Qseven
PQ7-M108
User's Guide Revision 0.2

Revision History

R0.1	Preliminary
R0.2	Revise Block Diagram/ Add Power Consumption info/ Add MTBF Prediction Modify input format

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1 Introduction

PQ7-M108, Portwell's new Qseven Module product, the successor of PQ7-M108. Qseven is an Industrial Computer On Module standard, there are two form factors, 70 x 70 mm and smaller form factor 70 x 40 mm which known as uQseven. The Qseven connector use total 230 edge fingers that mate with MXM connector. The PQ7-M108 is powered by Intel Apollo Lake platform, a new generation of its predecessor, Braswell. PQ7-M108 has many advantages such as better computing and graphics engine, 4K display (3840 x 2160 @ 30Hz) but lower power consumption. PQ7-M108 has on-board LPDDR4 RAM to support data transfer speeds of up to 2400MHz which is nearly 30% faster than DDR3L.

2 Block Diagram

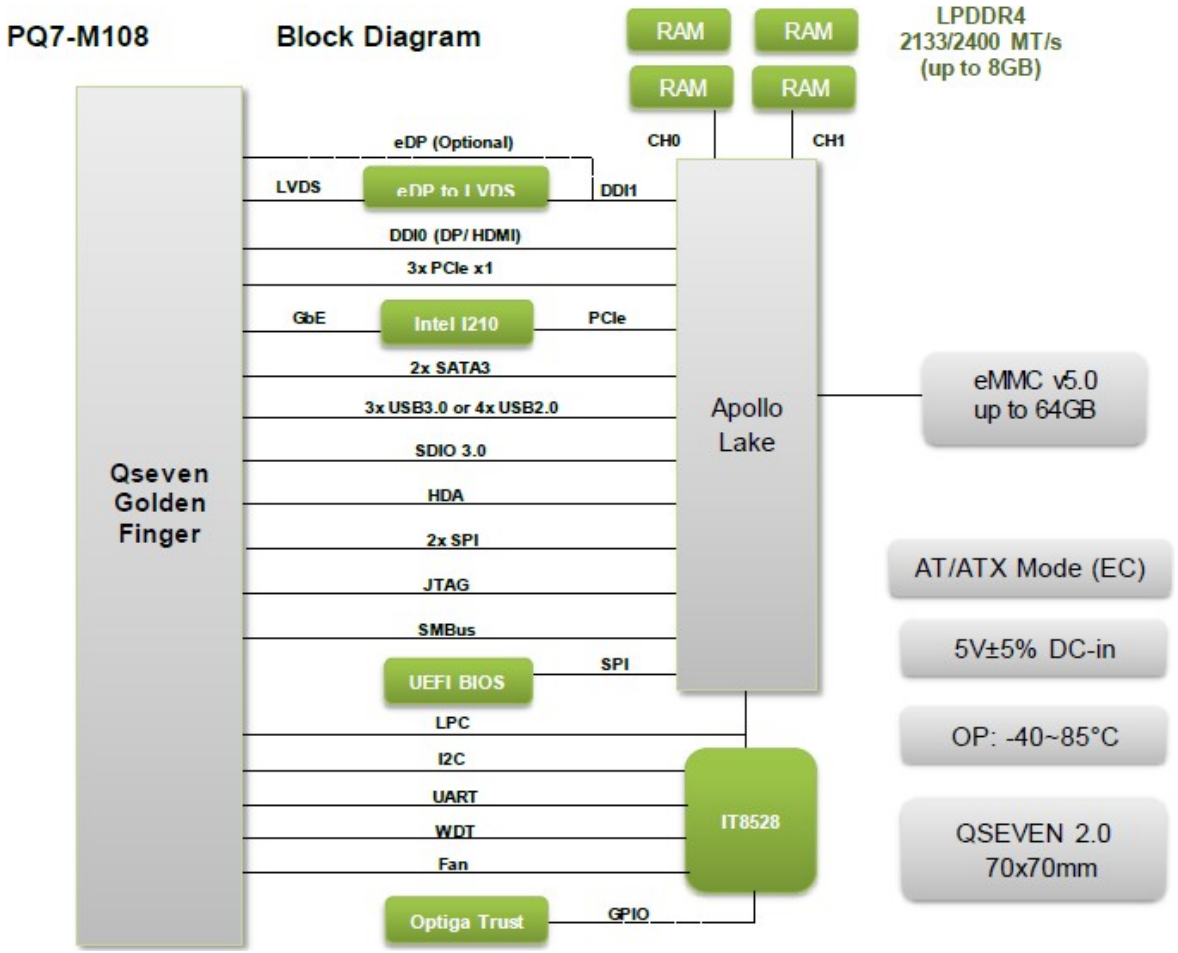

Figure 1 Block Diagram

3 Specifications

Product	➢ PQ7-M108
Form Factor	➢ Qseven v2.1 | 70 x 70mm / 2.76" x 2.76"
Processor	➢ Intel® Celeron® processor N3350 /Pentium® processor N4200 (code named Apollo Lake) ➢ Intel® Atom™ processor E3900 family (code named Apollo Lake-I) (See below section for processor list)
BIOS	➢ AMI Aptio5 BIOS
Memory	➢ On Board LPDDR4 Non-ECC ➢ 2GB | 4GB | 8GB (Optional)
Storage	➢ On Board eMMC v5.0 ➢ 8GB | 16GB | 32GB | 64GB (Optional)
Graphics Options	➢ Single/Dual channel LVDS @ 18/24 bit * ➢ eDP 1.3 (3840 x 2160p @ 60Hz) (signal shared with LVDS by BOM select) ➢ DP 1.2 (4096 x 2160 @ 60Hz)* ➢ HDMI 1.4b (3840 x 2160 @ 30Hz) (signal shared with DP by jumper or active connector on carrier) Note: * as default setting
Ethernet	➢ GbE ; Intel I210-AT/IT
Audio	➢ Intel® High Definition Audio

Serial IO	➢ LPC ➢ I2C ➢ Serial Ports (TX / RX) ➢ SMBus
PCI Express	➢ 4 PCI Express x1 Gen2 (5.0 GT/s)
USB	➢ 4 x USB2.0 (480 Mbps) ➢ 3 x USB3.0 (5 Gbps)
SATA	➢ 2 x SATA3.0 (6 Gbps)
Power DC IN	➢ +5VDC ± 5%
Hardware Monitors	➢ ITE 8528 Embedded Controller, Voltage, Fan and Temperature
Power Management	➢ ACPI 5.0
Environment	➢ Operating Temperature 0 C ~ 60 C (processor dependent) ➢ Storage Temperature 0 C ~ +60 C ➢ Relative Humidity 5%~95%

Table 1 PQ7-M108 Specification

3.1 PQ7-M108 Processor & Chipset list

PQ7-M108 Processor list	Intel® Atom™ x5-E3930	Intel® Atom™ x5-E3940	Intel® Atom™ x7-E3950	Intel® Pentium® N4200	Intel® Celeron® N3350
Performance					
# of Cores	2	4	4	4	2
# of Threads	2	4	4	4	2
Processor Base Frequency	1.30 GHz	1.60 GHz	1.60 GHz	1.10 GHz	1.10 GHz
Burst Frequency	1.80 GHz	1.80 GHz	2.00 GHz	2.50 GHz	2.40 GHz
Cache	2 MB L2	2 MB L2	2 MB L2	2 MB L2	2 MB L2
TDP	6.5 W	9.5 W	12 W	6 W	6 W
Scenario Design Power (SDP)				4 W	4 W
Memory Specifications					
Max Memory Size (dependent o	8 GB	8 GB	8 GB	8 GB	8 GB
Memory Types	LPDDR4 up to 2133 MT/s	LPDDR4 up to 2133 MT/s	LPDDR4 up to 2400 MT/s	LPDDR4 up to 2400 MT/s	LPDDR4 up to 2400 MT/s
Max # of Memory Channels	4	4	4	2	2
Graphics Specifications					
Processor Graphics ‡	Intel® HD Graphics 500	Intel® HD Graphics 500	Intel® HD Graphics 505	Intel® HD Graphics 505	Intel® HD Graphics 500
Graphics Base Frequency	400.00 MHz	400.00 MHz	500.00 MHz	200.00 MHz	200.00 MHz
Graphics Burst Frequency	550.00 MHz	600.00 MHz	650.00 MHz	750.00 MHz	650.00 MHz
Graphics Video Max Memory	2 GB	2 GB	2 GB	8 GB	8 GB
Graphics Output	LVDS/eDP/DP/HDMI	LVDS/eDP/DP/HDMI	LVDS/eDP/DP/HDMI	LVDS/eDP/DP/HDMI	LVDS/eDP/DP/HDMI
Execution Units	2	2	2	2	2
4K Support	Yes, at 60Hz	Yes, at 60Hz	Yes, at 60Hz		
Expansion Options					
PCI Express Revision	2.0	2.0	2.0	2.0	2.0
PCI Express Configurations ‡	1x4 or 4x1	1x4 or 4x1	1x4 or 4x1	1x4 or 4x1	1x4 or 4x1

Table 2 PQ7-M108 Processor list

3.2 Supported Operating Systems

The PQ7-M108 supports the following operating systems.

Category	Operating System	Supported
Microsoft	Windows 10 Enterprise (64bit)	Yes
Linux	Yocto Project BSP tool-based embedded Linux distribution (64-bit)	TBD

Table 3 Supported Operating Systems

3.3 Windows OS driver

Please download the drivers from Portwell website

http://drivers.Portwell.com/IPC_Driver/PQ7/PQ7_M108/

Item	Driver version	Description
Chipset	10.1.1.35	WIN10 x86,x64
Graphic	21.22.16.4550	WIN10 x64
Audio	6.0.1.8135	WIN10 x64
TXE_Driver	3.0.10.1129	WIN10 x64
LAN I210	21.1.30.0	WIN10
Serial IO Driver	30.100.1631.3	WIN10

Table 4 Windows OS driver list

3.4 Electrical Characteristics

Input voltage	+5VDC ± 5%
RTC Battery Consumption	6uA
Power on mode	AT / ATX

Table 5 Electrical Characteristics

3.5 Power sequence

ATX Mode for 1st Power on

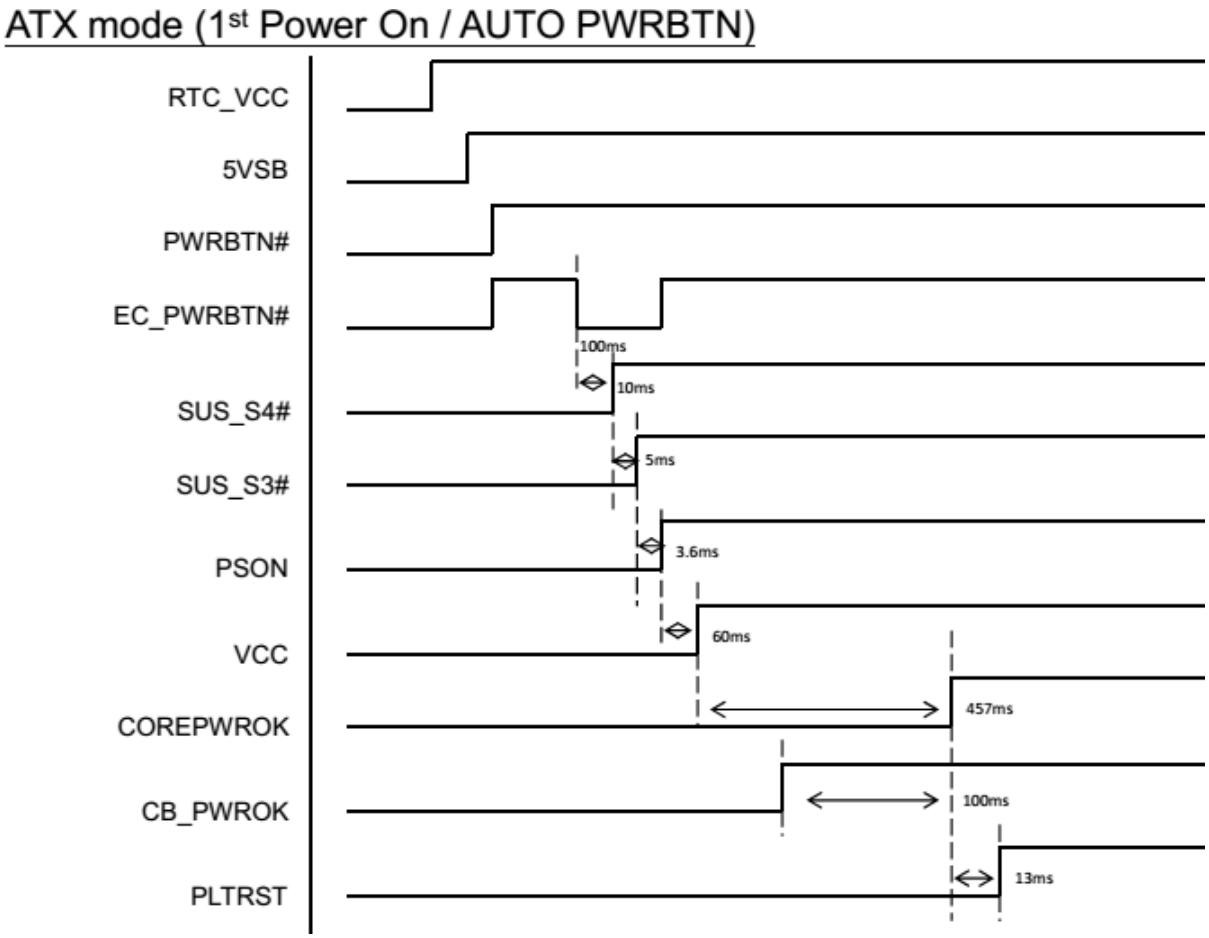

Figure 2 Power sequence ATX Mode (1st Power On)

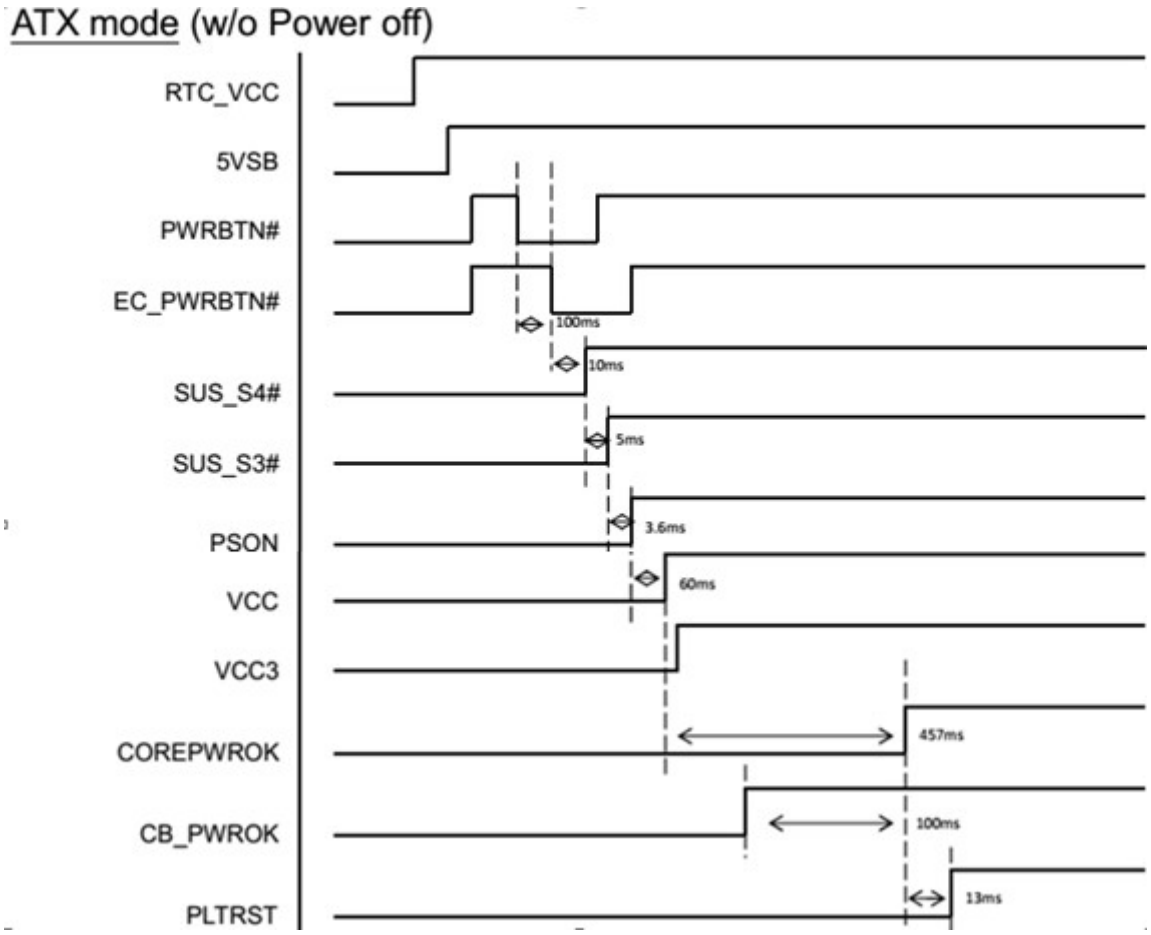

Figure 3 Power sequence ATX Mode (w/o power off)

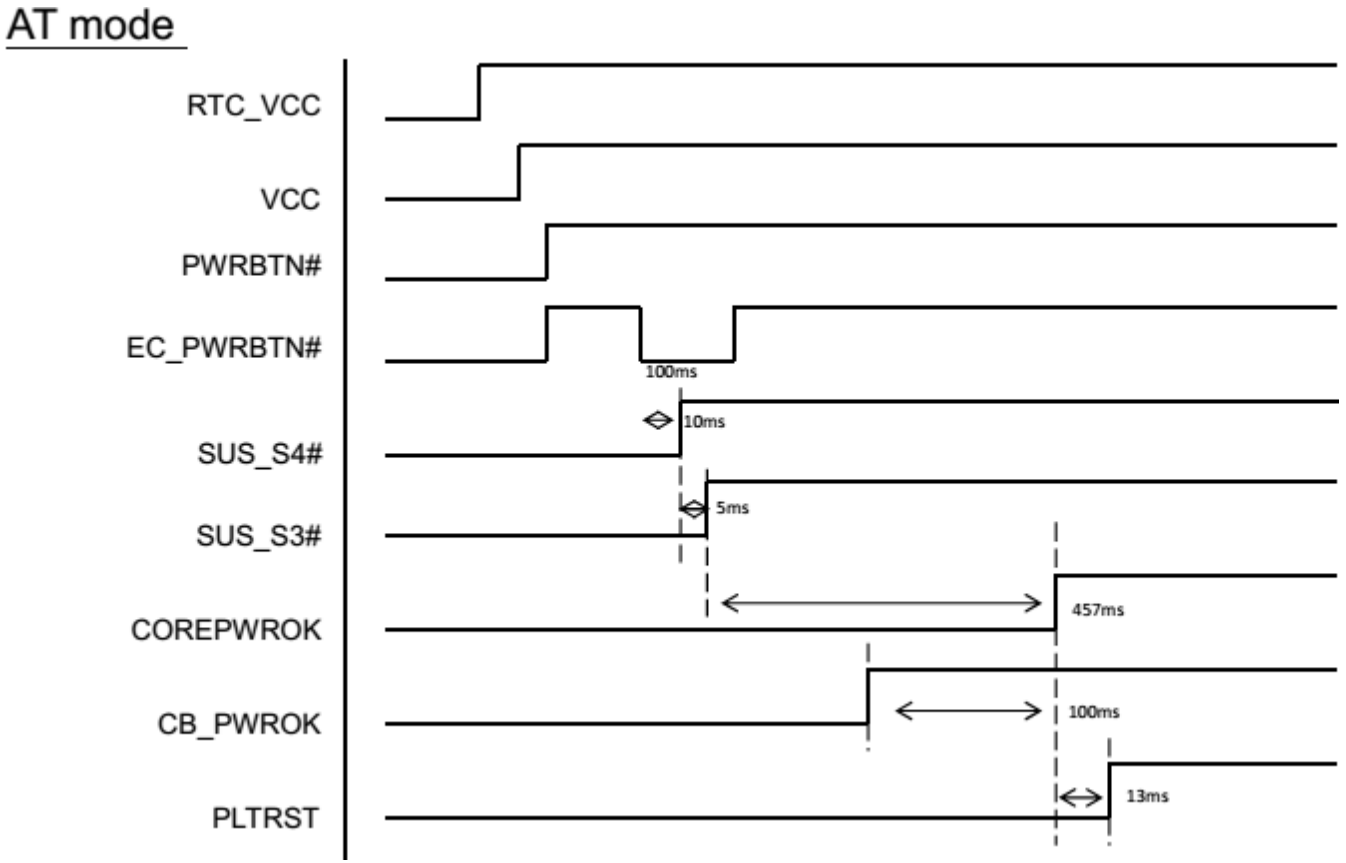

Figure 4 Power sequence AT Mode

3.6 Power Consumption

The power consumption values were measured with the following setup:

- PQ7-M108 COM
- PQ7-C201 carrier board
- Portwell cooling solution
- Microsoft Windows 10 (UEFI, 64-bit)

※Different carrier and BIOS setup may lead to different power consumption and CPU frequency result.

MAX Mode	S0 (Watt)	S0 Peak (Watt)	S3 (Watt)	Frequency (S0)
Intel® Celeron® Processor N3350	28.2	29.5	3.7	2.3 GHz
Intel® Pentium® Processor N4200	26.9	27.9	2.0	2.0 GHz
Intel® Atom™ x5-E3930 Processor	25.8	27.4	3.7	1.8 GHz
Intel® Atom™ x5-E3940 Processor	TBA	TBA	TBA	1.8 GHz
Intel® Atom™ x7-E3950 Processor	25.1	26.4	2.2	1.8 GHz

IDLE Mode	S0 (Watt)	S0 Peak (Watt)	S3 (Watt)	Frequency (S0)
Intel® Celeron® Processor N3350	11.5	12.1	3.5	1.1 GHz
Intel® Pentium® Processor N4200	10.1	10.8	2.8	1.1 GHz
Intel® Atom™ x5-E3930 Processor	11.3	12.0	3.4	
Intel® Atom™ x5-E3940 Processor	TBA	TBA	TBA	1.3 GHz
Intel® Atom™ x7-E3950 Processor	10.6	11.6	2.9	1.3 GHz

IDLE/ Max is defined as following table:

	IDLE	Max
BIOS	None Turbo* & Mini cores**	Turbo* & Full cores**
USB	K/M x1	K/M x1 + USB3.0 Dummy load
COM	NA	RS 232 (COM3)
LAN	NA	LAN cable to other system
SD Card	NA	Read/Write test by Burn-in

*Non Turbo: EIST & Turbo & C-state set "disable"

Turbo: EIST & Turbo set "enable", C-state & Power limit set "disable"

**Mini cores: Active core set "1"

Full Cores: Active core set "full"

***The fan and SATA drives were powered externally.

3.7 Mean-Time-Between-Failure Prediction

Applicable Model	All PQ7-M108 series module
Prediction Standard	Bellcore TR-332, Issue 6 (SR-332 Issue 1), Electronics
Environment	Temperature: 40°C, Level 1
Failure Rate	4.977 (FPMH)
MTBF	200,944.375 (hrs)

Table 6 MTBF Prediction

* An MTBF measurement is based on a statistical sample and is not intended to predict any one specific unit's reliability; thus MTBF is not, and should not be construed as, a warranty measurement.

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3.8 Mechanical Dimensions

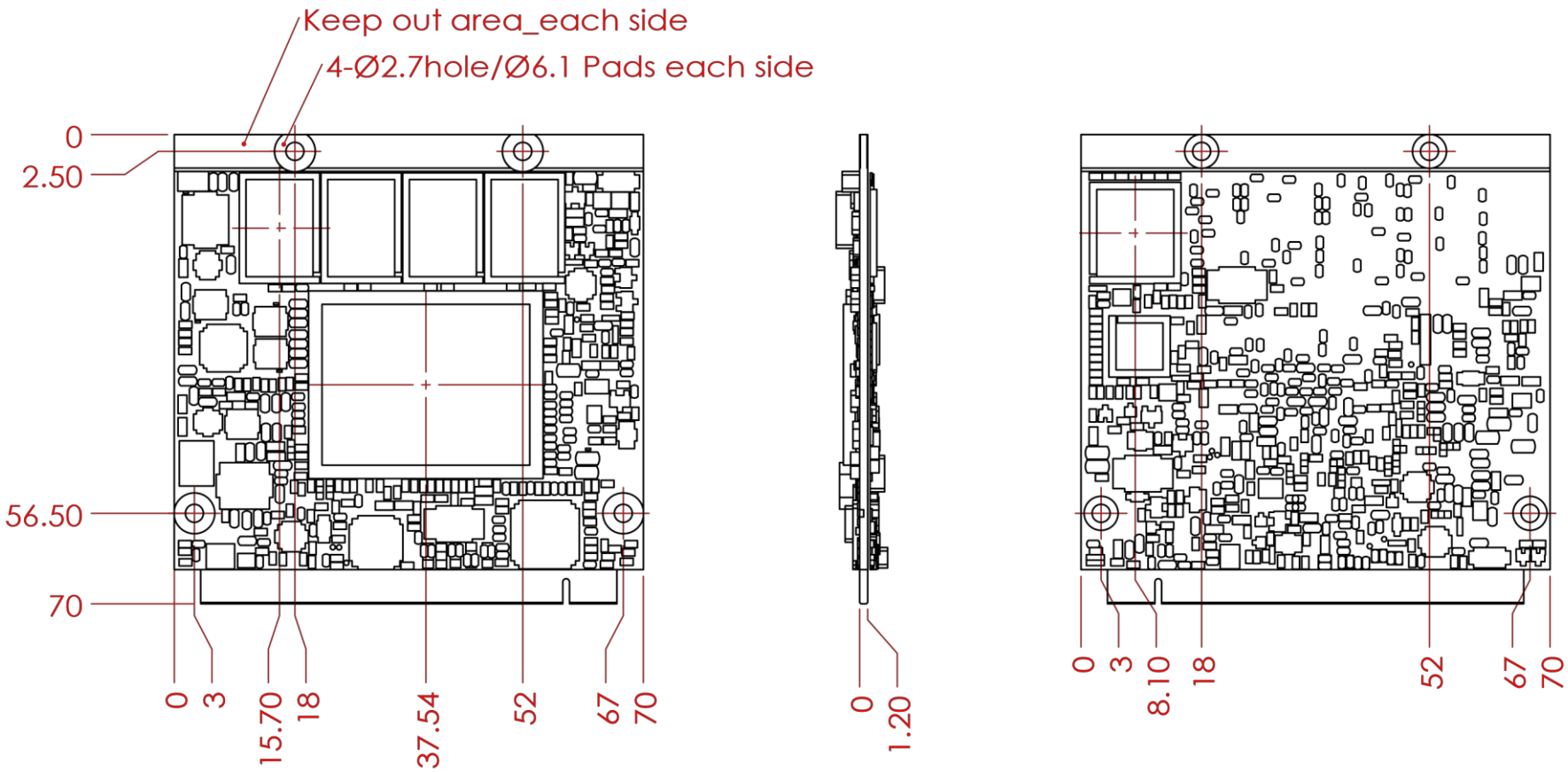


Figure 5 Mechanical Dimensions - Top/Bottom

3.9 PQ7-M108 and Coolerweight

PQ7-M108	27.0g
Heat Sink (with screws)	69.0g
Heat Spreader (with screws)	61.5g
Heat Sink + Heat spreader (with screws)	131.0g

Table 7 Net weight

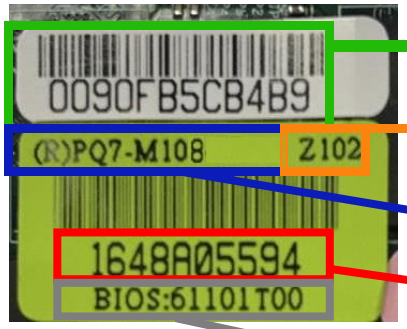
3.10 Environmental Specifications

Storage Temperature	0 ~ 50°C (APL) | -40 ~ 85°C (APL-I) (board level only)
Operation Temperature	0 ~ 50°C (APL) | -40 ~ 85°C (APL-I) (board level only)
Storage Humidity	0% ~ 95%
Operation Humidity	0% ~ 95%

✻Processor frequency performance may decrease when operation temperature over 50°C under different thermal solutions

Table 8 Environmental Specifications

3.11 Label Definition



MAC LABEL

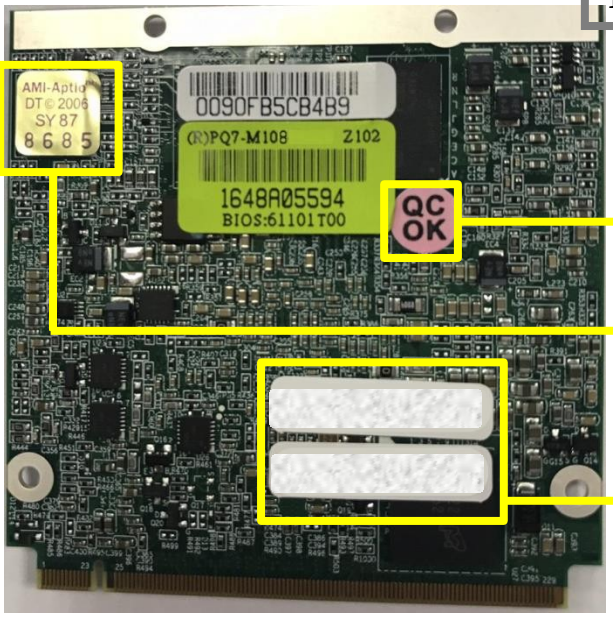
BOARD REVISION

PRODUCT NUMBER

SERIAL NUMBER

BIOS VERSION

MAC and S/N LABEL



QC LABEL

BIOS AUTHORITY LABEL

CUSTOMER LABEL BY REQUEST

4 Heat sink / Cooler dimensions

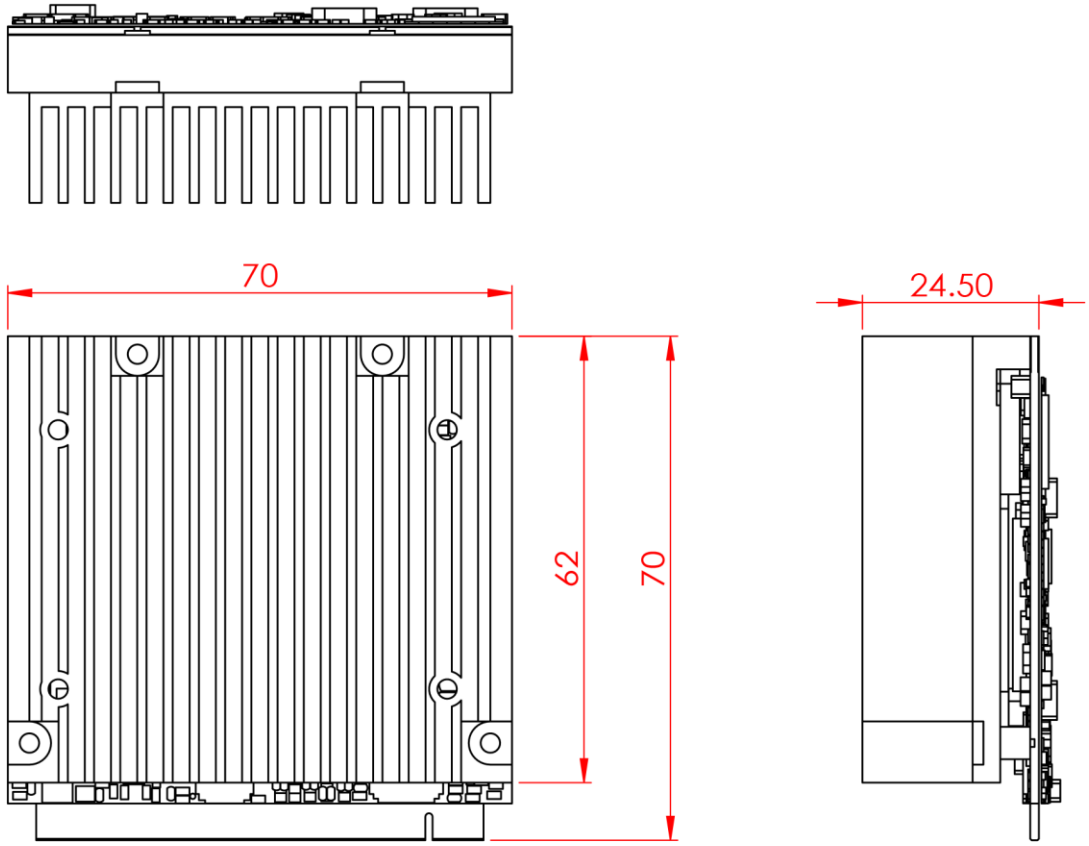


Figure 6 Heat sink / cooler mechanical dimensions

4.1 H/S Assembly Guide

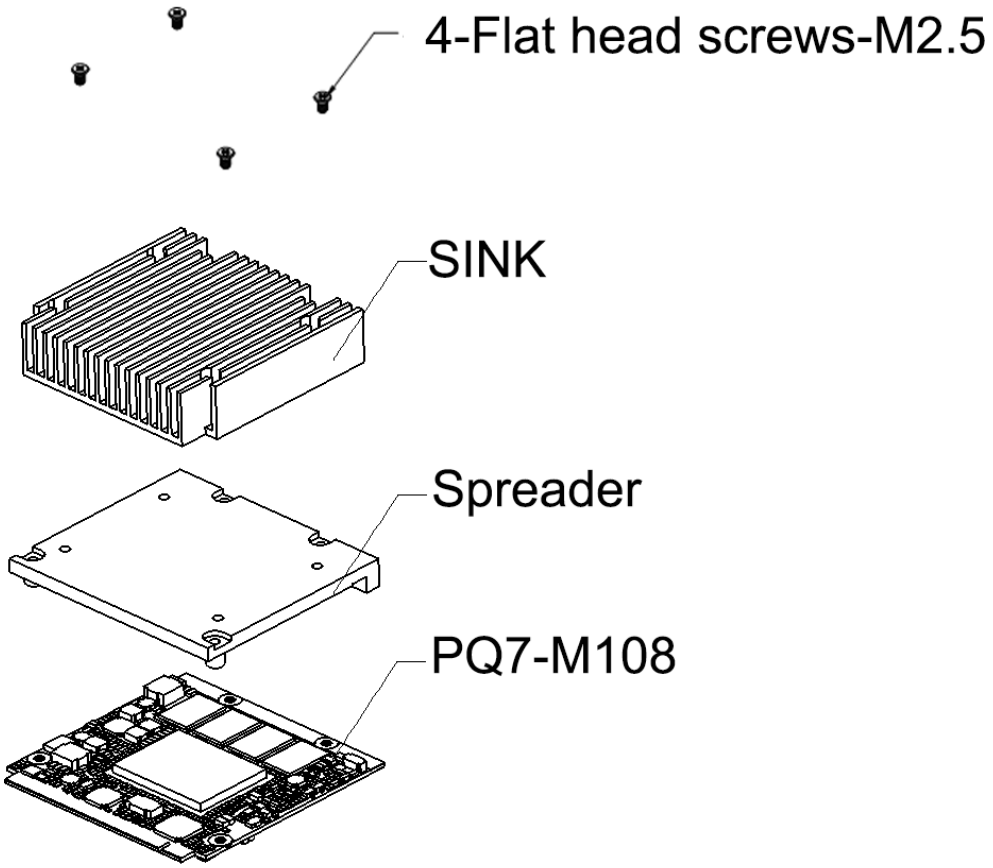


Figure 7 H/S Assembly guide

4.2 Packaging

Package	Appearance	Size
Anti-Static bubble bag		180x135mm
White Paper Box		210x151x40mm
Shipping Box (10 pcs White paper box)		595x300x195mm

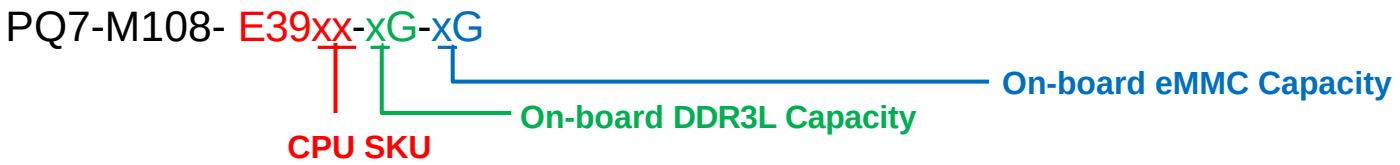
Table 9 Packaging

4.3 Ordering Guide

PQ7-M108

Product	Ordering P/N	Status
PQ7-M108-N3350-4G-8G	AB7-3019Z	Contact Us
PQ7-M108-N4200-4G-8G	AB7-3054Z	Contact Us
PQ7-M108-E39xx-xG-xG	TBA	TBA

Table 10 Ordering Guide - PQ7-M108



Accessory

Product	Ordering P/N	Status
PQ7-M108 Heat Spreader	B8308940 (for N3350/N4200) B8309030 (for E3930/E3940/E3950)	Available
PQ7-M108 Heat Sink Set (N3350/N4200)	B8308970 (for N3350/N4200) B8308980 (for E3930/E3940/E3950)	Available
PQ7-C201	AB1-3B45	Available

Table 11 Ordering Guide - Accessory

5 Pin out Tables

PIN	SIGNAL	GROUP	PIN	SIGNAL	GROUP
1	GND		2	GND	
3	L1_MDI3_N	LAN	4	L1_MDI2_N	LAN
5	L1_MDI3_P		6	L1_MDI2_P	
7	L1_100#		8	L1_1000#	
9	L1_MDI1_N		10	L1_MDI0_N	
11	L1_MDI1_P		12	L1_MDI0_P	
13	L1_LINK#		14	L1_LINK#/ACT#	
15	NC		16	KBC_SLP_S4#	
17	WAKE1#		18	KBC_SLP_S3#	
19	ICH_SUS_STAT_N		20	PWRBTN#_D	
21	ICH_PME_N		22	LID#_R	
23	GND		24	GND	
KEY					
25	GND		26	ATX_PWROK	
27	BATLOW_N_3P3		28	SYS_RESET_N	
29	SATA_TXP0	SATA	30	SATA_TXP1	SATA
31	SATA_TXN0		32	SATA_TXN1	
33	SATA_LED_N		34	GND	
35	SATA_RXP0		36	SATA_RXP1	
37	SATA_RXN0		38	SATA_RXN1	
39	GND		40	GND	
41	BIOS_DISABLE		42	SD3_CLK	SD
43	SD3_CD#	SD	44	NC	
45	SD3_CMD		46	SD3_WP	
47	SD2_PWREN_3P3		48	SD3_D1	

Table 12 PQ7-M108 Pin-out 1-5

PIN	SIGNAL	GROUP	PIN	SIGNAL	GROUP
49	SD3_D0		50	SD3_D3	SD
51	SD3_D2		52	NC	
53	NC		54	NC	
55	NC		56	NC	
57	GND		58	GND	
59	HDA_SYNC_3P3	Audio	60	SMB_CLK_3P3A	SMBUS
61	HDA_RST_N_3P3		62	SMB_DATA_3P3A	
63	HDA_BIT_CLK_3P3		64	SMB_ALERT_N_EC	
65	HDA_SDIN0_3P3		66	KBC_SCL1	Audio
67	HDA_SDOUT_3P3		68	KBC_SDA1	
69	PM_THRM#_R		70	WDTRIG#	
71	NC		72	WDTO	
73	GND		74	GND	
75	USB3_TXN0	USB3.0	76	USB3_RXN0	USB3.0
77	USB3_TXP0		78	USB3_RXP0	
79	NC		80	NC	
81	USB3_TXN2	USB3.0	82	USB3_RXN2	USB3.0
83	USB3_TXP2		84	USB3_RXP2	
85	USB_OC1_N_3P3		86	USB_OC0_N_3P3	
87	USB2_DN3	USB2.0	88	USB2_DN2	USB2.0
89	USB2_DP3		90	USB2_DP2	
91	NC		92	NC	
93	USB2_DN1	USB2.0	94	USB2_DN0	USB2.0
95	USB2_DP1		96	USB2_DP0	
97	GND		98	GND	
99	LVDS_A0+	LVDS /EDP	100	LVDS0_CHB_TXP0	LVDS

Table 13 PQ7-M108 Pin-out 2-5

PIN	SIGNAL	GROUP	PIN	SIGNAL	GROUP
101	LVDS_A0-	LVDS /EDP	102	LVDS0_CHB_TXN0	LVDS
103	LVDS_A1+		104	LVDS0_CHB_TXP1	
105	LVDS_A1-		106	LVDS0_CHB_TXN1	
107	LVDS_A2+		108	LVDS0_CHB_TXP2	
109	LVDS_A2-		110	LVDS0_CHB_TXN2	
111	LVDS0_VDDEN		112	LVDS0_LIGHT_EN	LVDS /EDP
113	LVDS_A3+		114	LVDS0_CHB_TXP3	LVDS
115	LVDS_A3-		116	LVDS0_CHB_TXN3	
117	GND		118	GND	
119	LVDS_CLKA+	LVDS /EDP	120	LVDS0_CHB_CLKP	LVDS
121	LVDS_CLKA-		122	LVDS0_CHB_CLKN	
123	DDI1_BKLT_CTRL_3P3		124	NC	
125	LVDS0_DDC_DATA		126	DDI1_HPD#_CN	DP
127	LVDS0_DDC_CLK		128	NC	
129	NC		130	NC	
131	DDI0_TXP3	DP /TMDS	132	USB3_TXN1	USB 3.0
133	DDI0_TXN3		134	USB3_TXP1	
135	GND		136	GND	
137	DDI0_TXP1	DP /TMDS	138	DDI0_AUX_DP	DP
139	DDI0_TXN1		140	DDI0_AUX_DN	
141	GND		142	GND	
143	DDI0_TXP2	DP /TMDS	144	USB3_RXN1	USB 3.0
145	DDI0_TXN2		146	USB3_RXP1	USB 3.0
147	GND		148	GND	
149	DDI0_TXP0	DP /TMDS	150	DDI0_DDC_SDA	TMDS

Table 14 PQ7-M108 Pin-out 3-5

PIN	SIGNAL	GROUP	PIN	SIGNAL	GROUP
151	DDI0_TXN0	DP /TMDS	152	DDI0_DDC_SCL	TMDS
153	DDI0_HPD#		154	DDI0_HPD#	DP /TMDS
155	PCIECLK_DIFF_P0	PCIE	156	ICH_WAKE_N_R	
157	PCIECLK_DIFF_N0		158	CB_PLTRST	
159	GND		160	GND	
161	PCIE_TXP3	PCIE	162	PCIE_RXP3	PCIE
163	PCIE_TXN3		164	PCIE_RXN3	
165	GND		166	GND	
167	PCIE_TXP2	PCIE	168	PCIE_RXP2	PCIE
169	PCIE_TXN2		170	PCIE_RXN2	
171	TXDA#_EC		172	RTSA_3P3_EC	
173	PCIE_TXP1	PCIE	174	PCIE_RXP1	PCIE
175	PCIE_TXN1		176	PCIE_RXN1	
177	RXDA#_EC		178	CTSA_3P3_EC	
179	PCIE_TXP0	PCIE	180	PCIE_RXP0	PCIE
181	PCIE_TXN0		182	PCIE_RXN0	
183	GND		184	GND	
185	LAD0	LPC	186	LAD1	LPC
187	LAD2		188	LAD3	
189	LPC_CLKOUT1		190	LFRAME_N	
191	ICH_SERIRQ		192	NC	
193	V3P3_RTC	VCC_RTC	194	SPKR	
195	FAN_TACHIN	FAN	196	FAN_PWMOUT	FAN
197	GND		198	GND	
199	ICH_SPI_MOSI_3P3	SPI	200	ICH_SPI_CS0_N_3P3	SPI
201	ICH_SPI_MISO_3P3		202	ICH_SPI_CS1_N_3P3	
203	ICH_SPI_CLK_3P3		204	MXM_TRST_N	

Table 15 PQ7-M108 Pin-out 4-5

PIN	SIGNAL	GROUP	PIN	SIGNAL	GROUP
205	5VSB	VCC_5V_SB	206	5VSB	VCC_5V_SB
207	MXM_TCK		208	MXM_TDI	
209	MXM_TDO		210	MXM_TMS	
211	NC		212	NC	
213	NC		214	NC	
215	NC		216	NC	
217	NC		218	NC	
219	VCC	VCC5	220	VCC	VCC5
221	VCC		222	VCC	
223	VCC		224	VCC	
225	VCC		226	VCC	
227	VCC		228	VCC	

Table 16 PQ7-M108 Pin-out 5-5

6 BIOS Setup Items

PQ7-M108 enters the boot process by AMI Aptio5 BIOS which is stored in an EEPROM through SPI interface on Module. Boot from Carrier board is also supported; please consult with your Sales Representatives for PQ7-M108 Carrier Design Guide.

6.1 Entering Setup -- Launch System Setup

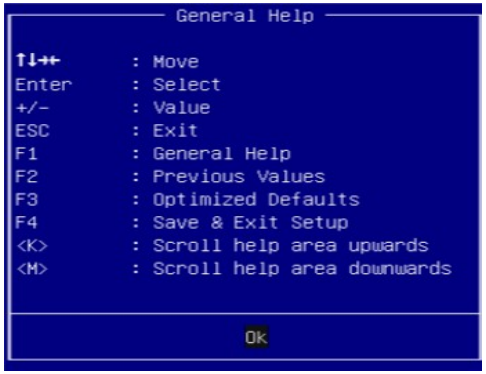
Power on PQ7-M108 Module and the system will start POST (Power On Self Test) process. When the message below appears on the screen, press <Del> key will enter BIOS setup screen.

Press <Del> to enter SETUP

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

Press <F1> to see General Help

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



6.2 Main

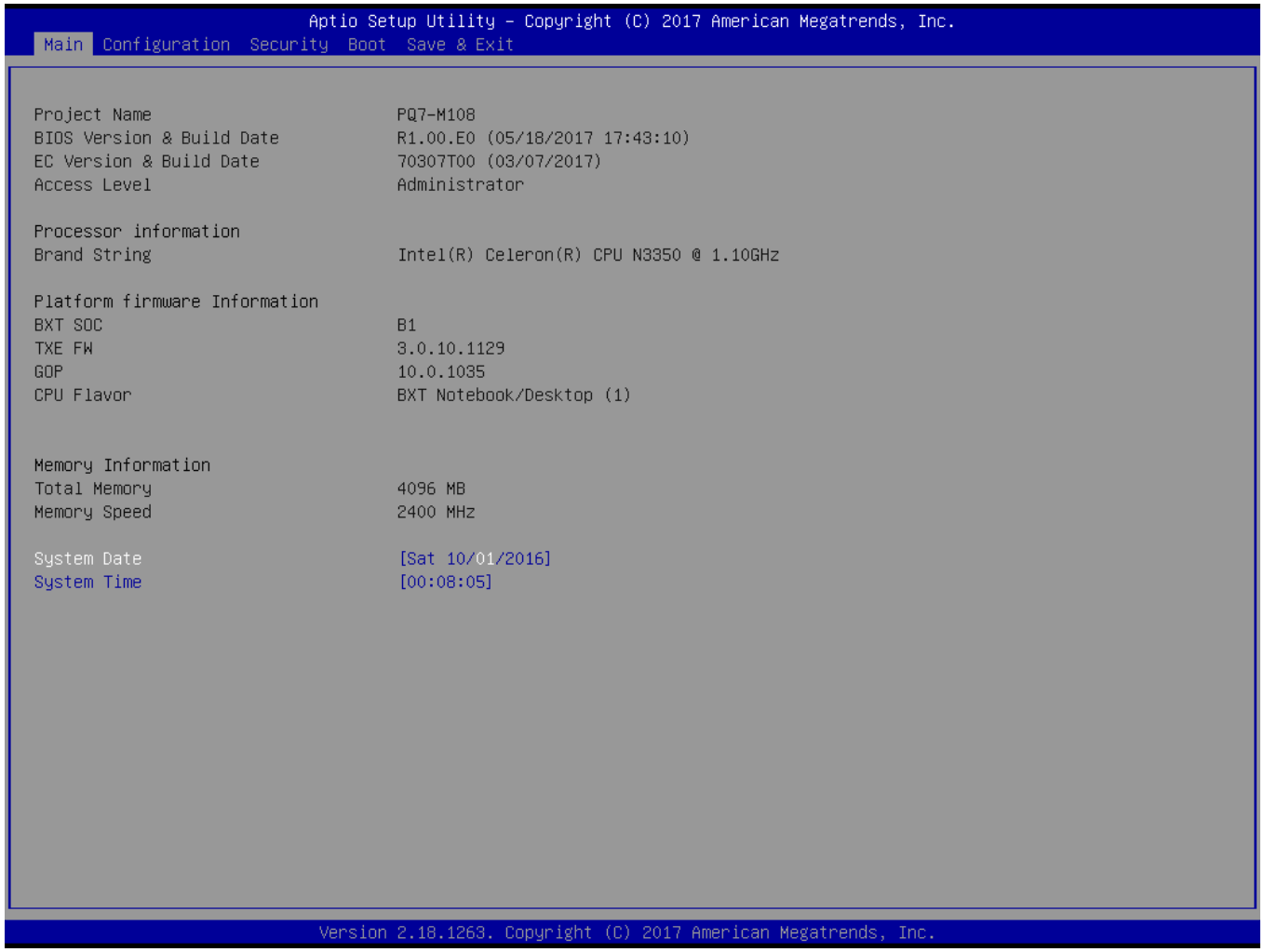


Figure 8 BIOS - Main 1-2

6.3 Configuration

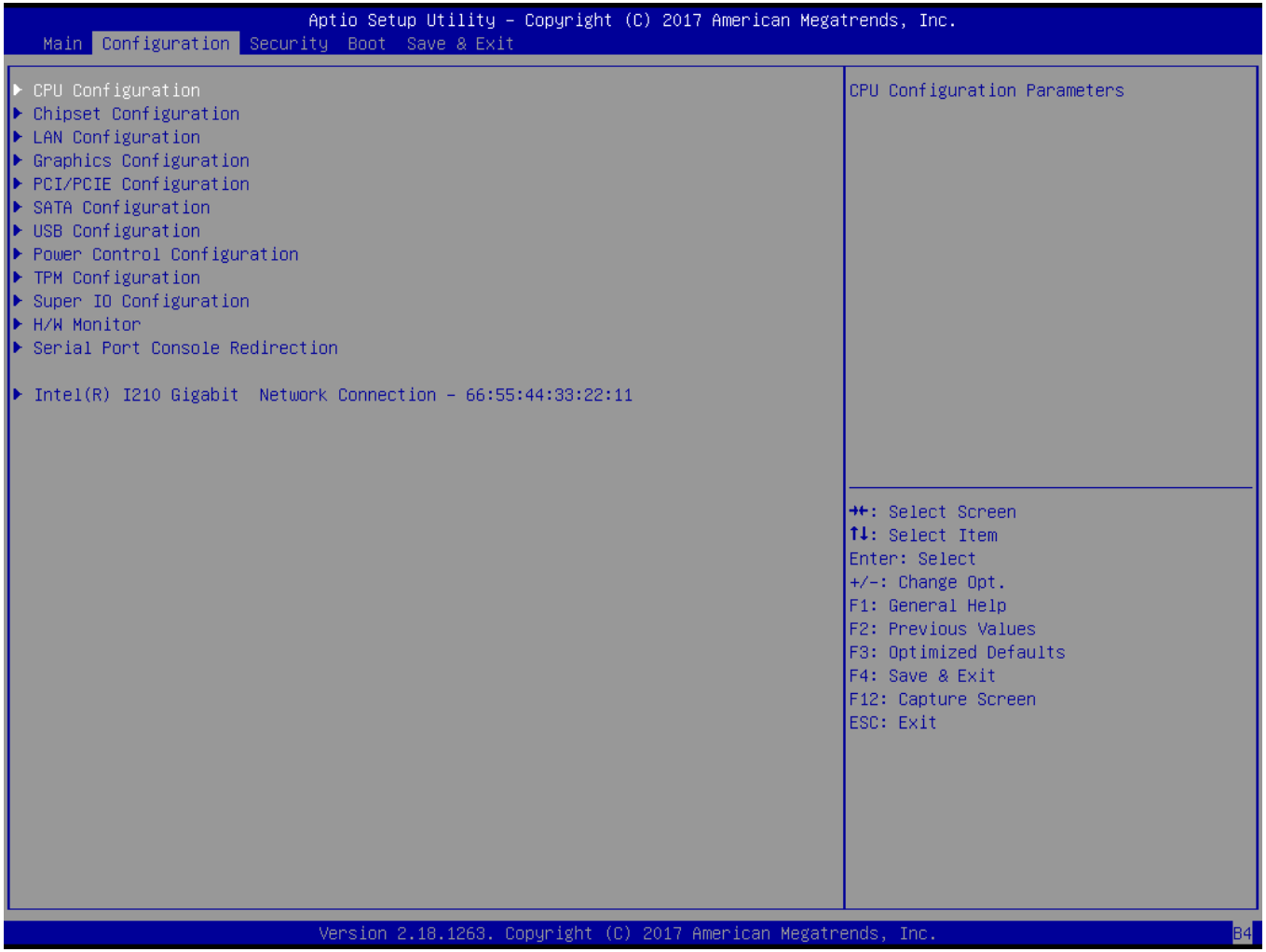


Figure 9 BIOS - Configuration

6.4 CPU

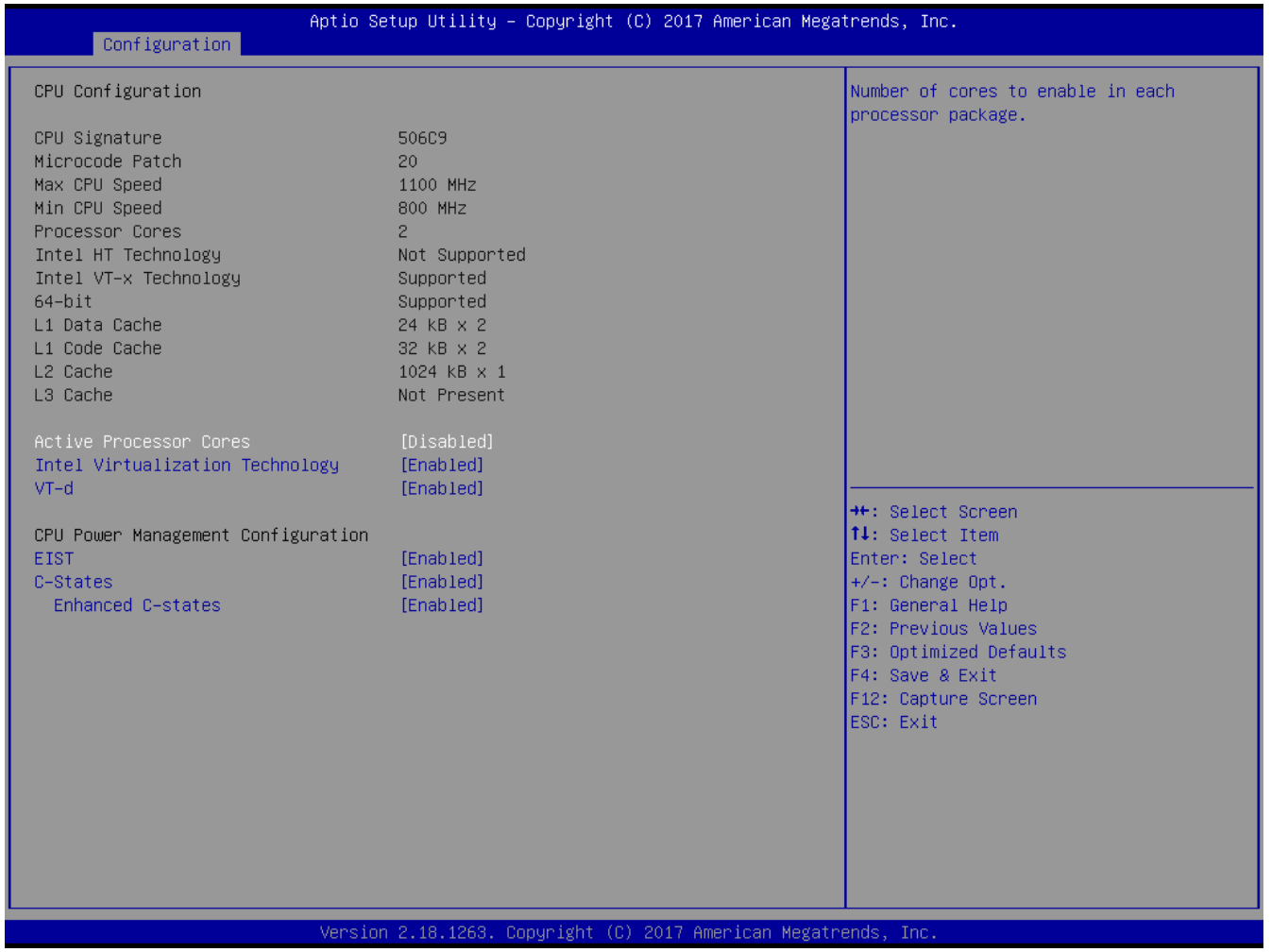


Figure 10 BIOS - Configuration - CPU 1-2

6.5 Chipset

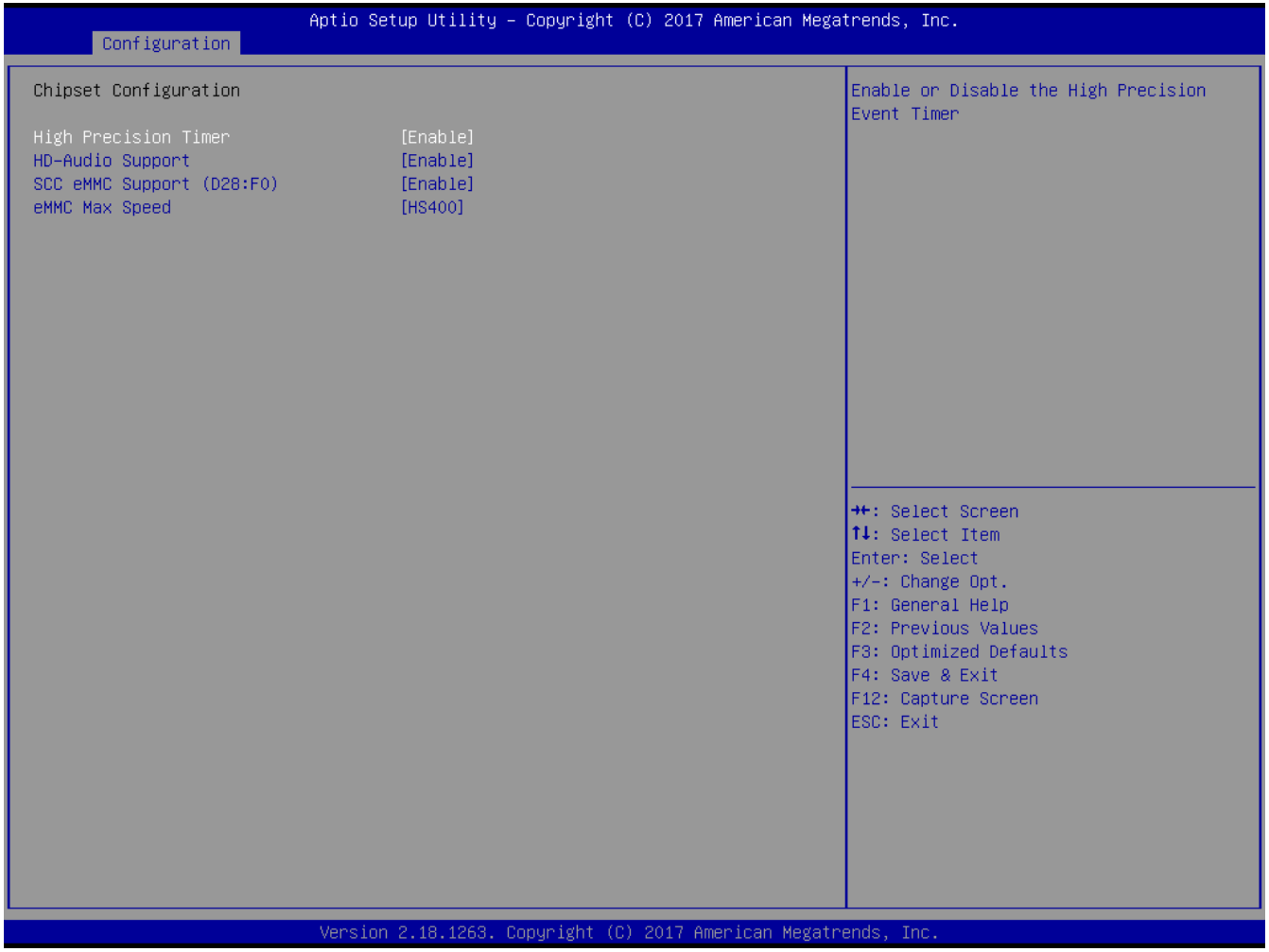


Figure 11 BIOS - Configuration - Chipset

6.6 LAN

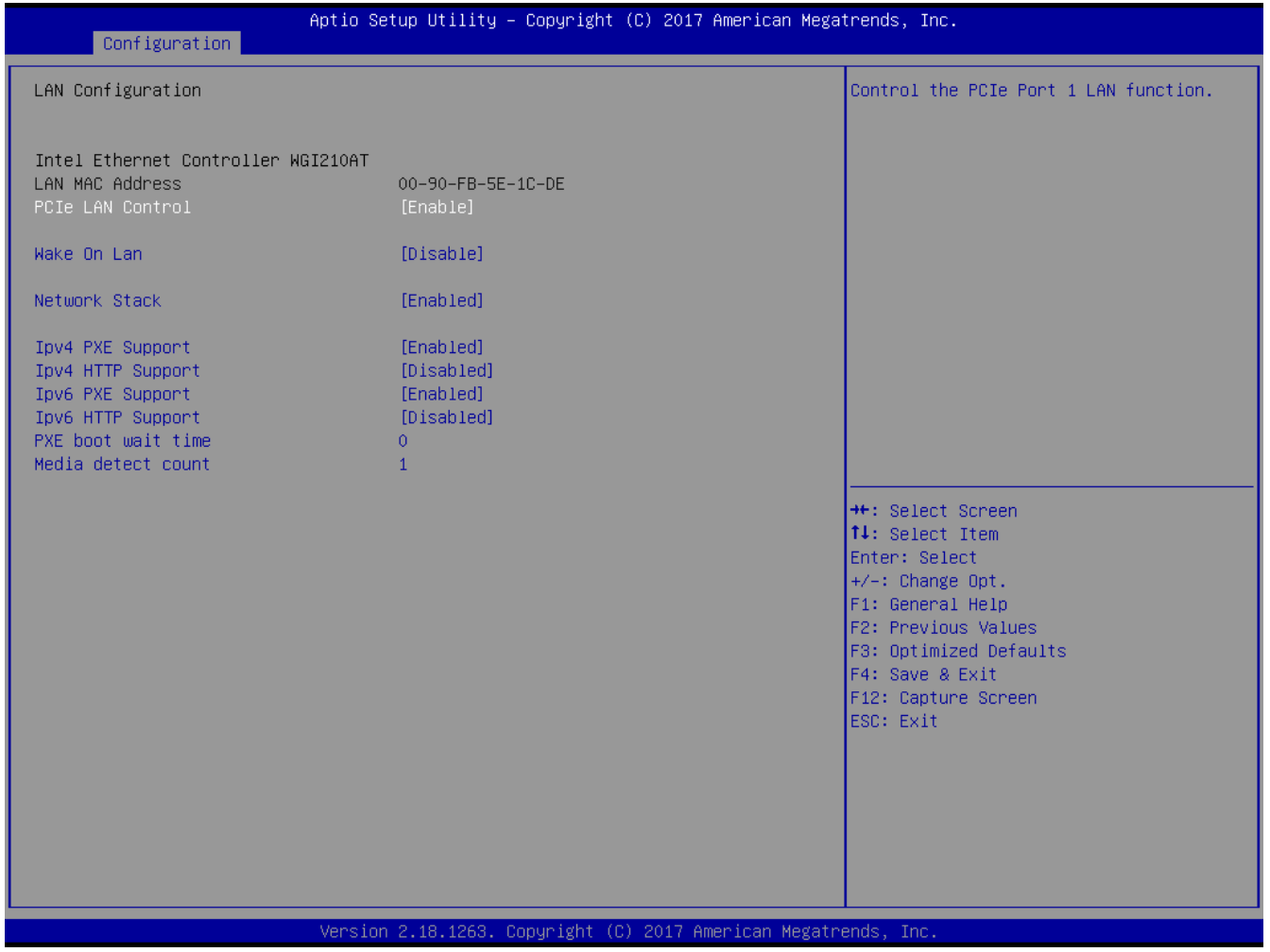


Figure 12 BIOS - Configuration - LAN

6.7 Graphics

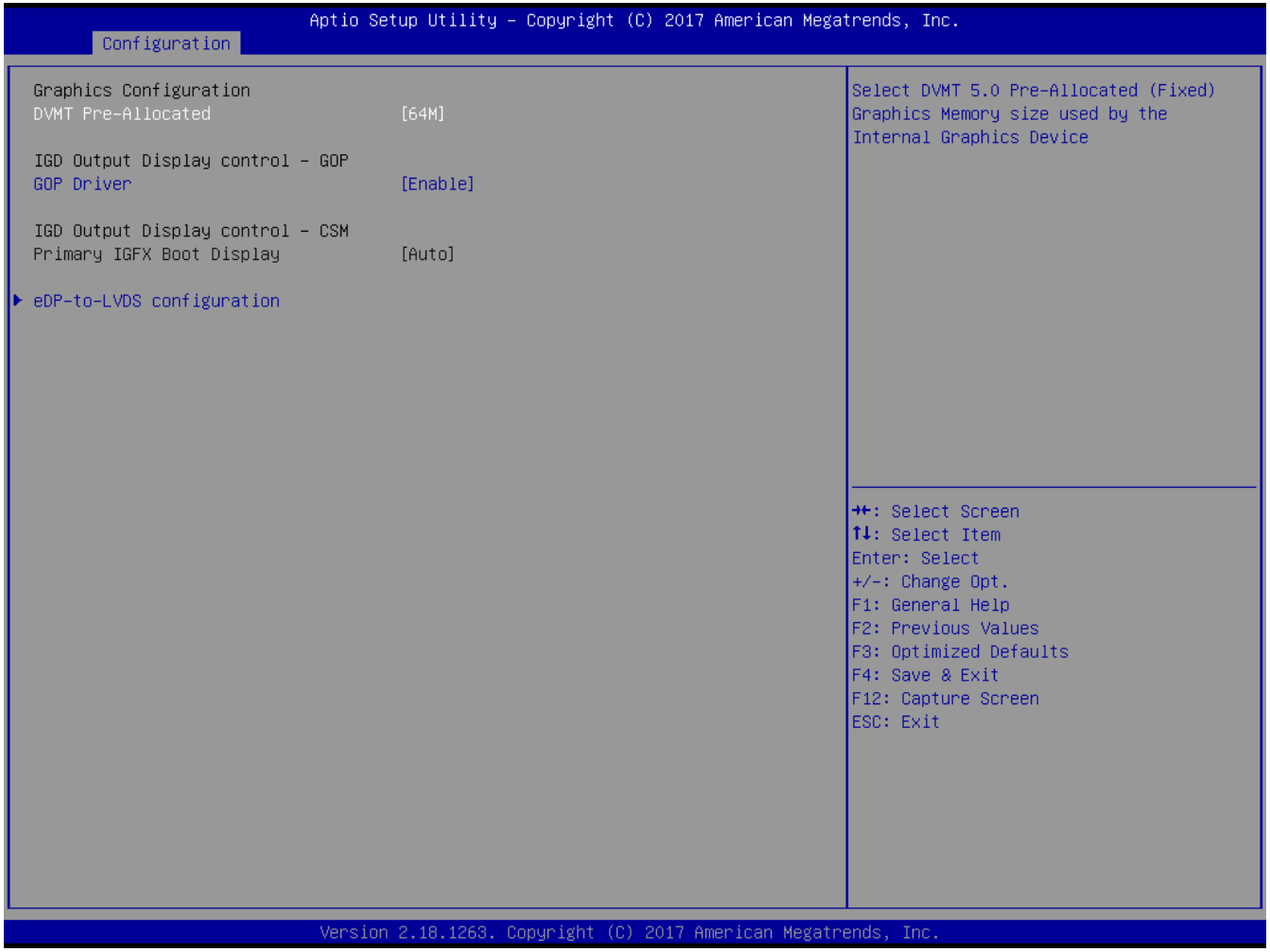


Figure 13 BIOS - Configuration – Graphics

6.7.1 eDP-to-LVDS configuration

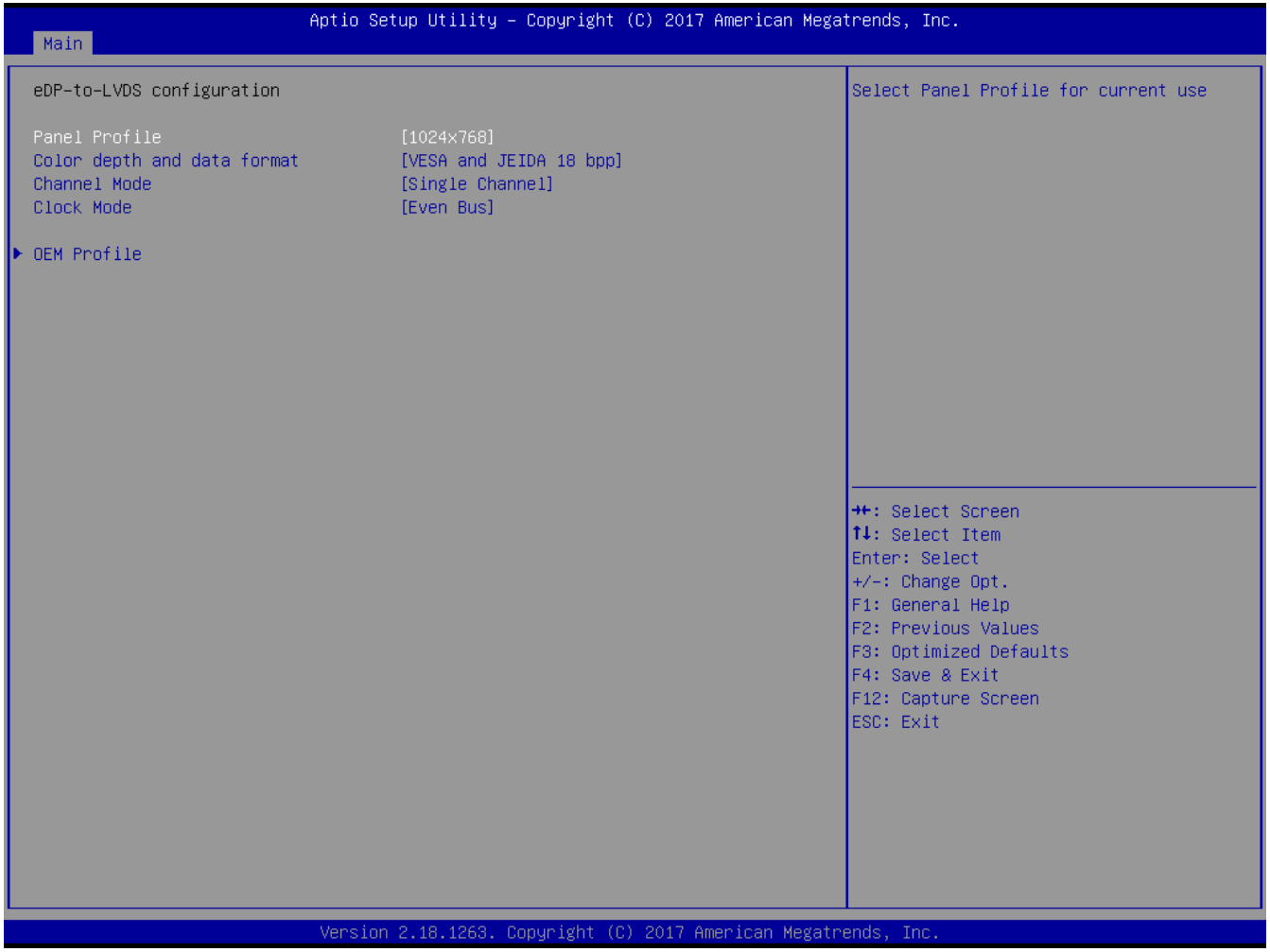


Figure 14 BIOS - Graphics - eDP-to-LVDS configuration

6.7.2 OEM Profile

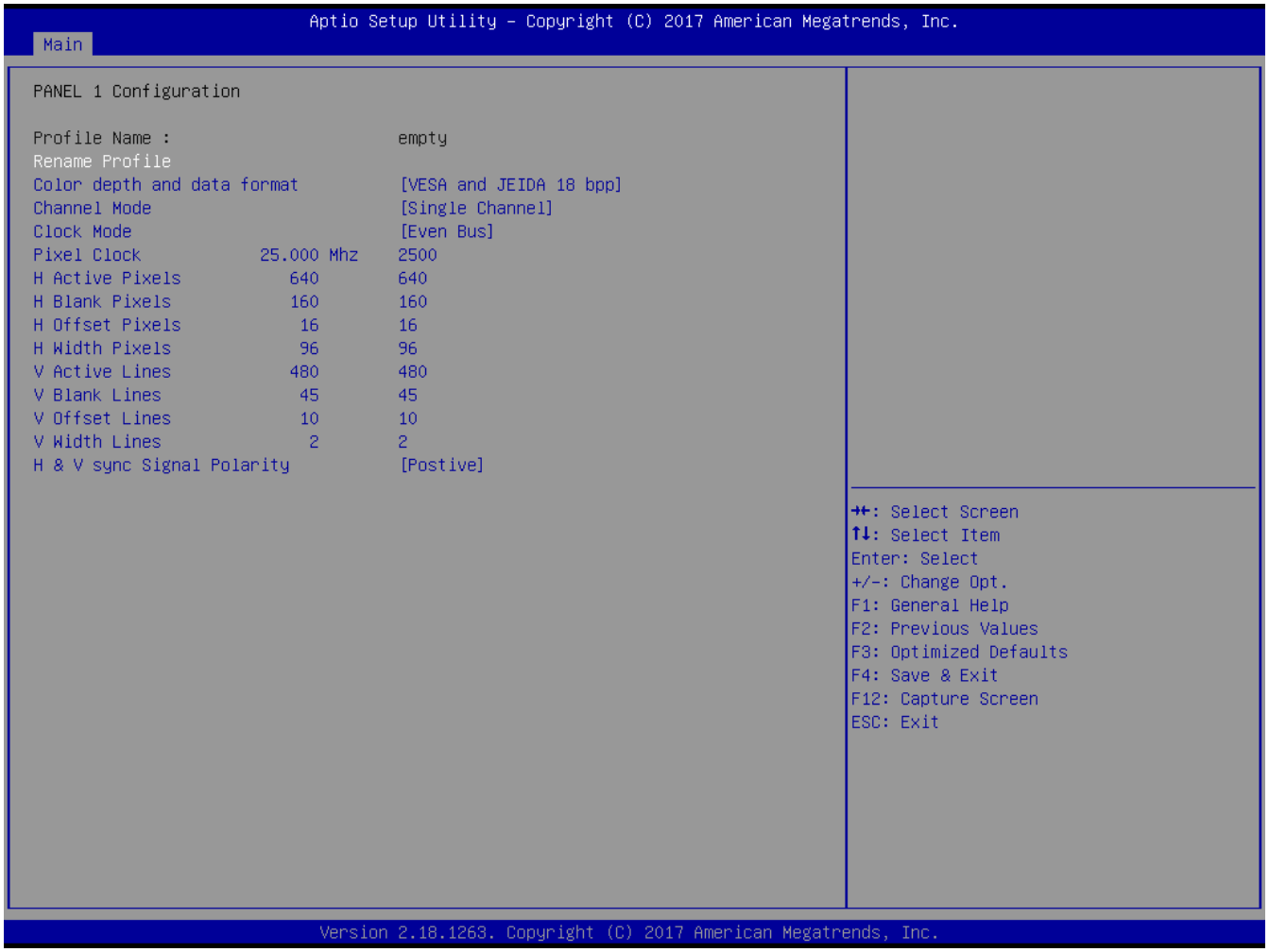


Figure 15 BIOS - PTN3460 - OEM

6.8 PCIE

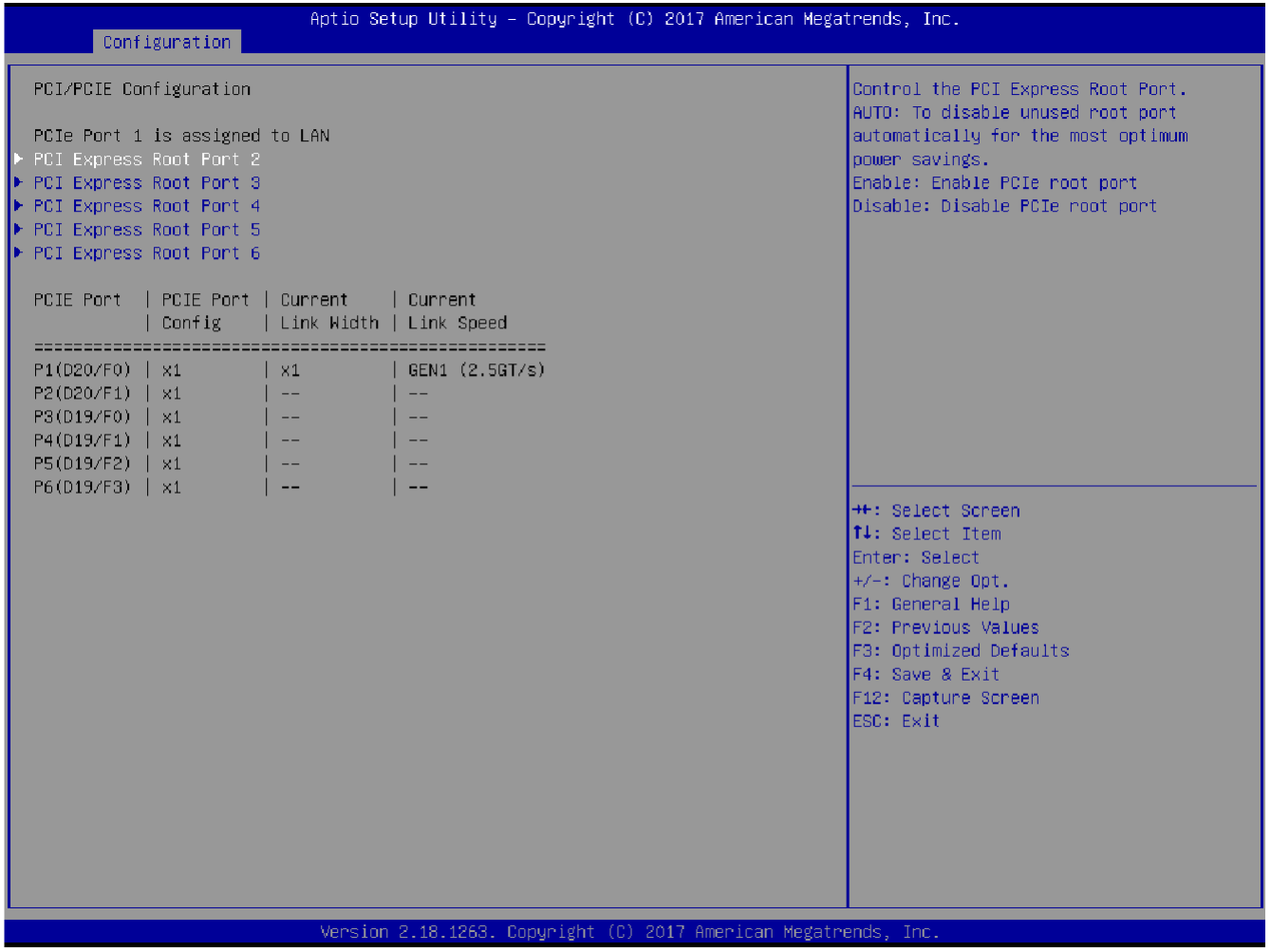


Figure 16 BIOS - Configuration - PCIE 1-2

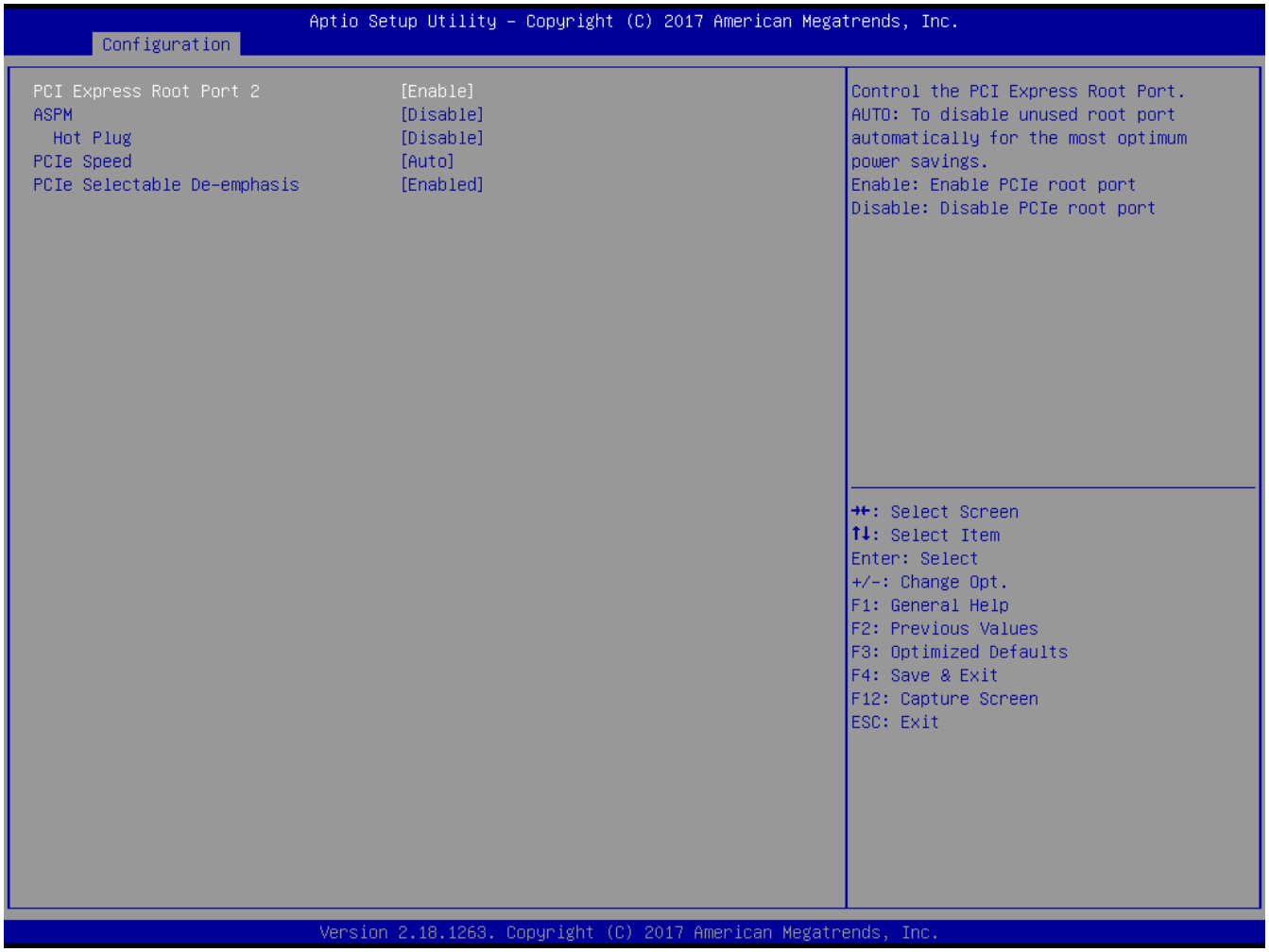


Figure 17 BIOS - Configuration - PCIE 2-2

6.9 SATA

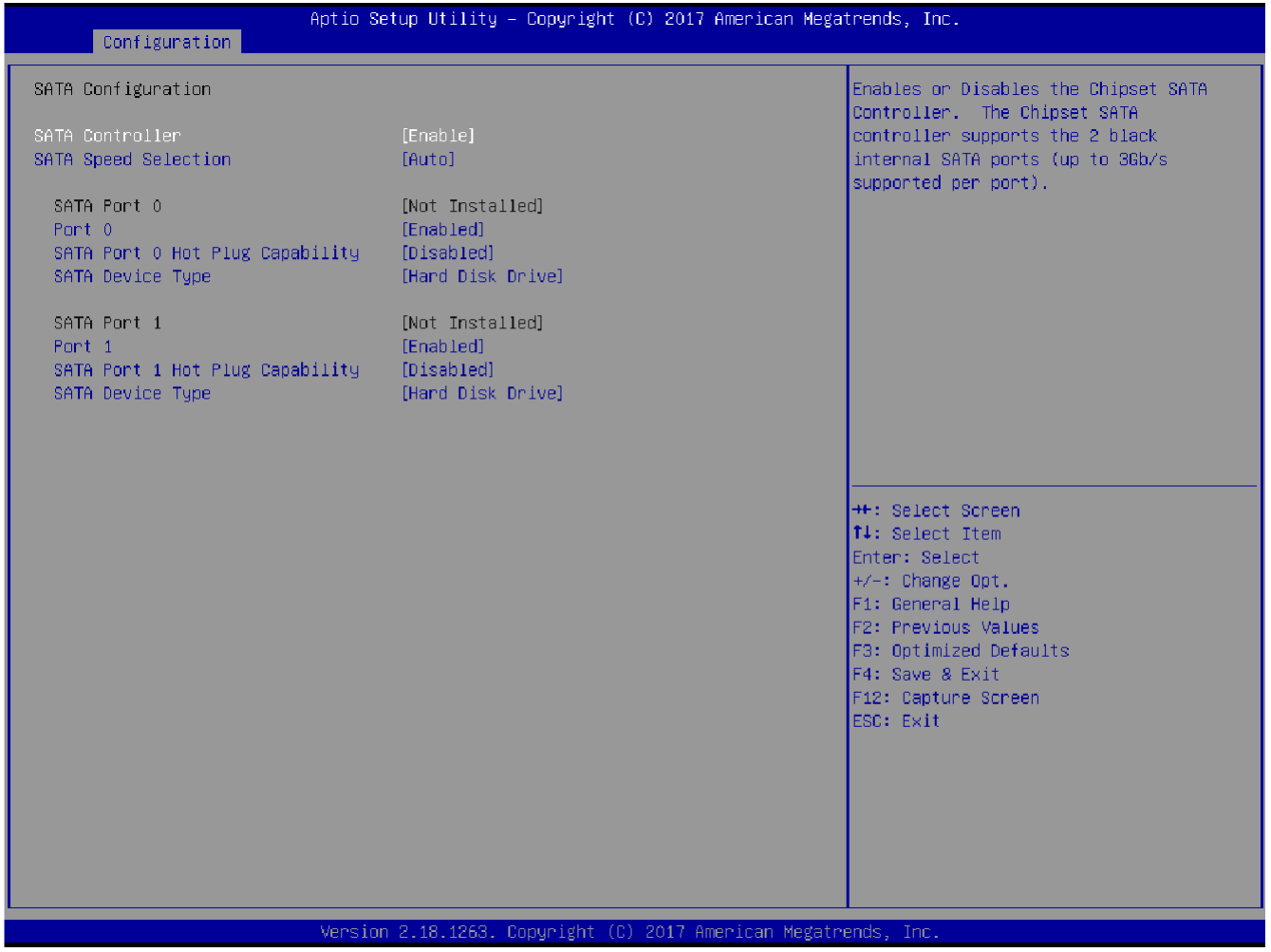


Figure 19 BIOS - Configuration - SATA

6.10 USB

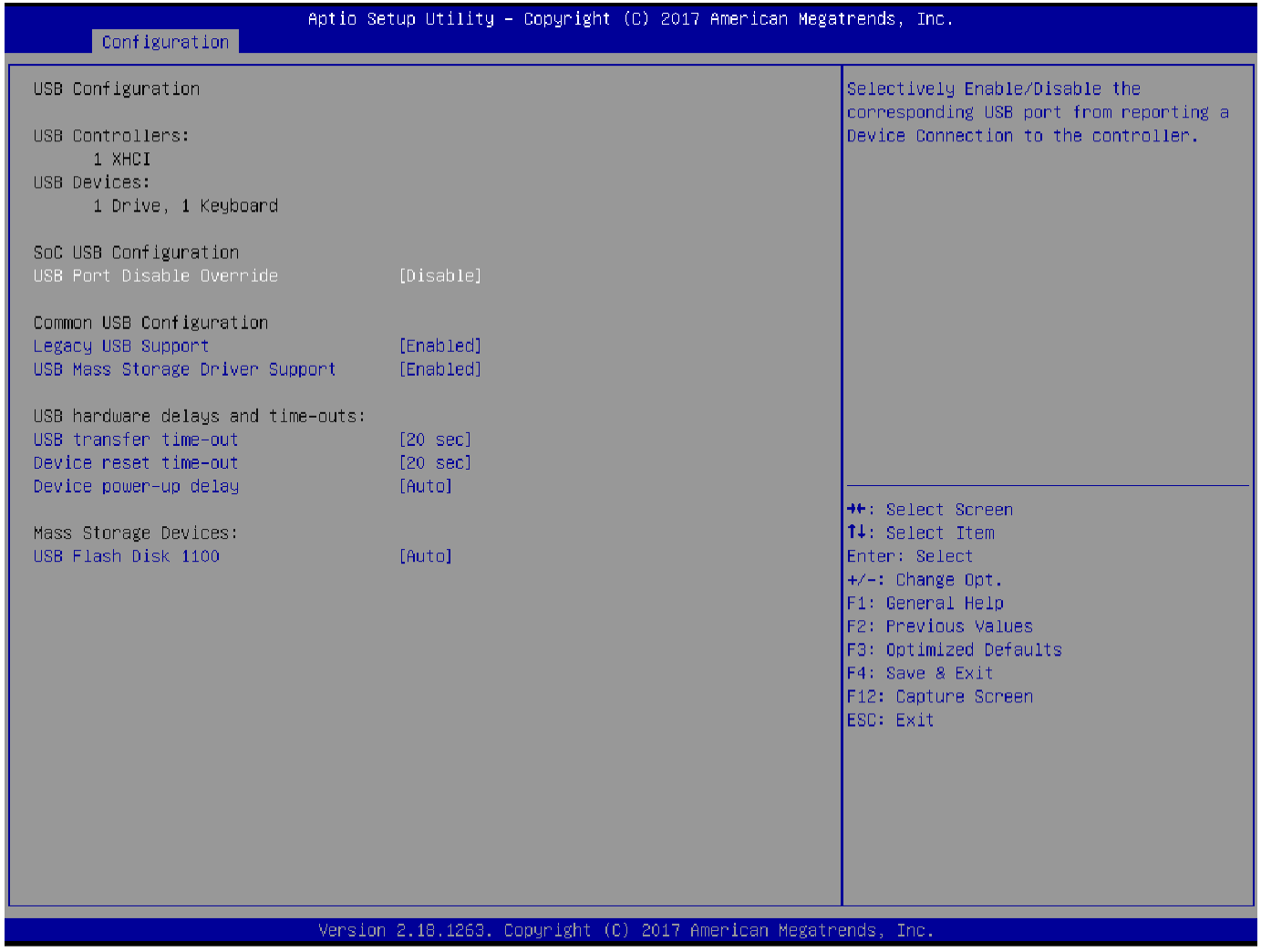


Figure 18 BIOS - Configuration - USB 1-2

6.11 Power Control

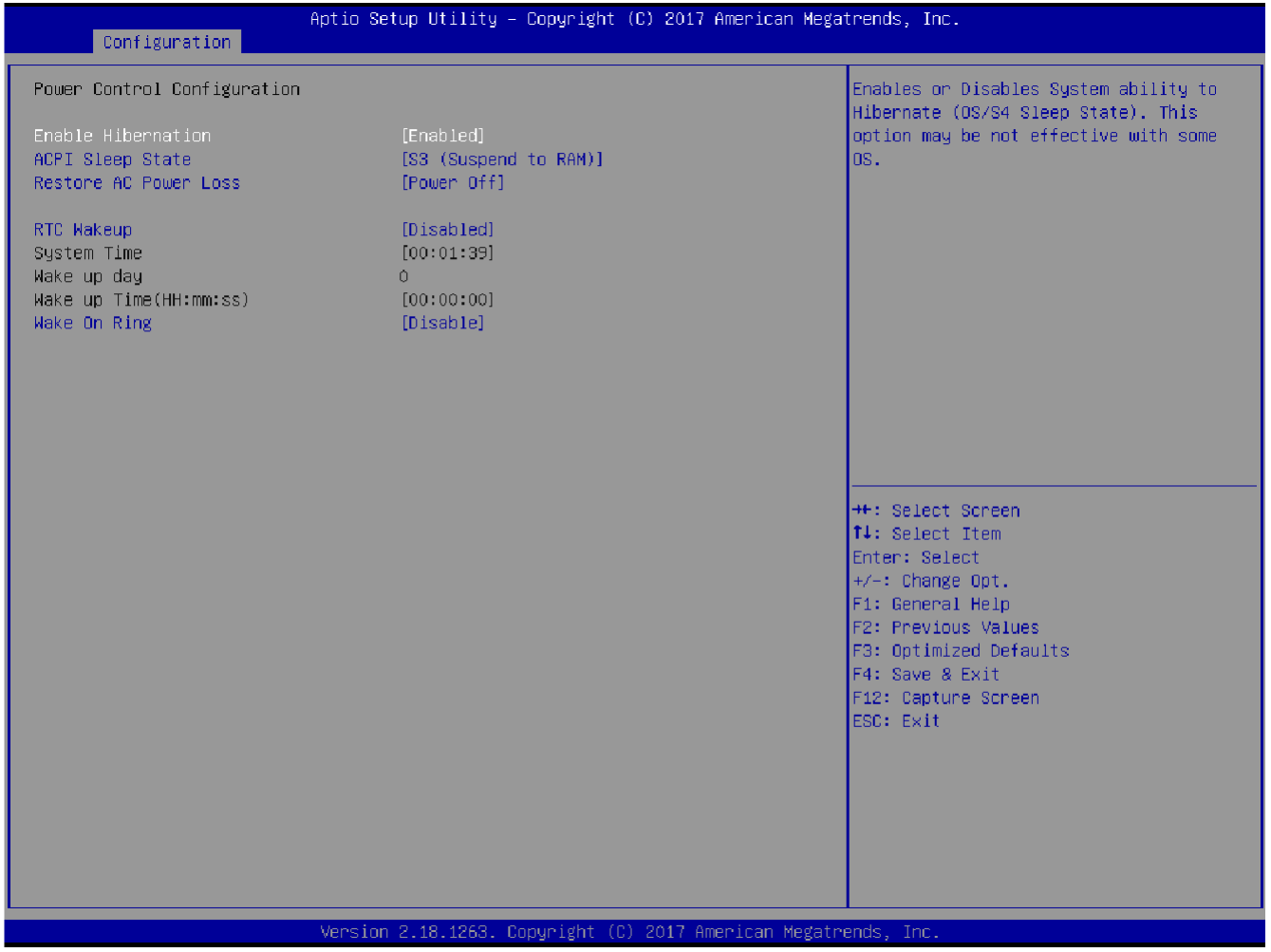


Figure 19 BIOS - Configuration - Power

6.12 TPM

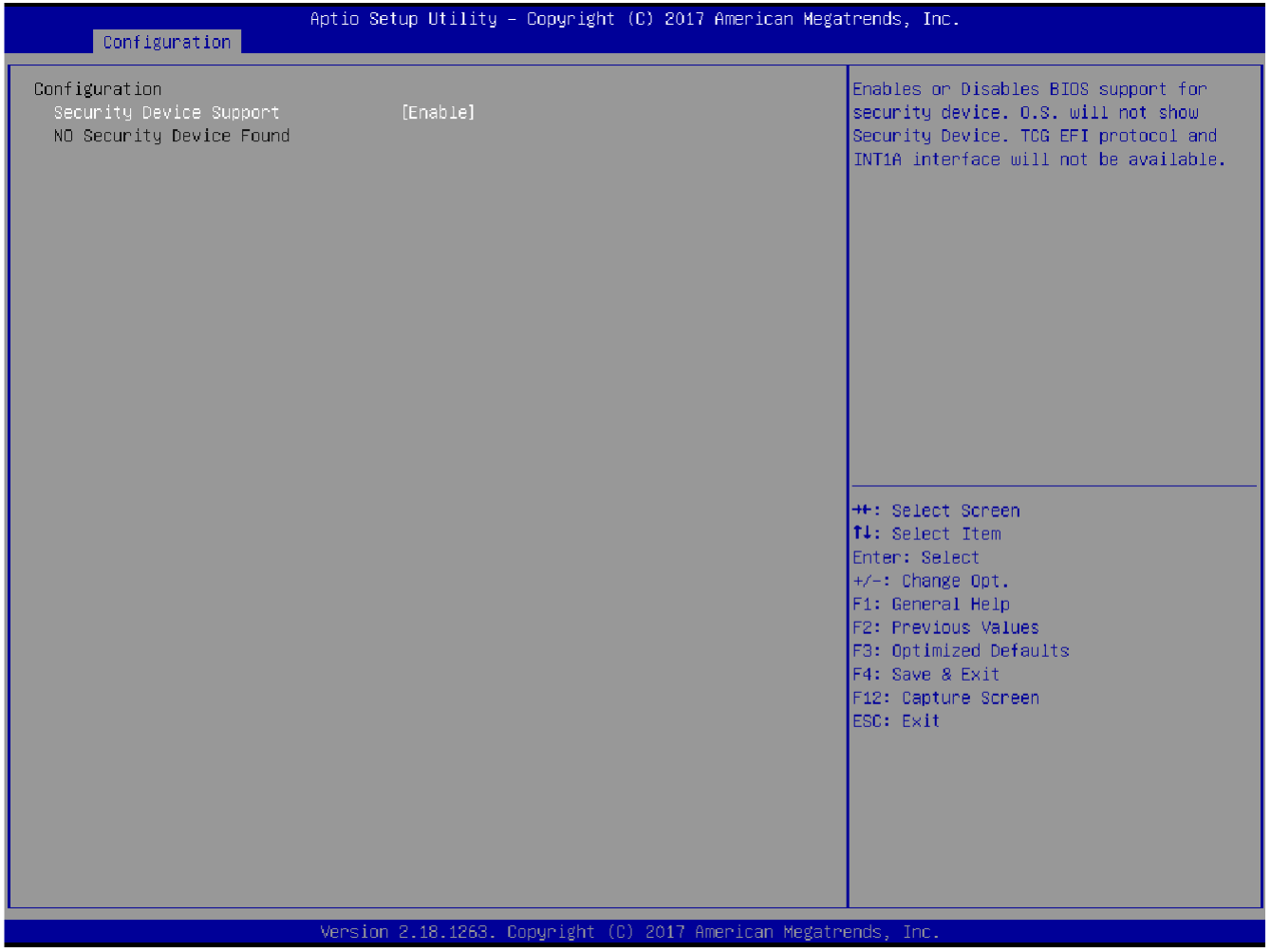


Figure 20 BIOS - Configuration - TPM

6.13 SuperIO

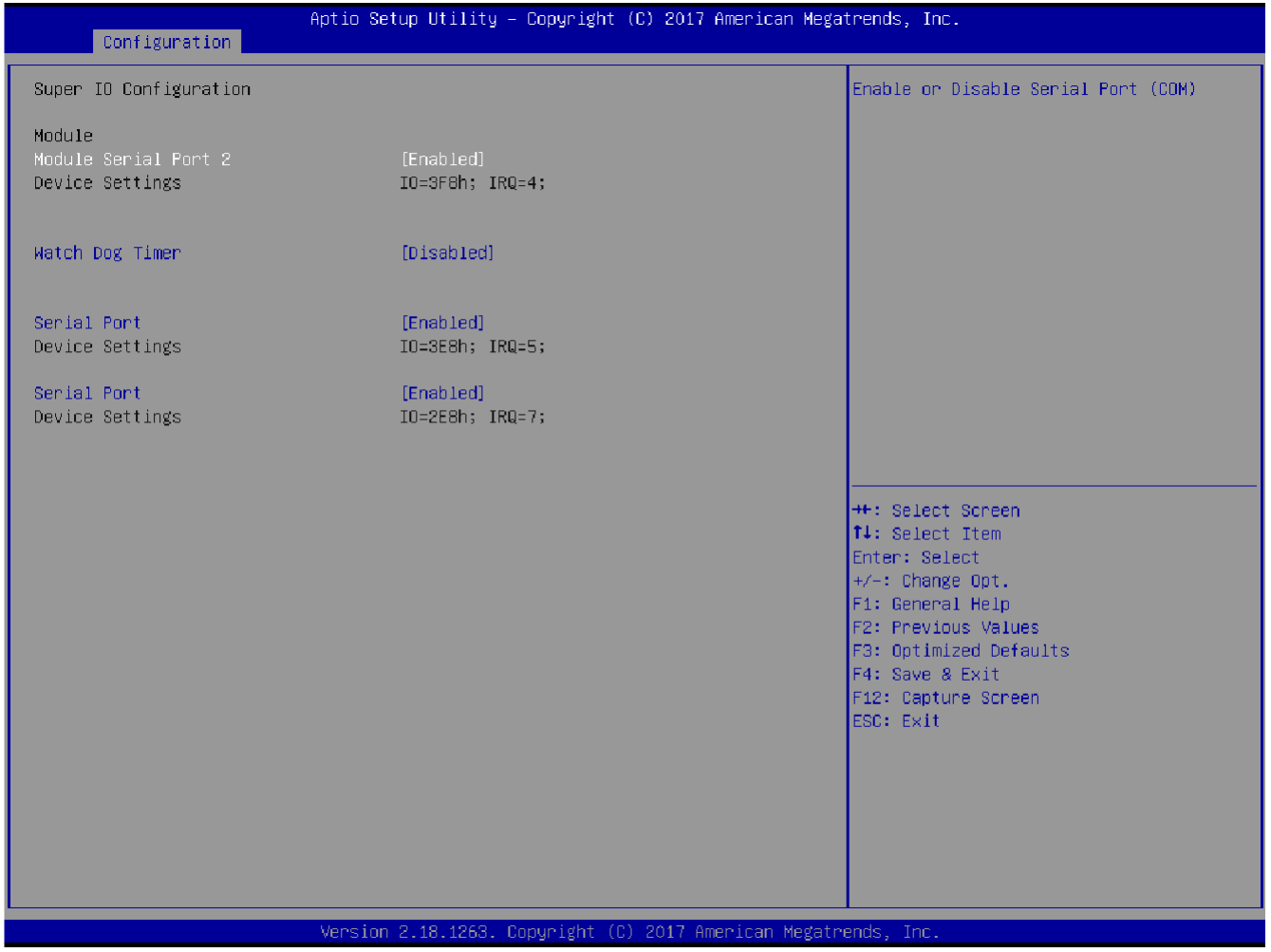


Figure 21 BIOS - Configuration - SuperIO

6.14 H/W Monitor

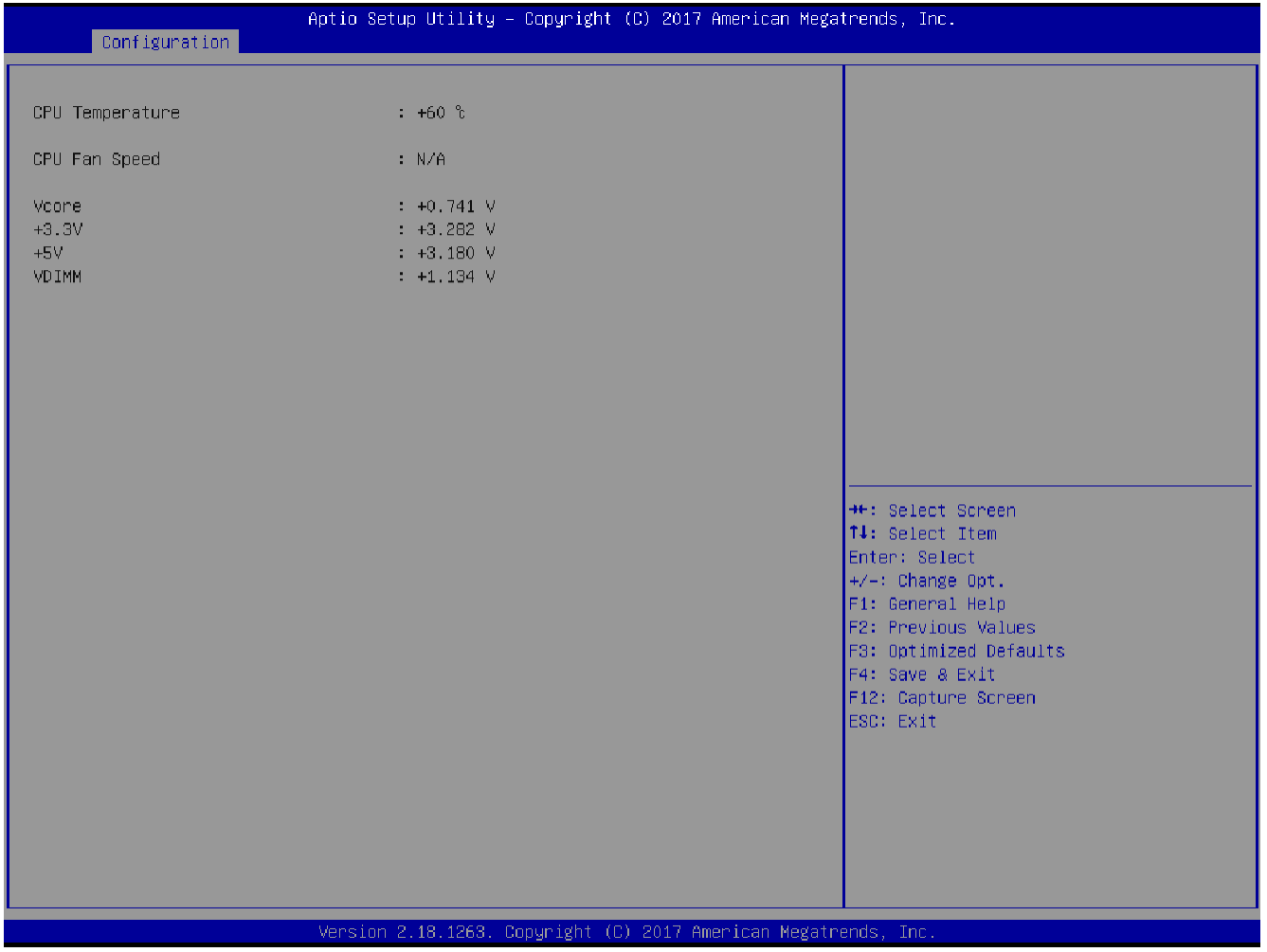


Figure 22 BIOS - Configuration - H/W Monitor

6.15 Serial Port Console

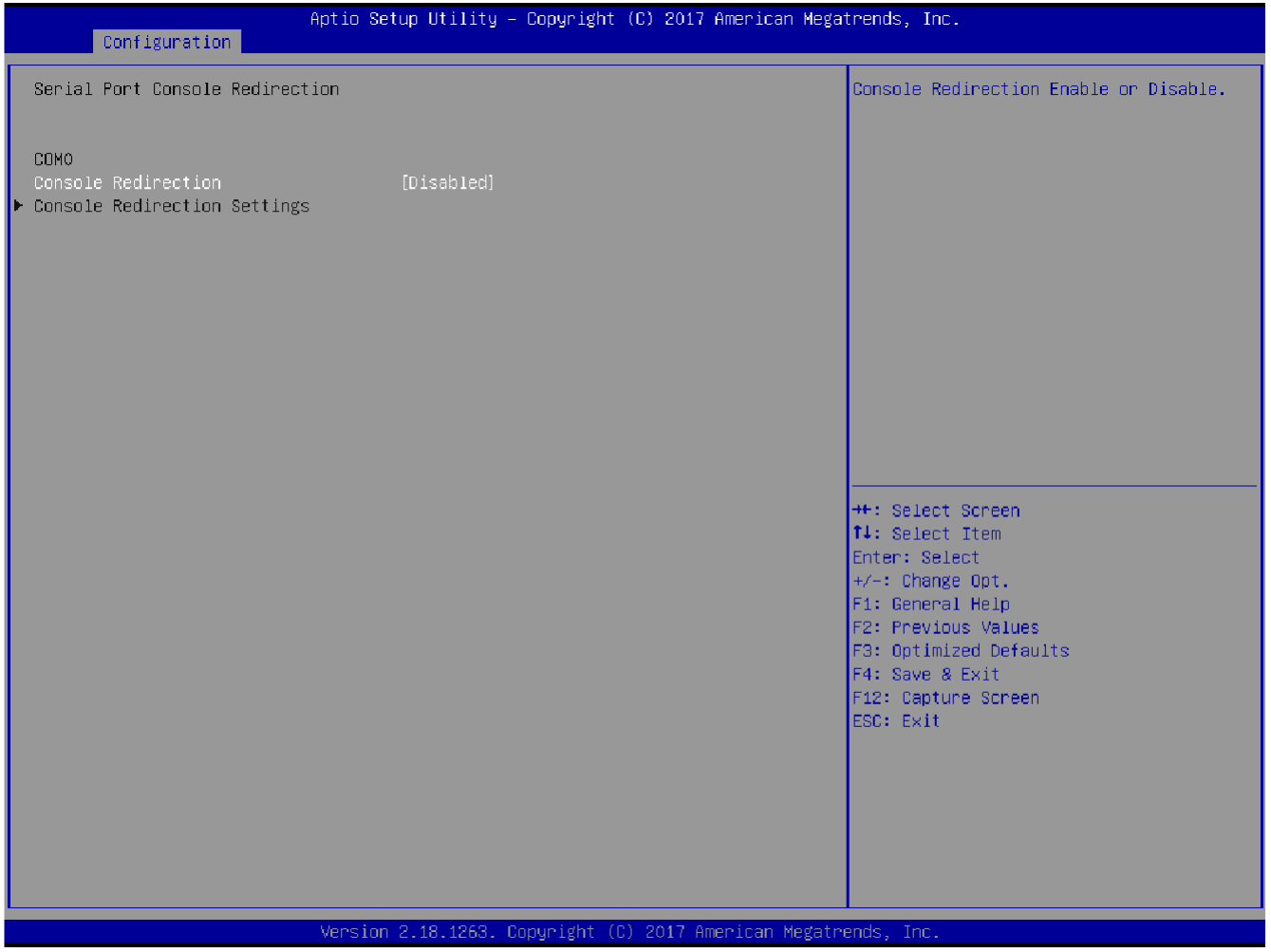


Figure 23 BIOS - Configuration - Serial Port Console

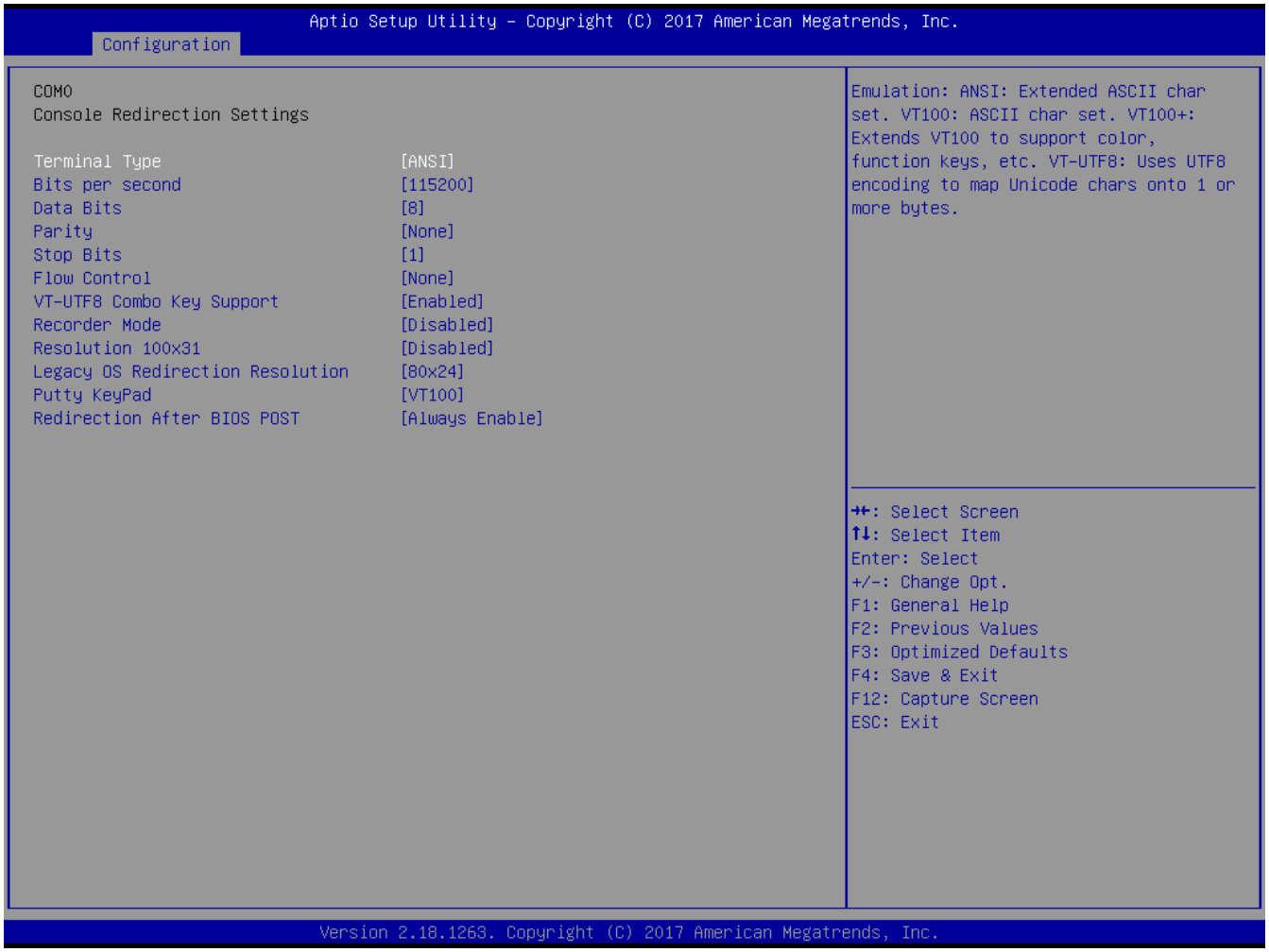


Figure 24 COM0 Console Redirection Settings

6.16 Security

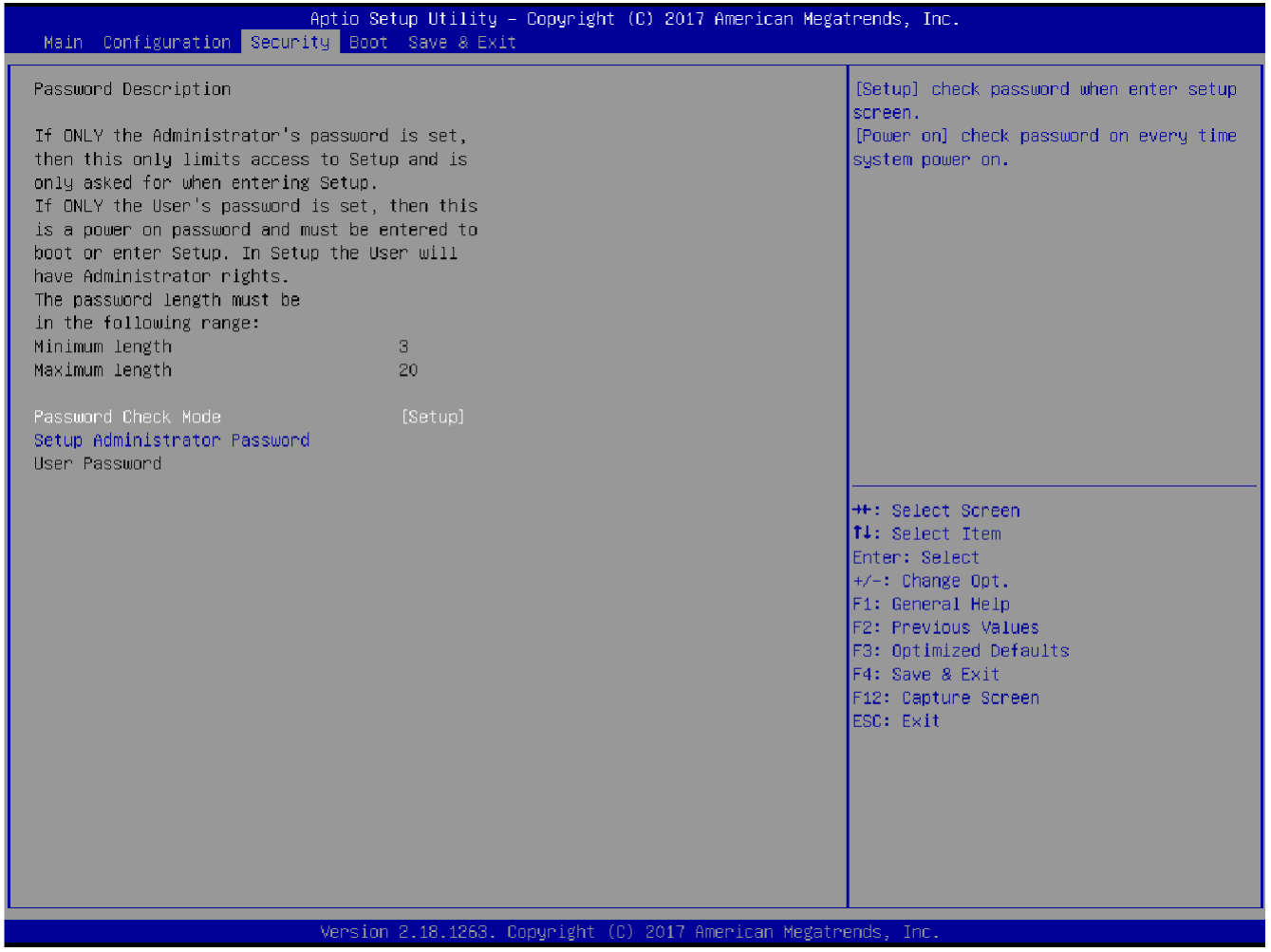


Figure 25 BIOS - Security

6.17 Boot

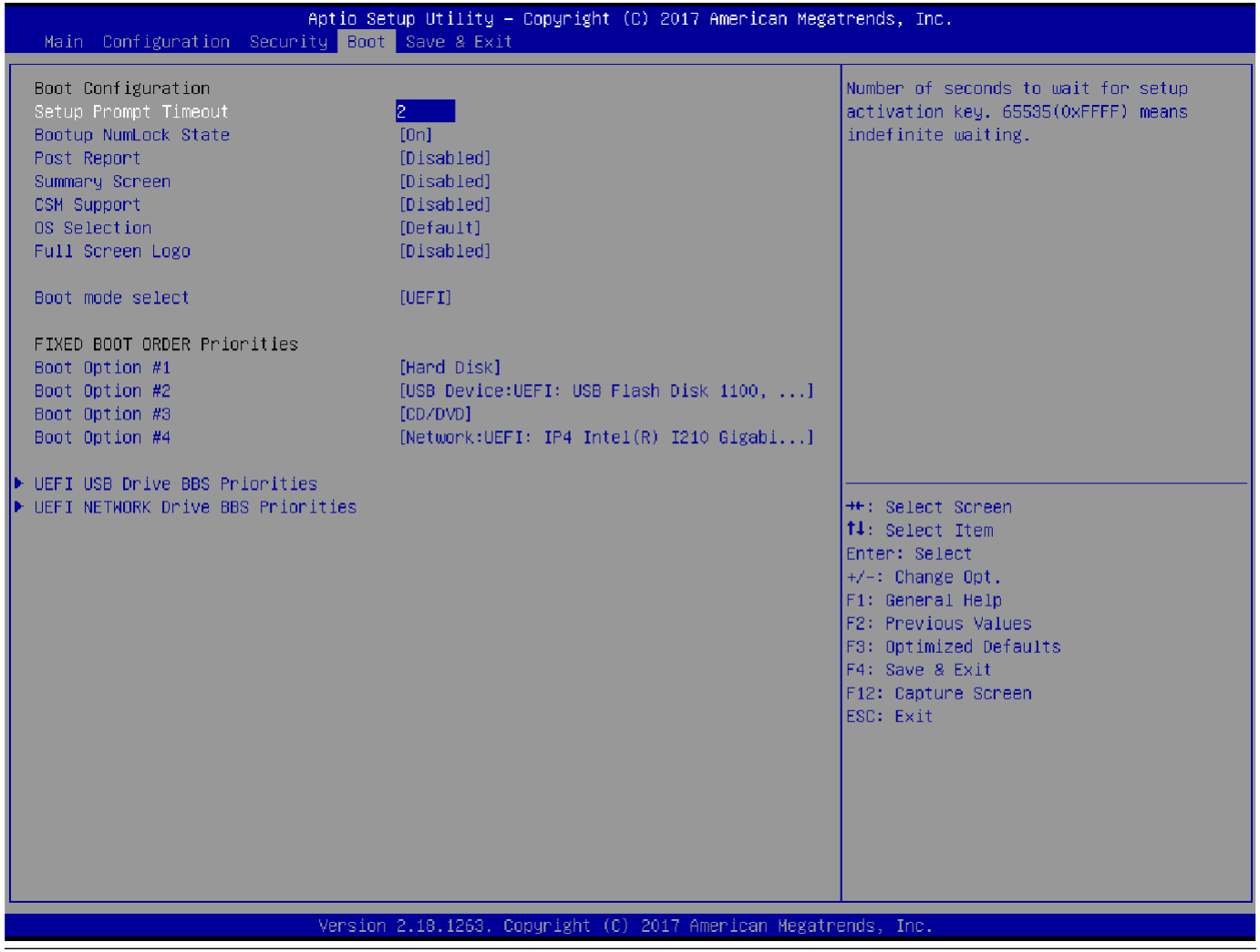


Figure 26 BIOS - Boot

6.18 Save & Exit

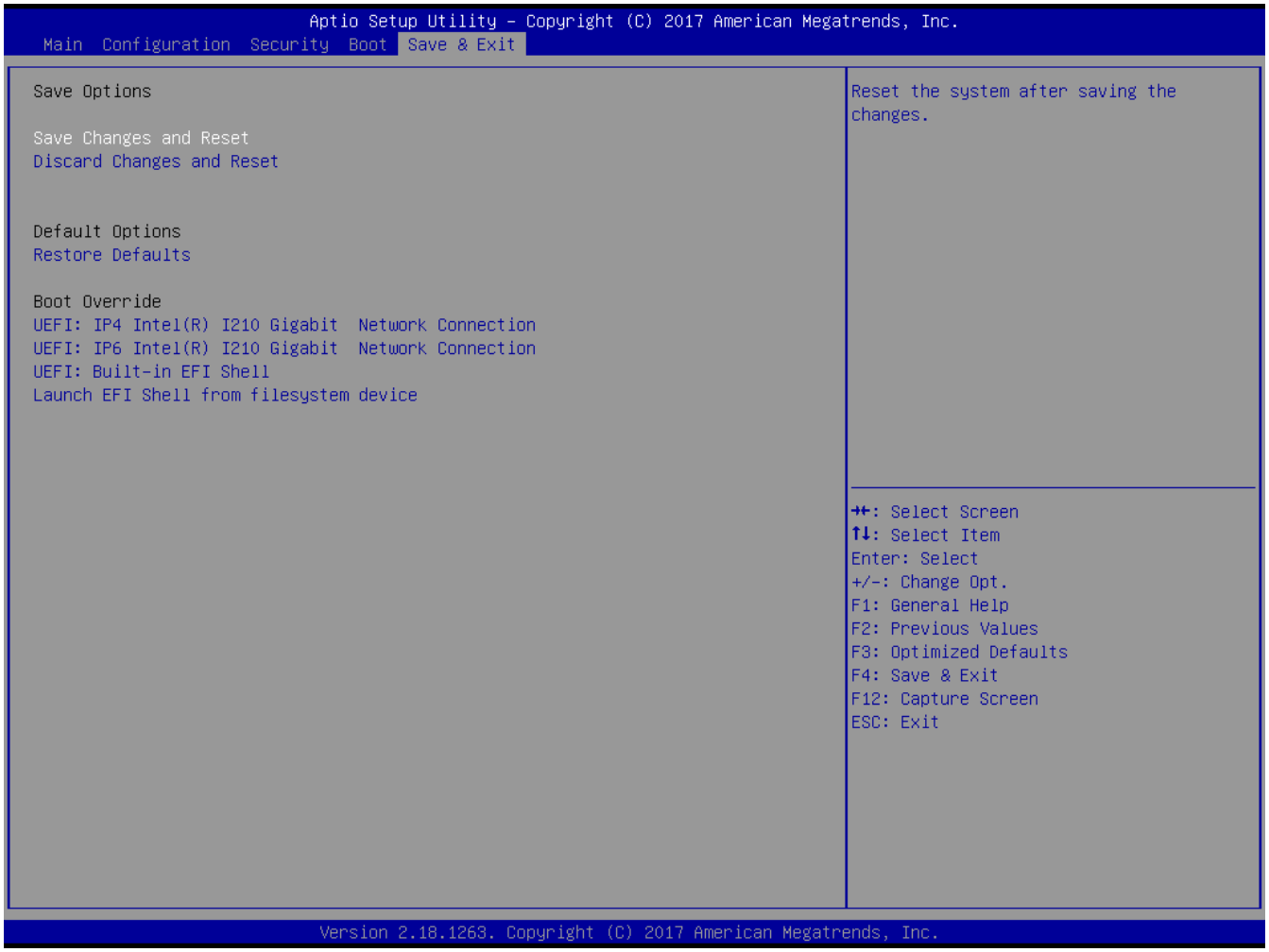


Figure 27 BIOS - Save & Exit

7 System Resources

Device	I/O Address	Note
Embedded Controller (ITE8528)	6E/6F	EC Address
	62/66	EC ACPI CMD Port
	200/201	EC BRAM Port for I2C function
	0x3F8~0x3FF	EC UART0

Table 17 System Resource - EC IO Address

Interrupt Request Lines IRQ		
IRQ#	*Current Use*	*Default Use*
IRQ 0	System ROM	System Timer
IRQ 1	System ROM	Keyboard Event
IRQ 2	【Unassigned】	Usable IRQ
IRQ 3	System ROM	COM2
IRQ 4	System ROM	COM1
IRQ 5	【Unassigned】	Usable IRQ
IRQ 6	System ROM	Diskette Event
IRQ 7	【Unassigned】	Usable IRQ
IRQ 8	System ROM	Real-Time Clock
IRQ 9	【Unassigned】	Usable IRQ
IRQ 10	【Unassigned】	Usable IRQ
IRQ 11	【Unassigned】	Usable IRQ
IRQ 12	System ROM	IBM Mouse Event
IRQ 13	System ROM	Coprocessor Error
IRQ 14	System ROM	Hard Disk Event
IRQ 15	【Unassigned】	Usable IRQ

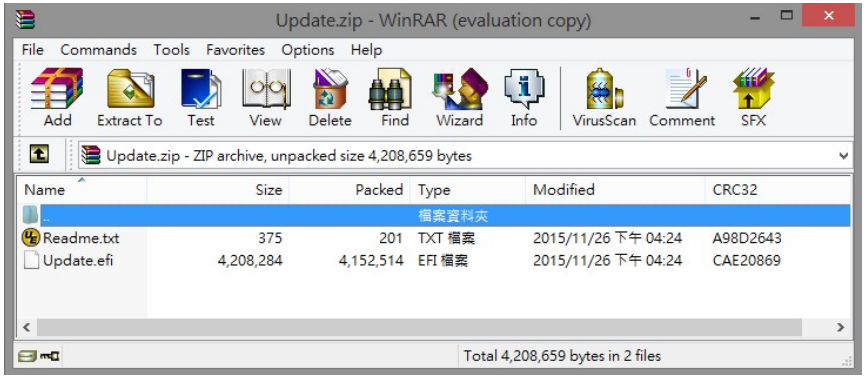
Table 18 System Resource IRQ

8 BIOS Update

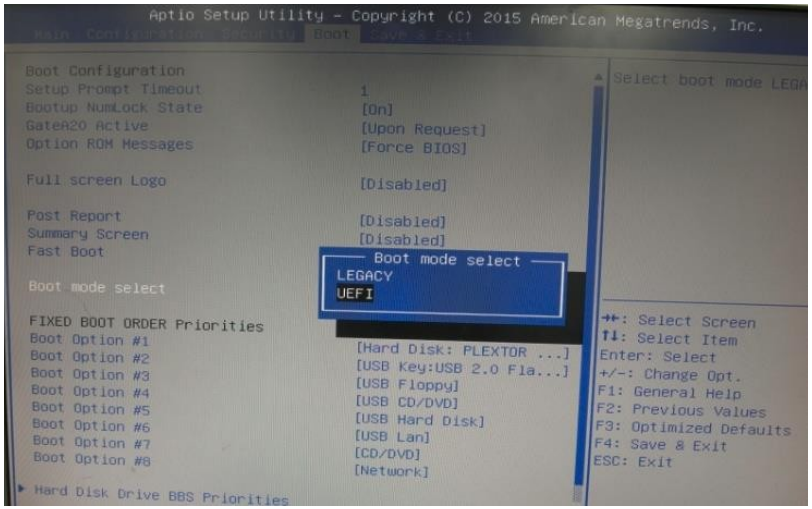
BIOS/EC UEFI Update SOP process

Step 1. Prepare a USB DOK (Caution : Must be FAT or FAT32 format).

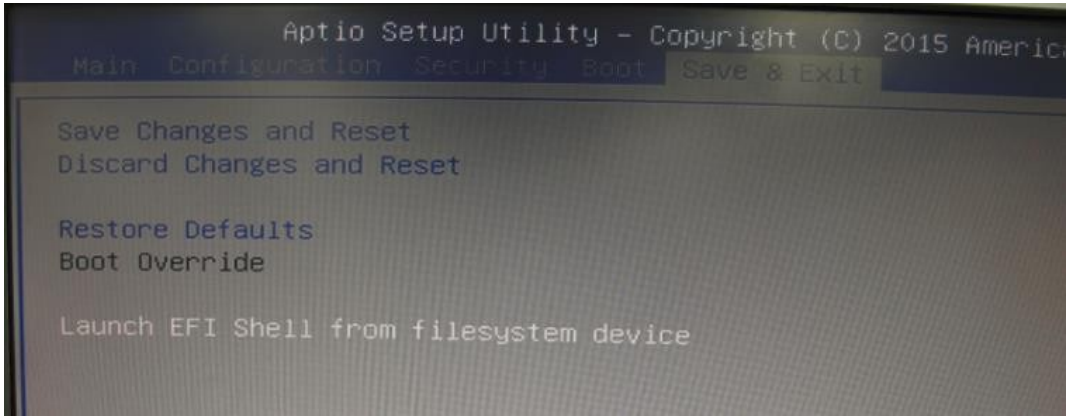
Step 2. Unzip update file to the USB DOK.



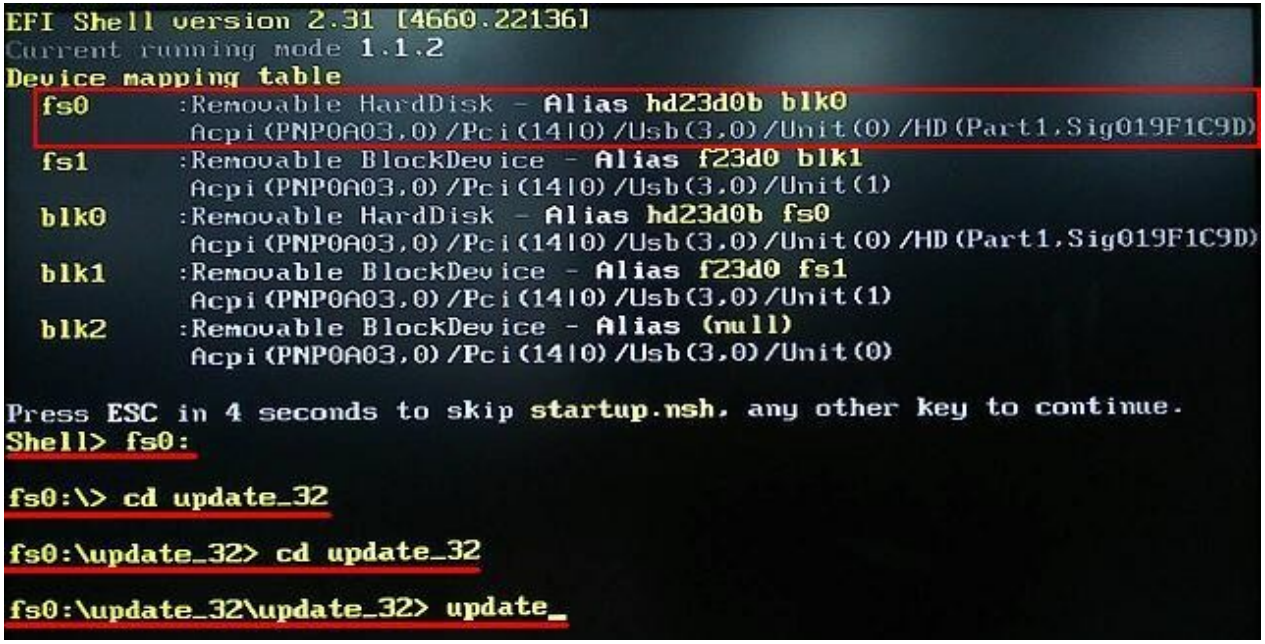
Step 3. Select UEFI boot mode in the BIOS boot menu and save, then restart the system.



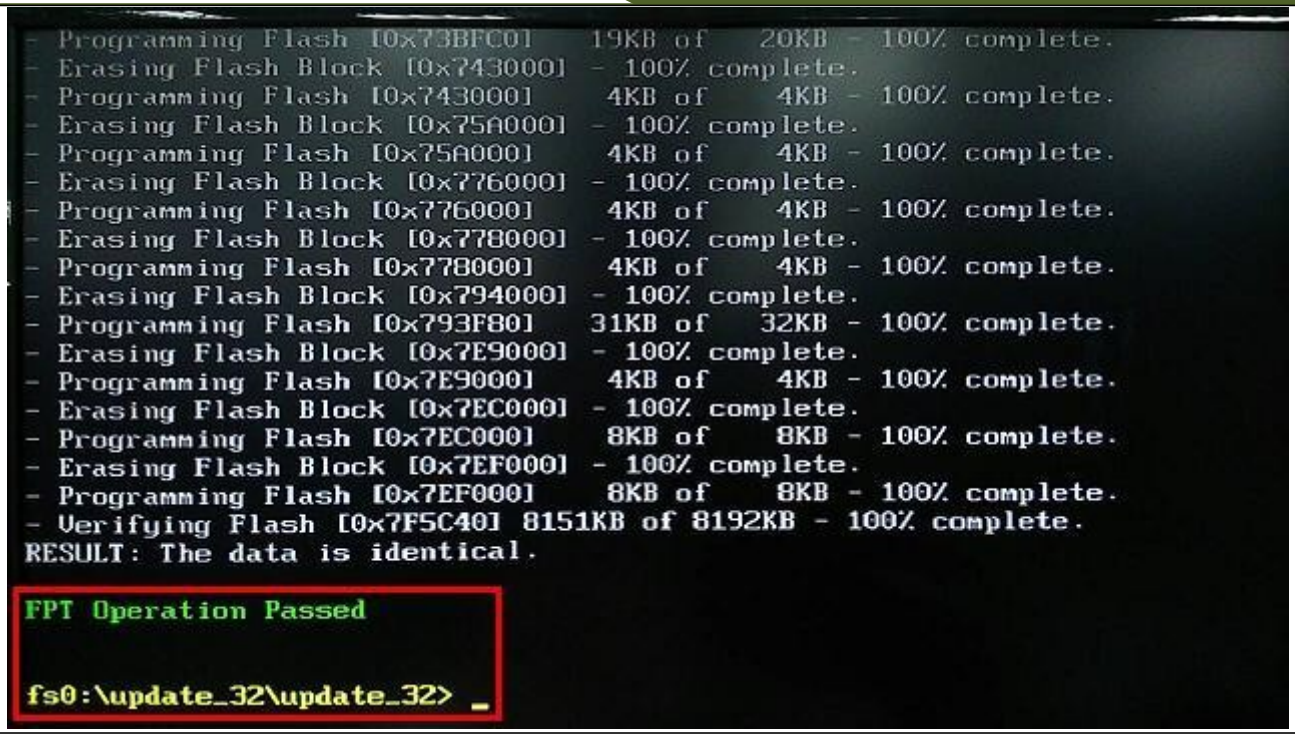
Step 4. Plug the USB DOK to the target system and boot from UEFI Shell.



Step 5. Under the UEFI shell, direct to your USB DOK, below example fs0 and type command: "update" and press enter.



Step 6. The update process will start and you can see the update progress. Once finished, please power off and restart the system.



<End of BIOS/EC UEFI update process>

9 Industry Specifications

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

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