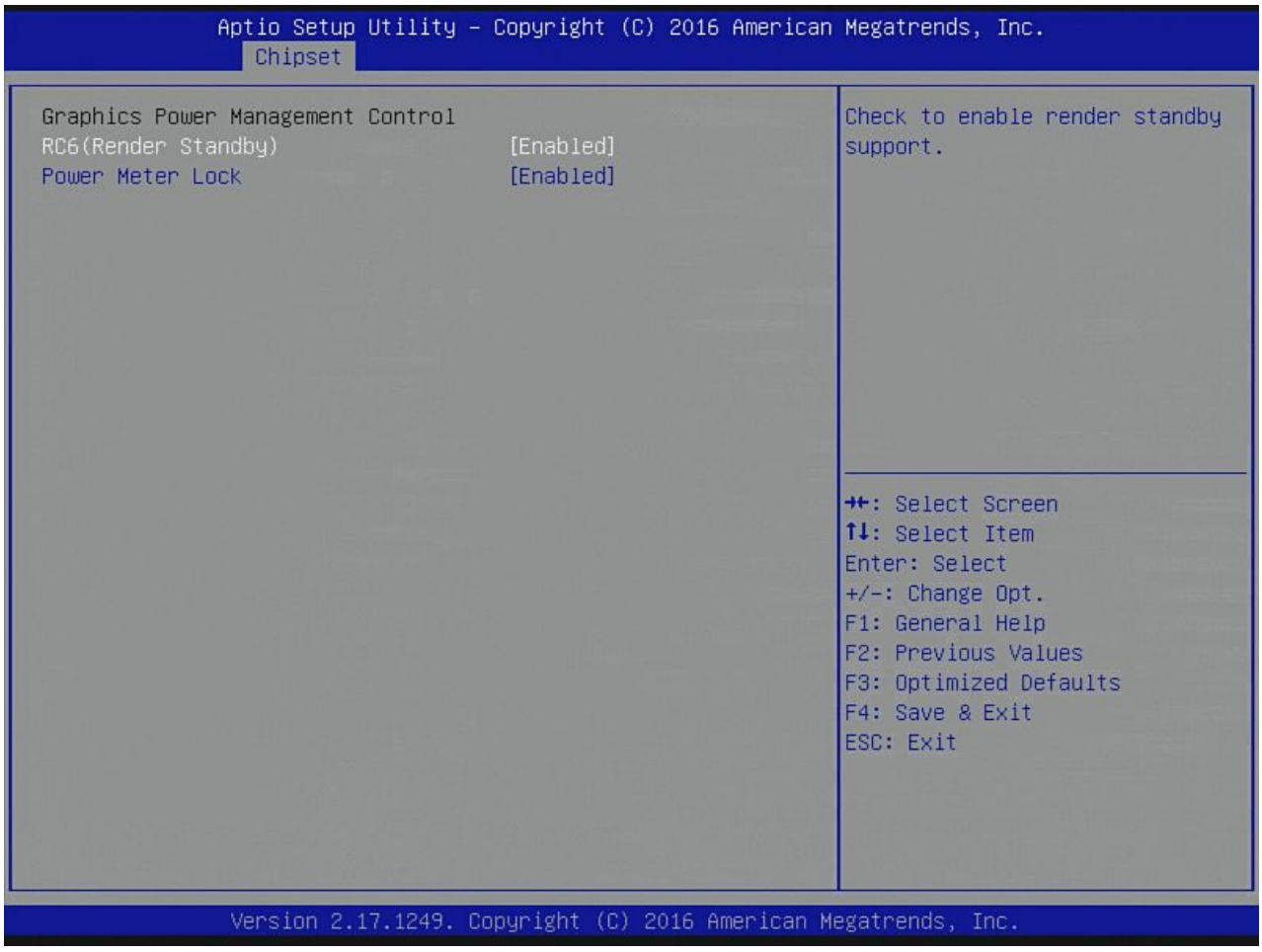
5.5.3.4. LCD Control



Feature	Options	Description
IGD - Boot Type	**Auto** EFP LFP EFP2	Select the Video Device activated during POST. This has no effect if external graphics are present.
Backlight Control	None/External **PWM** PWM Inverted I2C I2C Inverted	Backlight Control Setting
Intel Smooth Brightness Control	Disabled **Enabled**	If enabled, PWM values will be overridden by OS Power Options.
PWM Frequency	**200 Hz** 400 Hz 1 kHz 2 kHz 4 kHz 8 kHz 20 kHz 40 kHz	Set LCD backlight PWM frequency.
Backlight value	**128**	Set LCD backlight brightness (0-255).

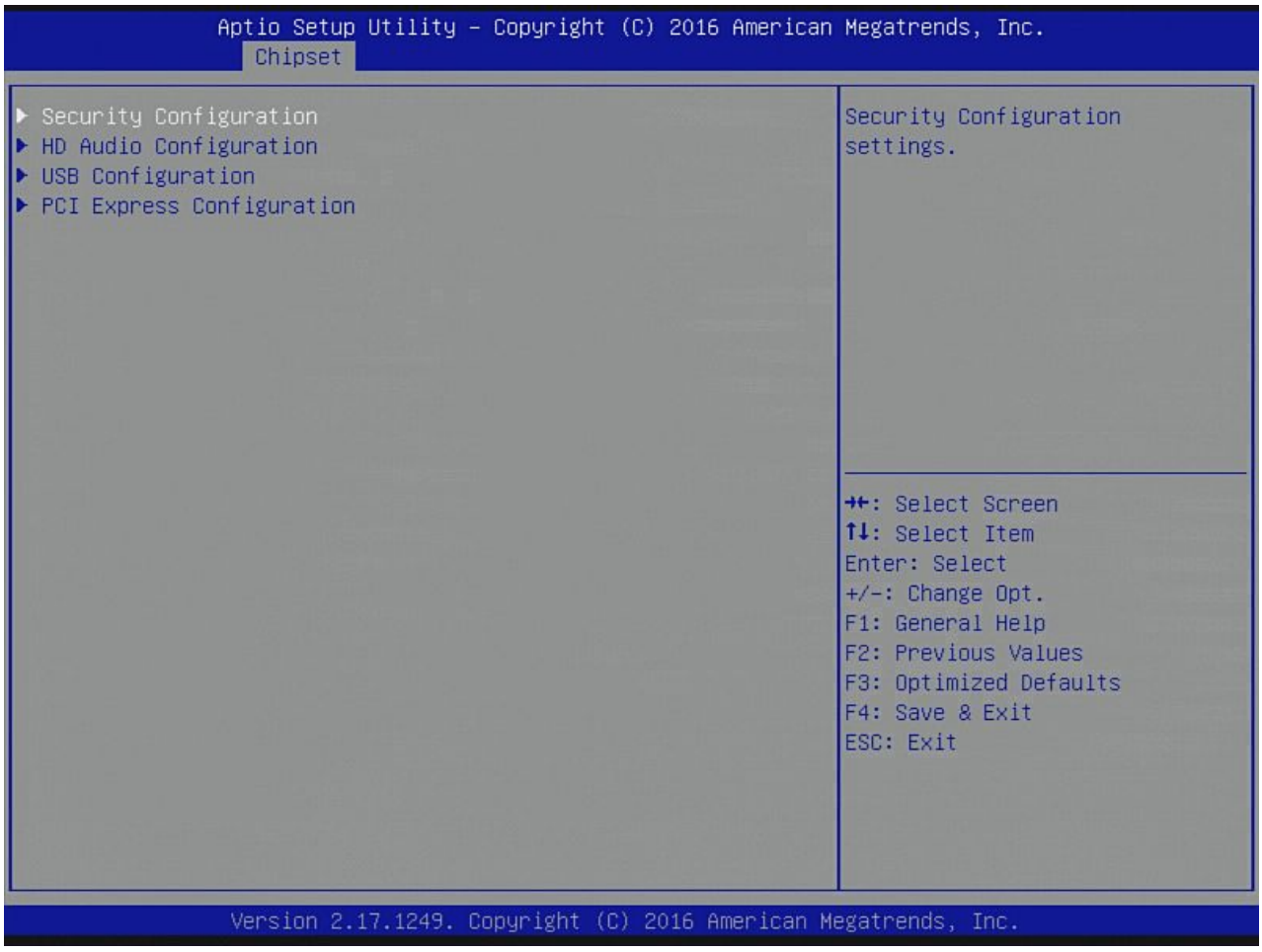
LVDS Clock Center Spreading	**No Spreading** 0.5% 1.0% 1.5% 2.0% 2.5%	Select LVDS clock frequency center spreading depth.
EFP1 Type	DisplayPort Only **DP with HDMI/DVI** HDMI/DVI	Integrated HDMI/DisplayPort Configuration with External Connectors.
EFP2 Type	DisplayPort Only **DP with HDMI/DVI** HDMI/DVI	Integrated HDMI/DisplayPort Configuration with External Connectors.

5.5.3.5. Graphics Power Management Control

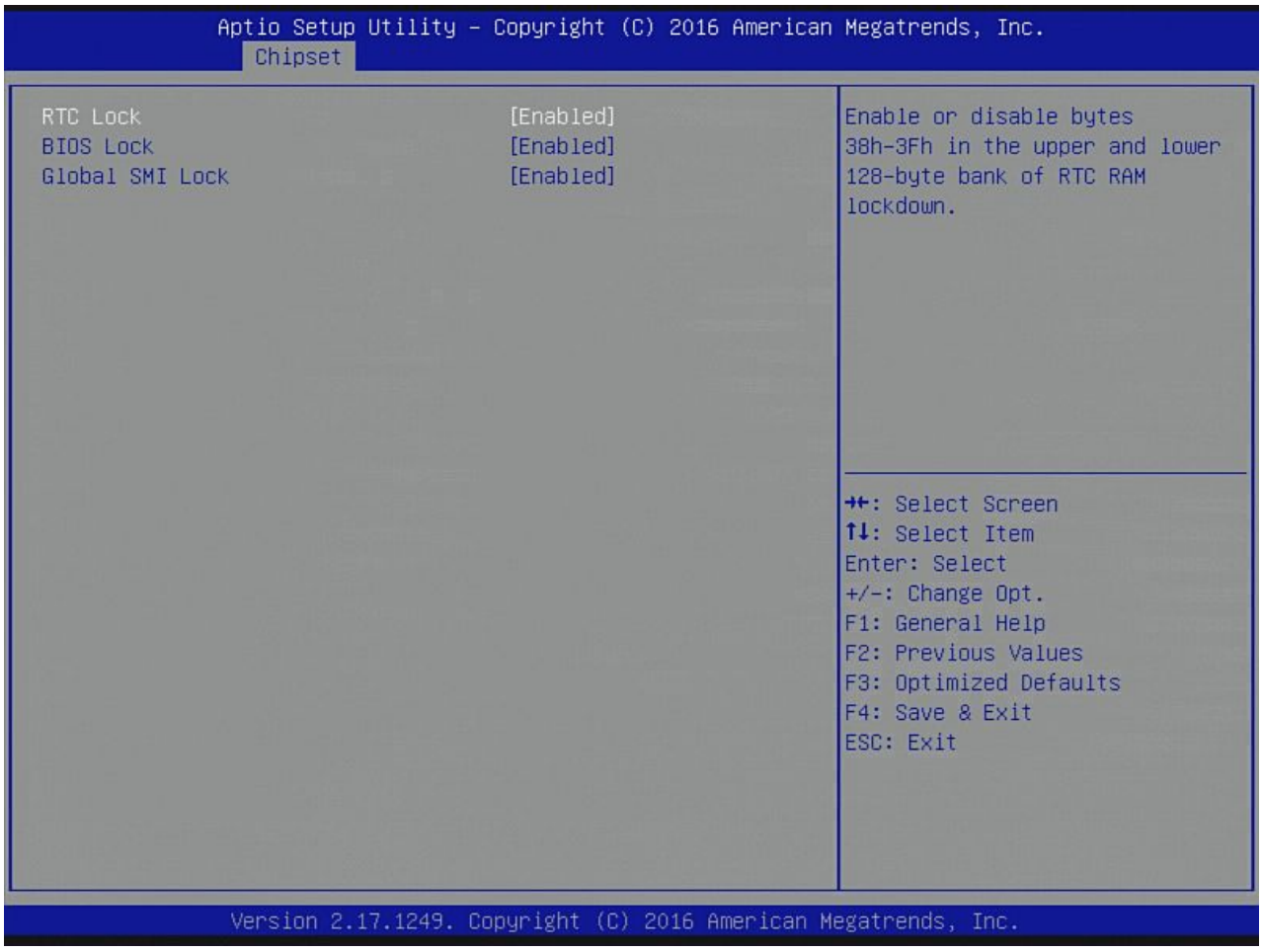


Feature	Options	Description
RC6(Render Standby)	**Enabled** Disabled	Check to enable render standby support.
Power Meter Lock	**Enabled** Disabled	Enable/Disable Power Meter Lock.

5.5.3.6. South Bridge

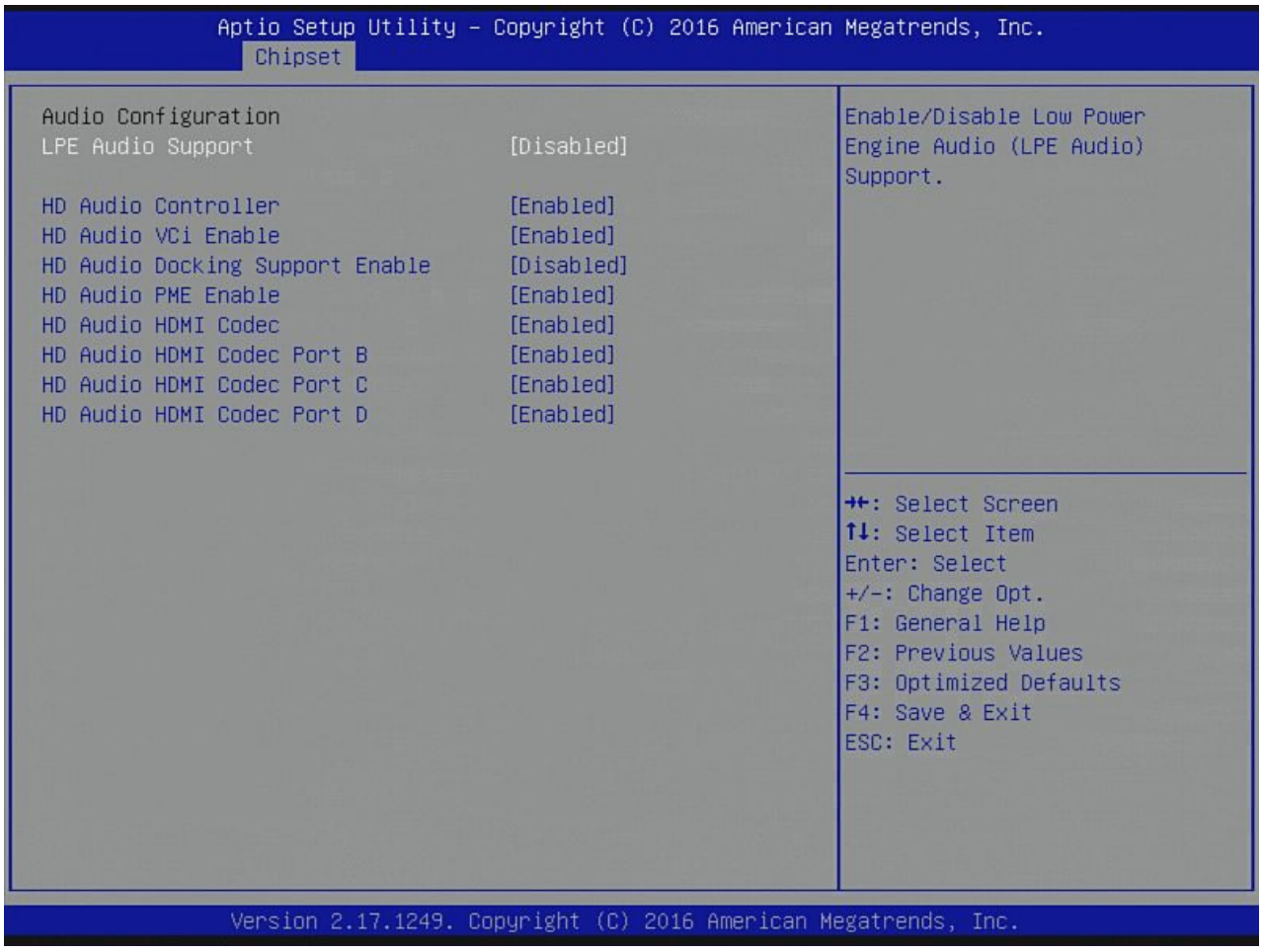


5.5.3.7. Security Configuration



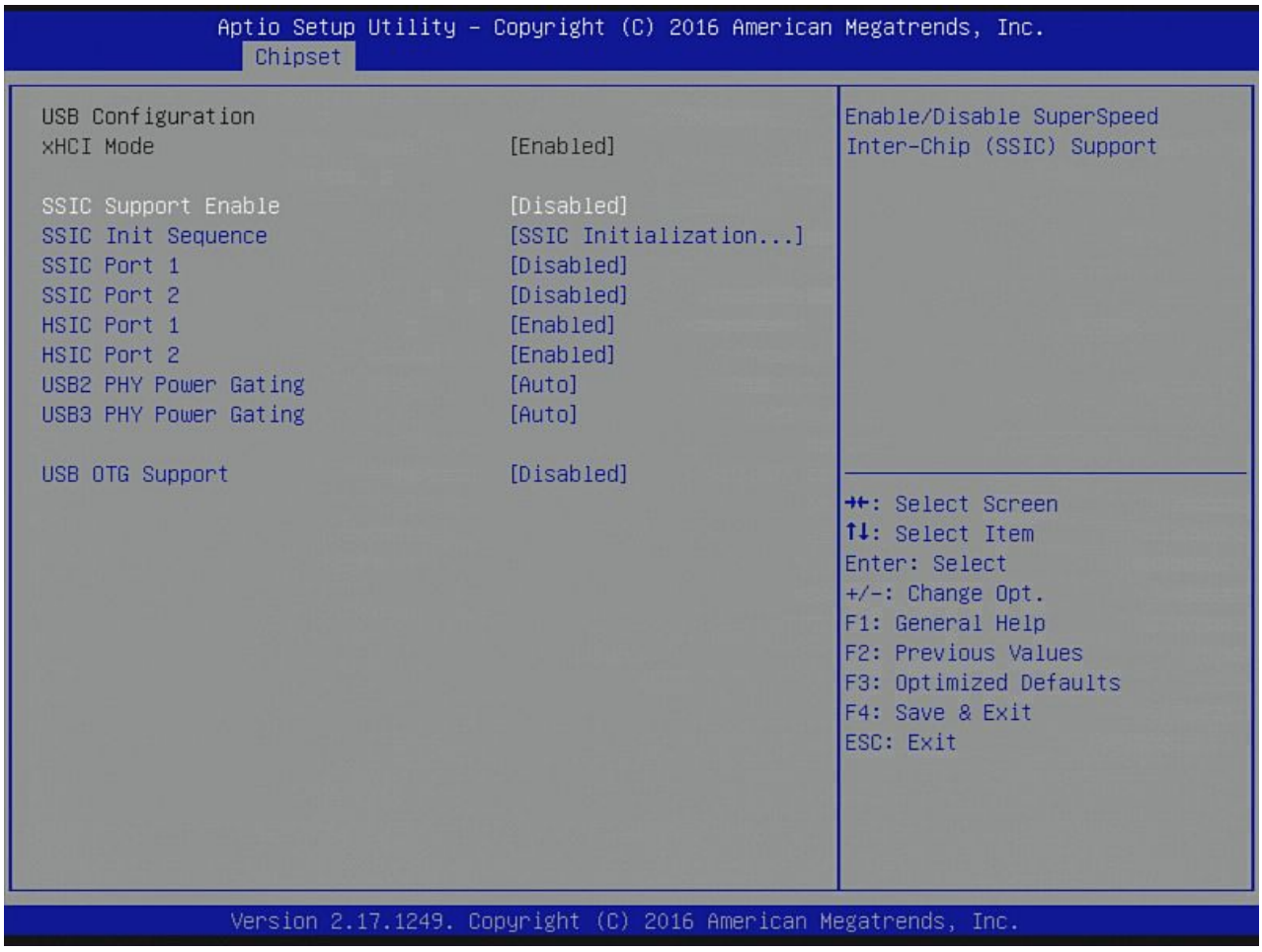
Feature	Options	Description
RTC Lock	**Enabled** Disabled	Enable or disable bytes 38h-3Fh in the upper and lower 128-byte bank of RTC RAM lockdown.
BIOS Lock	**Enabled** Disabled	Enable/Disable the BIOS Lock Enable feature.
Global SMI Lock	**Enabled** Disabled	Enable or Disable SMI lock.

5.5.3.8. HD Audio Configuration



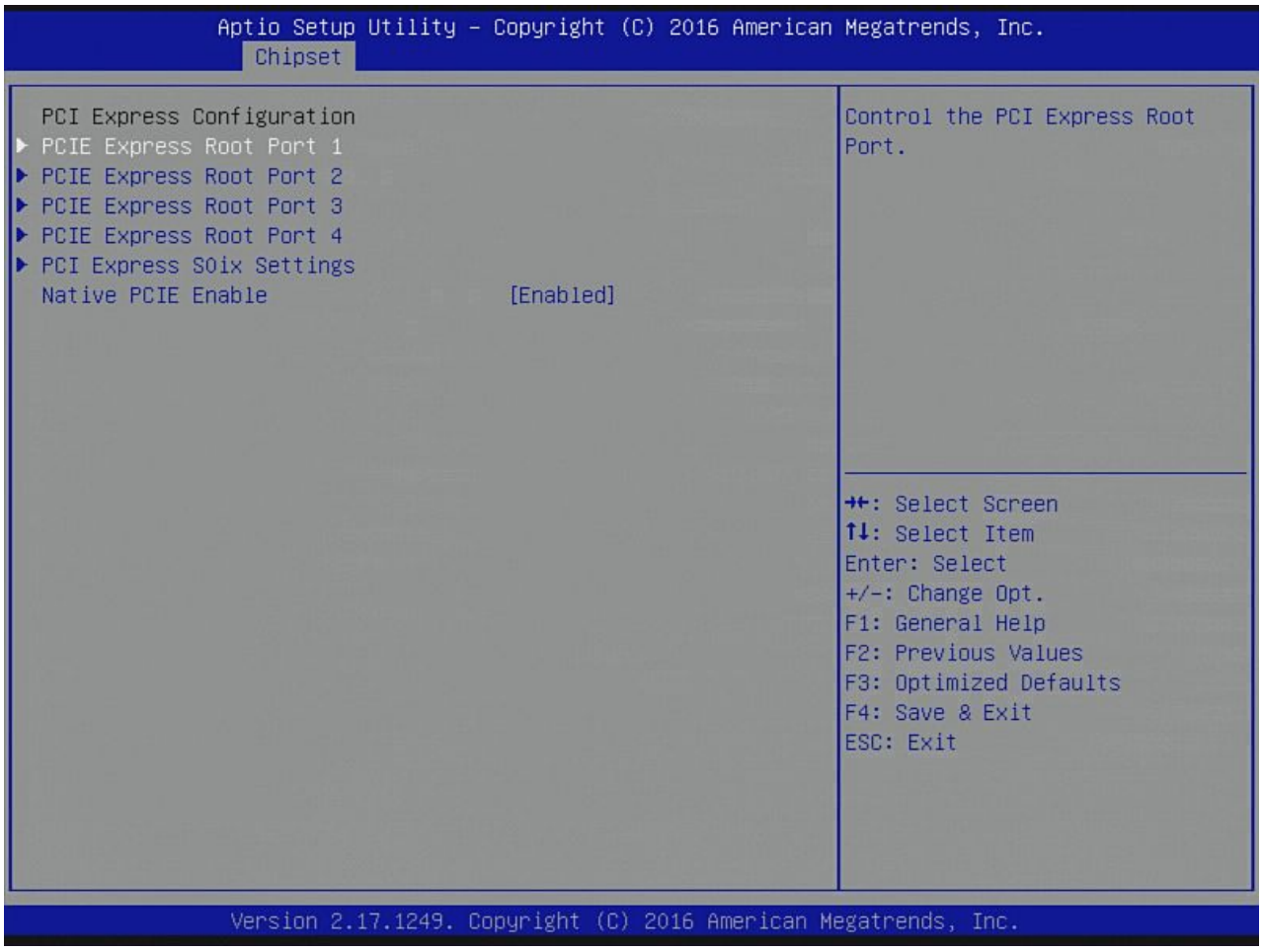
Feature	Options	Description
LPE Audio Support	**Disabled** PCI mode ACPI mode	Enable/Disable Low Power Engine Audio (LPE Audio) Support.
HD Audio Controller	**Enabled** Disabled	Control Detection of the HD audio device (HDA). Disabled = HD audio will be unconditionally disabled. Enabled = HD audio will be unconditionally enabled.
HD Audio VCi Enable	**Enabled** Disabled	Enable/Disable Virtual Channel 1 of HD Audio Controller.
HD Audio Docking Support Enable	Enabled **Disabled**	Enable/Disable docking support of HD Audio Controller.
HD Audio Docking PME Enable	**Enabled** Disabled	Enable/Disable power management capabilities of HD Audio Controller.
HD Audio HDMI Codec	**Enabled** Disabled	Enable/Disable internal HDMI codec for HD Audio.
HD Audio HDMI Codec Port B	**Enabled** Disabled	Enable/Disable internal HDMI Port for HD Audio.
HD Audio HDMI Codec Port C	**Enabled** Disabled	Enable/Disable internal HDMI Port for HD Audio.
HD Audio HDMI Codec Port D	**Enabled** Disabled	Enable/Disable internal HDMI Port for HD Audio.

5.5.3.9. USB Configuration



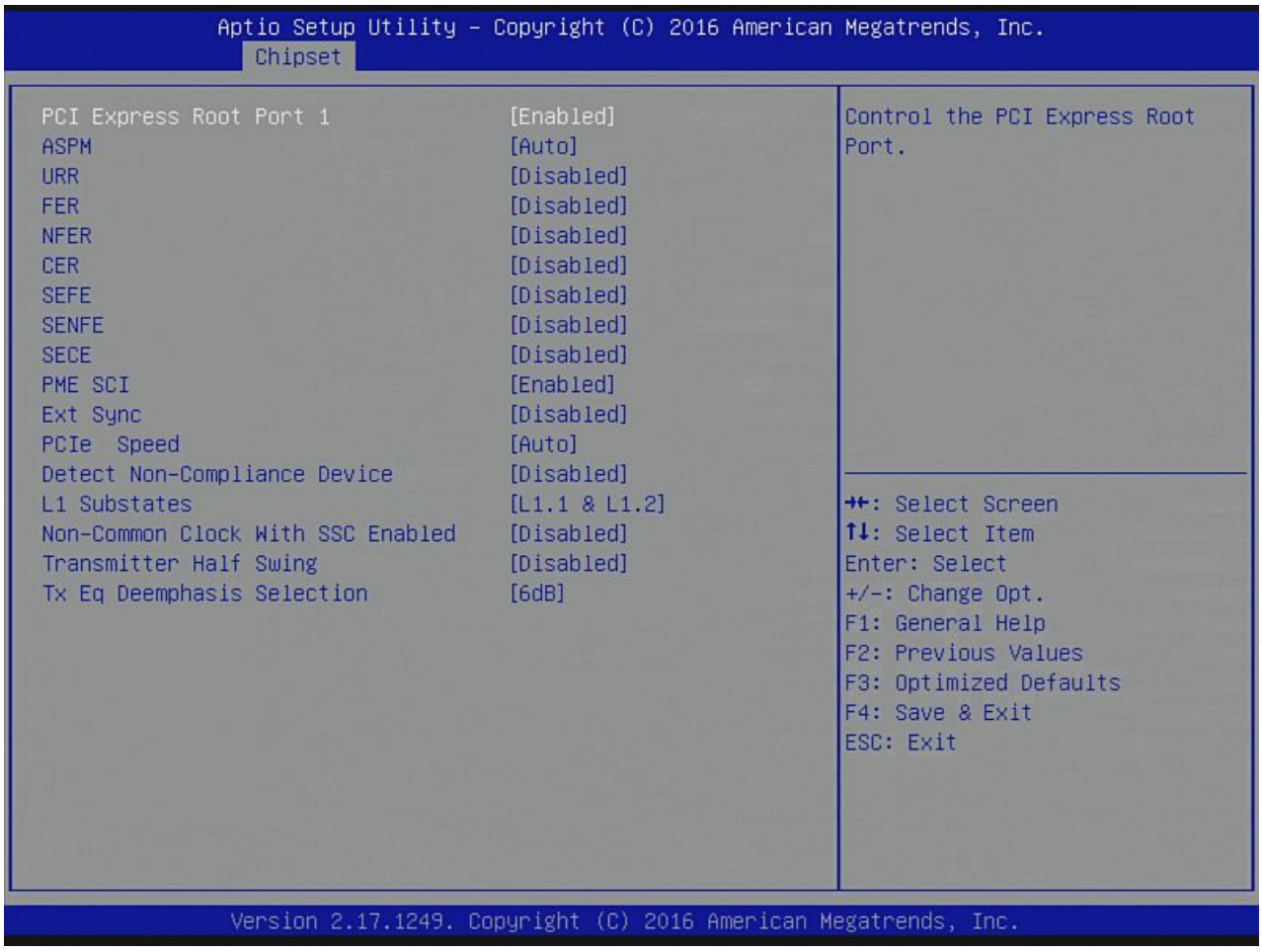
Feature	Options	Description
xHCI Mode	**Enabled**	Enable/Disable Low Power Engine Audio (LPE Audio) Support.
SSIC Support Enable	Enabled **Disabled**	Enable/Disable SuperSpeed Inter-Chip (SSIC) Support.
SSIC Init Sequence	**SSIC Initialization Sequence 1** SSIC Initialization Sequence 2	SSIC Initialization Sequence 1 – Windows, SSIC Initialization Sequence 2 - Android.
SSIC Port 1	Enabled **Disabled**	Enable/Disable SuperSpeed Inter-Chip (SSIC) Port 1.
SSIC Port 2	Enabled, **Disabled**	Enable/Disable SuperSpeed Inter-Chip (SSIC) Port 2.
HSIC Port 1	**Enabled** Disabled	Enable/Disable HighSpeed Inter-Chip (HSIC) Port 1.
HSIC Port 2	**Enabled** Disabled	Enable/Disable HighSpeed Inter-Chip (HSIC) Port 2.
USB2 PHY Power Gating	**Auto** Enabled Disabled	Enable/Disable power management capabilities of HD Audio Controller.
USB3 PHY Power Gating	**Auto** Enabled Disabled	Enable/Disable internal HDMI codec for HD Audio.
USB OTG Support	PCI mode **Disabled**	Enable/Disable internal HDMI Port for HD Audio.

5.5.3.10. PCI Express Configuration



Feature	Options	Description
Native PCIE Enable	**Enabled** Disabled	PCI Express native Support Enable/Disable. This feature is only available in Vista.

5.5.3.11. PCI Express Root Port 1 (2, 3, 4)

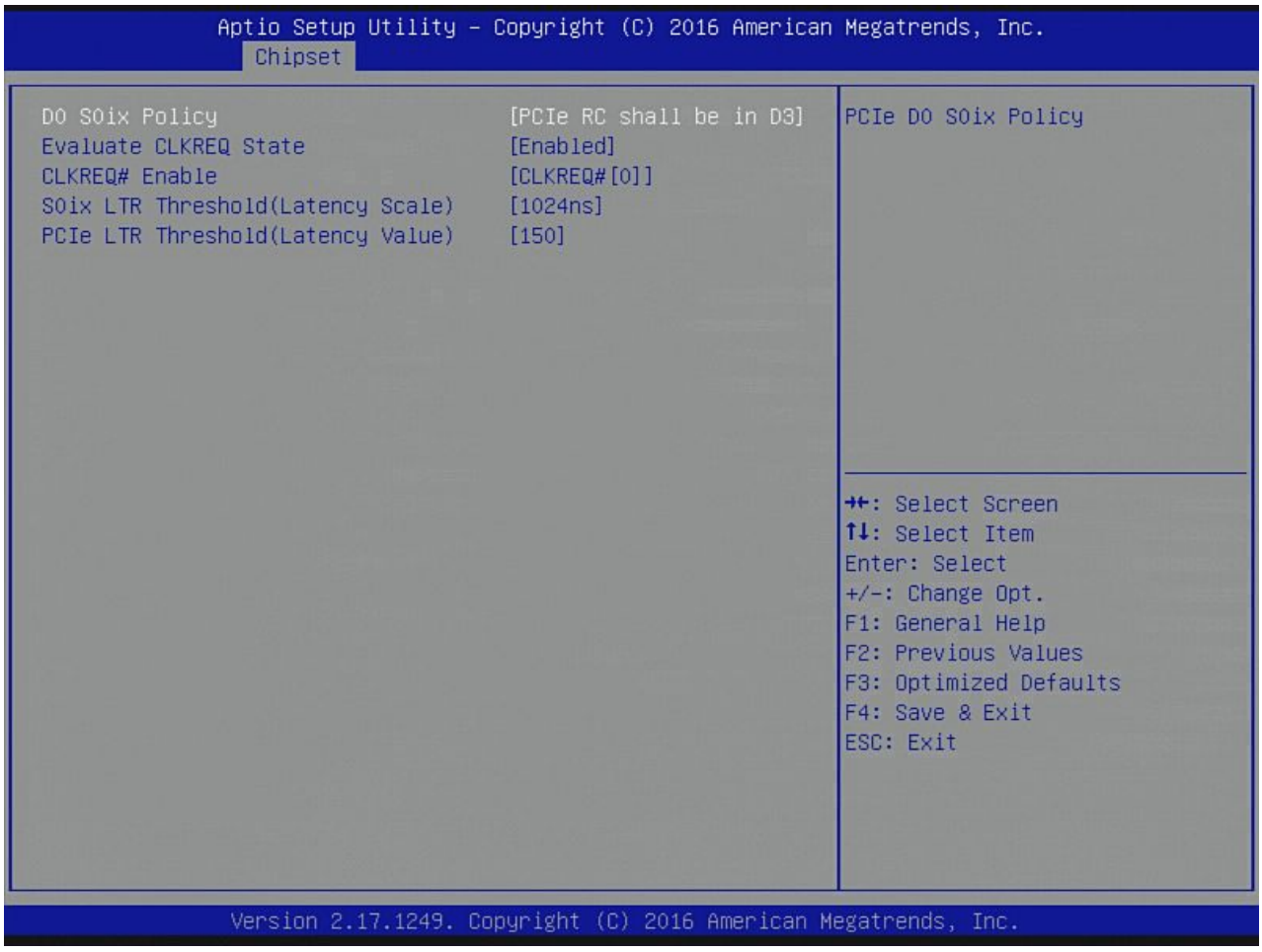


Feature	Options	Description
PCIE Express Root Port 1	**Enabled** Disabled	Control the PCI Express Root Port.
ASPM	Auto **Disabled** L0s L1 L0sL1	PCI Express Active State Power management settings.
URR	Enabled **Disabled**	PCI Express Unsupported Request Reporting Enable/Disable.
FER	Enabled **Disabled**	PCI Express Device Fatal Error Reporting Enable/Disable.
NFER	Enabled **Disabled**	PCI Express Device Non-Fatal Error Reporting Enable/Disable.
CER	Enabled **Disabled**	PCI Express Device Correctable Error Reporting Enable/Disable.
SEFE	Enabled **Disabled**	Root PCI Express System Error on Fatal Error Enable/Disable.
SENFE	Enabled **Disabled**	Enable or disable Root PCI Express System Error on Non-Fatal Error.

SECE	Enabled **Disabled**	Root PCI Express System Error on Correctable Error Enable/Disable.
PME SCI	**Enabled** Disabled	PCI Express PME SCI Enable/Disable.
Ext Sync	Enabled **Disabled**	Enable Express Ext Sync Enable/Disable.
PCIe Speed	**Auto** Gen2 Gen1	Configure PCIe Speed. CHV A1 always with Gen1 Speed.
Detect Non-Compliance Device	Enabled **Disabled**	Detect Non-Compliance PCI Express Device. If enable, it will take more time at POST time.
L1 Substates	Disabled L1.1 L1.2 **L1.1 & L1.2**	PCI Express L1 Substates settings.
Non-Common Clock With SSC Enabled	Enabled **Disabled**	Assume the roo port is operating at non-common clock with SSC enabled.
Transmitter Half Swing	Enabled **Disabled**	Transmitter Half Swing Enable/Disable.
Tx Eq Deemphasis Selection	3.5dB **6dB**	Select the level of de-emphasis for Upstream component.

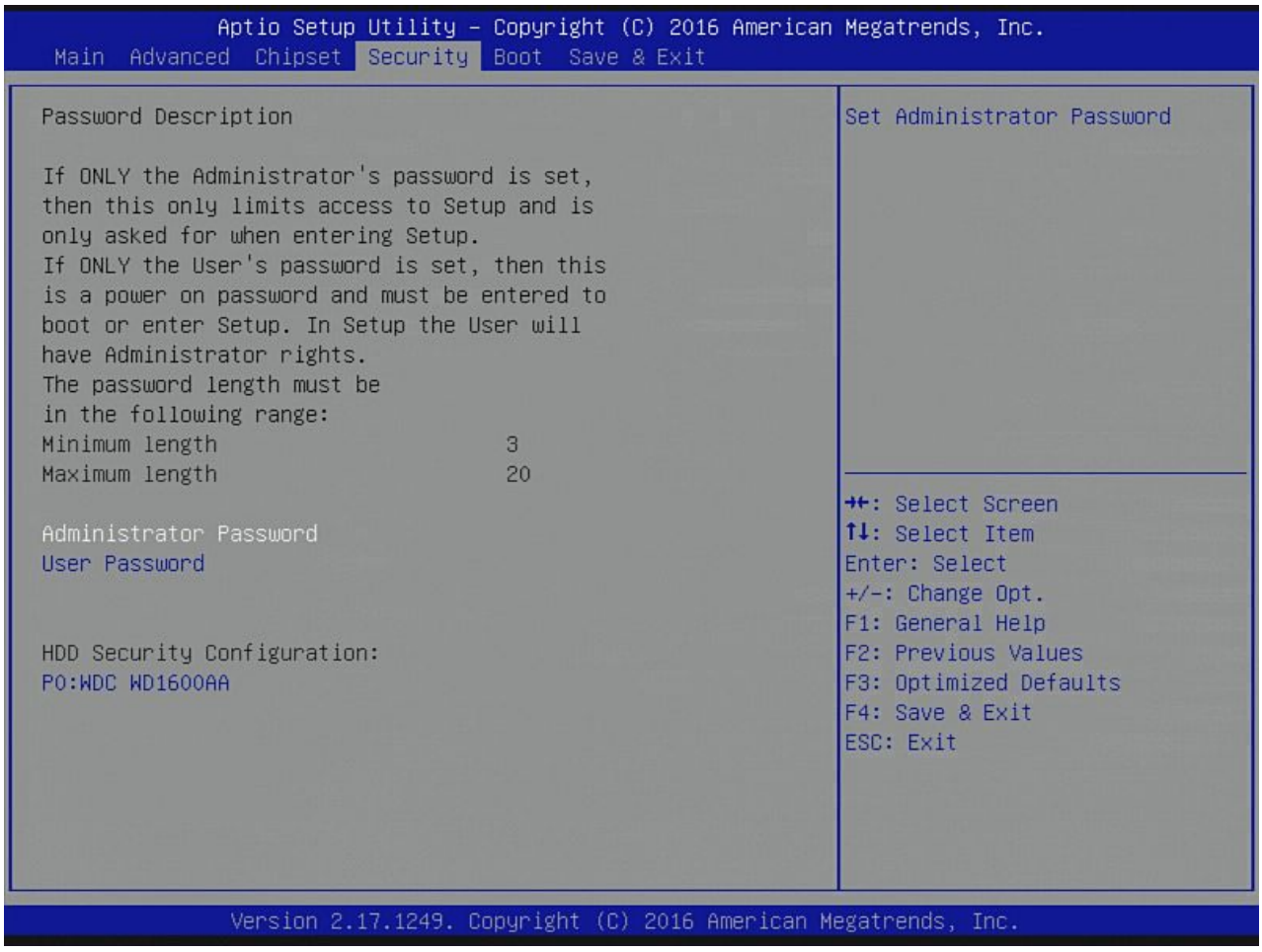
We strongly recommend not to enable ASPM. Enabling ASPM may cause problems recognizing some PCI devices.

5.5.3.12. PCI Express S0ix Settings



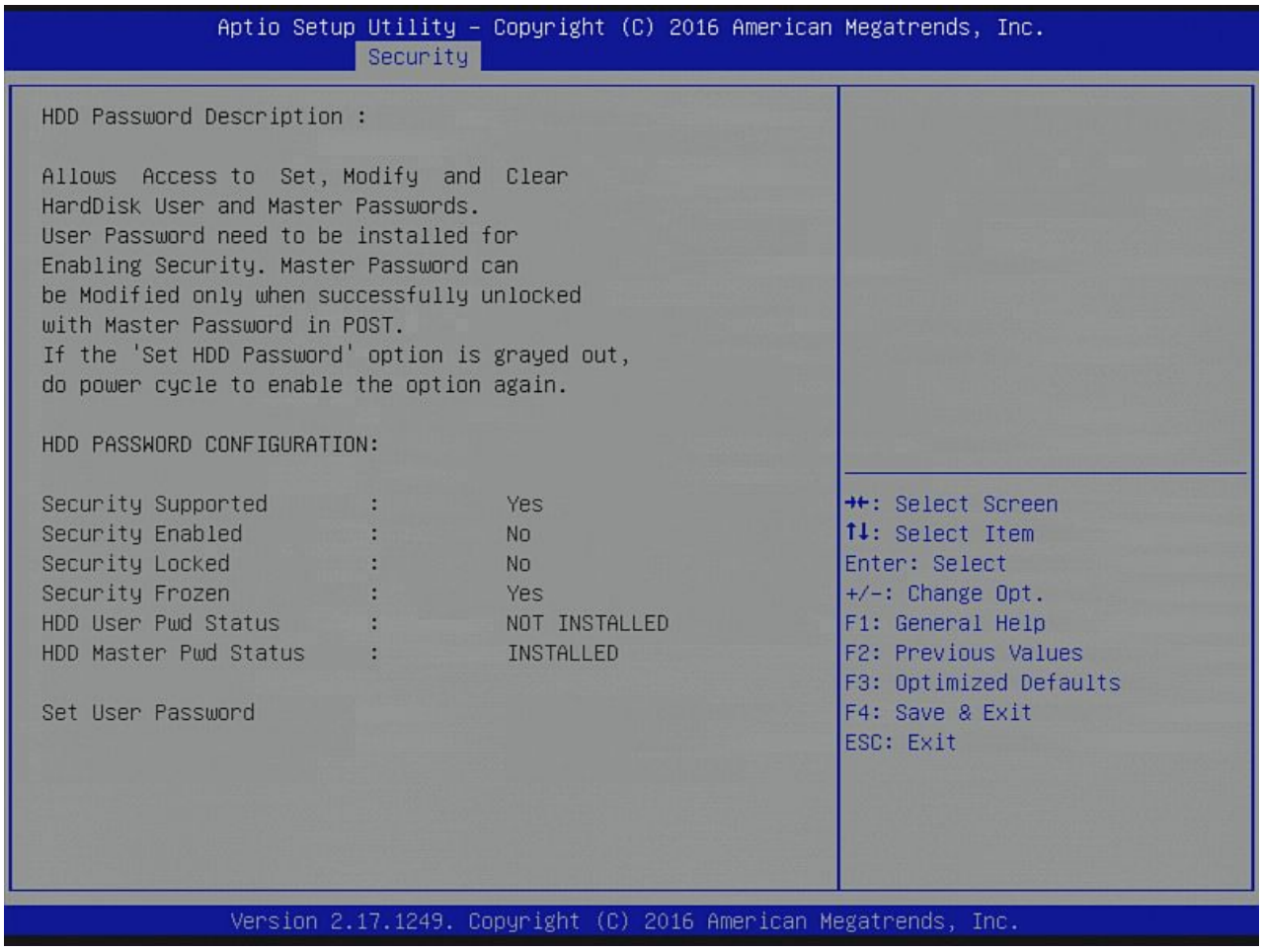
Feature	Options	Description
D0 S0ix Policy	**PCIe RC shall be in D3** S0i1 is the deepest S0ix state PCIe RC is in D0 when entering S0ix Reserved	Control the PCI Express Root Port.
Evaluate CLKREQ State	**Enabled** Disabled	Enable/disable evaluation of CLKREQ state.
CLKREQ# Enable	**CLKREQ# [0]** CLKREQ# [1] CLKREQ# [2] CLKREQ# [3]	CLKREQ# [x] shall be evaluate during PCIe in D0 S0ix entry and criteria checking
S0ix LTR Threshold (Latency Scale)	1ns 32ns **1024ns** 32,768ns 1,048,576ns 33,554,321ns	PCIe S0ix LTR Threshold: Latency Scale
PCIe LTR Threshold (Latency Value)	**150**	PCIe S0ix LTR Threshold: Latency Value. This value is multiplied by latency Scale

5.5.4. Security

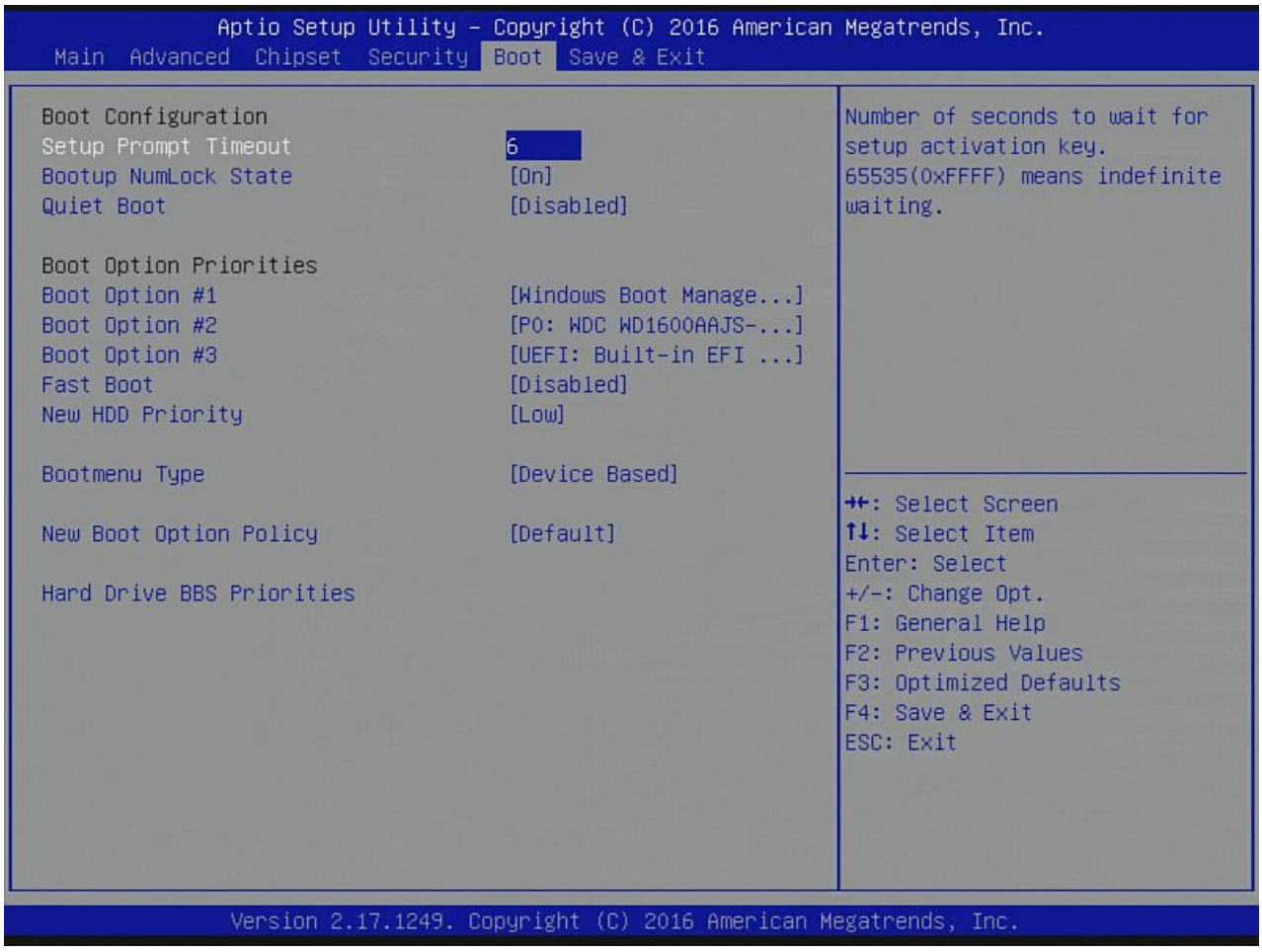


Feature	Options	Description
Administrator Password	-	Set Administrator Password
User Password	-	Set User Password
HDD Security Configuration	See next screen!	HDD Security Configuration for selected drive.

5.5.5. HDD Security Configuration



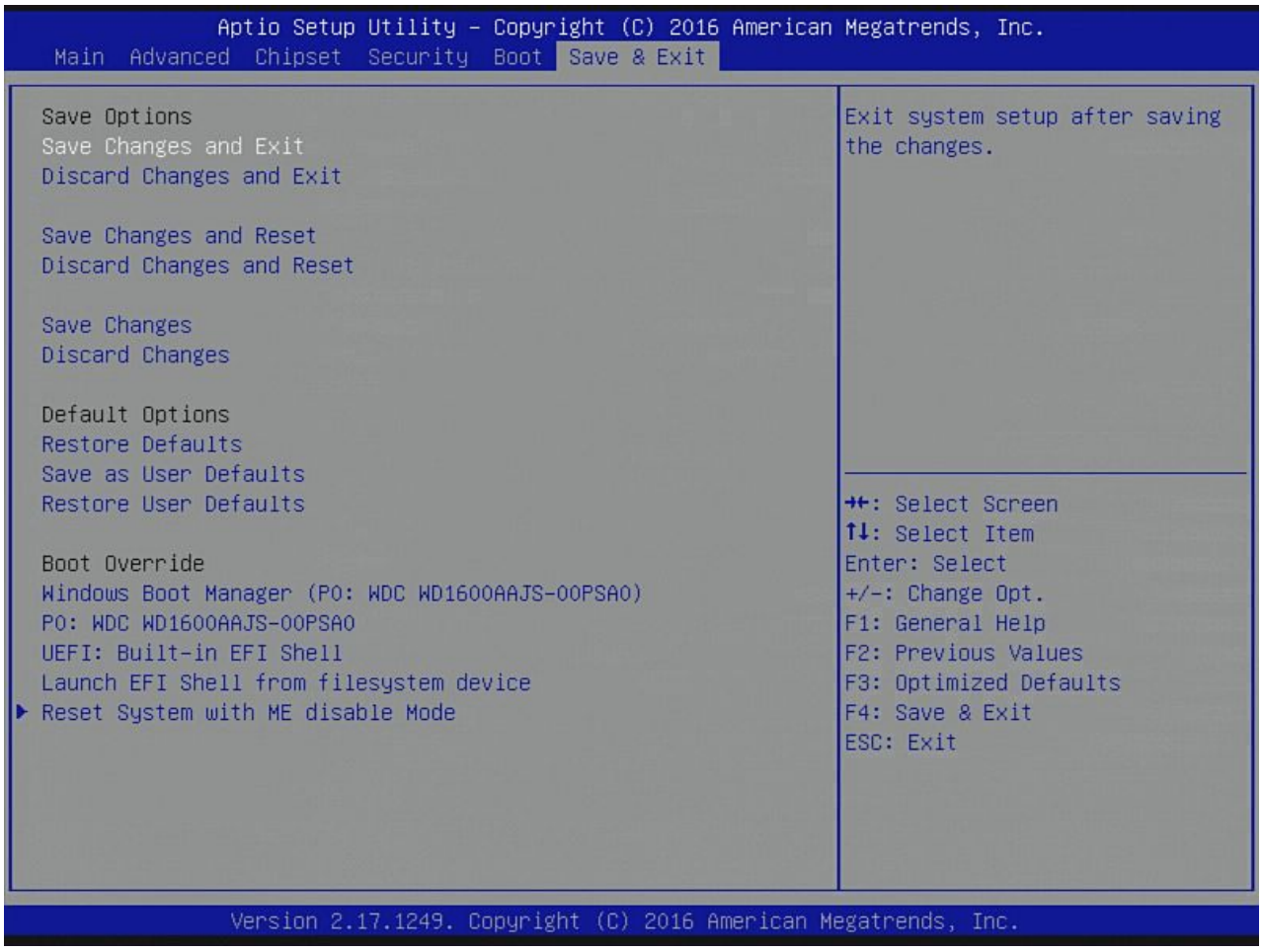
5.5.6. Boot



Feature	Options	Description
Setup Prompt Timeout	**6**	Number of seconds to wait for setup activation key 65535(0xFFF) means indefinite waiting
Bootuo NumLock State	**On** Off	Select the keyboard NumLock state
Quiet boot	**Disabled** Enabled	Enables or disables Quiet boot option
Boot Option #1	**Windows Boot manager (P0: WDC WD1600AAJS-00PSA0)** UEFI: built-in EFI Shell Disabled	Sets the system boot order
Boot Option #2	Windows Boot manager (P0: WDC WD1600AAJS-00PSA0) **UEFI: built-in EFI Shell** Disabled	Sets the system boot order
Fast boot	**Disabled** Enabled	Enables or disables boot with initialization of a minimal set of devices required to launch active boot option. Has no effect for BBS boot options.
New HDD Priority	**Low** High	Boot priority for new connected HDD.

Bootmenu Type	**Device Based** Port Based	Enables Device or Port Based Bootmenu
New Boot Option Policy	**Default** Place First Place Last	Controls the placement of newly detected UEFI boot options

5.5.7. Save & Exit



Feature	Options	Description
Save Changes and Exit	-	Exit system setup after saving the changes.
Discard Changes and Exit	-	Exit system setup without saving any changes.
Save Changes and Reset	-	Reset system after saving the changes.
Discard Changes and Reset	-	Reset system without saving any changes.
Save Changes	-	Save Changes done so far to any of the setup options.
Discard Changes	-	Discard Changes done so far to any of the setup options.
Restore Defaults	-	Restore/Load Default values for all the setup options.
Save as User Defaults	-	Save the changes done so far as User Defaults.
Restore User Defaults	-	Restore the User Defaults to all the setup options.
Boot Override	List of all boot options	Boot directly from selected device

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Global Headquarters

KONTRON S&T AG

Lise-Meitner-Str. 3-5
86156 Augsburg
Germany
Tel.: + 49 821 4086-0
Fax: + 49 821 4086-111
info@kontron.com