

MS-98N1

Industrial Computer Board

User Guide

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Revision

V1.0, 2023/05

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Regulatory Notices

FCC-B Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and radiates radio frequency energy, and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no quarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected

NOTE

- The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
- Shield interface cables and AC power cord, if any, must be used in order to comply with the emission limits.

FCC Conditions

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

CE Conformity

Hereby, Micro-Star International CO., LTD declares that this device is in compliance with the essential safety requirements and other relevant provisions set out in the European Directive.



WFFF Statement

Under the European Union ("EU") Directive on Waste Electrical and Electronic Equipment, Directive 2012/19/EU, products of "electrical and electronic equipment" cannot be discarded as municipal waste anymore and manufacturers of covered electronic equipment will be obligated to take back such products at the end of their useful life.



Battery Information

Please take special precautions if this product comes with a battery.

- Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer.
- Avoid disposal of a battery into fire or a hot oven, or mechanically crushing or cutting of a battery, which can result in an explosion.
- Avoid leaving a battery in an extremely high temperature or extremely low air pressure environment that can result in an explosion or the leakage of flammable liquid or gas.
- Do not ingest battery. If the coin/button cell battery is swallowed, it can cause severe internal burns and can lead to death. Keep new and used batteries away from children

European Union:



Batteries, battery packs, and accumulators should not be disposed of as unsorted household waste. Please use the public collection system to return, recycle, or treat them in compliance with the local regulations.

BSMI:



廢電池請回收

For better environmental protection, waste batteries should be collected separately for recycling or special disposal.

California, USA:



The button cell battery may contain perchlorate material and requires special handling when recycled or disposed of in California. For further information please visit: http://www.dtsc.ca.gov/hazardouswaste/perchlorate/

Chemical Substances Information

In compliance with chemical substances regulations, such as the EU REACH Regulation (Regulation EC No. 1907/2006 of the European Parliament and the Council). MSI provides the information of chemical substances in products at:

https://csr.msi.com/global/index

Environmental Policy

• The product has been designed to enable proper reuse of parts and recycling and should not be thrown away at its end of life.



- Users should contact the local authorized point of collection for recycling and disposing of their end-of-life products.
- Visit the MSI website and locate a nearby distributor for further recycling information
- Users may also reach us at gpcontdev@msi.com for information regarding proper Disposal, Take-back, Recycling, and Disassembly of MSI products.

Green Product Features

- Reduced energy consumption during use and stand-by
- Limited use of substances harmful to the environment and health
- Easily dismantled and recycled
- Reduced use of natural resources by encouraging recycling
- · Extended product lifetime through easy upgrades
- Reduced solid waste production through take-back policy

Copyright and Trademarks Notice

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Technical Support

If a problem arises with your product and no solution can be obtained from the user's manual, please contact your place of purchase or local distributor. Alternatively, please visit https://www.msi.com/support/ for further guidance.

Safety Information

- The components included in this package are prone to damage from electrostatic discharge (ESD). Please adhere to the following instructions to ensure successful computer assembly.
- Ensure that all components are securely connected. Loose connections may cause the computer to not recognize a component or fail to start.
- Hold the motherboard by the edges to avoid touching sensitive components.
- It is recommended to wear an electrostatic discharge (ESD) wrist strap when handling the motherboard to prevent electrostatic damage. If an ESD wrist strap is not available, discharge yourself of static electricity by touching another metal object before handling the motherboard.
- Store the motherboard in an electrostatic shielding container or on an anti-static pad whenever the motherboard is not installed.
- Before turning on the computer, ensure that there are no loose screws or metal components on the motherboard or anywhere within the computer case.
- Do not boot the computer before installation is completed. This could cause permanent damage to the components as well as injury to the user.
- If you need help during any installation step, please consult a certified computer technician.
- Always turn off the power supply and unplug the power cord from the power outlet before installing or removing any computer component.
- Keep this user guide for future reference.
- Keep this motherboard away from humidity.
- Make sure that your electrical outlet provides the same voltage as is indicated on the PSU, before connecting the PSU to the electrical outlet.
- Place the power cord such a way that people can not step on it. Do not place anything over the power cord.
- All cautions and warnings on the motherboard should be noted.
- If any of the following situations arises, get the motherboard checked by service personnel:
 - Liquid has penetrated into the computer.
 - The motherboard has been exposed to moisture.
 - The motherboard does not work well or you can not get it work according to user quide.
 - The motherboard has been dropped and damaged.
 - The motherboard has obvious sign of breakage.
- Do not leave this motherboard in an environment above 60°C (140°F), it may damage the motherboard.

Specifications

Model	MS-98N1
Form factor	Mini-ITX
Dimensions	170 x 170mm (6.7 x 6.7 inches)
	PC Client SKUs
Processor	- Intel® Elkhart Lake J6412/ N6210 SoC 4.5W up to 12W (Burst)
FIUCESSUI	Embedded SKUs
	- Intel® Atom® x6211E Processor 4.5W up to 12W (Burst)
Chipset	Within processor
	• 2 x DDR4 S0-DIMM slots (260-pin, horizontal)
Memory	- Dual Channel for DDR4, Non-ECC
inclinor y	- Up to 3200 MT/s
	- Up to 32 GB
Network	• 2 x Intel® I225V PCIe 2.5 GbE LAN (for PC client SKUs)
network	• 2 x Intel® I225-IT PCIe 2.5 GbE LAN (for embedded SKUs)
	• 1 x SATA 3.0 6Gb/s port
Storage	• 1 x M.2 M Key slot (2242)
	- SATA 3.0
	• 1 x M.2 B Key slot (2242/ 3042)
	- With PCIe x1, USB3.2 Gen 1 & USB 2.0 signal
	- Support Nano SIM holder
Expansion	- Support 5G modules
Slots	• 1 x M.2 E Key slot (2230)
	- With PCIe x1 & USB 2.0 signal
	• 1 x Nano SIM Holder
	- Supported by M.2 B key (SIM) slot
	• 1 x LVDS up to 1920x1200 @60Hz (Co-lay eDP)
	• 1 x eDP up to 4096×2160 @60 Hz (Co-lay LVDS)
	• 1 x DP 1.4a up to 4096×2160 @60Hz (Co-lay VGA, option by SKU)
	• 1 x HDMI™ 1.4b up to 4096x2160 @24Hz
Graphics	3 independent display modes supported
	- LVDS or eDP
	- HDMI™
	- DP/ VGA
	<u> </u>

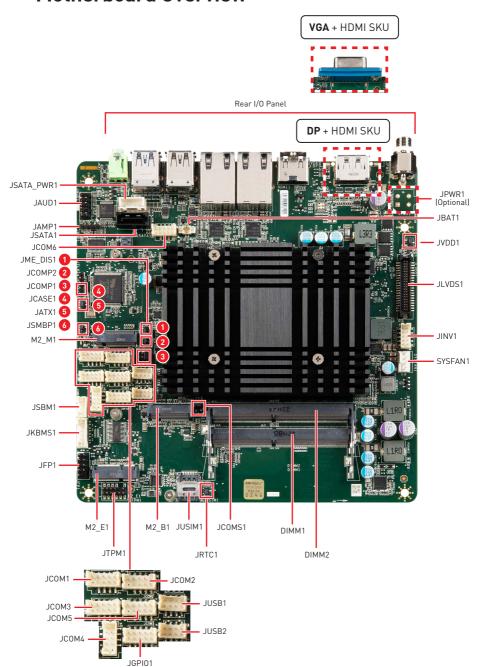
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Model	MS-98N1
	Realtek® ALC897 High Definition Audio Codec
	- Co-lay ALC888S-VD2
Audio	• 3 x Connectors for audio
	- 1 x Line-out Jack (Rear I/O)
	- 2 x 5-pin headers for front audio (Headphone & Mic-in)
	• 1 x VGA port
	• 1 x DisplayPort (default, VGA by SKU option)
	• 1 x HDMI™ connector
Rear Panel I/0	• 3 x USB 3.2 Gen 1 Type-A ports (5 Gbps)
	• 1 x USB 2.0 Type-A ports (480 Mbps)
	• 2 x 2.5 GbE RJ-45 LAN ports
	• 1 x Line-out jack
	• 1 x SATA power connector
	• 1 x LVDS Inverter box header
	• 1 x LVDS + eDP Wafer Connector
	• 1 x System fan box header
	• 1 x PS/2® keyboard & mouse box header
	• 1 x Front panel connector
	• 1 x SPI TPM module header
	• 1 x Front audio header
	• 1 x Audio amplifier header
	• 1 x GPIO (DIO) connector
Onboard I/O	• 1 x COM port box header
	• 2 x USB 2.0 box headers
	• 1 x CMOS battery header
	• 2 x COM power jumpers
	• 1 x Clear CMOS jumper
	• 1 x ME jumper
	• 1 x AT/ ATX mode select jumper
	• 1 x SMBus power jumper (for JSMB1)
	• 1 x Clear RTC battery jumper
	• 1 x LVDS power jumper
	• 1 x Chassis Intrusion jumper
Power	12V/ 19V/ 24V DC-in

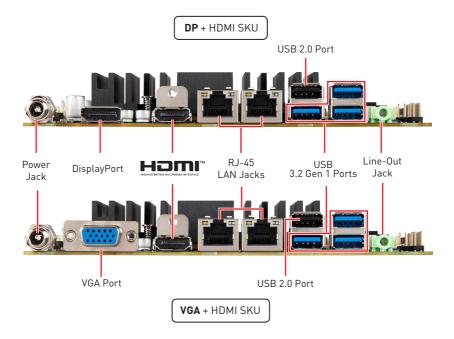
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Model	MS-98N1
	Operating Temperature
	- PC Client SKUs: 0 ~ 60°C with 0.7m/s air flow
Environment	- Embedded SKUs: -20 ~ 70°C with 0.7m/s air flow
	• Storage Temperature: -20 ~ 80°C
	• Humidity: 10 ~ 90%, non-condensing

Motherboard Overview



Rear I/O Panel



Power Jack

Power supplied through this jack supplies power to your system.

DisplayPort

DisplayPort is a digital display interface standard. This connector is used to connect a monitor with DisplayPort inputs.

H⊅**m**I[™] Connector

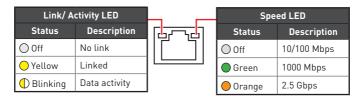
The High-Definition Multimedia Interface (HDMI™) is an all-digital audio/video interface capable of transmitting uncompressed streams. HDMI™ supports all TV format, including standard, enhanced, or high-definition video, plus multi-channel digital audio on a single cable.

VGA Port

The DB15-pin female connector is provided for monitors.

RJ-45 I AN Jack

The standard single RJ45 LAN jack is provided for connection to the Local Area Network (LAN). You can connect a network cable to it.



USB 3.2 Gen 1 Port

This connector is provided for USB peripheral devices. (Speed up to 5 Gbps)

USB 2.0 Port

This connector is provided for USB peripheral devices. (Speed up to 480 Mbps)



Important

High-speed devices are recommended for USB 3.2 ports whereas low-speed devices, such as mouse or keyboard, are suggested to be plugged into the USB 2.0 ports.

Line-Out Jack

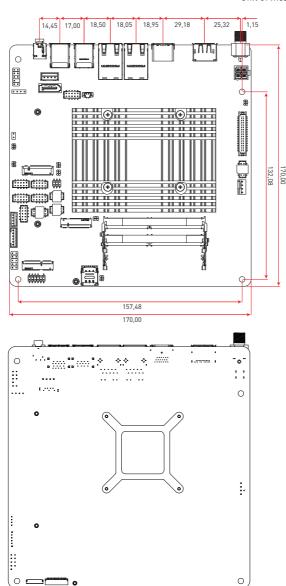
This connector is provided for headphones or speakers.

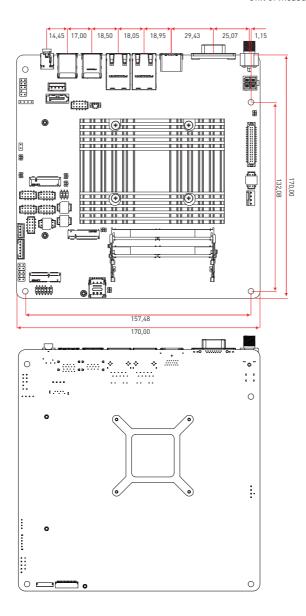
ME Overview

Board Dimension

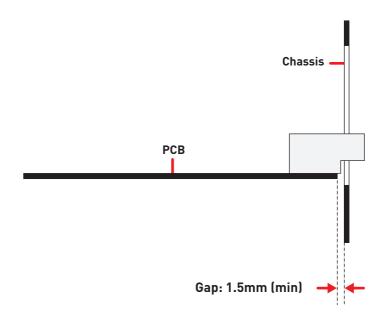
DP + HDMI SKU

Unit of measurement: mm





Suggested Chassis I/O Gap Dimension



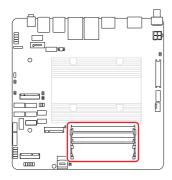
Component Contents

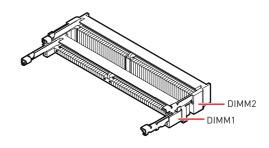
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Memory

DIMM1~2: DDR4 SO DIMM Slots

The SO-DIMM slots is intended for memory modules.





Installing SO DIMM Slot

- 1. Locate the SO-DIMM slot. Align the notch on the DIMM with the key on the slot and insert the DIMM into the slot
- 2. Push the DIMM gently downwards until the slot levers click and lock the DIMM in place.
- 3. To uninstall the DIMM, flip the slot levers outwards and the DIMM will be released instantly.



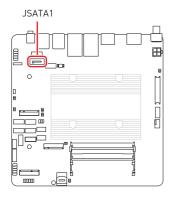
Important

- Always insert memory modules in the **DIMM1** slot first.
- You can barely see the golden finger if the DIMM is properly inserted in the DIMM slot.
- To ensure system stability for Dual channel mode, memory modules must be of the same type, number and density.

Storage

JSATA1: SATA 3.0 6Gb/s Port

This connector is SATA 6Gb/s interface port, it can connect to one SATA device.





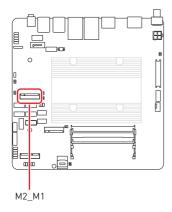


Important

- This SATA port supports hot plug.
- Please do not fold the SATA cable at a 90-degree angle. Data loss may result during transmission otherwise.
- SATA cables have identical plugs on either sides of the cable. However, it is recommended that the flat connector be connected to the motherboard for space saving purposes.

M2_M1: M.2 Slot (M Key, 2242)

Please install the M.2 solid-state drive (SSD) into the M.2 slot as shown below.



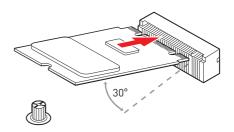


Watch the video to learn how to Install M.2 SSD.

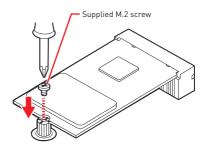


Installing M.2 SSD

1. Insert your M.2 SSD into the M.2 slot at a 30-degree angle.



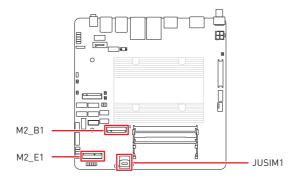
2. Secure the M.2 SSD in place with the supplied M.2 screw.



Feature

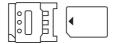
Supports SATA 3.0 signal.

Expansion Slots



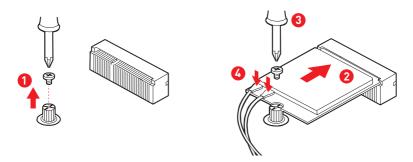
JUSIM1: Nano SIM Holder

This holder is provided for 3G, 4G, LTE, 5G Nano SIM cards.



M2_E1: M.2 Slot (E Key, 2230)

Please install the Wi-Fi/ Bluetooch card into the M.2 slot as shown below.

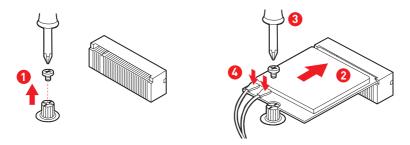


Feature

• M2_E1 slot supports PCIe x 1 & USB 2.0 signal.

M2_B1: M.2 Slot (B Key, 2242/3042)

Please install the WWAN Card/ solid-state drive (SSD) into the M.2 slot as shown below.

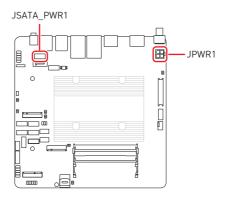


Feature

- Supports PCIe x 1, USB 3.2 Gen 1, USB 2.0 signal.
- Supports 5G modules.

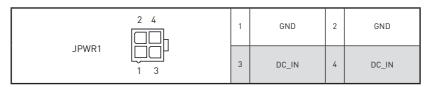
Connectors

Power Connectors



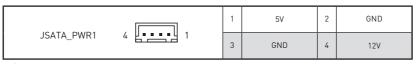
JPWR1: DC-In Power Connector (Optional)

This connector allows you to connect a power supply.



JSATA_PWR1: SATA Power Connector

This connector is used to provide power to SATA devices.





Important

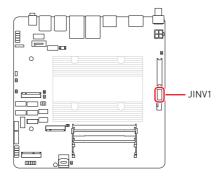
Make sure that all the power cables are securely connected to a proper power supply to ensure stable operation of the system.

Graphics Connectors

JINV1: LVDS Inverter Box Header

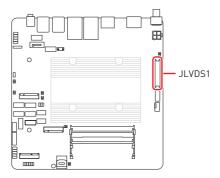
The connector is provided for LCD backlight options.

		1	GND	2	GND
	10 9	3	VCC5	4	VCC5
JINV1		5	+12V	6	+12V
	2 1	7	INV_ON#1	8	N/A
		9	L_BKLT_CTRL#1	10	N/A



JLVDS1: LVDS+eDP Wafer Connector

This connector is designed for use with LVDS/eDP interface flat panels. When connecting your flat panel to this connector, be sure to check the panel data sheet to ensure that you set the **JVDD1 LVDS power jumper** to the appropriate power voltage.



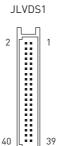


Please refer to the following pages for the pin-out of the LVDS + eDP Box Header and the pin-out for LVDS/eDP interface flat panels.

JLVDS1



eDP Panel (P1)	98N1 I	eDP Panel (P1)			
Lane3_P	EDP_LINE3_DP	1	2	EDP_LINE2_DP	Lane2_P
Lane3_N	EDP_LINE3_DN	3	4	EDP_LINE2_DN	Lane2_N
	DDC0_CLK_7513_R	5	6	DDC0_DATA_7513_R	
LCD_VCC	LCD_VDD	7	8	LCD_VDD	LCD_VCC
LCD_VCC	LCD_VDD	9	10	VCC3	
	BKLT_EN	11	12	LVDS_DETECT#	LCD_GND
Lane1_P	LVDSA_DATA1+	13	14	EHPDET/ LVDSA_DATA0+	HPD
Lane1_N	LVDSA_DATA1-	15	16	LVDSA_DATA0-	
H_GND	GND	17	18	GND	H_GND
	LVDSA_DATA3+	19	20	LVDSA_DATA2+	Lane0_P
	LVDSA_DATA3-	21	22	LVDSA_DATA2-	Lane0_N
H_GND	GND	23	24	GND	H_GND
	LVDSB_DATA1+	25	26	LVDSB_DATA0+	
	LVDSB_DATA1-	27	28	LVDSB_DATA0-	
H_GND	GND	29	30	GND	GND
	LVDSB_DATA3+	31	32	LVDSB_DATA2+	
	LVDSB_DATA3-	33	34	LVDSB_DATA2-	
	NA	35	36	GND	GND
	LVDSB_CLK+	37	38	LVDSA_CLK+	AUX_CH_P
	LVDSB_CLK-	39	40	LVDSA_CLK-	AUX_CH_N



LVDS Panel (P1)	98N1 I	LVDS Panel (P1)			
	EDP_LINE3_DP	1	2	EDP_LINE2_DP	
	EDP_LINE3_DN	3	4	EDP_LINE2_DN	
	DDC0_CLK_7513_R	5	6	DDC0_DATA_7513_R	
VCC	LCD_VDD	7	8	LCD_VDD	VCC
VCC	LCD_VDD	9	10	VCC3	
	BKLT_EN	11	12	LVDS_DETECT#	GND
RX01+	LVDSA_DATA1+	13	14	EHPDET/ LVDSA_DATA0+	RX00+
RX01-	LVDSA_DATA1-	15	16	LVDSA_DATA0-	RX00-
GND	GND	17	18	GND	GND
RX03+	LVDSA_DATA3+	19	20	LVDSA_DATA2+	RX02+
RX03-	LVDSA_DATA3-	21	22	LVDSA_DATA2-	RX02-
GND	GND	23	24	GND	GND
RXE1+	LVDSB_DATA1+	25	26	LVDSB_DATA0+	RXE0+
RXE1-	LVDSB_DATA1-	27	28	LVDSB_DATA0-	RXE0-
GND	GND	29	30	GND	GND
RXE3+	LVDSB_DATA3+	31	32	LVDSB_DATA2+	RXE2+
RXE3-	LVDSB_DATA3-	33	34	LVDSB_DATA2-	RXE2-
	NA	35	36	GND	GND
RXEC+	LVDSB_CLK+	37	38	LVDSA_CLK+	RX0C+
RXEC-	LVDSB_CLK-	39	40	LVDSA_CLK-	RXOC-

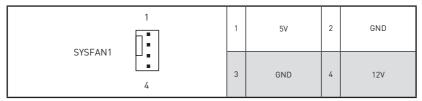


Pin 12 is a detect pin. When using a customized LVDS cable, pin 12 should be a signal ground with a low impedance. Otherwise, LVDS will not function.

Other Connectors

SYSFAN1: System Fan Box Header

The fan power connector supports system cooling fans with +12V. When connecting the wire to the connectors, always note that the red wire is the positive and should be connected to the +12V; the black wire is Ground and should be connected to GND. If the motherboard has a System Hardware Monitor chipset onboard, you must use a specially designed fan with speed sensor to take advantage of the fan control.

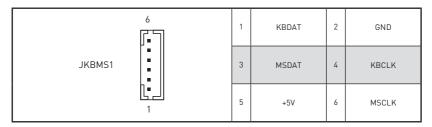


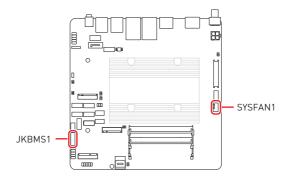


Please refer to the recommended CPU fans at processor's official website or consult the vendors for proper CPU cooling fan.

JKBMS1: PS/2® Keyboard & Mouse Box Header

This connector is used to connect PS/2® keyboard and mouse.





JFP1: Front Panel Connector

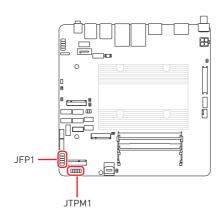
This front-panel connector is provided for electrical connection to the front panel switches & LEDs and is compliant with Intel Front Panel I/O Connectivity Design Guide.

	1	HDD LED+	2	POWER LED
1 2	3	HDD LED-	4	POWER LED
JFP1	5	RESET SWITCH-	6	POWER SWITCH+
9	7	RESET SWITCH+	8	POWER SWITCH-
	9	N/A	10	No pin

JTPM1: SPI TPM Module Header

This connector connects to a TPM (Trusted Platform Module) (optional). Please refer to the TPM security platform manual for more details.

JTPM1 12 11 12 2 11	1	3.3 V	2	CS
	3	MIS0	4	MOSI
	5	N/A	6	CLK
	7	GND	8	RST
	9	N/A	10	No pin
	11	N/A	12	GND



JAUD1: Front Audio Header

This connector allows you to connect front panel audio.

	1	MIC_IN_L	2	AGND
1 2	3	MIC_IN_R	4	N/A
JAUD1	5	LINE_IN_R	6	SEN_MC
9	7	SENSE_B	8	No pin
	9	LINE_IN_L	10	SEN_LIN

JAMP1: Audio Amplifier Header

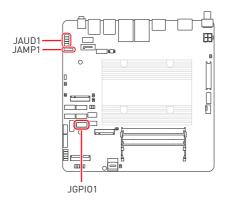
The connector is used to connect audio amplifiers to enhance audio performance.

JAMP1	1 4	1	AMP_RN	2	AMP_RP
JAMPI	1 [2.2.2] 4	3	AMP_LN	4	AMP_LP

JGPI01: GPI0 (DI0) Box Header

This connector is provided for the General-Purpose Input/Output (GPIO) peripheral module.

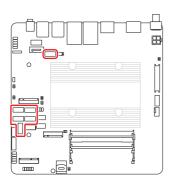
			1	GND	2	5V
	9	1	3	N_GP00	4	N_GPI0
JGPI01			5	N_GP01	6	N_GPI1
	10	2	7	N_GP02	8	N_GPI2
			9	N_GP03	10	N_GPI3

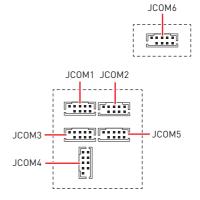


JCOM1~6: COM Port Box Headers

These connectors are a 16550A high speed communications port that sends/ receives 16 bytes FIFOs. You can attach a serial device to it.

			1	NDCD	2	NSIN
	9	1	3	NSOUT	4	NDTR
JCOM1~6		5	GND	6	NDSR	
	10	2	7	NRTS	8	NCTS
			9	N/A (VCC, COM1~2)	10	No pin





JCOM1 Connector

Supports RS-232/422/485, With RI/0V/5V/12V.

JCOM2 Connector

Supports RS-232/422/485, With 0V/5V/12V.

JCOM3~6 Connectors

Support RS-232.

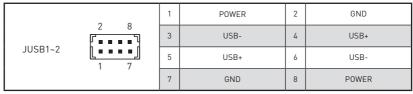
	RS232			
PIN	SIGNAL	DESCRIPTION		
1	NDCD	Data Carrier Detect		
2	NSIN	Signal In		
3	NS0UT	Signal Out		
4	NDTR	Data Terminal Ready		
5	GND	Signal Ground		
6	NDSR	Data Set Ready		
7	NRTS	Request To Send		
8	NCTS	Clear To Send		
9	VCC_COM	VCC_COM		

RS422				
PIN	SIGNAL	DESCRIPTION		
1	422 TXD-	Transmit Data, Negative		
2	422 TXD+	Transmit Data, Positive		
3	422 RXD+	Receive Data, Positive		
4	422 RXD-	Receive Data, Negative		
5	GND	Signal Ground		
6	NC	No Connection		
7	NC	No Connection		
8	NC	No Connection		
9	NC	No Connection		

	RS485			
PIN	SIGNAL	DESCRIPTION		
1	TXD-	Transmit Data, Negative		
2	NC	No Connection		
3	TXD+	Transmit Data, Positive		
4	NC	No Connection		
5	GND	Signal Ground		
6	NC	No Connection		
7	NC	No Connection		
8	NC	No Connection		
9	NC	No Connection		

JUSB1~2: USB 2.0 Box Headers

These connectors are ideal for connecting USB devices such as keyboard, mouse, or other USB-compatible devices.



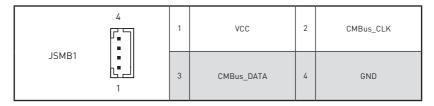


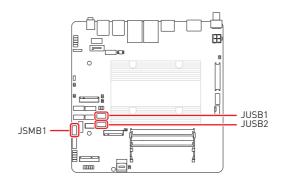
Important

Note that the POWER and GND pins must be connected correctly to avoid possible damage.

JSMB1: SMBus Box Header

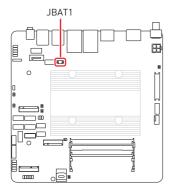
This connector, known as I2C, is for users to connect System Management Bus (SMBus) interface.





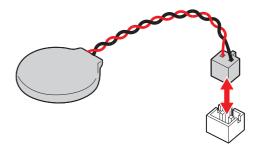
JBAT1: CMOS Battery Header

If the CMOS battery is out of charge, the time in the BIOS will be reset and the data of system configuration will be lost. In this case, you need to replace the CMOS battery.



Replacing CMOS battery

- 1. Unplug the battery wire from the BAT1 connector and remove the battery.
- 2. Connect the new CR2032 battery with wire to the BAT1 connector.





WARNING

KEEP OUT OF REACH OF CHILDREN

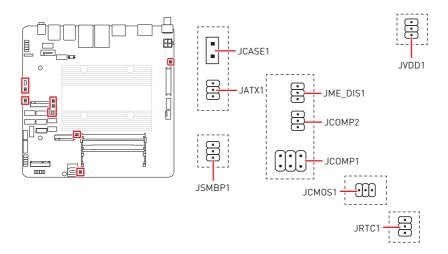


- Swallowing can lead to chemical burns, perforation of soft tissue, can death.
- Severe burns can occur within 2 hours of ingestion.
- If you think batteries might have been swallowed or placed inside any part of the body, seek immediate medical attention.

Jumpers



Avoid adjusting jumpers when the system is on; it will damage the motherboard.



Jumper Name	Default Setting	Description
	2 6 1 5	COM Power Jumper
JC0MP1		1-2: 5V (Default)
JCOMPT		3-4: 12V
		5-6: NRI
		COM Power Jumper
JC0MP2	1	1-2: 5V
		2-3: 12V (Default)
	1	Clear CMOS Jumper
JCM0S1		1-2: Normal (Default)
		2-3: Clear CMOS
	1	ME Jumper
JME_DIS1		1-2: ME enabled (Default)
		2-3: ME disabled
	1	AT/ ATX Mode Select Jumper
JATX1		1-2: ATX (Default)
		2-3: AT

Jumper Name	Default Setting	Description
	1	SMBus Power Jumper (for JSMB1)
JSMBP1		1-2: 5V (Default)
		2-3: 3.3V
	1	Clear RTC Battery Jumper
JRTC1		1-2: Normal (Default)
		2-3: Clear RTC
	1	LVDS Power Jumper
JVDD1		1-2: 3V (Default)
		2-3: 5V
		Chassis Intrusion Jumper
JCASE1	Normal (default)	This connector connects to the chassis intrusion switch cable. If the chassis is opened, the chassis intrusion mechanism will be activated. The system will record this status and show a warning message on the screen. To clear the warning, you must enter the BIOS utility and clear the record.

BIOS Setup

This chapter provides information on the BIOS Setup program and allows users to configure the system for optimal use.

Users may need to run the Setup program when:

- An error message appears on the screen at system startup and requests users to run SETUP.
- Users want to change the default settings for customized features.



Important

- Please note that BIOS update assumes technician-level experience.
- As the system BIOS is under continuous update for better system performance, the illustrations in this chapter should be held for reference only.

Entering Setup

Power on the computer and the system will start POST (Power On Self Test) process. When the message below appears on the screen, press or <F2> key to enter Setup, <F11> key to Boot Menu, <F12> key to PXE Boot.

Press or <F2> to enter SETUP

If the message disappears before you respond and you still wish to enter Setup, restart the system by turning it OFF and On or pressing the RESET button. You may also restart the system by simultaneously pressing <Ctrl>, <Alt>, and <Delete> keys.



Important

The items under each BIOS category described in this chapter are under continuous update for better system performance. Therefore, the description may be slightly different from the latest BIOS and should be held for reference only.

Control Keys

$\leftarrow \rightarrow$	Select Screen		
↑ ↓	Select Item		
Enter	Select		
+-	Change Value		
Esc	Exit		
F1	General Help		
F7	Previous Values		
F9	Optimized Defaults		
F10	Save & Reset*		
F12	Screenshot capture		
<k></k>	Scroll help area upwards		
<m></m>	Scroll help area downwards		

^{*} When you press <F10>, a confirmation window appears and it provides the modification information. Select between Yes or No to confirm your choice.

Getting Help

Upon entering setup, you will see the Main Menu.

Main Menu

The main menu lists the setup functions you can make changes to. You can use the **arrow keys** ($\uparrow \downarrow$) to select the item. The on-line description of the highlighted setup function is displayed at the bottom of the screen.

Sub-Menu

If you find a right pointer symbol appears to the left of certain fields that means a sub-menu can be launched from this field. A sub-menu contains additional options for a field parameter. You can use **arrow keys (** $\uparrow \downarrow$) to highlight the field and press <Enter> to call up the sub-menu. Then you can use the control keys to enter values and move from field to field within a sub-menu. If you want to return to the main menu, just press the **<Esc>.**

General Help <F1>

The BIOS setup program provides a General Help screen. You can call up this screen from any menu by simply pressing <F1>. The Help screen lists the appropriate keys to use and the possible selections for the highlighted item. Press **<Esc>** to exit the Help screen

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The Menu Bar



▶ Main

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

Advanced

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

■ Boot

Use this menu to specify the priority of boot devices.

Security

Use this menu to set supervisor and user passwords.

Chipset

This menu controls the advanced features of the on-board chipsets.

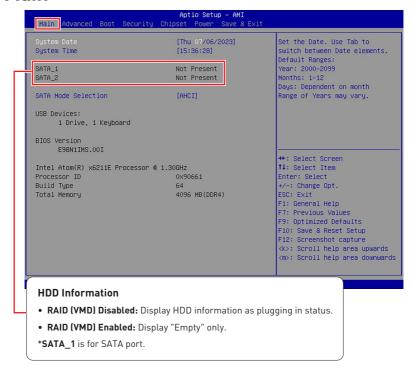
Power

Use this menu to specify your settings for power management.

Save & Exit

This menu allows you to load the BIOS default values or factory default settings into the BIOS and exit the BIOS setup utility with or without changes.

Main



System Date

This setting allows you to set the system date. Use <Tab> key to switch between date elements.

Format: <Day> <Month> <Date> <Year>.

System Time

This setting allows you to set the system time. Use <Tab> key to switch between time elements.

Format: <Hour> <Minute> <Second>.

SATA Mode Selection

This setting specifies SATA controller mode.

[AHCI] AHCI (Advanced Host Controller Interface), is a technical standard for an interface that allows the software to communicate with Serial ATA (SATA) devices. It offers advanced SATA features such as Native Command Queuing (NCQ) and hot-plugging.

[RAID] RAID (Redundant Array of Independent Disks) is a virtual disk storage technology that combines multiple physical disks into one unit for data redundancy, performance improvement, or both.

Advanced



► Full Screen Logo Display

This BIOS feature determines if the BIOS should hide the normal POST messages with the motherboard or system manufacturer's full-screen logo.

[Enabled] BIOS will display the full-screen logo during the boot-up

sequence, hiding normal POST messages.

[Disabled] BIOS will display the normal POST messages, instead of the full-

screen logo.

Please note that enabling this BIOS feature often adds 2-3 seconds to the booting sequence. This delay ensures that the logo is displayed for a sufficient amount of time. Therefore, it is recommended to disable this BIOS feature for faster boot-up.

Bootup NumLock State

This setting is to set the state of the Num Lock key on the keyboard when the system is powered on.

[On] Turn on the Num Lock key when the system is powered on.

[Off] Allow users to use the arrow keys on the numeric keypad.

▶ CPU Configuration



► Intel Virtualization Technology

Enables or disables Intel Virtualization technology.

[Enabled] Enables Intel Virtualization technology and allows a platform to

run multiple operating systems in independent partitions. The system can function as multiple systems virtually.

[Disabled] Disables this function

► Active Performance-cores

Select the number of active Performance-cores (P-cores).

► Intel® SpeedStep(tm)

Enabling or disabling Intel® SpeedStep(tm) determines whether the processor's power-saving feature is active.

[Enabled] When enabled, Intel® SpeedStep(tm) will utilize Enhanced Intel®

> SpeedStep Technology (EIST) to optimize power consumption by adjusting the processor's performance states (P-States). This allows the operating system (OS) to dynamically adjust the processor's voltage and core frequency based on workload, resulting in lower average power consumption and reduced heat

production.

[Disabled] The processor will report its actual maximum CPUID (CPU

Identification) input value when gueried.

► Intel® Speed Shift Technology

Intel® Speed Shift Technology is a feature designed to enhance the performance and power efficiency of Intel processors.

[Enabled] Allows the processor to manage power consumption by utilizing

hardware performance state (P-State) transitions. It dynamically adjust its frequency and voltage in real-time without relying on the

operating system(OS).

[Disabled] Disable this function.

► C States

This setting controls the C-States (CPU Power states).

[Enabled] Detects the idle state of system and reduce CPU power

consumption accordingly.

[Disabled] Disable this function.

Super IO Configuration



► Serial Port 1/2/3/4/5/6

This setting enables or disables the specified serial port.

» Change Settings

This setting is used to change the address & IRQ settings of the specified serial port.

» Mode Select

Select an operation mode for Serial Port 1/2/3/4/5/6.

► FIFO Mode

This setting controls the FIFO (First In First Out) data transfer mode.

► Shared IRQ Mode

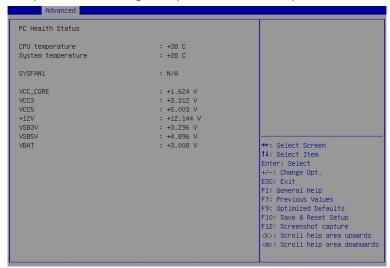
This setting provides the system with the ability to share interrupts among its serial ports.

▶ Watch Dog Timer

You can enable the system watchdog timer, a hardware timer that generates a reset when the software that it monitors does not respond as expected each time the watchdog polls it.

► H/W Monitor (PC Health Status)

These items display the current status of all monitored hardware devices/ components such as voltages, temperatures and all fans' speeds.



Smart Fan Configuration



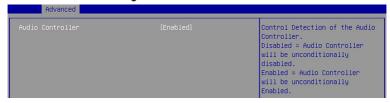
► SYSFAN1

This setting enables or disables the Smart Fan function. By using Smart Fan, you can automatically adjust the fan speed of your system based on the temperature of your CPU/system, preventing overheating from causing damage to your system. The item below will display when SYSFAN1 is enabled.

» Min. Speed (%)

Set the beginning speed of the System fan from 0~87.5%.

► PCI/PCIE Device Configuration

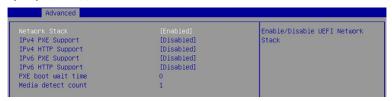


► Audio Controller

This setting enables or disables the detection of the onboard audio controller.

Network Stack Configuration

This menu provides Network Stack settings for users to enable network boot (PXE) from BIOS.



▶ Network Stack

This menu provides Network Stack settings for users to enable network boot (PXE) from BIOS. The following items will display when **Network Stak** is enabled.

» IPV4 PXE Support

Enables or disables IPv4 PXE boot support.

» IPV4 HTTP Support

Enables or disables Ipv4 HTTP Support.

» IPV6 PXE Support

Enables or disables Ipv6 PXE Support.

» IPV6 HTTP Support

Enables or disables Ipv6 HTTP Support.

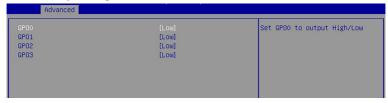
» PXE boot wait time

Use this option to specify the wait time to press the ESC key to abort the PXE boot. Press "+" or "-" on your keyboard to change the value. The default setting is 0.

» Media detect count

Use this option to specify the number of times media will be checked. Press "+" or "-" on your keyboard to change the value. The default setting is 1.

► GPIO Group Configuration



► GP00 ~ GP03

These settings control the operation mode of the specified GPIO.

► PCIE ASPM settings

This menu provide settings for PCIe ASPM (Active State Power Management) level for different installed devices.



► M2_B1/ M2_E1

Sets PCI Express ASPM (Active State Power Management) state for power saving.

Boot



▶ Boot Option #1

This setting allows users to set the sequence of boot devices where BIOS attempts to load the disk operating system.

Security



Administrator Password

Administrator Password controls access to the BIOS Setup utility.

User Password

User Password controls access to the system at boot and to the BIOS Setup utility.

Chassis Intrusion

Enables or disables recording messages while the chassis is opened. This function is ready for the chassis equips a chassis intrusion jumper(switch).

[Enabled] Once the chassis is **opened**, the system will record and issue

a warning message. A beep sound will be emitted before this

function is reset.

[Disabled] Once the chassis is **closed**, the system will record and issue a

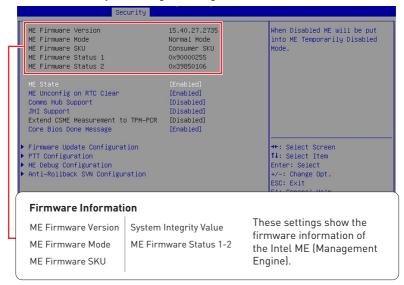
warning message.

[Reset] Clear the warning message. After clearing the message, please

return to Enabled or Disabled.

PCH-FW Configuration

This menu allows you to configure settings related to the PCH firmware.



► ME State

This menu controls the Intel® Management Engine State (ME state) parameters. which provides various management and security capabilities. The following items will display when **ME State** is enabled.

» ME Unconfig on RTC Clear

Enables or disables ME Unconfig on RTC Clear. Enabling this item resets the ME configuration to its default state, removing any customizations or settings applied.

» Comms Hub Support

Enables or disables the communications hub support.

» JHI Support

Enables or disables JHI Support. JHI stands for Intel® Dynamic Application Loader Host Interface Service (Intel® DAL HIS) and is the engineering name for this feature. Enabling JHI Support in the BIOS settings allows the system to utilize this interface for communication between trusted applications and host-based applications.

» Core BIOS Done Message

Enables or disables Core BIOS Done Message sent to ME.

► Firmware Update Configuration

Securi	ty			
Ме FW Image Re-Flash	[Disabled]	Enable/Disable Me FW Image		
FW Update	[Enabled]	Re-Flash function.		

» ME FW Image Re-Flash

Enables or disables the ME Firmware Image Re-flashing.

» Local FW Update

Enables or disables the capability to perform a firmware update of the ME locally.

► PTT Configuration

Intel® Platform Trust Technology (PTT) is a platform functionality for credential storage and key management used by Microsoft Windows.



» TPM Device Selection

Select TPM (Trusted Platform Module) devices from PTT or dTPM (Discrete TPM).

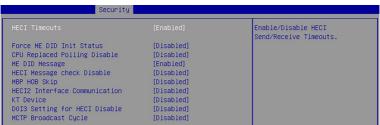
[PTT] Enables PTT in SkuMgr.

[MTPM] Disables PTT in SkuMgr. Warning! PTT/ dTPM will be disabled

and all data saved on it will be lost.

► ME Debug Configuration

This menu allows you to configure debug-related options for the Intel® Management Engine (ME).



» HFCI Timeouts

This setting enables/ disables the HECI (Host Embedded Controller Interface) send/ receive timeouts.

» Force ME DID Init Status

Forces the ME Device ID (DID) initialization status value.

» CPU Replaced Polling Disable

Setting this option disables the CPU replacement polling loop.

» ME DID Message

Enables or disables the display of a message containing the ME Device ID (DID).

» HECI Message Check Disable

This setting disables message check for BIOS boot path when sending messages.

» MBP HOB Skip

Setting this option will skip ME's Memory-Based Protection (MBP) H0B region.

» HECI2 Interface Communication

This setting Adds/ Removes HECI2 device from PCI space.

» KT Device

Enables or disables Key Transfer (KT) Device.

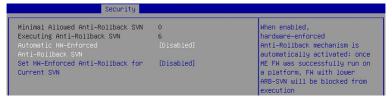
» DOI3 Setting for HECI Disable

Setting this option disables setting DOI3 bit for all HECI devices.

» MCTP Broadcast Cycle

Enables or disables Management Component Transport Protocol (MCTP) Broadcast Cycle.

► Anti-Rollback SVN Configuration



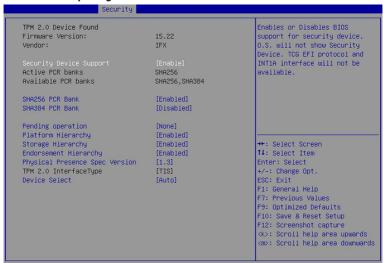
» Automatic HW-Enforced Anti-Rollback SVN

Setting this item enables will automatically activate the hardware-enforced antirollback protection based on the Secure Version Number (SVN). Once enabled, the hardware will enforce that only firmware updates with an SVN equal to or higher than the current SVN can be installed.

» Set HW-Enforced Anti-Rollback for Current SVN

Enable HW ERB mechanism for current ARB SVN value. FW with lower ARB-SVN will be blocked from execution. The value will be restored to disable after the command is sent. This item will display when Automatic HW-Enforced Anti-Rollback SVN is enabled.

▶ Trusted Computing



▶ Security Device Support

This item enables or disables BIOS support for security device. When set to [Disable], the OS will not show security device.

► SHA256/ SHA384 PCR Bank

These settings enables or disables the SHA256 PCR Bank and SHA384 PCR Bank.

► Pending Operation

When Security Device Support is set to [Enable], Pending Operation will appear. It is advised that users should routinely back up their TPM secured data.

[TPM Clear] Clear all data secured by TPM.

[None] Discard the se lection.

► Platform Hierarchy, Storage Hierarchy, Endorsement Hierarchy

These settings enables or disables the Platform Hierarchy, Storage Hierarchy and Endorsement Hierarchy.

► Physical Presence Spec Version

This settings show the Physical Presence Spec Version.

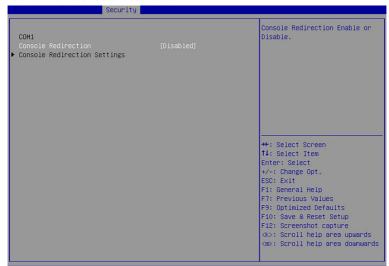
► TPM 2.0 Interface Type

This setting shows the TPM 2.0 Interface Type.

► Device Select

Select your TPM device through this setting.

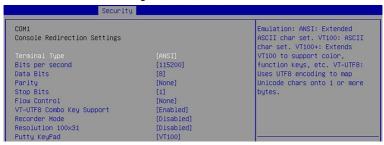
Serial Port Console Redirection



► Console Redirection

Console Redirection operates in host systems that do not have a monitor and keyboard attached. This setting enables or disables the operation of console redirection. When set to [Enabled], BIOS redirects and sends all contents that should be displayed on the screen to the serial COM port for display on the terminal screen. Besides, all data received from the serial port is interpreted as keystrokes from a local keyboard.

► Console Redirection Settings (COM1)



» Terminal Type

To operate the system's console redirection, you need a terminal supporting ANSI terminal protocol and a RS-232 null modem cable connected between the host system and terminal(s). You can select emulation for the terminal from this setting.

[ANSI] Extended ASCII character set

[VT100] ASCII character set.

[VT100Plus] Extends VT100 to support color, function keys, etc.

[VT-UTF8] Uses UTF8 encoding to map Unicode characters onto one or

more bytes.

» Bits per second, Data Bits, Parity, Stop Bits

These setting specifies the transfer rate (bits per second, data bits, parity, stop bits) of Console Redirection.

» Flow Control

Flow control is the process of managing the rate of data transmission between two nodes. It's the process of adjusting the flow of data from one device to another to ensure that the receiving device can handle all of the incoming data. This is particularly important where the sending device is capable of sending data much faster than the receiving device can receive it.

» VT-UTF8 Combo Key Support

This setting enables or disables the VT-UTF8 combination key support for ANSI/ VT100 terminals

» Recorder Mode, Resolution 100x31

These settings enables or disables the recorder mode and the resolution 100x31.

» Putty KeyPad

PuTTY is a terminal emulator for Windows. This setting controls the numeric keypad for use in PuTTY.

Secure Boot



► Secure Boot

Secure Boot function can be enabled only when the Platform Key (PK) is enrolled and running accordingly.

► Secure Boot Mode

Selects the secure boot mode. This item appears when **Secure Boot** is enabled.

The system will automatically load the secure keys from BIOS. [Standard]

[Custom] Allows user to configure the secure boot settings and manually load the secure keys.

► Restore Factory Keys

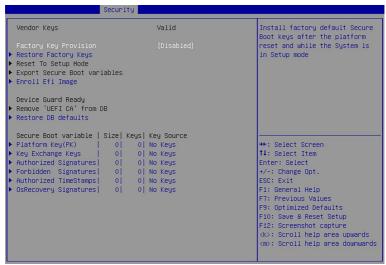
Allows you to restore all factory default keys. The settings will be applied after reboot or at the next reboot. This item appears when "Secure Boot Mode" sets to [Custom]

► Reset to setup Mode

Allows you to delete all the Secure Boot keys (PK,KEK,db,dbt,dbx). The settings will be applied after reboot or at the next reboot. This item appears when "Secure Boot Mode" sets to [Custom].

▶ Key Management

Press Enter key to enter the sub-menu. Manage the secure boot keys. This item appears when "Secure Boot Mode" sets to [Custom].



» Platform Key (PK):

The Platform Key (PK) can protect the firmware from any un-authenticated changes. The system will verify the PK before your system enters the OS. Platform Key (PK) is used for updating KEK.

» Set New Key

Sets a new PK to your system.

» Delete Key

Deletes the PK from your sysatem.

» Key Exchange Keys (KEK):

Key Exchange Key (KEK) is used for updating DB or DBX.

» Set New Key

Sets a new KEK to your system.

» Append Key

Loads an additional KEK from storage devices to your system.

» Delete Kev

Deletes the KEK from your system.

» Authorized Signatures (db):

Authorized Signatures (db) lists the signatures that can be loaded.

» Set New Key

Sets a new db to your system.

» Append Key

Loads an additional db from storage devices to your system.

» Delete Key

Deletes the db from your system.

» Forbidden Signatures (dbx):

Forbidden Signatures (dbx) lists the forbidden signatures that are not trusted and cannot be loaded.

» Set New Key

Sets a new dbx to your system.

» Append Key

Loads an additional dbx from storage devices to your system.

» Delete Key

Deletes the dbx from your system.

» Authorized TimeStamps (dbt):

Authorized TimeStamps (dbt) lists the authentication signatures with authorization time stamps.

» Set New Key

Sets a new DBT to your system.

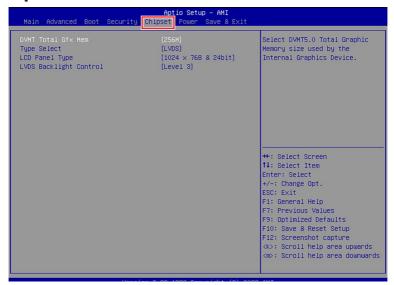
» Append Key

Loads an additional DBT from storage devices to your system.

» OsRecovery Singnatures (dbr):

Lists the available signatures for OS recovery.

Chipset



DVMT Total Gfx Mem

This setting specifies the total graphics memory size for Dynamic Video Memory Technology (DVMT).

▶ Type Select

Set your video signal interface as LVDs or eDP.

► LCD Panel Type

This setting specifies the LCD Panel's resolution and distribution formats. The item will display when LVDS is enabled.

► LVDS Backlight Control

This setting controls the intensity of the LED's backlight output. When lighting conditions are brighter, set it high for a clearer image and low when it is darker.

LED's backlight output			
[Level 1]	20%		
[Level 2]	40%		
[Level 3]	60%		
[Level 4]	80%		
[Level 5]	100%		

Power

Main Advanced Boot Secur	Aptio Setup – AMI ity Chipset Power Save &	Exit
Restore AC power Loss	[Last State]	Enable or disable System wake on from S3/S4/S5 alarm event.
Deep Sleep Mode	[S4 + S5]	When enabled, System will wake on the hr::min::sec specified
Advanced Resume Events Contro	01	
PS/2	[Disabled]	
OnChip USB	[Disabled]	
Lan/PCIE PME/ Ring	[Disabled]	
RTC	[Disabled]	

Restore AC Power Loss

This setting specifies whether your system will reboot after a power failure or interrupt occurs. Available settings are:

[Power Off] Leaves the computer in the power off state.

[Power On] Leaves the computer in the power on state.

[Last State] Restores the system to the previous status before power failure or

interrupt occurred.

Deep Sleep Mode

The setting enables or disables the Deep S5 power saving mode. S5 is almost the same as G3 Mechanical Off, except that the PSU still supplies power, at a minimum, to the power button to allow return to S0. A full reboot is required. No previous content is retained. Other components may remain powered so the computer can "wake" on input from the keyboard, clock, modem, LAN, or USB device

OnChip USB

The item allows the activity of the OnChip USB device to wake up the system from S4/S5 sleep state.

► LAN/ PCIE PME/Ring

Enables or disables the system to be awakened from power saving modes when activity or input signal of onboard PCIE PME/Ring is detected.

▶ RTC

When [Enabled], your can set the date and time at which the RTC (real-time clock) alarm awakens the system from suspend mode.

Save & Exit



Save Changes and Reset

Save changes to CMOS and reset the system.

Discard Changes and Exit

Abandon all changes and exit the Setup Utility.

Discard Changes

Abandon all changes.

► Load Optimized Defaults

Use this menu to load the default values set by the motherboard manufacturer specifically for optimal performance of the motherboard.

Save as User Defaults

Save changes as the user's default profile.

Restore User Defaults

Restore the user's default profile.

Launch EFI Shell from filesystem device

This setting helps to launch the EFI Shell application from one of the available file system devices.

GPIO WDT SMBus Access Programming

This chapter provides WDT (Watch Dog Timer), GPIO (General Purpose Input/ Output) and SMBus Access programming guide.

Abstract

In this section, code examples based on C programming language provided for customer interest. Inportb, Outportb, Inportl and Outportl are basic functions used for access IO ports and defined as following.

Inportb: Read a single 8-bit I/O port.

Outportb: Write a single byte to an 8-bit port.

Inportl: Reads a single 32-bit I/O port.

Outportl: Write a single long to a 32-bit port.

General Purpose IO

1. General Purposed IO – GPIO/DIO

The GPIO port configuration addresses are listed in the following table:

Name	IO Port	IO address	Name	IO Port	IO address
N_GPI0	0x12	Bit 6	N_GPO0	0x21	Bit 2
N_GPI1	0x12	Bit 7	N_GPO1	0x11	Bit 4
N_GPI2	0x22	Bit 0	N_GPO2	0x11	Bit 0
N_GPI3	0x22	Bit 1	N_GPO3	0x11	Bit 1

Note: GPIO should be accessed through controller device 0x6E on SMBus. The associated access method in examples (SMBus_ReadByte, SMBus_WriteByte) are provided in part 3.

1.1 Set output value of GPO

- 1. Read the value from GPO port.
- 2. Set the value of GPO address.
- 3. Write the value back to GPO port.

```
Example: Set N_GPO0 output "high"
```

```
val =SMBus_ReadByte (0x6E, 0x21); // Read value from N_GPO0 port through SMBus.
val = val | (1<<2); // Set N_GPO0address (bit 2) to 1 (output "high").
SMBus_WriteByte (0x6E, 0x21, val); // Write back to N_GPO0 port through SMBus.</pre>
```

Example: Set N GPO1 output "low"

```
val = SMBus_ReadByte (0x6E, 0x11); // Read value from N_GPO1 port through SMBus..
val = val & (~(1<<4)); // Set N_GPO1 address (bit 4) to 0 (output "low").
SMBus_WriteByte (0x6E, 0x11, val); // Write back to N_GPO1 port through SMBus.
```

1.2 Read input value from GPI:

- 1. Read the value from GPI port.
- 2. Get the value of GPI address.

Example: Get N_GPI2 input value.

```
val = SMBus_ReadByte (0x6E, 0x22); // Read value from N_GPI2 port through SMBus.
val = val & (1<<0); // Read N_GPI2 address (bit 0).
if (val) printf ("Input of N_GPI2 is High");
else printf ("Input of N_GPI2 is Low");</pre>
```

Example: Get N_GPI3 input value.

```
val = SMBus_ReadByte (0x6E, 0x22); // Read value from N_GPI3 port through SMBus.
val = val & (1<<1); // Read N_GPI3 address (bit 1).
if (val) printf ("Input of N_GPI3 is High");
else printf ("Input of N_GPI3 is Low");</pre>
```

Watchdog Timer

2. Watchdog Timer - WDT

The base address (WDT BASE) of WDT configuration registers is 0xA10.

2.1 Set WDT Time Unit

```
val = Inportb (WDT BASE + 0x05);
                                        // Read current WDT setting
val = val \mid 0x08;
                                         // minute mode. val = val & 0xF7 if second mode
Outportb (WDT BASE + 0x05, val);
                                         // Write back WDT setting
```

2.2 Set WDT Time

```
Outportb (WDT_BASE + 0x06, Time);
                                       // Write WDT time, value 1 to 255.
```

2.3 **Enable WDT**

```
val = Inportb (WDT_BASE + 0x0A);
                                         // Read current WDT PME setting
val = val \mid 0x01;
                                         // Enable WDT OUT: WDOUT_EN (bit 0) set to 1.
Outportb (WDT BASE + 0x0A, val);
                                         // Write back WDT setting.
val = Inportb (WDT BASE + 0x05);
                                         // Read current WDT setting
val = val \mid 0x20;
                                         // Enable WDT by set WD_EN (bit 5) to 1.
Outportb (WDT BASE + 0x05, val);
                                         // Write back WDT setting.
```

2.4 Disable WDT

```
val = Inportb (WDT_BASE + 0x05);
                                        // Read current WDT setting
val = val & 0xDF:
                                        // Disable WDT by set WD EN (bit 5) to 0.
Outportb (WDT BASE + 0x05, val);
                                        // Write back WDT setting.
```

2.5 **Check WDT Reset Flag**

If the system has been reset by WDT function, this flag will set to 1.

```
val = Inportb (WDT BASE + 0x05);
                                        // Read current WDT setting.
val = val & 0x40;
                                        // Check WDTMOUT_STS (bit 6).
if (val) printf ("timeout event occurred");
else
         printf ("timeout event not occurred");
```

2.6 **Clear WDT Reset Flag**

```
val = Inportb (WDT BASE + 0x05);
                                        // Read current WDT setting
val = val | 0x40;
                                        // Set 1 to WDTMOUT STS (bit 6);
Outportb (WDT BASE + 0x05, val);
                                        // Write back WDT setting
```

SMBus Access

3. SMBus Access

The base address of SMBus must know before access.

The relevant bus and device information are as following.

```
#define IO_SC 0xCF8

#define IO_DA 0xCFC

#define PCIBASEADDRESS 0x80000000

#define PCI_BUS_NUM 0

#define PCI_DEV_NUM 31

#define PCI_FUN_NUM 4
```

3.1 Get SMBus Base Address

3.2 SMBus_ReadByte (char DEVID, char offset)

Read the value of OFFSET from SMBus device DEVID.

```
Outportb (LOWORD (SMBUS_BASE), 0xFE);

Outportb (LOWORD (SMBUS_BASE) + 0x04, DEVID + 1); //out Base + 04, (DEVID + 1)

Outportb (LOWORD (SMBUS_BASE) + 0x03, OFFSET); //out Base + 03, OFFSET

Outportb (LOWORD (SMBUS_BASE) + 0x02, 0x48); //out Base + 02, 48H

mdelay (20); //delay 20ms to let data ready

while ((Inportl (SMBUS_BASE) & 0x01) != 0); //wait SMBus ready

SMB_DATA = Inportb (LOWORD (SMBUS_BASE) + 0x05); //input Base + 05
```

3.3 SMBus WriteByte (char DEVID, char offset, char DATA)

Write DATA to OFFSET on SMBus device DEVID.

```
Outportb (LOWORD (SMBUS_BASE), 0xFE);

Outportb (LOWORD (SMBUS_BASE) + 0x04, DEVID); //out Base + 04, (DEVID)

Outportb (LOWORD (SMBUS_BASE) + 0x03, OFFSET); //out Base + 03, OFFSET

Outportb (LOWORD (SMBUS_BASE) + 0x05, DATA); //out Base + 05, DATA

Outportb (LOWORD (SMBUS_BASE) + 0x02, 0x48); //out Base + 02, 48H

mdelay (20); //wait 20ms
```