AXIOMTEK

MIRU130

Machine Vision SBC with AMD® RYZEN™ Embedded V1605B/V1807B

User's Manual

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CAUTION

If you replace wrong batteries, it causes the danger of explosion. It is recommended by the manufacturer that you follow the manufacturer's instructions to only replace the same or equivalent type of battery, and dispose of used ones.

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ESD Precautions

Computer boards have integrated circuits sensitive to static electricity. To prevent chipsets from electrostatic discharge damage, please take care of the following jobs with precautions:

- Do not remove boards or integrated circuits from their anti-static packaging until you are ready to install them.
- Before holding the board or integrated circuit, touch an unpainted portion of the system unit chassis for a few seconds. It discharges static electricity from your body.
- Wear a wrist-grounding strap, available from most electronic component stores, when handling boards and components.

Trademarks Acknowledgments

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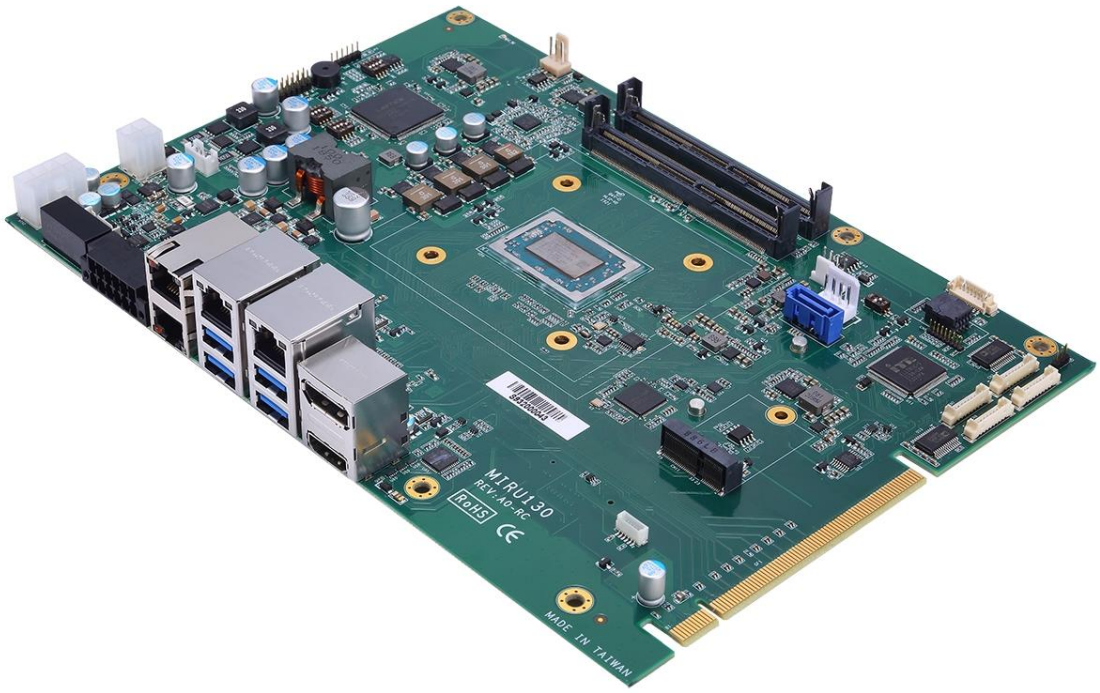
Chapter 1
Introduction



The MIRU130, a proprietary SBC for machine vision, supports AMD® RYZEN® Embedded V1605B/V1807B processor. It delivers outstanding system performance through high-bandwidth interfaces, multiple I/O functions for interactive applications and various embedded computing solutions.

The MIRU130 has two 260-pin unbuffered SO-DIMM sockets for DDR4 2400/3200MHz memory with maximum capacity up to 16GB. There are two Gigabit/Fast Ethernet ports, two Gigabit PoE-PSE ports, one SATA port with transfer rate up to 6Gb/s, four USB 3.1 Gen 2 super speed compliant, two isolated digital-in, and two isolated digital-out that can achieve the best stability and reliability for industrial applications. Additionally, it provides you with unique embedded features, such as four serial ports (one RS-232/422/485, three RS-232) and vision I/O, such as two CH trigger-in, two CH trigger-out, one CH incremental quadrature encoder input (A/B/Z) and two CH LED lighting control.

1.1 Features

- AMD® RYZEN™ quad core V1807B (3.35GHz) and V1605B (2.0GHz)
- 2 DDR4 SO-DIMM support up to 16GB memory capacity
- 4 USB 3.1 Gen 2 ports
- 4 COM ports
- 2 GbE LAN
- 2 GbE PoE-PSE
- 1 M.2 Key B
- 1 M.2 Key E
- +12V only DC-in supported

1.2 Specifications

- **CPU**
  - AMD® RYZEN™ quad core V1807B 3.35GHz.
  - AMD® RYZEN™ quad core V1605B 2.0GHz.

- **Thermal Solution**
  - Active.

- **Operating Temperature**
  - -20°C~-60°C.

- **BIOS**
  - American Megatrends Inc. UEFI (Unified Extensible Firmware Interface) BIOS.
  - 64Mbit SPI Flash, DMI, Plug and Play.
  - PXE Ethernet Boot ROM.

- **System Memory**
  - Two 260-pin unbuffered DDR4 SO-DIMM sockets.
  - For V1605B, maximum up to 8GB DDR4 2400MHz memory for single SO-DIMM socket. Total up to 16GB.
  - For V1807B, maximum up to 8GB DDR4 3200MHz memory for single SO-DIMM socket. Total up to 16GB.

- **Onboard Multi I/O**
  - Controller: Fintek F81803.
  - Four serial ports:
    - COM1 supports RS-232/422/485 by BIOS selecting.
    - COM2~4 support RS-232 only.

- **Serial ATA**
  - One SATA-600 connector.
  - One M.2 Key B connector in 2242 (3042) and 2280.

- **USB Interface**
  - Four USB ports with fuse protection and complies with USB Spec. Rev. 3.1 Gen 2 in Type A connector.

- **Display**
  - One HDMI with resolution max. up to 3840x2160 @30Hz.
  - One DisplayPort supports DP++ with max. resolution 3840x2160 @60Hz.

- **Watchdog Timer**
  - 1~255 seconds or minutes; up to 255 levels.

- **Ethernet**
  - Two LAN ports with Realtek RTL8111G support 1000/100/10Mbps Gigabit/Fast Ethernet with Wake-on-LAN and PXE Boot ROM.
  - Two PoE-PSE by Realtek RTL8111G support 1000/100/10Mbps Gigabit/Fast Ethernet with 30W power which is compliant with IEEE802.3at standard.

- **Audio**
  - N/A

- **Digital I/O**
  - Two isolated digital-in.
  - Two isolated digital-out.
  - Two isolated trigger-in.
  - Two isolated trigger-out for camera.

- **Vision I/O**
  - Two CH LED lighting control output, supporting dimming control.
  - One CH incremental quadrature encoder input (A/B/Z).

- **Expansion Interface**
  - One M.2 Key E connector in 2230.

- **Power Input**
  - One 2x4-pin connector.
  - +12V DC-in only.
  - AT auto power on function supported.

- **Power Management**
  - ACPI (Advanced Configuration and Power Interface).

Note

All specifications and images are subject to change without notice.

1.3 Utilities

- Graphics driver
- Ethernet driver
- PCIe Bridge driver

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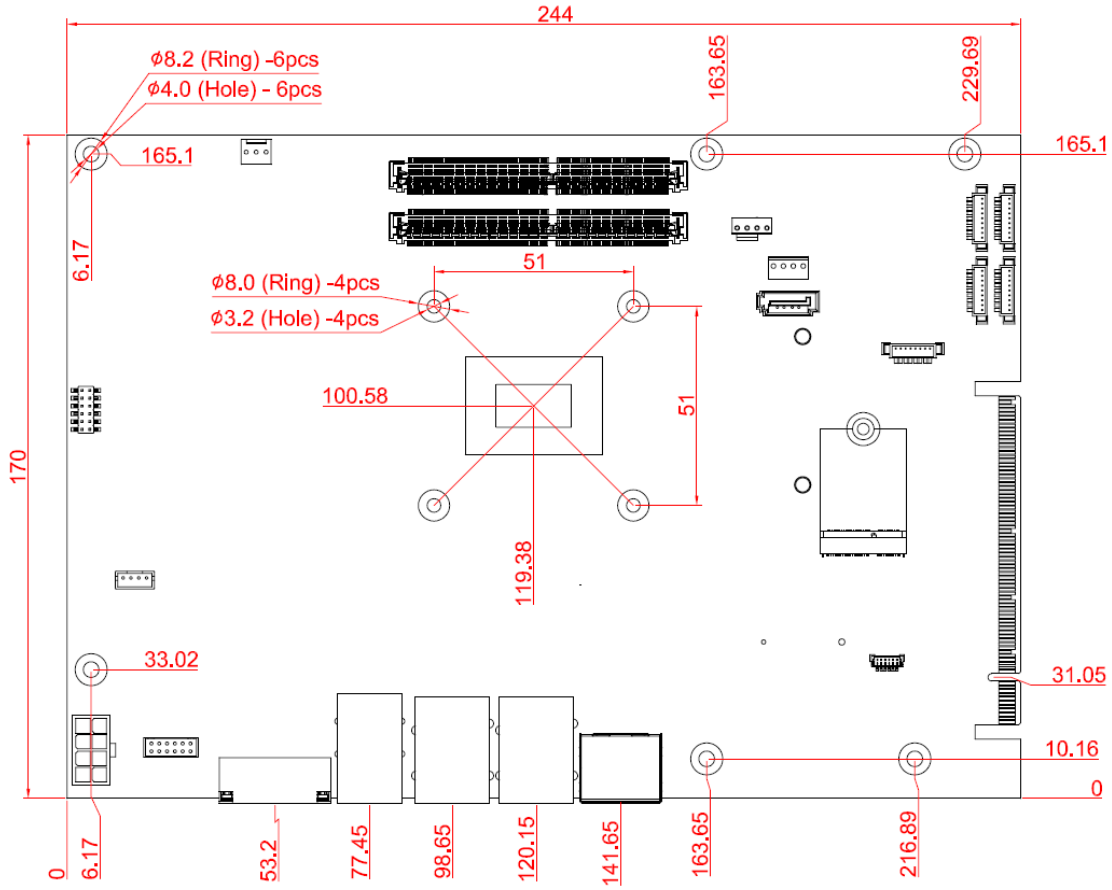
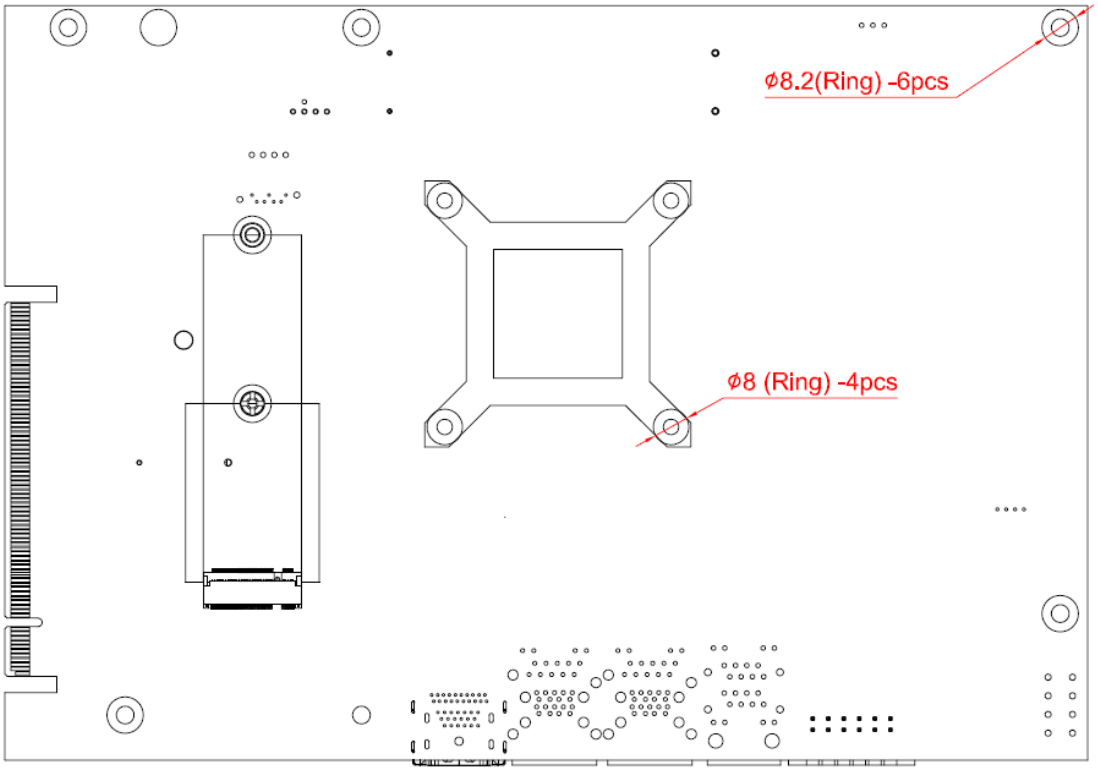
Chapter 2
Board and Pin Assignments

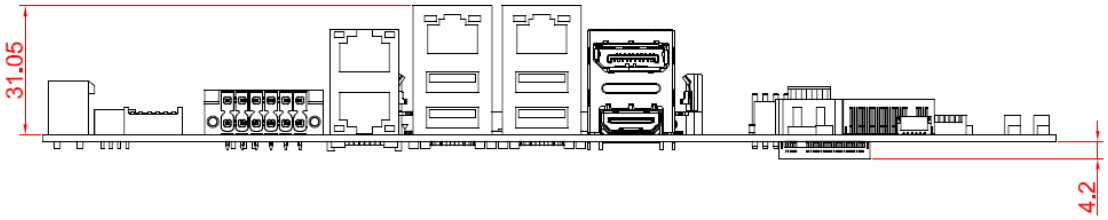
2.1 Board Dimensions and Fixing Holes



Top View

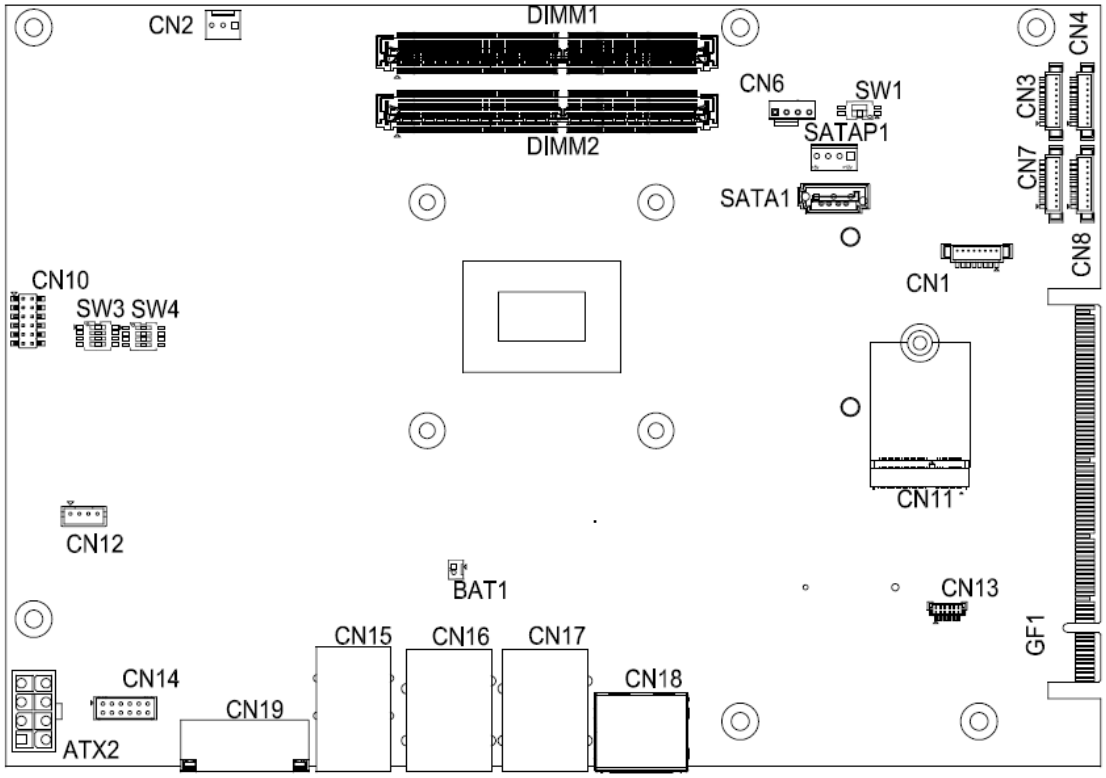


Bottom View

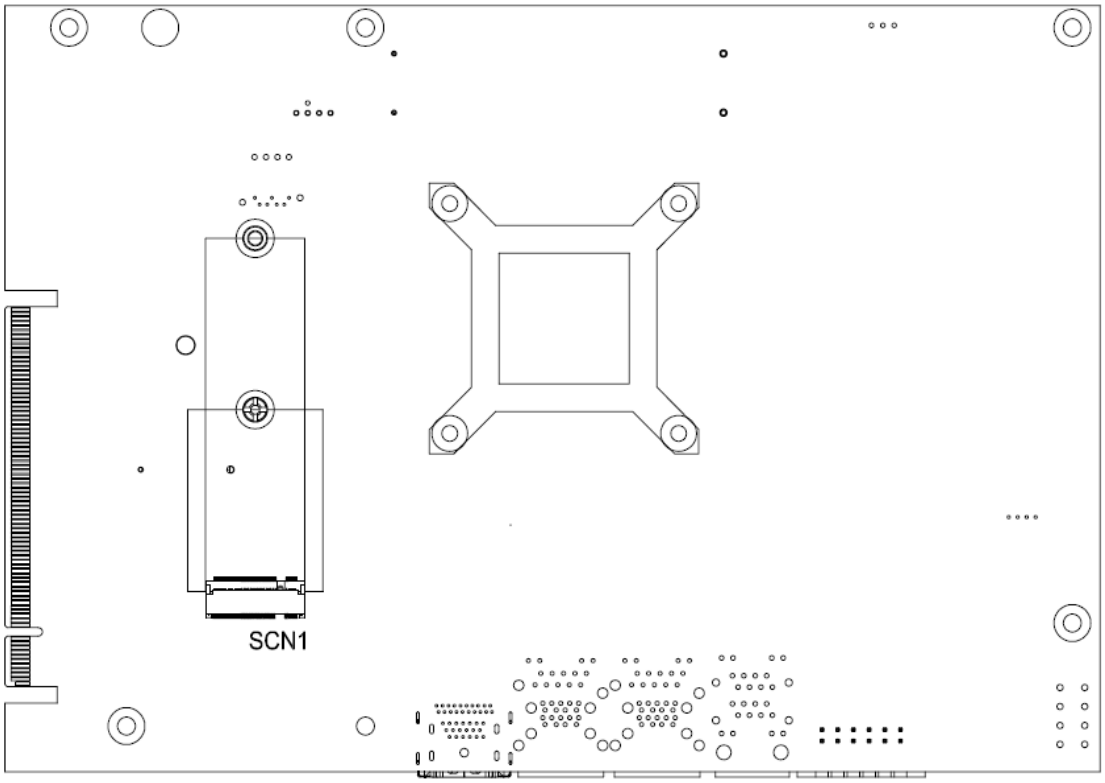


Side View

2.2 Board Layout



Top View



Bottom View

2.3 Switch Settings

Properly configure switch settings on the MIRU130 to meet your application purpose. Below you can find a summary table of all switches and onboard default settings.

Note

Once the default switch setting needs to be changed, please do it under power-off condition.

Switch	Description	Setting
SW1	Auto Power On Default: Enable	SW1-1 ON
	Restore BIOS Optimal Defaults Default: Normal Operation	SW1-2 OFF
SW3	LED Lighting Control Output Current Setting Default: 100mA	SW3-1 ON
SW4		SW4-1 ON

2.3.1 Auto Power On and Restore BIOS Optimal Defaults (SW1)

If dip1 of SW1 (SW1-1) is set to ON position, the system will be automatically power on without pressing soft power button. If it is set to OFF position, it is necessary to manually press soft power button to power on the system.

The dip2 of SW1 (SW1-2) is for restoring BIOS default status. Flip SW1-2 to ON position for a few seconds then flip it back to OFF position. Doing this procedure can restore BIOS optimal defaults.

Function	Setting
Enable auto power on (Default)	SW1-1 ON
Disable auto power on	SW1-1 OFF
Restore BIOS optimal	SW1-2 ON
Normal operation (Default)	SW1-2 OFF

2.3.2 LED Lighting Control Output Current Setting (SW3 and SW4)

Use SW3 and SW4 to choose different LED lighting control output current.

Output Current	Setting
100mA (Default)	SW3-1 ON SW4-1 ON
250mA	SW3-2 ON SW4-2 ON
350mA	SW3-3 ON SW4-3 ON
500mA	SW3-4 ON SW4-4 ON

2.4 Connectors

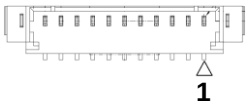
Signals go to other parts of the system through connectors. Loose or improper connection might cause problems, please make sure all connectors are properly and firmly connected. Here is a summary table of connectors on the hardware.

Connector	Description
CN1	TPM Wafer Connector
CN2, CN6	Fan Connectors
CN3, CN4, CN7, CN8	COM Wafer Connectors
CN10	Front Panel Connector
CN11	M.2 2230 Key E Connector
CN12	LED Lighting Control Wafer Connector
CN13	SIM Card Wafer Connector
CN14	Encoder Wafer Connector
CN15	PoE-PSE Port
CN16, CN17	Ethernet and USB 3.1 Ports
CN18	DisplayPort and HDMI Connector
CN19	Digital I/O Connector
ATX2	ATX Power Connector
BAT1	CMOS Battery Connector
SATA1	SATA Connector
SATAP1	SATA Power Connector
SCN1	M.2 Key B Connector
GF1	PCI-Express x16 Golden Finger
DIMM1, DIMM2	DDR4 SO-DIMM Connectors

2.4.1 TPM Wafer Connector (CN1)

The CN1 is an 8-pin (pitch=1.25mm) wafer connector which is compliant with Molex 510210800 for TPM module via SPI interface. AX93515 is TPM module which is suggested to use.

Pin	Signal
1	VCC
2	SPI_TPM_MISO
3	SPI_TPM_CLK
4	SPI_TPM_MOSI
5	SPI_TPM_CS_N
6	SPI_TPM_IRQ
7	PLTRST_N
8	GND

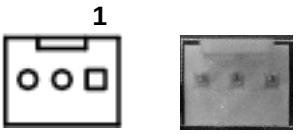


2.4.2 Fan Connectors (CN2 and CN6)

Fans are needed for cooling down CPU and system temperature. The board has two fan connectors. You can find fan speed within BIOS Setup Utility if fan is installed. For further information, see BIOS Setup Utility: Advanced\Hardware Monitor (see section 6.4).

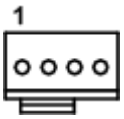
CN2 (for system fan):

Pin	Signal
1	GND
2	+12V level
3	Fan speed feedback



CN6 (for CPU fan):

Pin	Signal
1	GND
2	+12V level
3	Fan speed feedback
4	NC



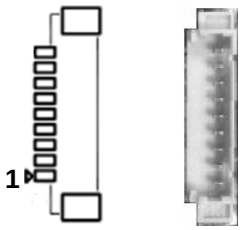
2.4.3 COM Wafer Connectors (CN3, CN4, CN7 and CN8)

These are four 9-pin (pitch=1.25mm) COM wafer connectors which are compliant with Molex 53047-0910. The pin assignments of RS-232/RS-422/RS-485 are listed in table below. If you need COM1 to support RS-422 or RS-485 communication mode, please refer to BIOS setting in section 6.4.

Option cable:
59380880250E COM Port Cable DB9 --9x1P L250mm P=1.25

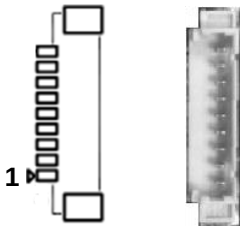
CN3, CN4, and CN7 (for COM2, COM3 and COM4):

Pin	RS-232
1	DCD
2	DSR
3	RXD
4	RTS
5	TXD
6	CTS
7	DTR
8	RI
9	GND



CN8 (for COM1):

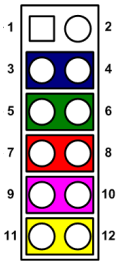
Pin	RS-232	RS-422	RS-485
1	DCD	TX-	Data-
2	DSR	No use	No use
3	RXD	TX+	Data+
4	RTS	No use	No use
5	TXD	RX+	No use
6	CTS	No use	No use
7	DTR	RX-	No use
8	RI	No use	No use
9	GND	No use	No use



2.4.4 Front Panel Connector (CN10)

This is a 2x6-pin header (pitch=2.0mm) for front panel interface.

Pin	Signal	Pin	Signal
1	Buzzer-	2	Buzzer+
3	GND	4	PWR_PSON
5	PWRLED-	6	PWRLED+
7	PWRSW-	8	PWRSW+
9	HW RST-	10	HW RST+
11	HDDLED-	12	HDDLED+



Internal Buzzer
Pin 1(-) and 2(+) connect the internal buzzer cable.

Power Status (PS-ON)
Pin 4 and pin 3 are PS-ON signal which are connected to know the power status of this board.

Power LED
Pin 6 connects anode (+) of LED and pin 5 connects cathode (-) of LED. The power LED lights up when the system is powered on.

Power On/Off Button
Pin 8 and 7 connect the power button on front panel to CPU board, which allows users to turn on or off power supply.

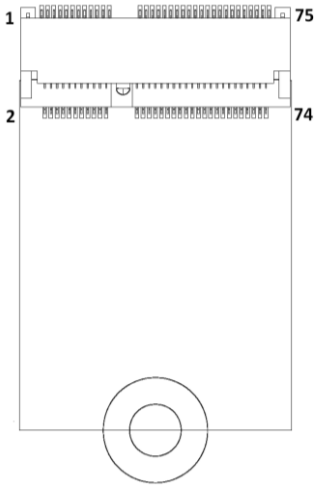
System Reset Switch
Pin 10 and 9 connect the case-mounted reset switch that reboots your computer without turning off the power switch. It is a better way to reboot your system for a longer life of system power supply.

HDD Activity LED
This connection is linked to hard drive activity LED on the control panel. LED flashes when HDD is being accessed. Pin 12 and 11 connect the hard disk drive to the front panel HDD LED, pin 11 is assigned as cathode(-) and pin 12 is assigned as anode(+).

2.4.5 M.2 2230 Key E Connector (CN11)

The CN11 is a M.2 2230 Key E connector. It is suggested to install the M.2 wireless module via PCIe x1 with 22mm width and 30mm length.

Pin	Signal	Pin	Signal
1	GND	2	+3.3V_SBY
3	NC	4	+3.3V_SBY
5	NC	6	NC
7	GND	8	NC
9	NC	10	NC
11	NC	12	NC
13	NC	14	NC
15	NC	16	NC
17	NC	18	GND
19	NC	20	NC
21	NC	22	NC
23	NC	24	**Key E**
25	**Key E**	26	
27		28	
29		30	
31		32	NC
33	GND	34	NC
35	PCIE3_TX_P	36	NC
37	PCIE3_TX_N	38	NC
39	GND	40	NC
41	PCIE3_RX_P	42	NC
43	PCIE3_RX_N	44	NC
45	GND	46	NC
47	CLK_PCIE3_P	48	NC
49	CLK_PCIE3_N	50	SUSCLK(+3.3V Level)
51	GND	52	PERST#(+3.3V Level)
53	CLKREQ0#	54	W_DIS2#(+3.3V Level)
55	PEWAKE0#	56	W_DI12#(+3.3V Level)
57	GND	58	SMB_DATA(+3.3V Level)
59	NC	60	SMB_CLK(+3.3V Level)
61	NC	62	ALERT#(+3.3V Level)
63	GND	64	NC
65	NC	66	NC
67	NC	68	NC
69	GND	70	NC
71	NC	72	+3.3V_SBY
73	NC	74	+3.3V_SBY
75	GND		

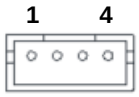


2.4.6 LED Lighting Control Wafer Connector (CN12)

The CN12 is a 4-pin (pitch=2.0mm) wafer connector for two channel LED lighting control interface. Each channel can be set for 100mA/250mA/350mA/500mA output by switch (see Section 2.3.2), supporting dimming control.

Option female connector:
5325104A00E TB EC381VM 4pin (F) 180D P=3.81mm DINKLE
Option cable:
594L1301200E PWR LED CBL HS4P P2.0/TB4P P3.81 L=12CM

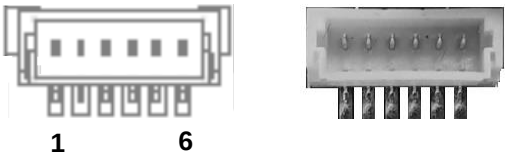
Pin	Signal
1	LED1+
2	LED1-
3	LED2+
4	LED2-



2.4.7 SIM Card Wafer Connector (CN13)

The CN13 is a 6-pin (pitch=1.0mm) wafer connector which is compliant with JST SHR-06V-SB for SIM Card interface. It is suggested to connect AX93A19 to have a SIM card slot.

Pin	Signal
1	PWR
2	RST
3	CLK
4	I/O
5	VPP
6	GND

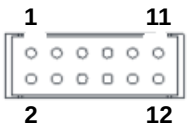


2.4.8 Encoder Wafer Connector (CN14)

This is a 2x6-pin (pitch=2.0mm) wafer connector which is compliant with JST PHDR-12VS for one CH incremental quadrature encoder input (A/B/Z).

Option cable:
594L1303500E DIO CBL D-SUB(F) 15P/HS2x6P P2.0 L=14CM

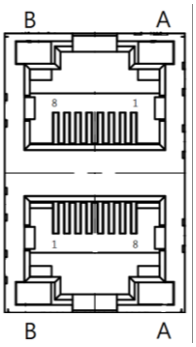
Pin	Signal	Pin	Signal
1	GND	2	GND
3	Encoder_A+	4	Encoder_A-
5	Encoder_B+	6	Encoder_B-
7	Encoder_Z+	8	Encoder_Z-
9	NC	10	GND
11	+5V	12	+5V



2.4.9 PoE-PSE Port (CN15)

The board has two RJ-45 PoE-PSE ports which is compliant with IEEE802.3at standard.

Pin	1000 Base-T	100/10 Base-T	Description
L1	BI_DA+	TX+	Bidirectional or Transmit Data+
L2	BI_DA-	TX-	Bidirectional or Transmit Data-
L3	BI_DB+	RX+	Bidirectional or Receive Data+
L4	BI_DC+	N.C.	Bidirectional or Not Connected
L5	BI_DC-	N.C.	Bidirectional or Not Connected
L6	BI_DB-	RX-	Bidirectional or Receive Data-
L7	BI_DD+	N.C.	Bidirectional or Not Connected
L8	BI_DD-	N.C.	Bidirectional or Not Connected
A	Speed LED 1000: Orange 100/10: Green/OFF		
B	Active Link LED (Yellow) Off: No link Blinking: Data activity detected		



2.4.10 Ethernet and USB 3.1 Ports (CN16 and CN17)

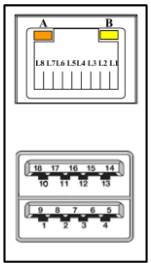
The motherboard comes with two high performance plug and play Ethernet interfaces (RJ-45) which are fully compliant with the IEEE 802.3 standard. Connection can be established by plugging one end of the Ethernet cable into this RJ-45 connector and the other end to a 1000/100/10 Base-T hub.

The Universal Serial Bus (compliant with USB 3.1 Gen2 (10Gb/s)) port 0~3 Type A connectors on the rear I/O are for installing USB peripherals.

LAN:

Pin	1000 Base-T	100/10 Base-T	Description
L1	BI_DA+	TX+	Bidirectional or Transmit Data+
L2	BI_DA-	TX-	Bidirectional or Transmit Data-
L3	BI_DB+	RX+	Bidirectional or Receive Data+
L4	BI_DC+	N.C.	Bidirectional or Not Connected
L5	BI_DC-	N.C.	Bidirectional or Not Connected
L6	BI_DB-	RX-	Bidirectional or Receive Data-
L7	BI_DD+	N.C.	Bidirectional or Not Connected
L8	BI_DD-	N.C.	Bidirectional or Not Connected
A	Speed LED 1000: Orange 100/10: Green/OFF		
B	Active Link LED (Yellow) Off: No link Blinking: Data activity detected		

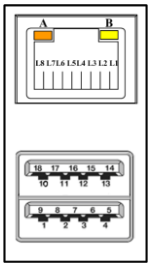
CN16



LAN1

USB

CN17



LAN2

USB

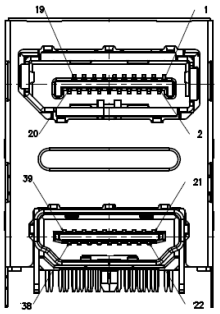
USB:

Pin	Signal	Pin	Signal
1	USB_VCC (+5V)	10	USB_VCC (+5V)
2	USB #0_D-	11	USB #1_D-
3	USB #0_D+	12	USB #1_D+
4	GND	13	GND
5	SSRX0-	14	SSRX1-
6	SSRX0+	15	SSRX1+
7	GND	16	GND
8	SSTX0-	17	SSTX1-
9	SSTX0+	18	SSTX1+

2.4.11 DisplayPort and HDMI Connector (CN18)

The CN18 is a double-deck connector with DisplayPort (upper) and HDMI (lower) port.

Pin	DP Signal	Pin	HDMI Signal
1	LANE 0	21	DATA2
2	GND	22	GND
3	LANE 0#	23	DATA2#
4	LANE 1	24	DATA1
5	GND	25	GND
6	LANE 1#	26	DATA1#
7	LANE 2	27	DATA0
8	GND	28	GND
9	LANE 2#	29	DATA1#
10	LANE 3	30	Clock
11	GND	31	GND
12	LANE 3#	32	Clock#
13	Detect Pin	33	NC
14	GND	34	NC
15	AUX CH	35	SCL
16	GND	36	SDA
17	AUX CH#	37	GND
18	Hot Plug Detect	38	+5V POWER
19	GND	39	Hot Plug Detect
20	DP_PWR(3.3V)		



DisplayPort

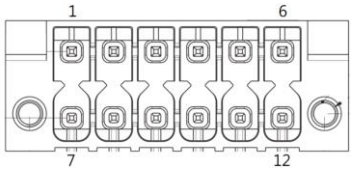
HDMI

2.4.12 Digital I/O Connector (CN19)

The CN19 is a 12-pin connector for digital I/O interface, including two isolated digital-in, two isolated digital-out, two isolated trigger-in and two isolated trigger-out for camera.

Option female connector:
53403060B00E CN-TB 2x6 P=3.5 180D 0159-0112 DINKLE

Pin	Signal	Pin	Signal
1	DI_COM	7	DO_PWR
2	DI 0	8	DO 0
3	DI 1	9	DO 1
4	Trigger input 0	10	Trigger output 0
5	Trigger input 1	11	Trigger output 1
6	ISO_GND	12	ISO_GND

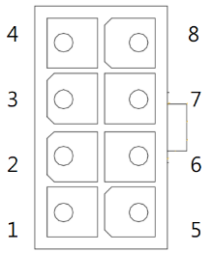


2.4.13 ATX Power Connector (ATX2)

Steady and sufficient power can be supplied to all components on the board by connecting the power connector. Please make sure all components and devices are properly installed before connecting the power connector.

The ATX2 is an 2x4-pin power input interface. Follow the connector orientation to plug the external power supply. Properly press down power supply plug until it completely and firmly fits into this connector. Loose connection may cause system instability.

Pin	Signal
1	GND
2	GND
3	GND
4	GND
5	+12V
6	+12V
7	+12V
8	+12V



2.4.14 CMOS Battery Connector (BAT1)

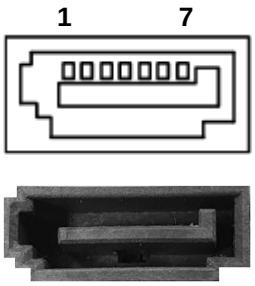
This connector is for CMOS battery interface.

Pin	Signal
1	+3.3V
2	GND

2.4.15 SATA Connector (SATA1)

This Serial Advanced Technology Attachment (Serial ATA or SATA) connector is for high-speed SATA interface. It is a computer bus interface for connecting to devices such as hard disk drive.

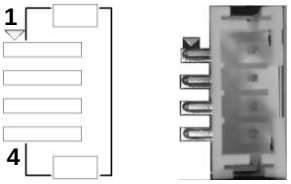
Pin	Signal
1	GND
2	SATA_TXP0
3	SATA_TXN0
4	GND
5	SATA_RXN0
6	SATA_RXP0
7	GND



2.4.16 SATA Power Connector (SATAP1)

This is a 4-pin (pitch=2mm) wafer connector, which is compliant with JST B4B-PH-K-S, for SATA power interface.

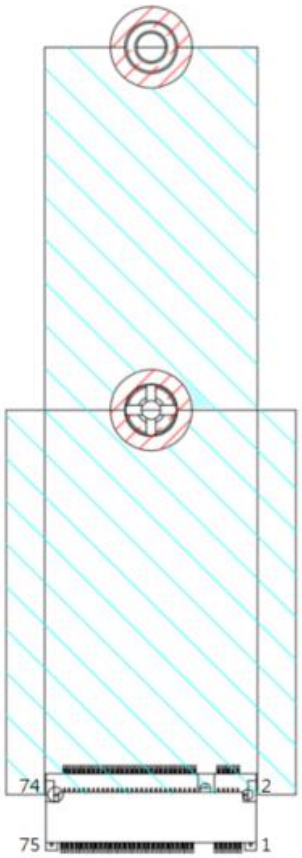
Pin	Signal
1	+12V
2	GND
3	GND
4	+5V



2.4.17 M.2 Key B Connector (SCN1)

The SCN1 is a M.2 Key B connector. It is suggested to install the M.2 storage module via SATA with 22mm width and 42mm or 80mm length or the M.2 cellular module via USB 2.0 or USB3.0 with 30mm width and 42mm length.

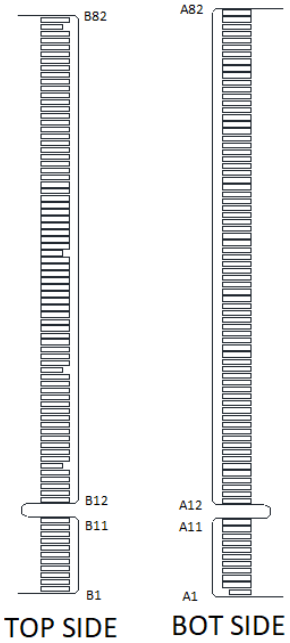
Pin	Signal	Pin	Signal
1	CONFIG_3	2	+3.3V_SBY
3	GND	4	+3.3V_SBY
5	GND	6	Full Card PWR OFF
7	USB_D3+	8	W_DISABLE#
9	USB_D3-	10	NC
11	GND	12	**Key B**
13	**Key B**	14	
15		16	
17		18	
19		20	NC
21	CONFIG_0	22	NC
23	GPIO11(+1.8V)	24	NC
25	NC	26	NC
27	GND	28	NC
29	USB3.0-RX- / PERn1(option)	30	SIM_RST
31	USB3.0-RX+ / PERp1(option)	32	SIM_CLK
33	GND	34	SIM_DATA
35	USB3.0-TX- / PETn1(option)	36	SIM_PWR
37	USB3.0-TX+ / PETn1(option)	38	NC
39	GND	40	SMB_CLK_SBY(+1.8V)
41	SATA1_RX_P / PERn0(option)	42	SMB_DATA_SBY(+1.8V)
43	SATA1_RX_N / PERp0(option)	44	NC
45	GND	46	NC
47	SATA1_TX_N	48	NC
49	SATA1_TX_P	50	PERST#
51	GND	52	CLKREQ#
53	NC	54	PEWAKE#
55	NC	56	NC
57	GND	58	NC
59	NC	60	NC
61	NC	62	NC
63	NC	64	NC
65	NC	66	NC
67	PLTRST	68	SUSCLK
69	CONFIG_1	70	+3.3V_SBY
71	GND	72	+3.3V_SBY
73	GND	74	+3.3V_SBY
75	CONFIG_2		



2.4.18 PCI-Express x16 Golden Finger (GF1)

The GF1 is a PCIe x16 golden finger to support PCIex8. The AX96809 riser card is suggested to use to have PCIex16 slot.

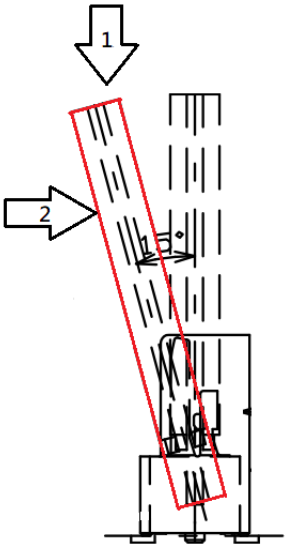
Pin	Signal	Pin	Signal
A1	PRSNT1#	B1	+12V
A2	+12V	B2	+12V
A3	+12V	B3	+12V
A4	GND	B4	GND
A5	NC	B5	SMCLK
A6	NC	B6	SMDAT
A7	NC	B7	GND
A8	NC	B8	+3.3V1
A9	+3.3V	B9	NC
A10	+3.3V	B10	3.3VAUX
A11	PWRGD	B11	WAKE_N
A12	GND	B12	NC
A13	REFCLK+	B13	GND
A14	REFCLK-	B14	HSOP_0
A15	GND	B15	HSON_0
A16	HSIP_0	B16	GND
A17	HSIN_0	B17	PRSNT2#
A18	GND	B18	GND
A19	NC	B19	HSOP_1
A20	GND	B20	HSON_1
A21	HSIP_1	B21	GND
A22	HSIN_1	B22	GND
A23	GND	B23	HSOP_2
A24	GND	B24	HSON_2
A25	HSIP_2	B25	GND
A26	HSIN_2	B26	GND
A27	GND	B27	HSOP_3
A28	GND	B28	HSON_3
A29	HSIP_3	B29	GND
A30	HSIN_3	B30	NC
A31	GND	B31	PRSNT2#1
A32	NC	B32	GND
A33	NC	B33	HSOP_4
A34	GND	B34	HSON_4
A35	HSIP_4	B35	GND
A36	HSIN_4	B36	GND
A37	GND	B37	HSOP_5
A38	GND	B38	HSON_5
A39	HSIP_5	B39	GND
A40	HSIN_5	B40	GND

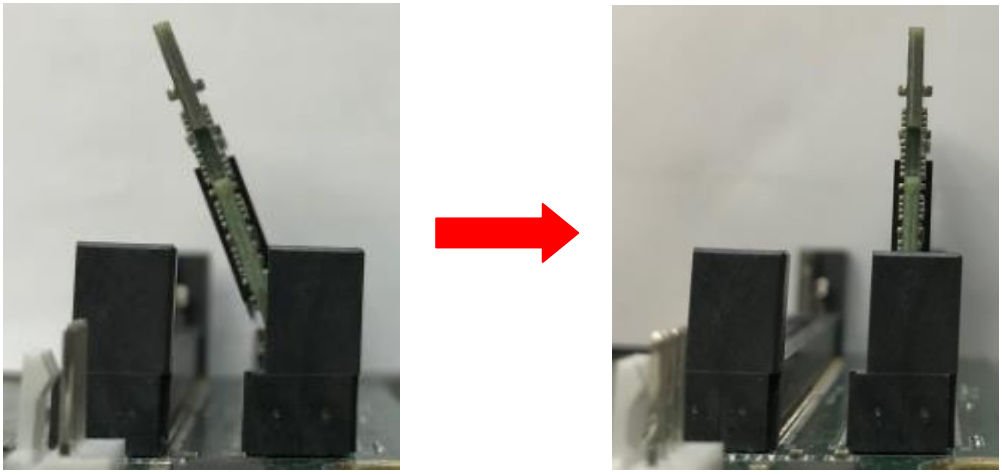


A41	GND	B41	HSOP_6
A42	GND	B42	HSON_6
A43	HSIP_6	B43	GND
A44	HSIN_6	B44	GND
A45	GND	B45	HSOP_7
A46	GND	B46	HSON_7
A47	HSIP_7	B47	GND
A48	HSIN_7	B48	PRSNT2#2
A49	GND	B49	GND
A50	NC	B50	NC
A51	GND	B51	NC
A52	NC	B52	GND
A53	NC	B53	GND
A54	GND	B54	NC
A55	GND	B55	NC
A56	NC	B56	GND
A57	NC	B57	GND
A58	GND	B58	NC
A59	GND	B59	NC
A60	NC	B60	GND
A61	NC	B61	GND
A62	GND	B62	NC
A63	GND	B63	NC
A64	NC	B64	GND
A65	NC	B65	GND
A66	GND	B66	NC
A67	GND	B67	NC
A68	NC	B68	GND
A69	NC	B69	GND
A70	GND	B70	NC
A71	GND	B71	NC
A72	NC	B72	GND
A73	NC	B73	GND
A74	GND	B74	NC
A75	GND	B75	NC
A76	NC	B76	GND
A77	NC	B77	GND
A78	GND	B78	NC
A79	GND	B79	NC
A80	NC	B80	GND
A81	NC	B81	NC
A82	GND	B82	NC

2.4.19 DDR4 SO-DIMM Set Up (DIMM1, DIMM2)

Install the memory module(s) into DIMM1 or DIMM2 carefully as indicated in image below. First, follow arrow 1, insert memory module at approximately 15 degree angle into the socket. Then push module in the direction of arrow 2 until it completely fits into DIMM1 or DIMM2.





Chapter 3
I/O Connection

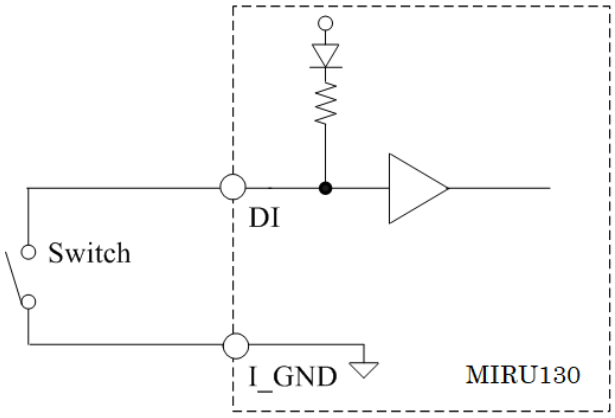
3.1 I/O Connection

Refer to this section to connect any cables between the MIRU130 and device. Each of the following I/O figures illustrates their respective connection on the MIRU130.

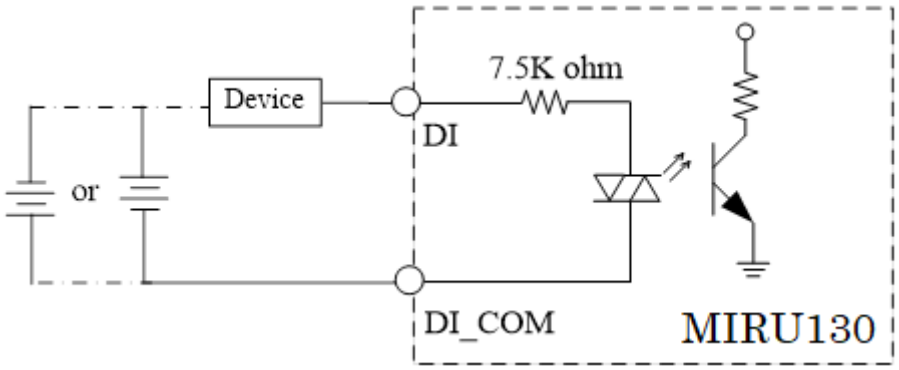
3.1.1 Isolated Digital Input

The following figure shows how to connect between external input source and the MIRU130.

Dry contact:



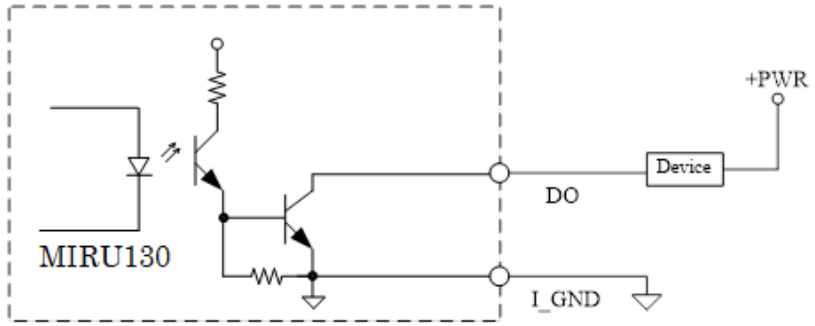
Wet contact:
Each of the isolated digital input channels accepts 0~30VDC with sink type and source type.



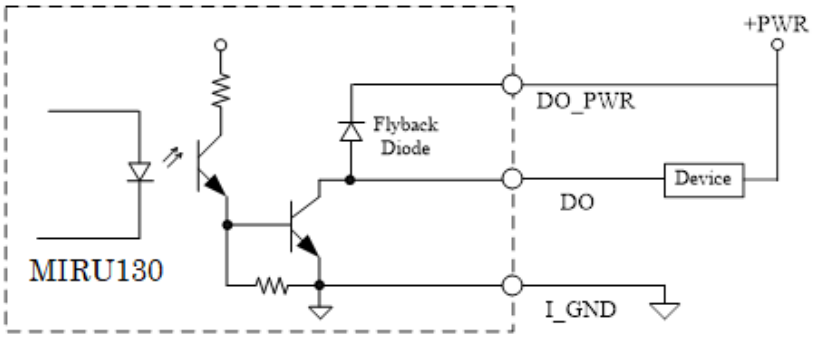
3.1.2 Isolated Digital Output

The following figure shows how to connect between an output channel and the MIRU130. If an external voltage 5~30VDC is applied to an isolated output channel, the current will flow from the external voltage source to the board. Please note that the current through each DO channel should not exceed 200mA.

Resister load:



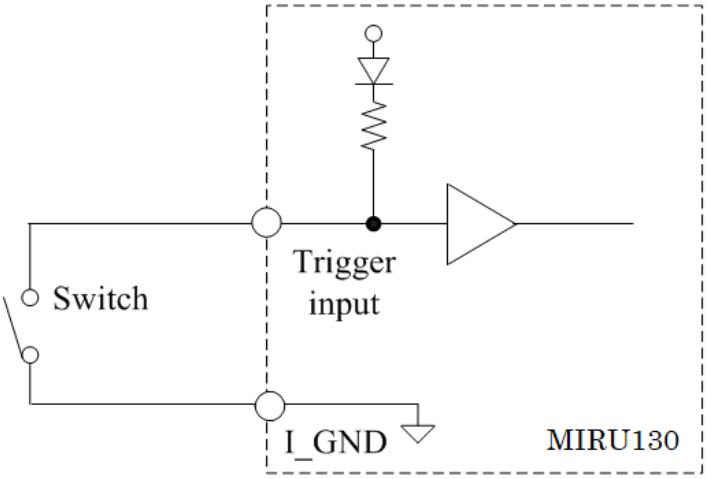
Inductive load:



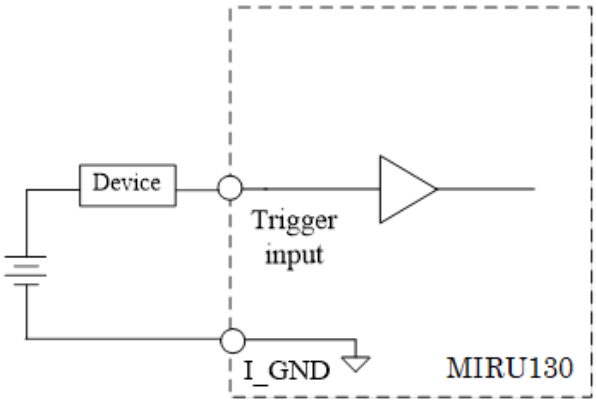
3.1.3 Isolated Trigger Input and Auto Measurement Input

The following figure shows how to connect between external input source and the MIRU130.

Dry contact:

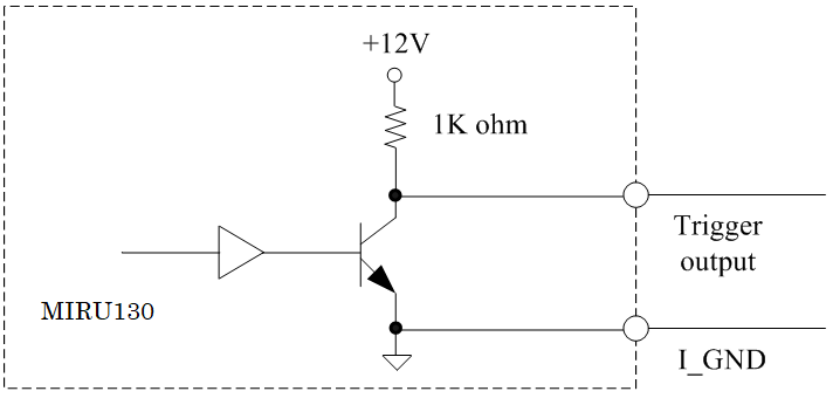


Wet contact:
Each of the isolated digital input channels accepts 0~30VDC with sink type.



3.1.4 Isolated Trigger Output

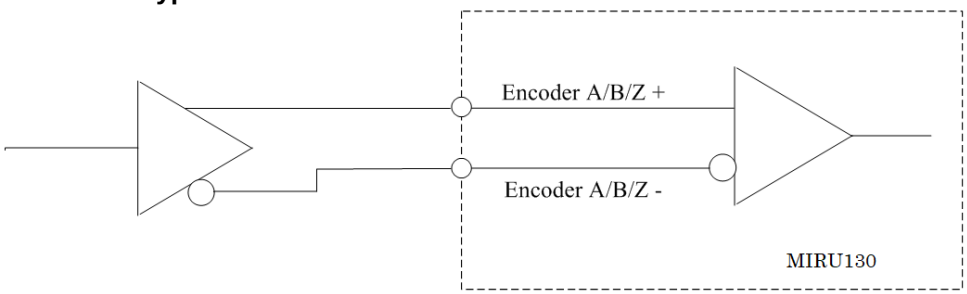
The following figure shows how to connect between an output channel and the MIRU130. The board provides voltage 12VDC for an isolated output channel.



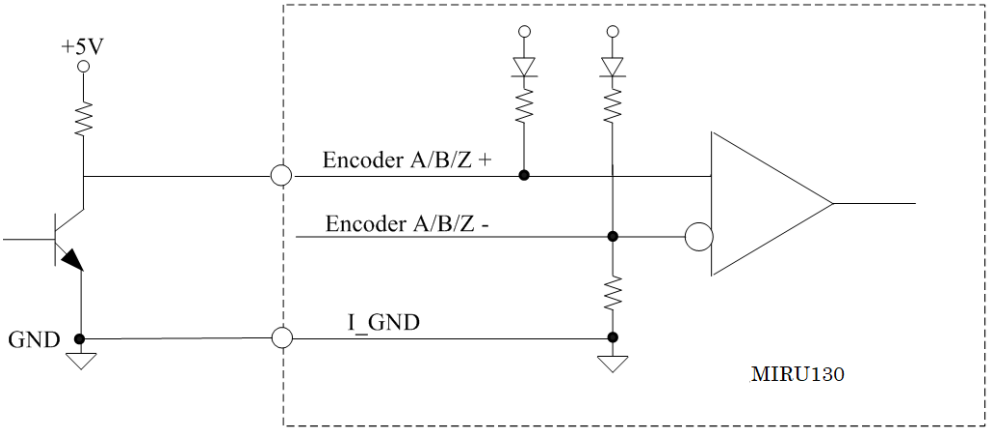
3.1.5 Isolated Encoder Input

The following figure shows how to connect between an input channel and the MIRU130.

Differential type:



5V Voltage Type:



Chapter 4
Operating

4.1 Operating

This section describes the detail operation of the MIRU130 vision I/O feature.

4.1.1 Encoder function

The MIRU130 vision I/O feature supports 1CH 16-bit incremental quadrature encoder input for the AB signal mode, which is used for applications where direction sensing is required. This mode consists of two square-wave pulse signals known as Phase A and Phase B generated by a rotating encoder. Phase A and Phase B signals are coded 90° out of phase from each other—Phase A is either 90° phase leading or lagging behind Phase B. The MIRU130 is able to count square-wave pulses of Phase A and Phase B, and then determine rotating direction of motor movement by comparing the phase relationship between Phase A and B:

- When the quadrature encoder is rotating in a clockwise direction, its signal will show a positive direction of Phase A leading Phase B.
- When the quadrature encoder rotates counterclockwise, its signal will show a negative direction of Phase A lagging behind Phase B.

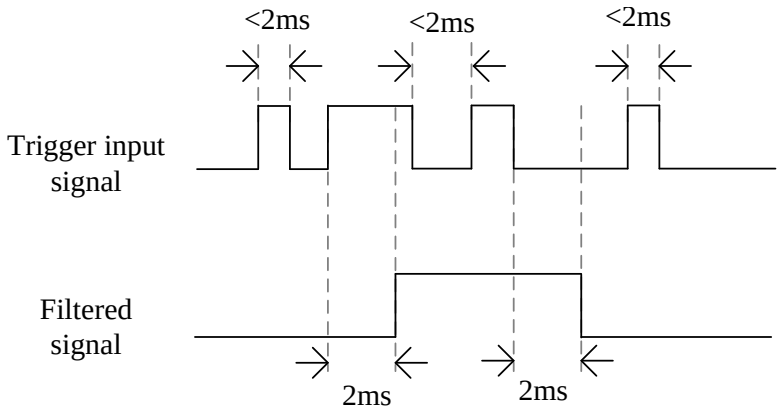
Besides direction, the quadrature encoder can generate another signal named Phase Z, which is produced once per complete rotation of the quadrature encoder. Phase Z is used by the MIRU130 baord to locate a specific position when the quadrature encoder completes a 360° rotation, so that the board can reset its counter value to zero if necessary.

In most cases, the x4 Phase AB signal mode is applied to incremental encoder devices. For example, an incremental encoder generates 1000 pulses per phase (A or B phase) when a motor completes a 360° rotation, but the count will show 4000 pulses.

4.1.2 Trigger Input/Output

The MIRU130's trigger input supports de-bounce filter function to help filter out environmental noise that can mix with normal encoder signals and affect the accuracy of the pulse count. The de-bounce filter defines the interval width for high/low signals. Signals with interval width less than the defined value will be filtered out.

Below is a diagram illustrating the case of filter timer set with a duration time of 2 millisecond:



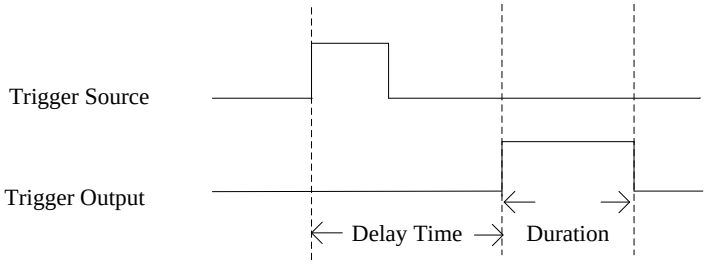
Trigger Output CH 0~1 provides the following parameters to configure:

- **Trigger source**
  The user can select any of the following items as a triggering condition that prompts the MIRU130 to generate a trigger output: Trigger Input CH 0~3, Encoder Phase Z, Encoder Check Pointer CH0~2.
  Note: One trigger source can be set to activate multiple trigger outputs.

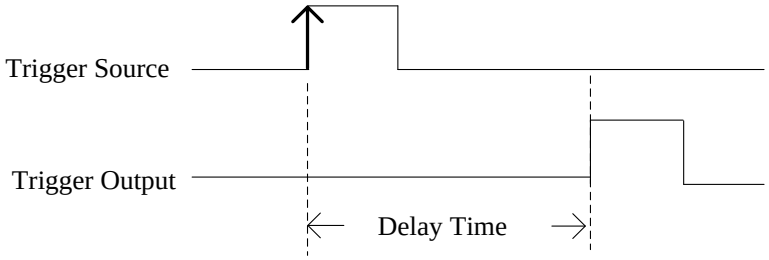
- **Delay time function**
  The user can set the delay time that the MIRU130 waits before it sends a trigger output.

- **Duration time**
  The user can adjust pulse width for the output signal.

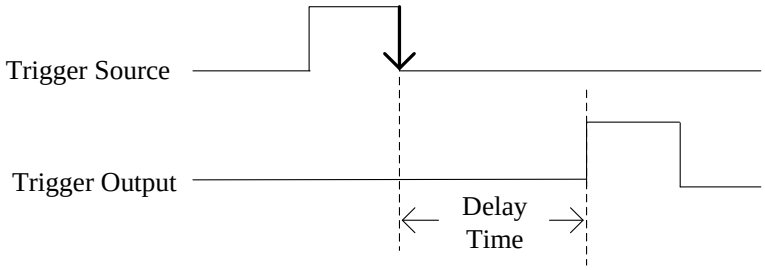
  Definitions of delay time and duration time are illustrated below:



- **Inverter**
  Trigger source mode can be set as rising trigger or falling trigger.



Rising Trigger



Falling Trigger

4.1.3 LED Lighting Control

Select Trigger Output CH 4~5 to perform LED light control including LED brightness settings for various machine vision applications.

Note: The MIRU130 card provides the power sources as below:

- Output voltage: 24VDC, max. 0.5A per channel.
- Each channel can be set to provide 100mA/250mA/350mA/500mA output by switch.

4.1.4 Interrupt

This function can send an interrupt signal to the host PC. The user can select two conditions from the list below for the MIRU130 to generate an interrupt signal:

1. Digital Input
2. Trigger Input
3. Encoder Phase Z
4. Encoder Check Pointer

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Chapter 5
Hardware Description

5.1 Microprocessors

The MIRU130 supports AMD® V1000 which enables your system to operate under Windows® 10 environments. The system performance depends on the microprocessor. Make sure all correct settings are arranged for the installed microprocessor to prevent the CPU from damages.

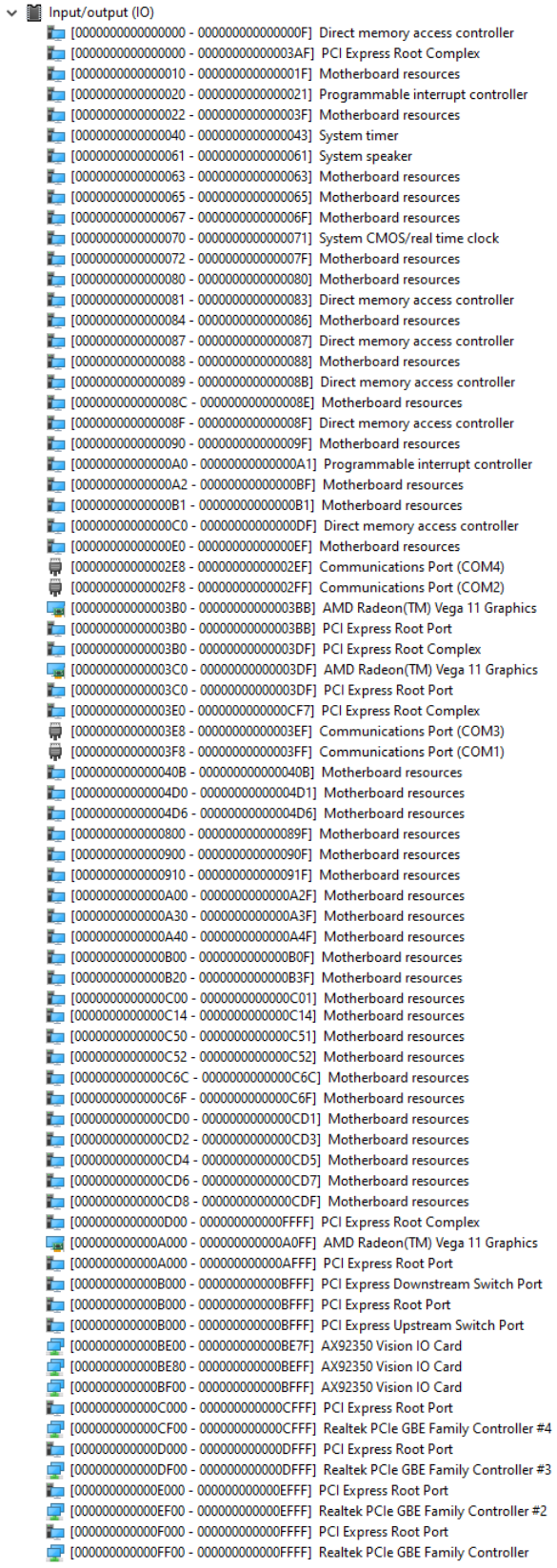
5.2 BIOS

The MIRU130 uses AMI Plug and Play BIOS with a single 64Mbit SPI Flash.

5.3 System Memory

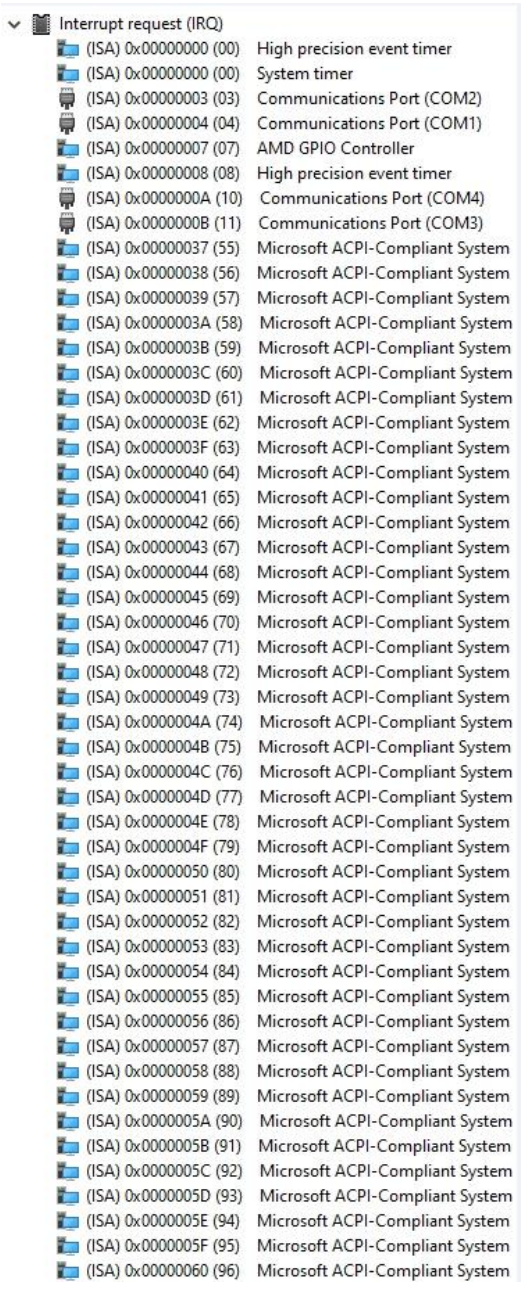
The MIRU130 supports two 260-pin DDR4 SO-DIMM sockets. The memory module comes in sizes of 2GB, 4GB and 8GB.

5.4 I/O Port Address Map



5.5 Interrupt Controller (IRQ) Map

The interrupt controller (IRQ) mapping list is shown as follows:



(ISA) 0x00000094 (148) Microsoft ACPI-Compliant System
(ISA) 0x00000095 (149) Microsoft ACPI-Compliant System
(ISA) 0x00000096 (150) Microsoft ACPI-Compliant System
(ISA) 0x00000097 (151) Microsoft ACPI-Compliant System
(ISA) 0x00000098 (152) Microsoft ACPI-Compliant System
(ISA) 0x00000099 (153) Microsoft ACPI-Compliant System
(ISA) 0x0000009A (154) Microsoft ACPI-Compliant System
(ISA) 0x0000009B (155) Microsoft ACPI-Compliant System
(ISA) 0x0000009C (156) Microsoft ACPI-Compliant System
(ISA) 0x0000009D (157) Microsoft ACPI-Compliant System
(ISA) 0x0000009E (158) Microsoft ACPI-Compliant System
(ISA) 0x0000009F (159) Microsoft ACPI-Compliant System
(ISA) 0x000000A0 (160) Microsoft ACPI-Compliant System
(ISA) 0x000000A1 (161) Microsoft ACPI-Compliant System
(ISA) 0x000000A2 (162) Microsoft ACPI-Compliant System
(ISA) 0x000000A3 (163) Microsoft ACPI-Compliant System
(ISA) 0x000000A4 (164) Microsoft ACPI-Compliant System
(ISA) 0x000000A5 (165) Microsoft ACPI-Compliant System
(ISA) 0x000000A6 (166) Microsoft ACPI-Compliant System
(ISA) 0x000000A7 (167) Microsoft ACPI-Compliant System
(ISA) 0x000000A8 (168) Microsoft ACPI-Compliant System
(ISA) 0x000000A9 (169) Microsoft ACPI-Compliant System
(ISA) 0x000000AA (170) Microsoft ACPI-Compliant System
(ISA) 0x000000AB (171) Microsoft ACPI-Compliant System
(ISA) 0x000000AC (172) Microsoft ACPI-Compliant System
(ISA) 0x000000AD (173) Microsoft ACPI-Compliant System
(ISA) 0x000000AE (174) Microsoft ACPI-Compliant System
(ISA) 0x000000AF (175) Microsoft ACPI-Compliant System
(ISA) 0x000000B0 (176) Microsoft ACPI-Compliant System
(ISA) 0x000000B1 (177) Microsoft ACPI-Compliant System
(ISA) 0x000000B2 (178) Microsoft ACPI-Compliant System
(ISA) 0x000000B3 (179) Microsoft ACPI-Compliant System
(ISA) 0x000000B4 (180) Microsoft ACPI-Compliant System
(ISA) 0x000000B5 (181) Microsoft ACPI-Compliant System
(ISA) 0x000000B6 (182) Microsoft ACPI-Compliant System
(ISA) 0x000000B7 (183) Microsoft ACPI-Compliant System
(ISA) 0x000000B8 (184) Microsoft ACPI-Compliant System
(ISA) 0x000000B9 (185) Microsoft ACPI-Compliant System
(ISA) 0x000000BA (186) Microsoft ACPI-Compliant System
(ISA) 0x000000BB (187) Microsoft ACPI-Compliant System
(ISA) 0x000000BC (188) Microsoft ACPI-Compliant System
(ISA) 0x000000BD (189) Microsoft ACPI-Compliant System
(ISA) 0x000000BE (190) Microsoft ACPI-Compliant System
(ISA) 0x000000BF (191) Microsoft ACPI-Compliant System
(ISA) 0x000000C0 (192) Microsoft ACPI-Compliant System
(ISA) 0x000000C1 (193) Microsoft ACPI-Compliant System
(ISA) 0x000000C2 (194) Microsoft ACPI-Compliant System
(ISA) 0x000000C3 (195) Microsoft ACPI-Compliant System
(ISA) 0x000000C4 (196) Microsoft ACPI-Compliant System
(ISA) 0x000000C5 (197) Microsoft ACPI-Compliant System
(ISA) 0x000000C6 (198) Microsoft ACPI-Compliant System
(ISA) 0x000000C7 (199) Microsoft ACPI-Compliant System
(ISA) 0x000000C8 (200) Microsoft ACPI-Compliant System
(ISA) 0x000000C9 (201) Microsoft ACPI-Compliant System
(ISA) 0x000000CA (202) Microsoft ACPI-Compliant System
(ISA) 0x000000CB (203) Microsoft ACPI-Compliant System
(ISA) 0x000000CC (204) Microsoft ACPI-Compliant System
(ISA) 0x00000100 (256) Microsoft ACPI-Compliant System
(ISA) 0x00000101 (257) Microsoft ACPI-Compliant System
(ISA) 0x00000102 (258) Microsoft ACPI-Compliant System
(ISA) 0x00000103 (259) Microsoft ACPI-Compliant System
(ISA) 0x00000104 (260) Microsoft ACPI-Compliant System
(ISA) 0x00000105 (261) Microsoft ACPI-Compliant System
(ISA) 0x00000106 (262) Microsoft ACPI-Compliant System
(ISA) 0x00000107 (263) Microsoft ACPI-Compliant System
(ISA) 0x00000108 (264) Microsoft ACPI-Compliant System
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(PCI) 0x00000035 (53) AMD Audio CoProcessor
(PCI) 0x00000035 (53) High Definition Audio Controller
(PCI) 0x00000036 (54) High Definition Audio Controller
(PCI) 0x00000037 (55) AMD SFH KMDF I2C
(PCI) 0xFFFFFFDD (-35) AX92350 Vision IO Card
(PCI) 0xFFFFFFDE (-34) Realtek PCIe GBE Family Controller #4
(PCI) 0xFFFFFFDF (-33) Realtek PCIe GBE Family Controller #3
(PCI) 0xFFFFFFE0 (-32) Realtek PCIe GBE Family Controller #2
(PCI) 0xFFFFFFE1 (-31) Realtek PCIe GBE Family Controller
(PCI) 0xFFFFFFE2 (-30) AMD Radeon(TM) Vega 11 Graphics
(PCI) 0xFFFFFFE3 (-29) AMD Radeon(TM) Vega 11 Graphics
(PCI) 0xFFFFFFE4 (-28) AMD Radeon(TM) Vega 11 Graphics
(PCI) 0xFFFFFFE5 (-27) AMD USB 3.10 eXtensible Host Controller - 1.10 (Microsoft)
(PCI) 0xFFFFFFE6 (-26) AMD USB 3.10 eXtensible Host Controller - 1.10 (Microsoft)
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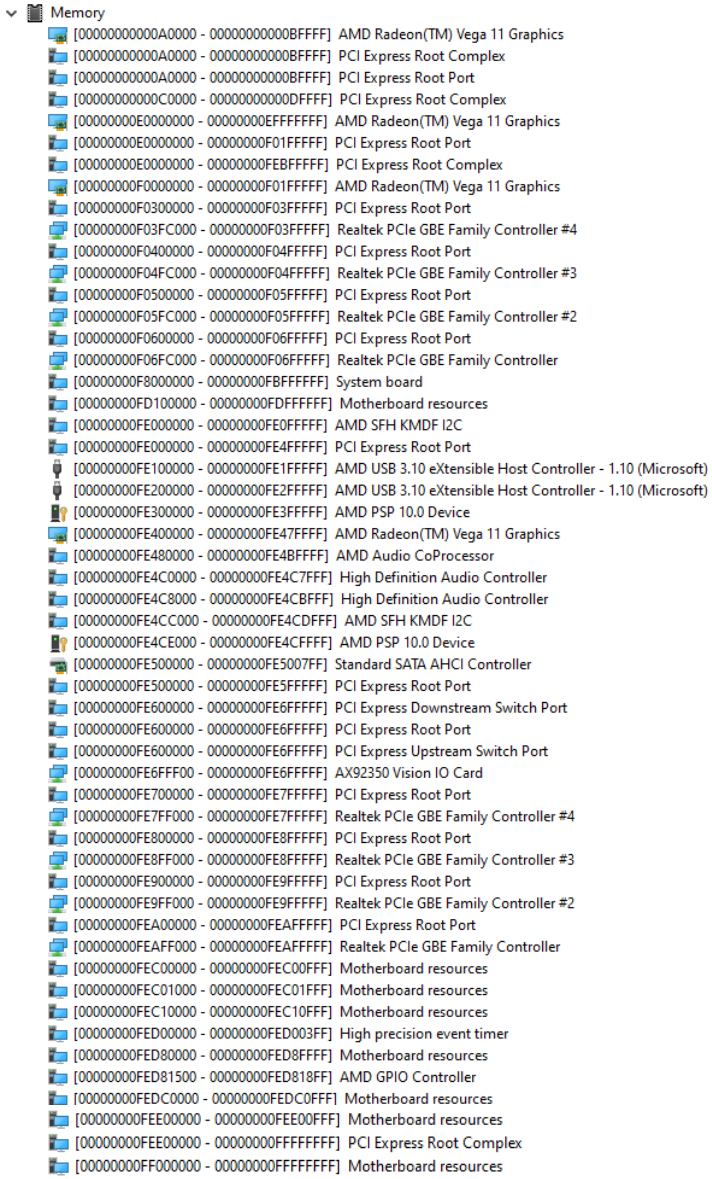
(PCI) 0xFFFFFFF5 (-11) AMD PSP 10.0 Device
(PCI) 0xFFFFFFF6 (-10) AMD PSP 10.0 Device
(PCI) 0xFFFFFFF7 (-9) Standard SATA AHCI Controller
(PCI) 0xFFFFFFF8 (-8) PCI Express Root Port
(PCI) 0xFFFFFFF9 (-7) PCI Express Root Port
(PCI) 0xFFFFFFFA (-6) PCI Express Root Port
(PCI) 0xFFFFFFFB (-5) PCI Express Root Port
(PCI) 0xFFFFFFFC (-4) PCI Express Root Port
(PCI) 0xFFFFFFFD (-3) PCI Express Root Port
(PCI) 0xFFFFFFFE (-2) PCI Express Root Port

5.6 Memory Map

The memory mapping list is shown as follows:



Chapter 6
AMI BIOS Setup Utility

The AMI UEFI BIOS provides users with a built-in setup program to modify basic system configuration. All configured parameters are stored in a flash chip to save the setup information whenever the power is turned off. This chapter provides users with detailed description about how to set up basic system configuration through the AMI BIOS setup utility.

6.1 Starting

To enter the setup screens, follow the steps below:

1. Turn on the computer and press the <Del> key immediately.
2. After you press the <Del> key, the main BIOS setup menu displays. You can access the other setup screens from the main BIOS setup menu, such as the Advanced and Chipset menus.

Note

If your computer cannot boot after making and saving system changes with BIOS setup, you can restore BIOS optimal defaults by setting SW1-2 (see section 2.4.1).

It is strongly recommended that you should avoid changing the chipset's defaults. Both AMI and your system manufacturer have carefully set up these defaults that provide the best performance and reliability.

6.2 Navigation Keys

The BIOS setup/utility uses a key-based navigation system called hot keys. Most of the BIOS setup utility hot keys can be used at any time during the setup navigation process. These keys include <F1>, <F2>, <Enter>, <ESC>, <Arrow> keys, and so on.

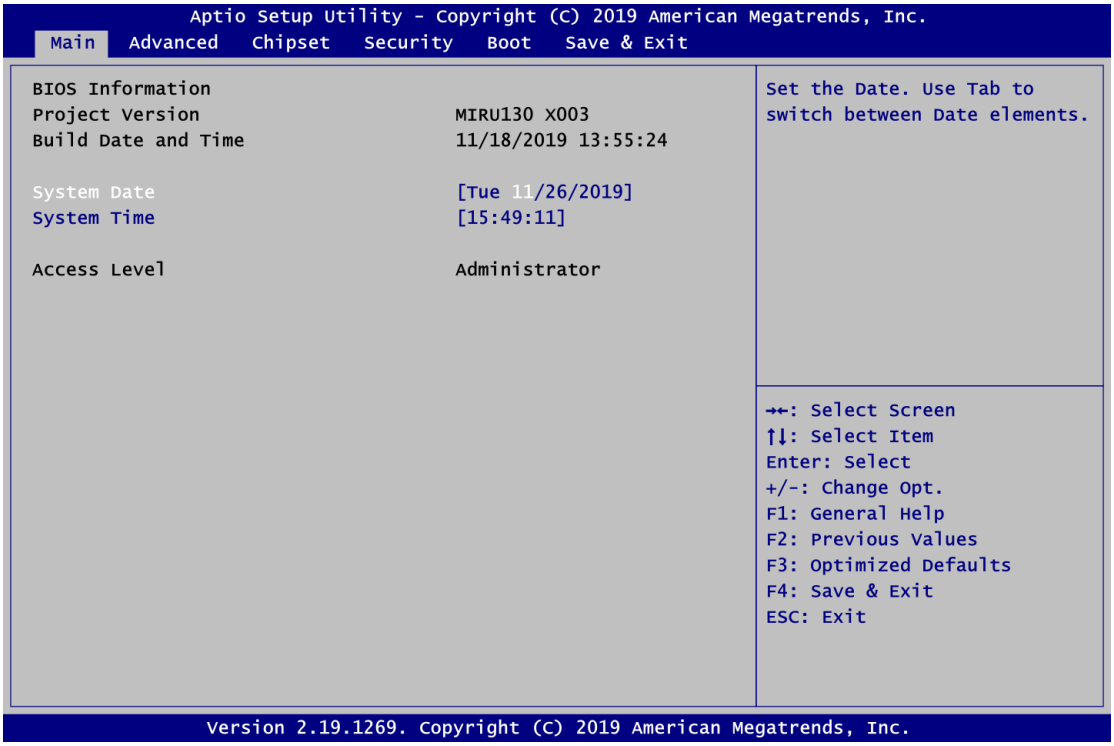
Note

Some of the navigation keys differ from one screen to another.

Hot Keys	Description
→← Left/Right	The Left and Right <Arrow> keys allow you to select a setup screen.
↑↓ Up/Down	The Up and Down <Arrow> keys allow you to select a setup screen or sub-screen.
+– Plus/Minus	The Plus and Minus <Arrow> keys allow you to change the field value of a particular setup item.
Tab	The <Tab> key allows you to select setup fields.
F1	The <F1> key allows you to display the General Help screen.
F2	The <F2> key allows you to Load Previous Values.
F3	The <F3> key allows you to Load Optimized Defaults.
F4	The <F4> key allows you to save any changes you have made and exit Setup. Press the <F4> key to save your changes.
Esc	The <Esc> key allows you to discard any changes you have made and exit the Setup. Press the <Esc> key to exit the setup without saving your changes.
Enter	The <Enter> key allows you to display or change the setup option listed for a particular setup item. The <Enter> key can also allow you to display the setup sub- screens.

6.3 Main Menu

When you first enter the setup utility, you will enter the Main setup screen. You can always return to the Main setup screen by selecting the Main tab. System Time/Date can be set up as described below. The Main BIOS setup screen is shown below.



- **BIOS Information**
  Display BIOS information.

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

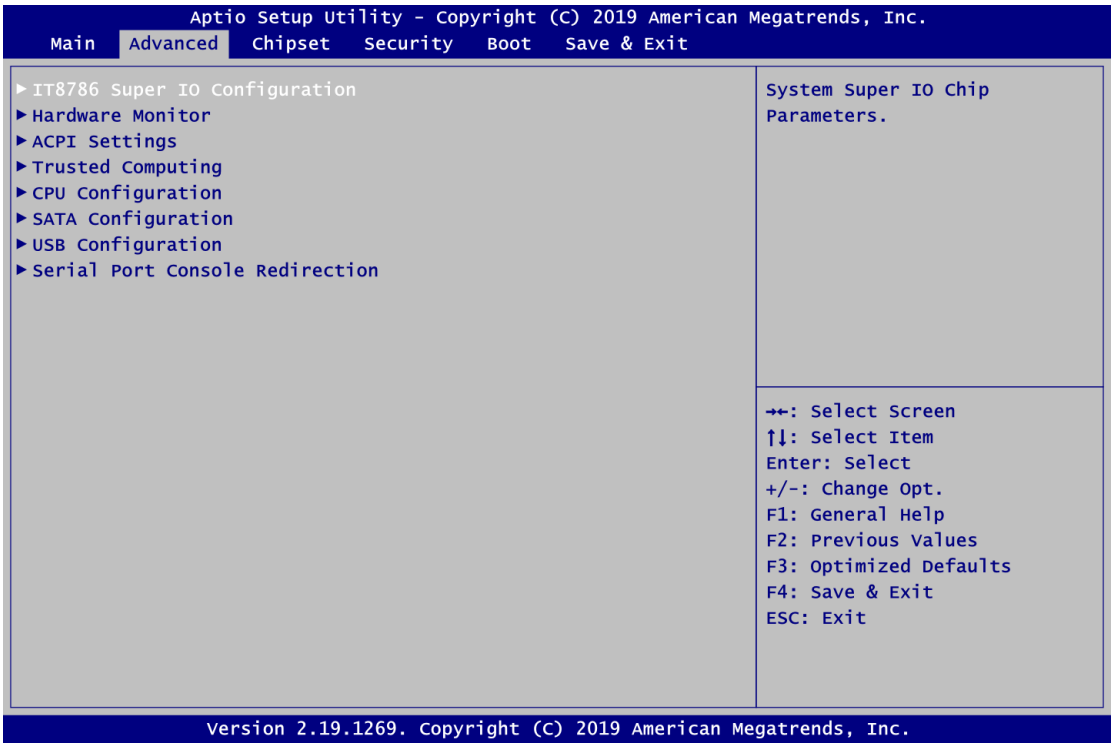
- **Access Level**
  Display the access level of current user.

6.4 Advanced Menu

The Advanced menu also allows users to set configuration of the CPU and other system devices. You can select any of the items in the left frame of the screen to go to the sub menus:

- ▶ IT8786 Super IO Configuration
- ▶ Hardware Monitor
- ▶ ACPI Settings
- ▶ Trusted Computing
- ▶ CPU Configuration
- ▶ SATA Configuration
- ▶ USB Configuration
- ▶ Serial Port Console Redirection

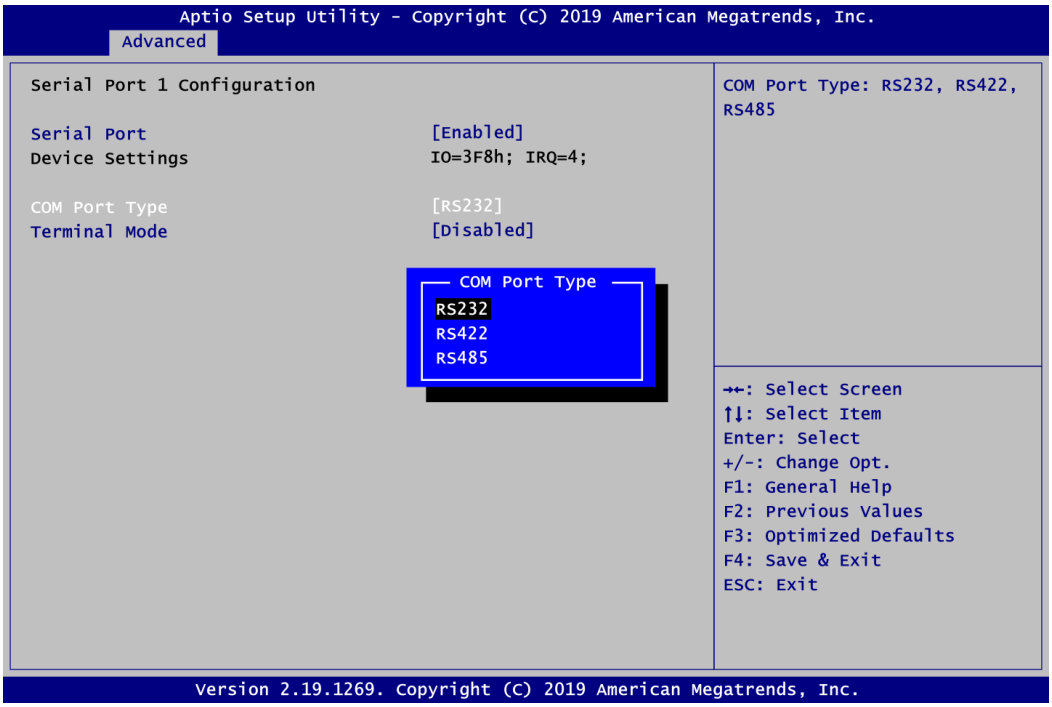
For items marked with "▶", please press <Enter> for more options.



- **IT8786 Super IO Configuration**
  You can use this screen to select options for serial port configuration, and change the value of the selected option. A description of the selected item appears on the right side of the screen. For items marked with "▶", please press <Enter> for more options.

Serial Port 1~4 Configuration
Use these items to set parameters related to serial port 1~4.

- **Serial Port 1 Configuration**

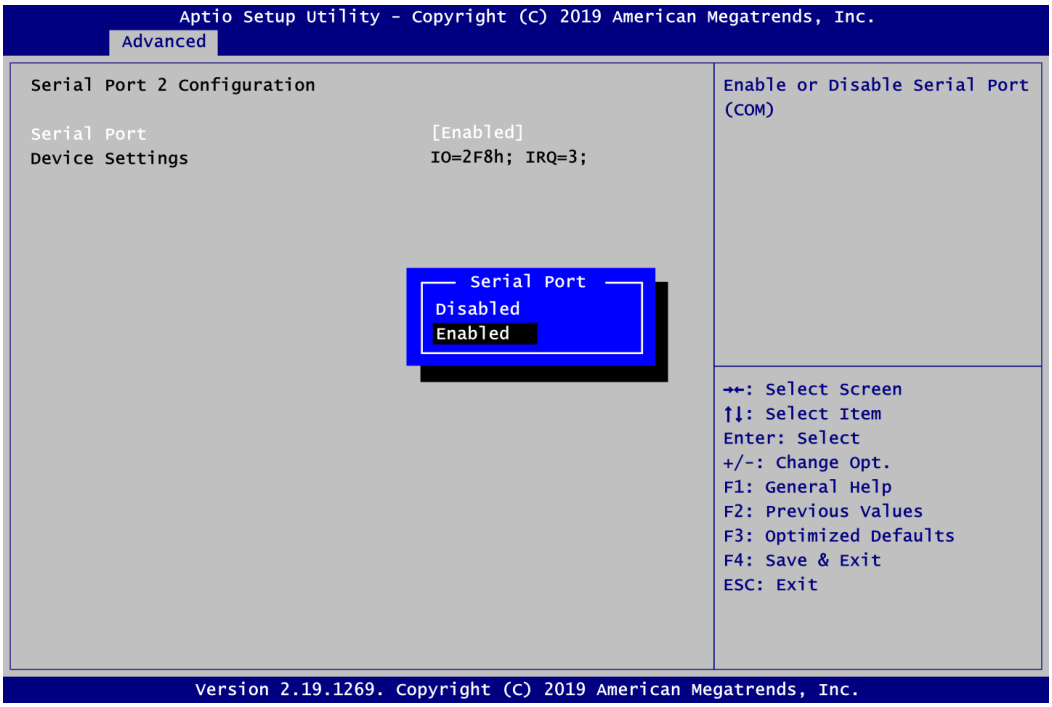


Serial Port
Enable or disable serial port 1. The optimal setting for base I/O address is 3F8h and for interrupt request address is IRQ4.

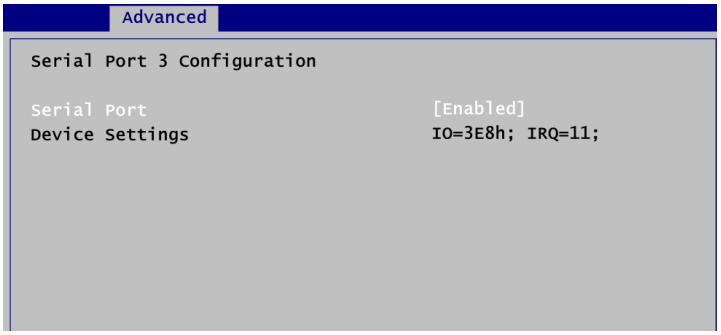
COM Port Type
Use this item to set RS-232/422/485 communication mode.

Terminal Mode
Enable terminal mode to enable the RS-422/485 termination resistor to enhance the signal.

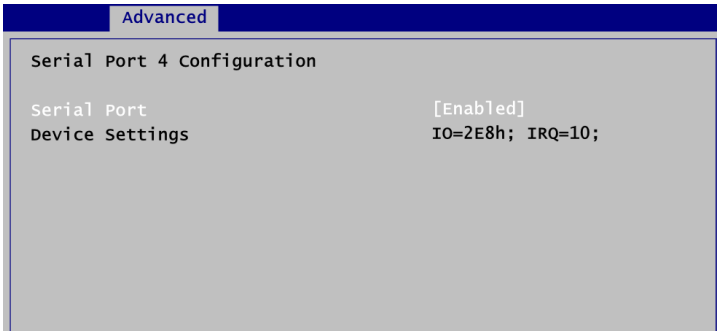
- **Serial Port 2~4 Configuration**



Serial Port
Enable or disable serial port 2. The optimal setting for base I/O address is 2F8h and for interrupt request address is IRQ3.

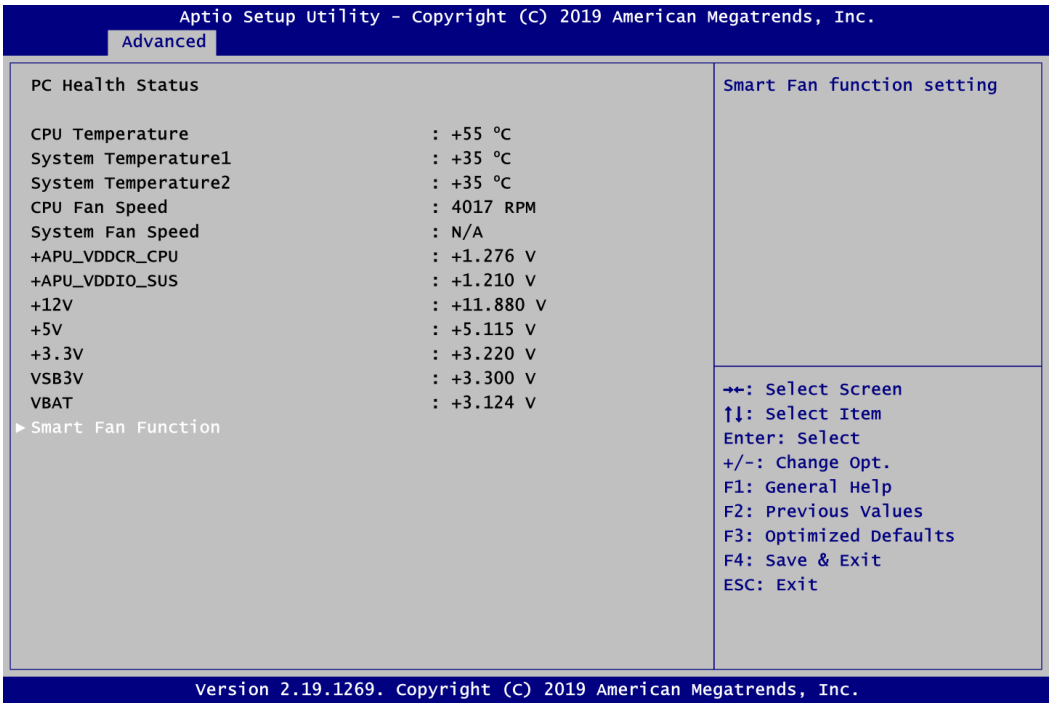


Enable or disable serial port 3. The optimal setting for base I/O address is 3E8h and for interrupt request address is IRQ11.



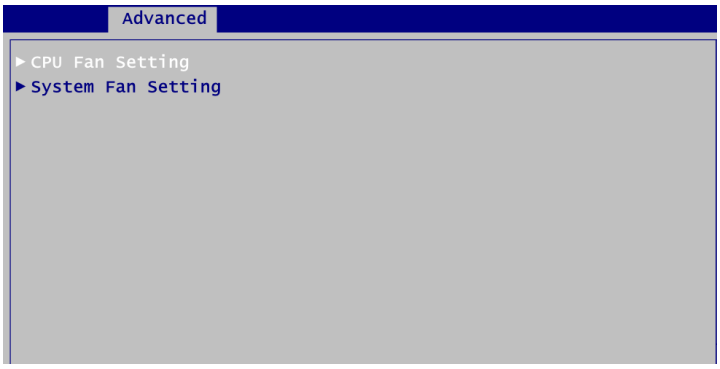
Enable or disable serial port 4. The optimal setting for base I/O address is 2E8h and for interrupt request address is IRQ10.

- **Hardware Monitor**
  This screen monitors hardware health status.

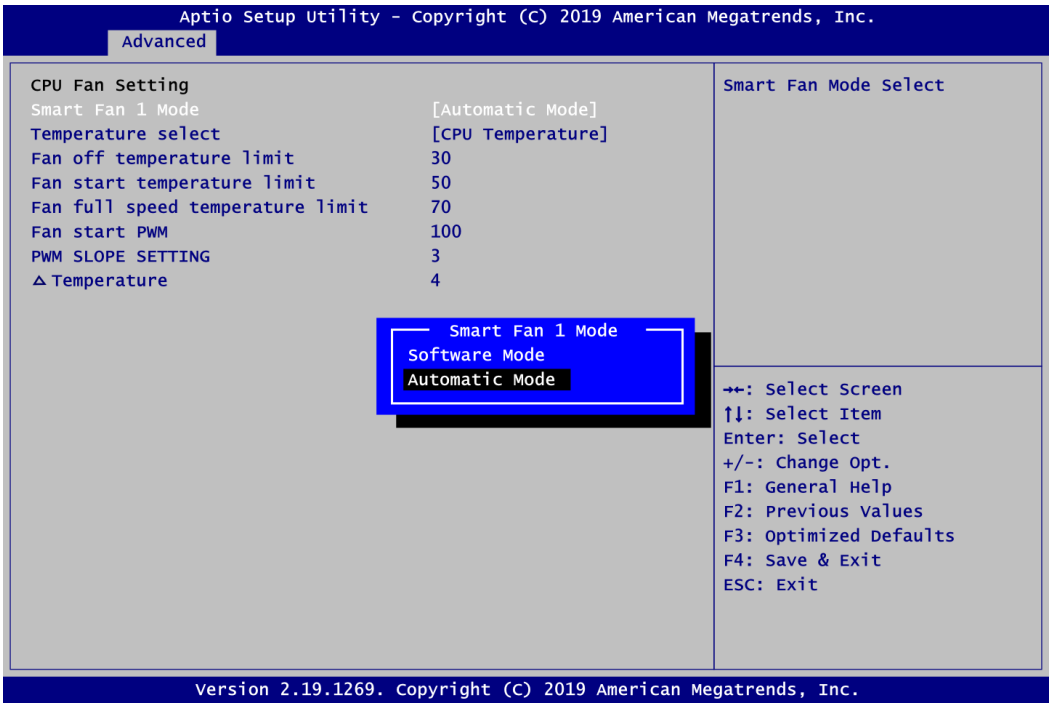


This screen displays the temperature of system and CPU, fan speed in RPM and system voltages.

Smart Fan Function
Use this item to set Smart Fan function: CPU Fan Setting and System Fan Setting.

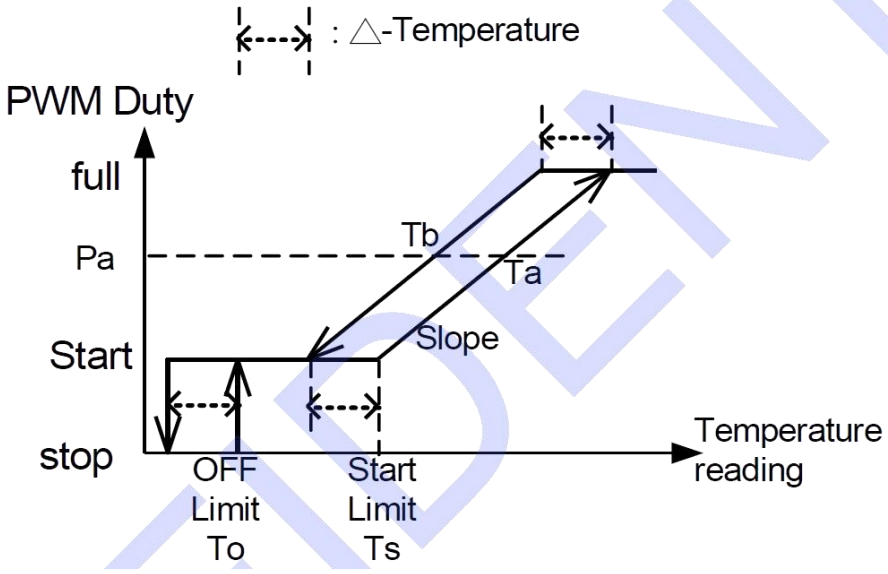


CPU/System Fan Setting

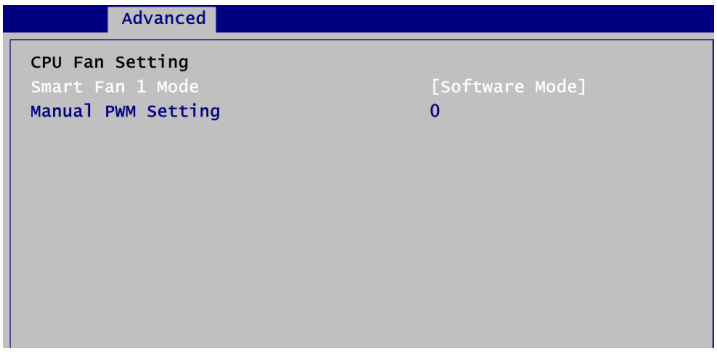


Smart Fan 1/2 Mode
The smart fan 1/2 configuration provides two modes: Software and Automatic Mode to control fan speed.

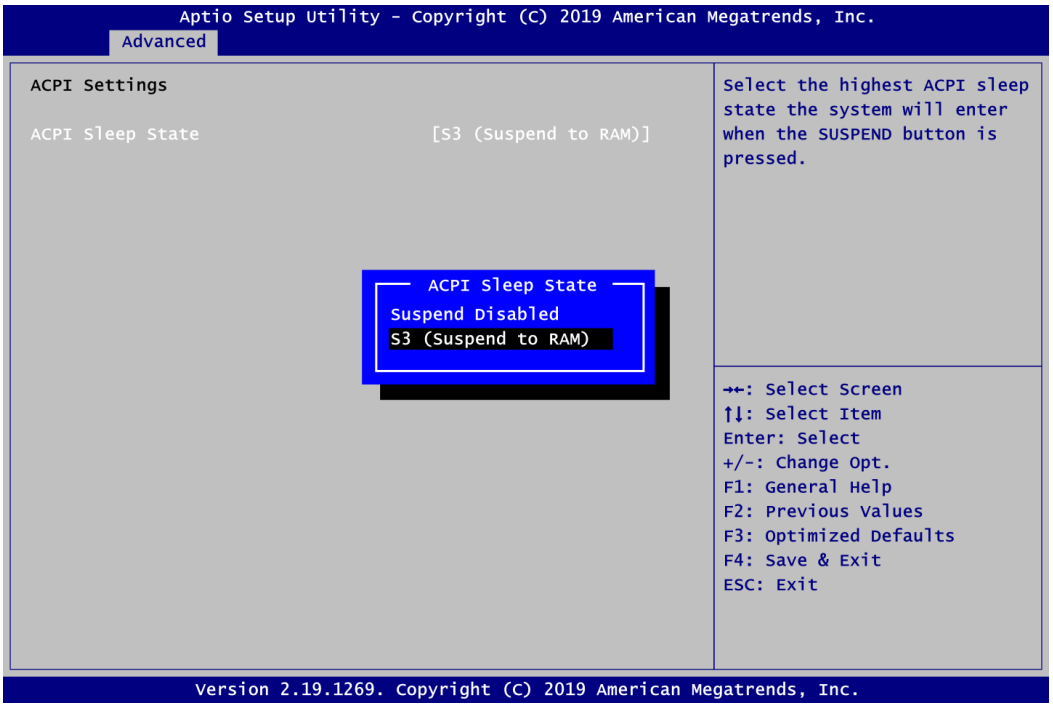
In Automatic Mode, the fan speed is controlled by the following parameters:
Temperature input selection: Choose System Temperature1, System Temperature2 or CPU Temperature.
Fan off temperature limit: The fan will off when temperature is lower than this limit.
Fan start temperature limit: The fan will work when temperature is higher than this limit.
Fan full speed temperature limit: The fan will run in full speed when temperature is higher than this limit.
Fan start PWM: The fan will start with this PWM value and its range is from 0 to 255.
PWM SLOPE SETTING: This is PWM slope selection.
△Temperature: Temperature interval.



In Software Mode, the fan speed is controlled manually by PWM value and its range is from 0 to 255 (see image below).

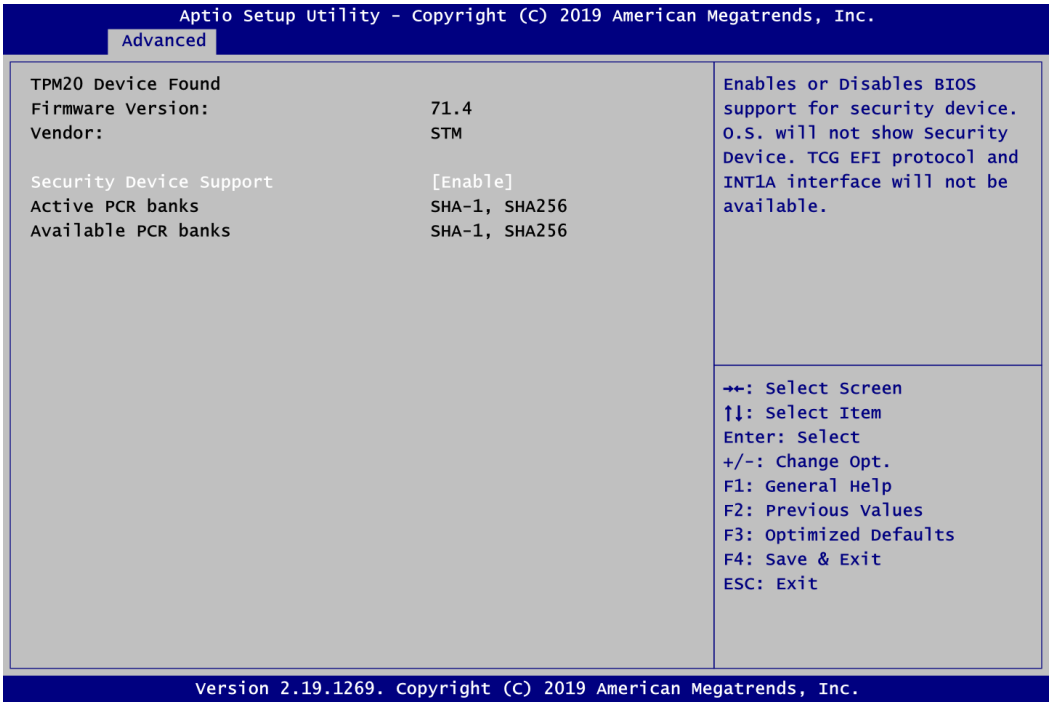


- **ACPI Settings**



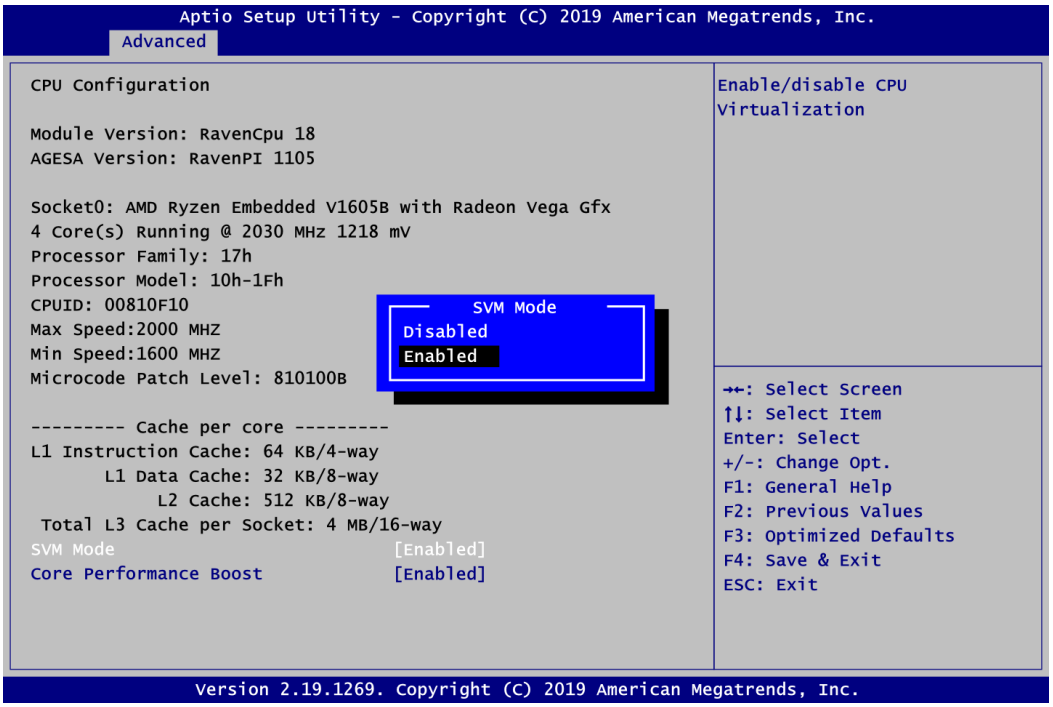
ACPI Sleep State
Select the ACPI (Advanced Configuration and Power Interface) sleep state. Configuration options are Suspend Disabled and S3 (Suspend to RAM). When S3 (Suspend to RAM) option is selected, the system will enter after suspend button is pressed.

- **Trusted Computing**
  You can use this screen for TPM (Trusted Platform Module) configuration. It also shows current TPM status information.



Security Device Support
Enable or disable BIOS support for security device.

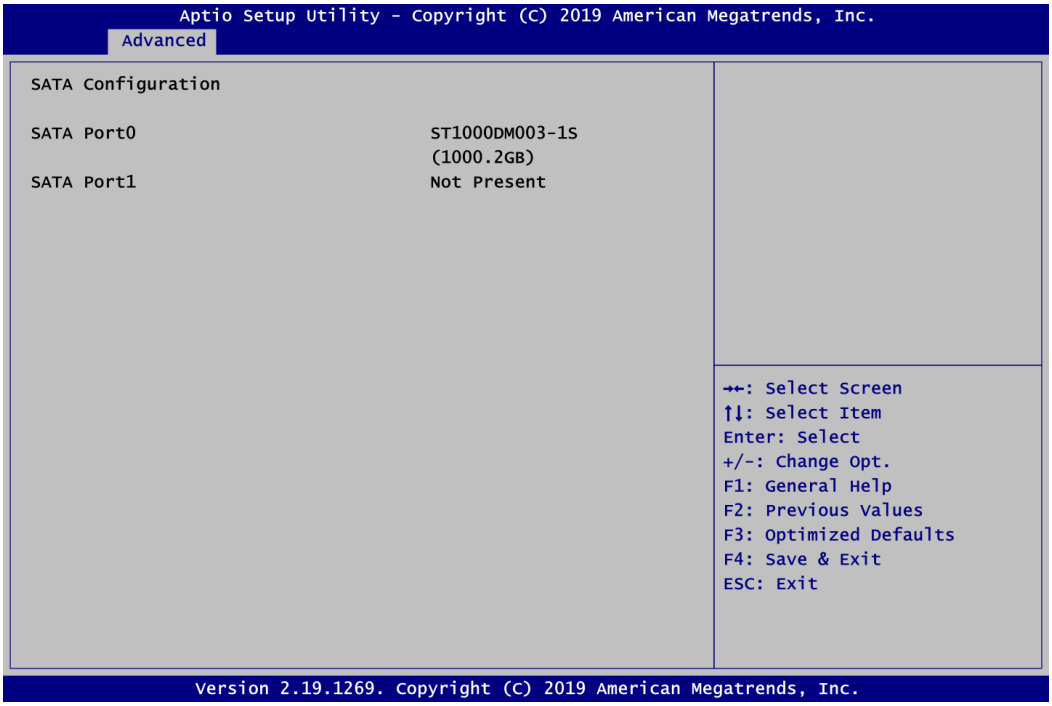
- **CPU Configuration**
  This screen shows the CPU Configuration.



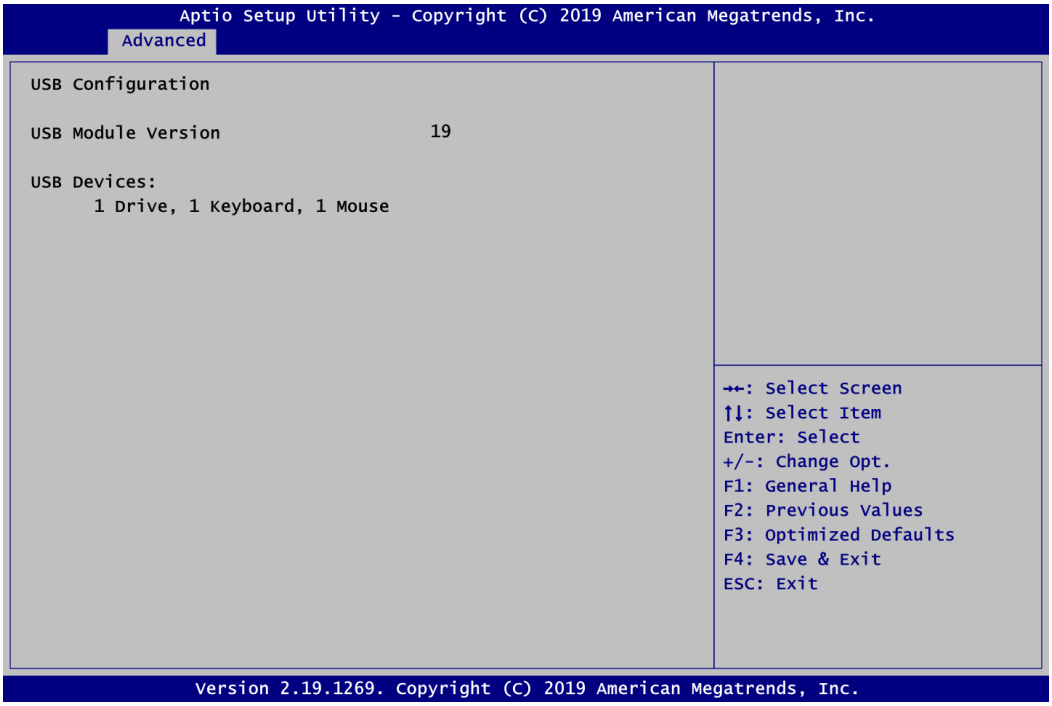
SVM Mode
Enable or disable SVM (Secure Virtual Machine) mode. Once enabled, you will be able to install a virtual machine on your system.

Core Performance Boost
If enabled, the CPU can be boosted up to its maximum clock speed when needed.

- **SATA Configuration**
  During system boot up, BIOS automatically detects the presence of SATA devices. In the SATA Configuration menu, you can see the hardware currently installed in SATA ports.

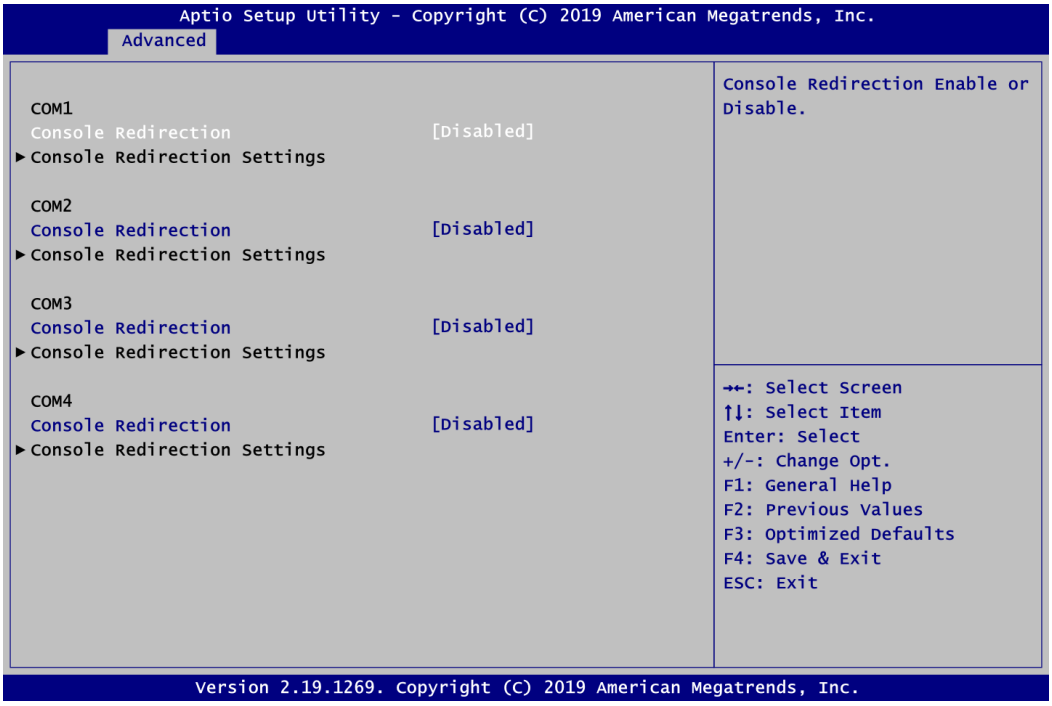


- **USB Configuration**

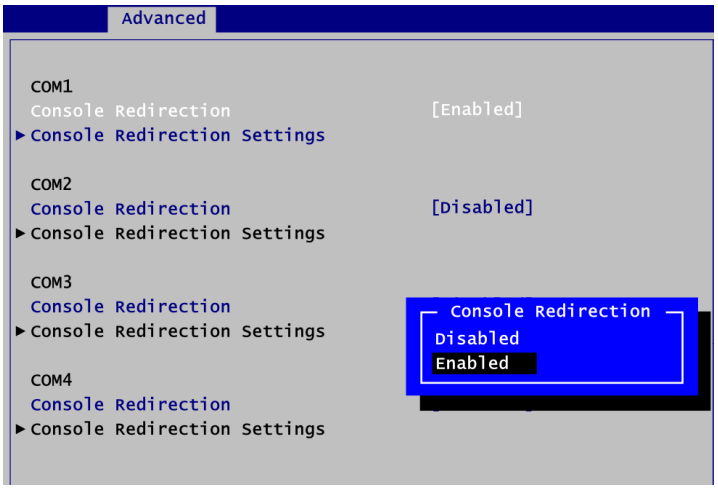


USB Devices
Display all detected USB devices.

- **Serial Port Console Redirection**
  You can use this screen to select options for Serial Port Console Redirection, and change the value of the selected option. A description of the selected item appears on the right side of the screen. For items marked with "▶", please press <Enter> for more options.

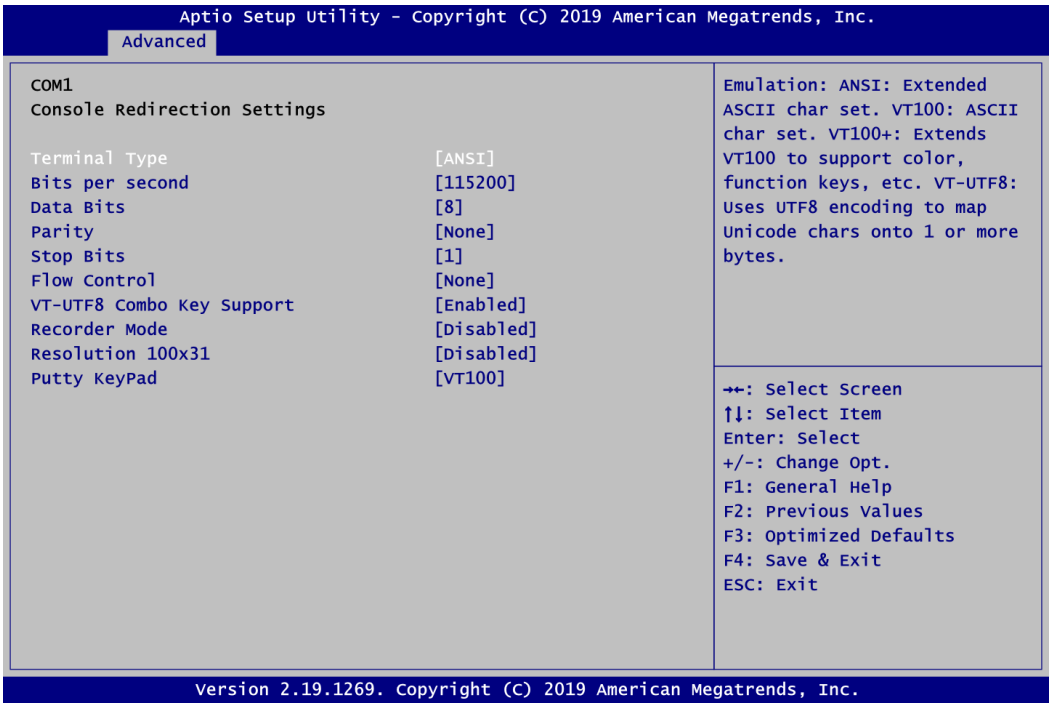


COM1\COM2\COM3\COM4 Console Redirection
Enable or disable COM1\COM2\COM3\COM4 console redirection. Once it is enabled, you will see the following screen.



COM1\COM2\COM3\COM4 Console Redirection Settings
When enabled, the settings specify how the host computer and the remote computer (which the user is using) will exchange data. Both computers should have the same or compatible settings.

- **Console Redirection Settings**

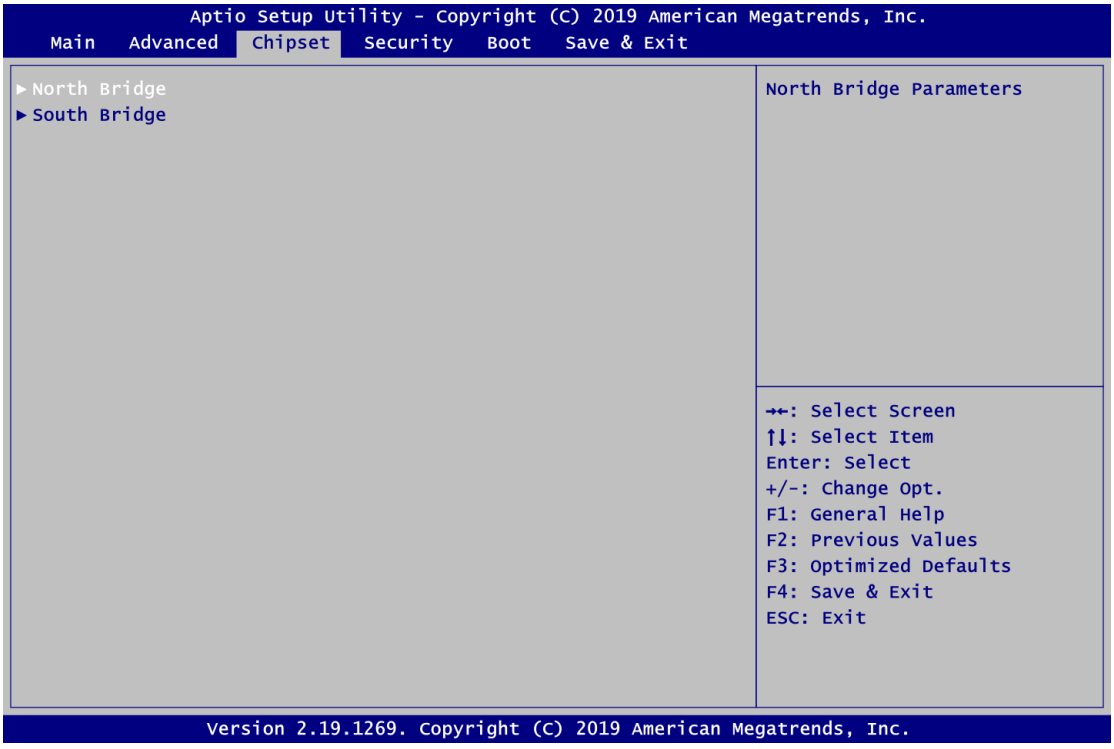


6.5 Chipset Menu

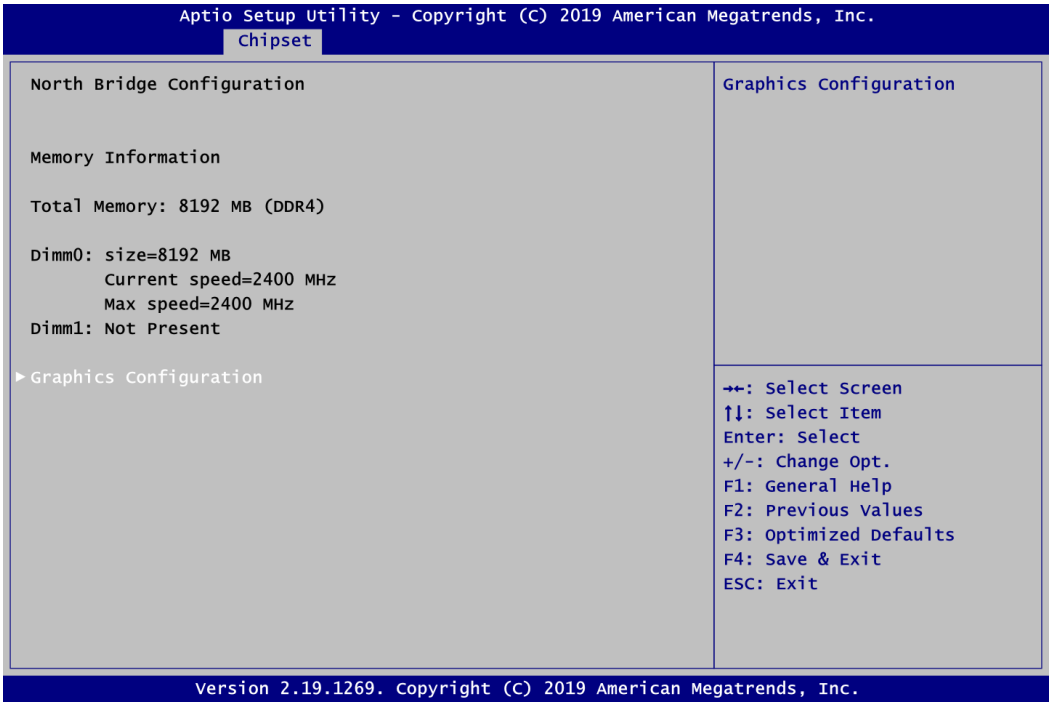
The Chipset menu allows users to change the advanced chipset settings. You can select any of the items in the left frame of the screen to go to the sub menus:

- ► North Bridge
- ► South Bridge

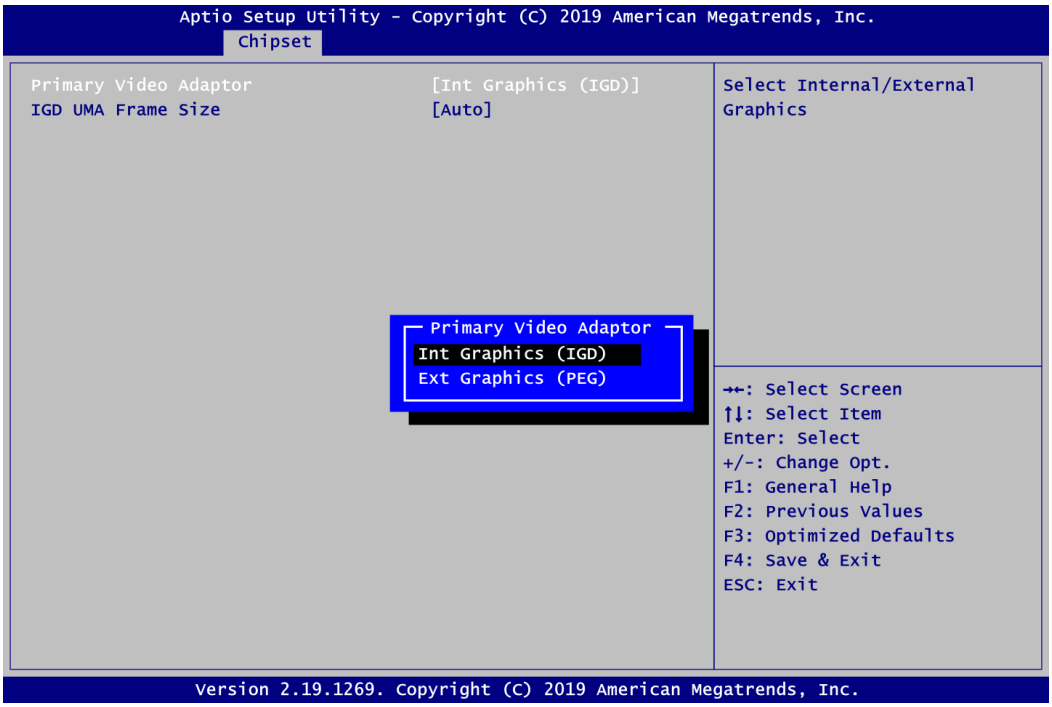
For items marked with "►", please press <Enter> for more options.



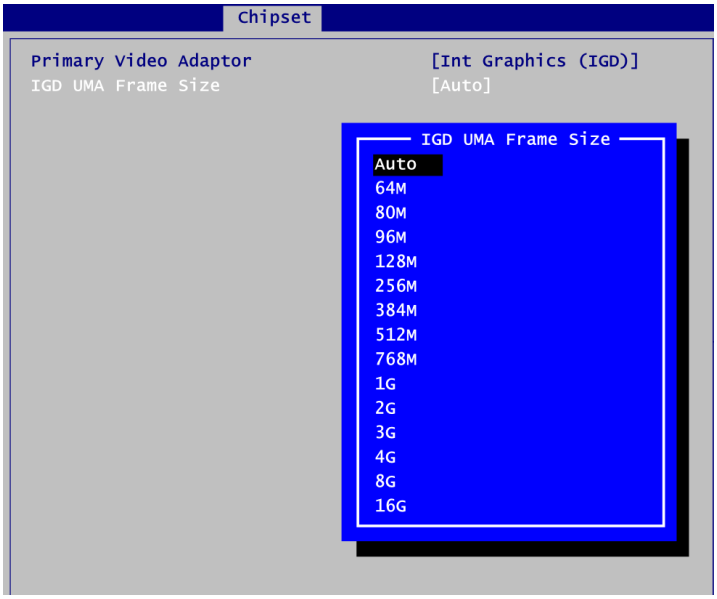
- **North Bridge**
  This screen displays system memory information. And it also allows users to configure parameters of North Bridge chipset.



Graphics Configuration
Open sub menu for parameters related to graphics configuration.

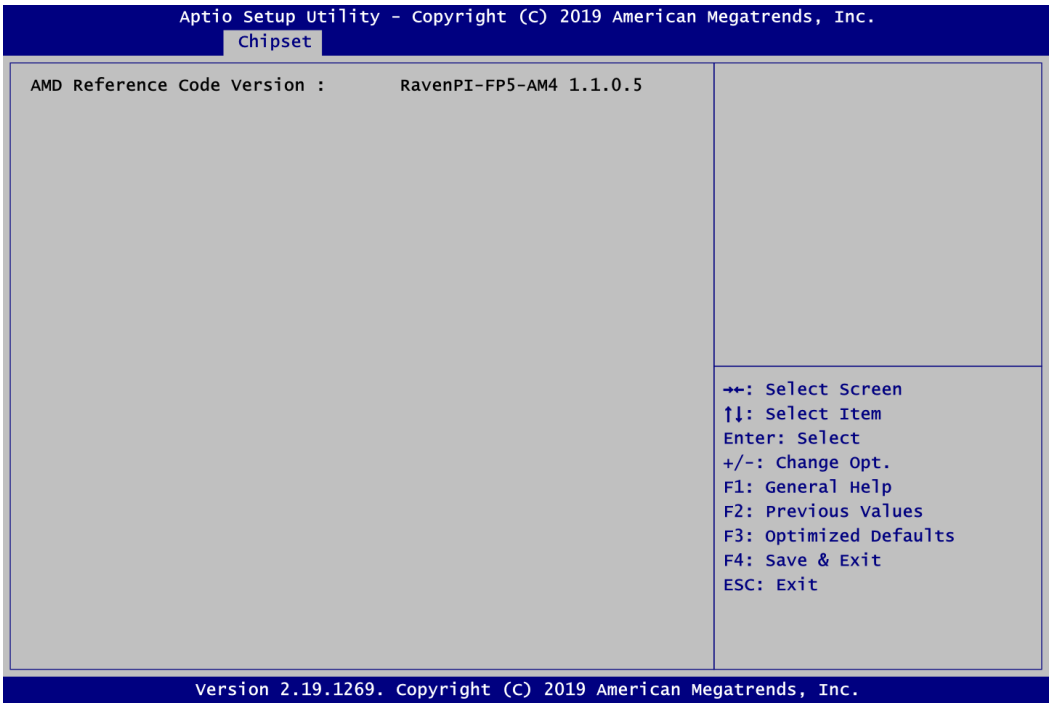


Primary Video Adaptor
Select Internal (CN18, see section 2.4.11) or External (the graphic card on GF1, see section 2.4.18) Graphics as primary display.



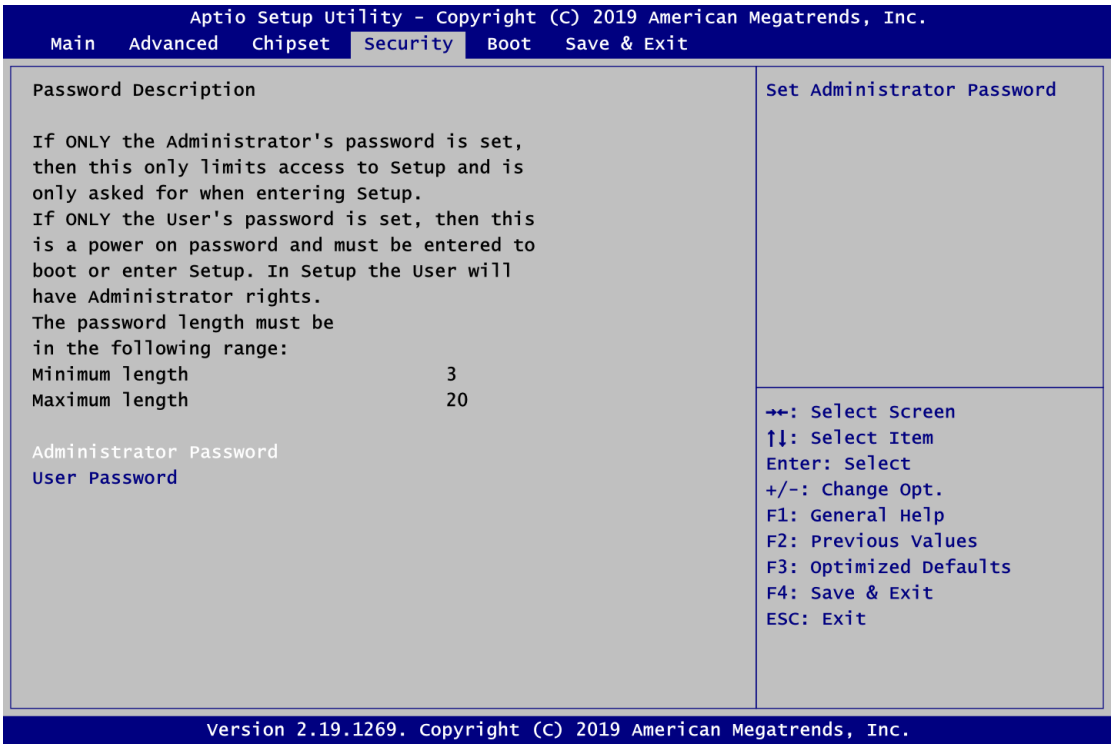
IGD UMA Frame Size
Set memory frame size for graphic.

- **South Bridge**
  This screen shows the AMD Reference Code Version information.



6.6 Security Menu

The Security menu allows users to change the security settings for the system.

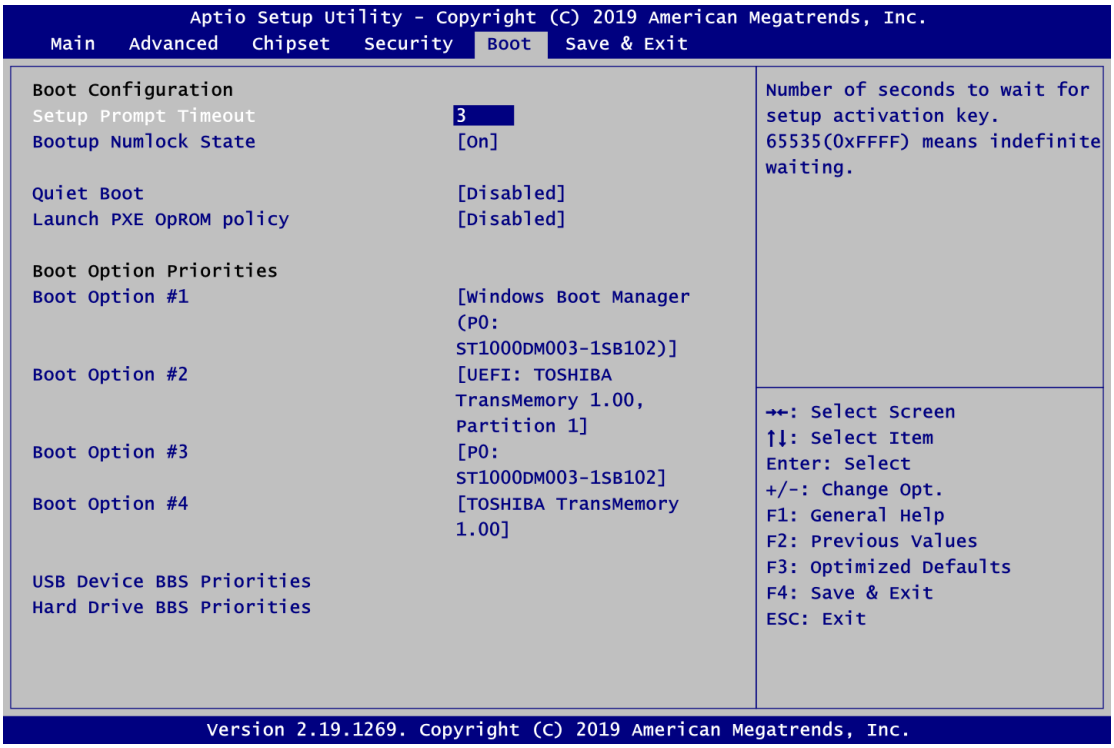


- **Administrator Password**.
  Set administrator password.

- **User Password**
  Set user password.

6.7 Boot Menu

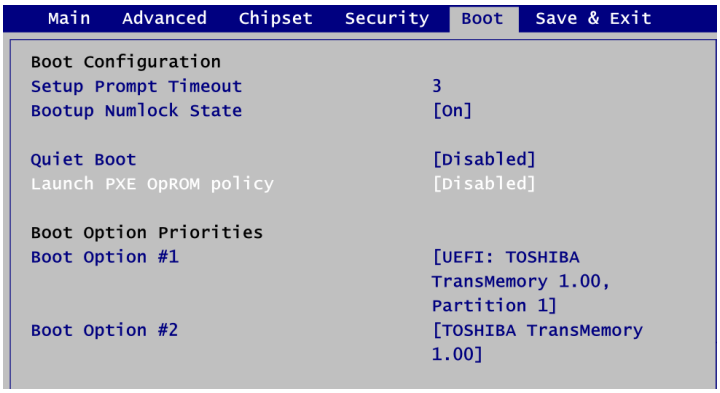
The Boot menu allows users to change boot options of the system.

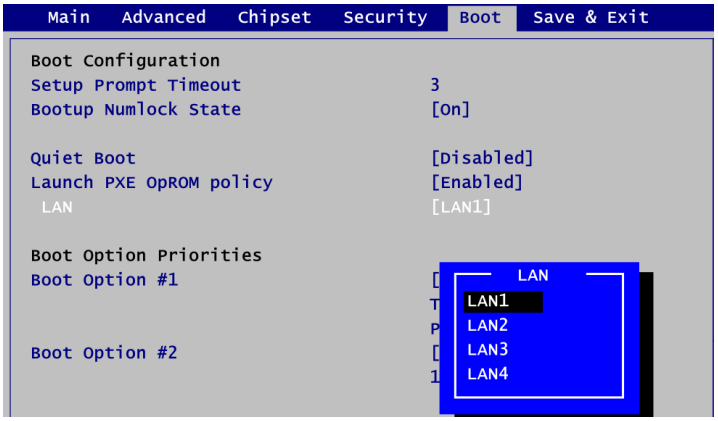


- **Setup Prompt Timeout**
  Number of seconds to wait for setup activation key. 65535(0xFFFF) means indefinite waiting.

- **Bootup NumLock State**
  Use this item to select the power-on state for the keyboard NumLock.

- **Quiet Boot**
  Select to display either POST output messages or a splash screen during boot-up.





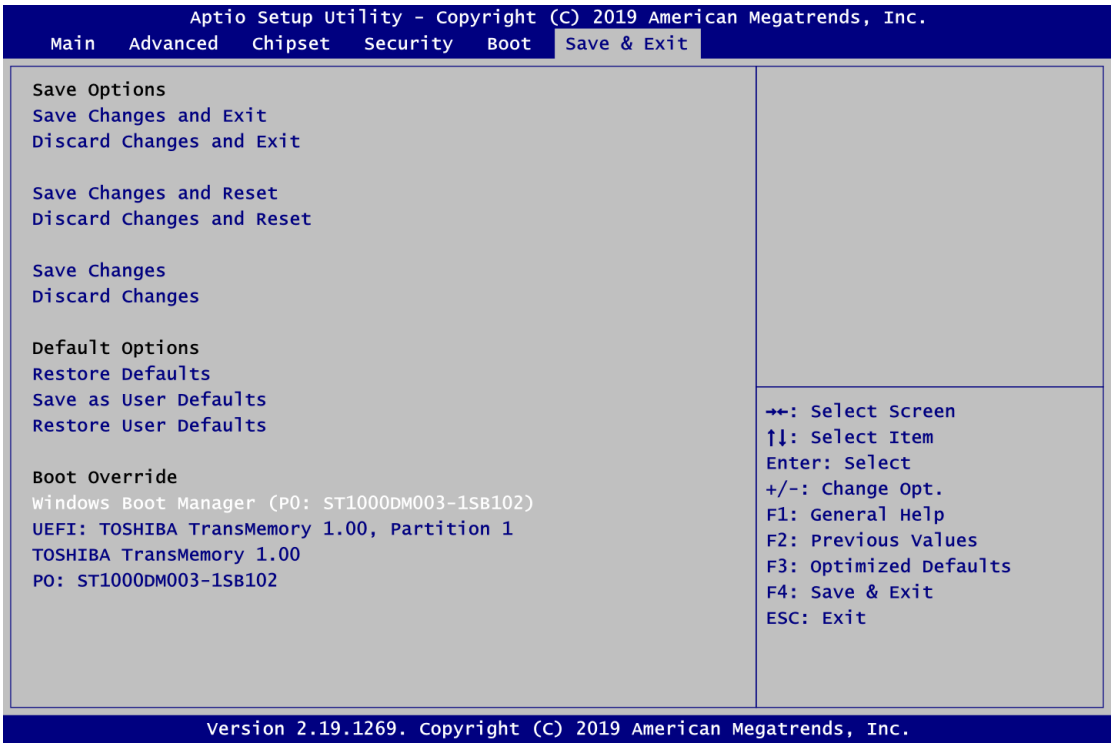
- **Launch PXE OpROM policy**
  Control the execution of UEFI PXE OpROM. When enabled, you may select which LAN device will enable PXE OpROM policy.

- **Boot Option Priorities [Boot Option #1, …]**
  These are settings for boot priority. Specify the boot device priority sequence from the available devices.

- **USB Device/Hard Drive BBS Priorities**
  Set the boot order of the specific devices in this group. This option appears only if at least one device of this group is detected.

6.8 Save & Exit Menu

The Save & Exit menu allows users to load your system configuration with optimal or fail-safe default values.



- **Save Changes and Exit**
  When you have completed the system configuration changes, select this option to leave Setup and return to Main Menu. Select Save Changes and Exit from the Save & Exit menu and press <Enter>. Select Yes to save changes and exit.

- **Discard Changes and Exit**
  Select this option to quit Setup without making any permanent changes to the system configuration and return to Main Menu. Select Discard Changes and Exit from the Save & Exit menu and press <Enter>. Select Yes to discard changes and exit.

- **Save Changes and Reset**
  When you have completed the system configuration changes, select this option to leave Setup and reboot the computer so the new system configuration parameters can take effect. Select Save Changes and Reset from the Save & Exit menu and press <Enter>. Select Yes to save changes and reset.

- **Discard Changes and Reset**
  Select this option to quit Setup without making any permanent changes to the system configuration and reboot the computer. Select Discard Changes and Reset from the Save & Exit menu and press <Enter>. Select Yes to discard changes and reset.

- **Save Changes**
  When you have completed the system configuration changes, select this option to save changes. Select Save Changes from the Save & Exit menu and press <Enter>. Select Yes to save changes.

- **Discard Changes**
  Select this option to quit Setup without making any permanent changes to the system configuration. Select Discard Changes from the Save & Exit menu and press <Enter>. Select Yes to discard changes.

- **Restore Defaults**
  It automatically sets all Setup options to a complete set of default settings when you select this option. Select Restore Defaults from the Save & Exit menu and press <Enter>.

- **Save as User Defaults**
  Select this option to save system configuration changes done so far as User Defaults. Select Save as User Defaults from the Save & Exit menu and press <Enter>.

- **Restore User Defaults**
  It automatically sets all Setup options to a complete set of User Defaults when you select this option. Select Restore User Defaults from the Save & Exit menu and press <Enter>.

- **Boot Override**
  Select a drive to immediately boot that device regardless of the current boot order.

Appendix A
Watchdog Timer

A.1 About Watchdog Timer

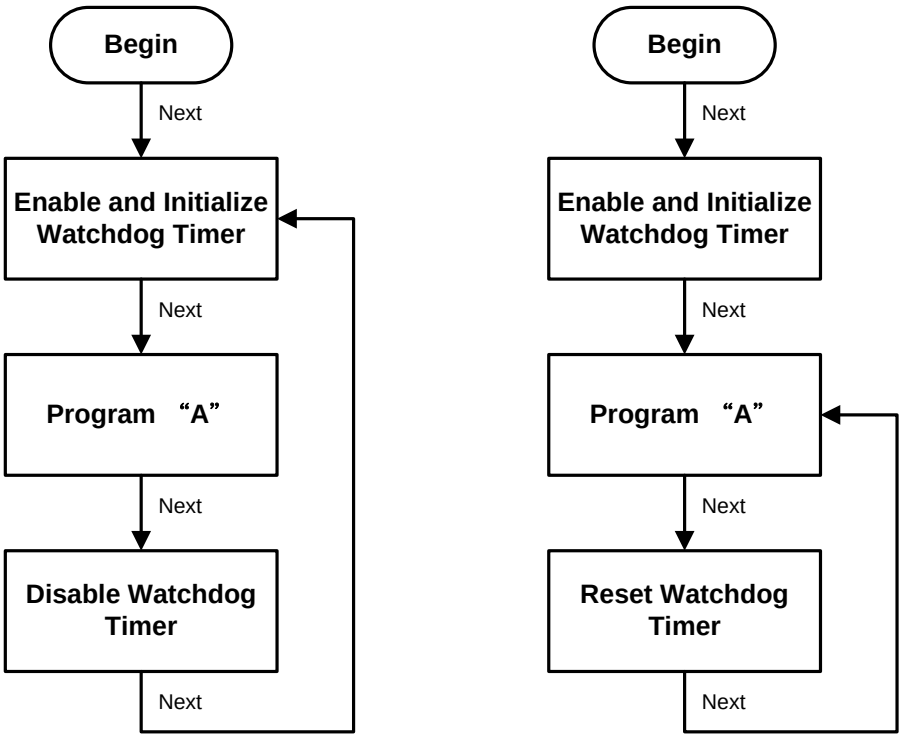
Software stability is major issue in most application. Some embedded systems are not watched by operator for 24 hours. It is usually too slow to wait for someone to reboot when computer hangs. The systems need to be able to reset automatically when things go wrong. The watchdog timer gives us solution.

The watchdog timer is a counter that triggers a system reset when it counts down to zero from a preset value. The software starts counter with an initial value and must reset it periodically. If the counter ever reaches zero which means the software has crashed, the system will reboot.

A.2 How to Use Watchdog Timer

The I/O port base addresses of watchdog timer are 2E (hex) and 2F (hex). The 2E (hex) and 2F (hex) are address and data port respectively.

Assume that program A is put in a loop that must execute at least once every 10ms. Initialize watchdog timer with a value bigger than 10ms. If the software has no problems; watchdog timer will never expire because software will always restart the counter before it reaches zero.



A.3 Sample Program

```
//************************************************************
//**                                                        **
//**        Copyright(C) 2018, Axiomtek co., Ltd            **
//**                                                        **
//**                    All Rights Reserved.                **
//**                                                        **
//************************************************************

#include <pc.h>
#include <stdio.h>

#define SIO_Index_Port                  0x2E
#define SIO_Data_Port                   0x2F
#define SIO_Enter_Configuration_Mode 0x01
#define SIO_Entry_key                   0x55
#define SIO_LDN_SEL_REGISTER            0x07
#define SIO_LogicalDevice_GPIO          0x07
#define SIO_Offset_Countdown_Type       0x72
#define SIO_Offset_Countdown_Timer      0x73
#define SIO_Countdown_Type_Second       0xC0
#define SIO_Countdown_Type_Minute       0x40
#define SIO_Exit_Configuration_Mode     0x02

void main() {
        int CountdownType=0;
        int WDTtimer=0;

                printf("Input Watch Dog Timer type, 1:Second ; 2:Minute    :");
                scanf("%d",&CountdownType);

                printf("\nInput Timer to countdown:");
                scanf("%d",&WDTtimer);
                printf("Start to countdown...");

                //
                // Enter Configuration Mode
                //
                outportw(SIO_Index_Port,0x87);
                outportw(SIO_Index_Port,SIO_Enter_Configuration_Mode);
                outportw(SIO_Index_Port,SIO_Entry_key);
                outportw(SIO_Index_Port,SIO_Entry_key);

                //
                // Select Logical device : GPIO
                //
                outportw(SIO_Index_Port,SIO_LDN_SEL_REGISTER);
                outportw(SIO_Data_Port,SIO_LogicalDevice_GPIO);
```

```
                    //
                    // Select count type for minute type or second type to execute WDT timer
                    // by below method.
                    //
                    outportw(SIO_Index_Port,SIO_Offset_Countdown_Type);
                    if(CountdownType == 1)
                    outportw(SIO_Data_Port,SIO_Countdown_Type_Second);
                    else if(CountdownType == 2)
                    outportw(SIO_Data_Port,SIO_Countdown_Type_Minute);

                    //
                    // Set WDT Timer
                    //
                    outportw(SIO_Index_Port,SIO_Offset_Countdown_Timer);
                    outportw(SIO_Data_Port,WDTtimer);

                    //
                    // Exit Configuration Mode
                    //
                    outportw(SIO_Index_Port,SIO_Exit_Configuration_Mode);
                    outportw(SIO_Index_Port,SIO_Exit_Configuration_Mode);
}
```