

PRIME Z390-P



Motherboard

E15011

Revised Edition v3
November 2018

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Safety information

Electrical safety

- To prevent electrical shock hazard, disconnect the power cable from the electrical outlet before relocating the system.
- When adding or removing devices to or from the system, ensure that the power cables for the devices are unplugged before the signal cables are connected. If possible, disconnect all power cables from the existing system before you add a device.
- Before connecting or removing signal cables from the motherboard, ensure that all power cables are unplugged.
- Seek professional assistance before using an adapter or extension cord. These devices could interrupt the grounding circuit.
- Ensure that your power supply is set to the correct voltage in your area. If you are not sure about the voltage of the electrical outlet you are using, contact your local power company.
- If the power supply is broken, do not try to fix it by yourself. Contact a qualified service technician or your retailer.

Operation safety

- Before installing the motherboard and adding components, carefully read all the manuals that came with the package.
- Before using the product, ensure all cables are correctly connected and the power cables are not damaged. If you detect any damage, contact your dealer immediately.
- To avoid short circuits, keep paper clips, screws, and staples away from connectors, slots, sockets and circuitry.
- Avoid dust, humidity, and temperature extremes. Do not place the product in any area where it may be exposed to moisture.
- Place the product on a stable surface.
- If you encounter technical problems with the product, contact a qualified service technician or your retailer.

About this guide

This user guide contains the information you need when installing and configuring the motherboard.

How this guide is organized

This guide contains the following parts:

- **Chapter 1: Product introduction**
This chapter describes the features of the motherboard and the new technology it supports. It includes descriptions of the switches, jumpers, and connectors on the motherboard.
- **Chapter 2: BIOS information**
This chapter discusses changing system settings through the BIOS Setup menus. Detailed descriptions for the BIOS parameters are also provided.

Where to find more information

Refer to the following sources for additional information and for product and software updates.

1. ASUS websites

The ASUS website provides updated information on ASUS hardware and software products. Refer to the ASUS contact information.

2. Optional documentation

Your product package may include optional documentation, such as warranty flyers, that may have been added by your dealer. These documents are not part of the standard package.

Conventions used in this guide

To ensure that you perform certain tasks properly, take note of the following symbols used throughout this manual.



DANGER/WARNING: Information to prevent injury to yourself when completing a task.



CAUTION: Information to prevent damage to the components when completing a task.



IMPORTANT: Instructions that you **MUST** follow to complete a task.



NOTE: Tips and additional information to help you complete a task.

Typography

Bold text

Indicates a menu or an item to select.

Italics

Used to emphasize a word or a phrase.

<Key>

Keys enclosed in the less-than and greater-than sign means that you must press the enclosed key.

Example: <Enter> means that you must press the Enter or Return key.

<Key1> + <Key2> + <Key3>

If you must press two or more keys simultaneously, the key names are linked with a plus sign (+).

Package contents

Check your motherboard package for the following items.

Motherboard	ASUS PRIME Z390-P motherboard
Cables	2 x SATA 6.0 Gb/s cables
Accessories	1 x I/O Shield 2 x M.2 screw packages
Application DVD	Support DVD
Documentation	User Guide



If any of the above items is damaged or missing, contact your retailer.

PRIME Z390-P specifications summary

CPU	<p>Intel® Socket 1151 for Intel® Core™ 9000 series, 8th Generation Core™ i7/ i5/ i3, Pentium® and Celeron® processors</p> <p>Supports 14nm CPU</p> <p>Supports Intel® Turbo Boost Technology 2.0*</p> <p>* The Intel® Turbo Boost Technology 2.0 support depends on the CPU types.</p> <p>** Refer to www.asus.com for Intel® CPU support list.</p>
Chipset	Intel® Z390 Chipset
Memory	<p>4 x DIMM, max. 64GB DDR4 4266(O.C.)*/4133(O.C.)*/4000(O.C.)*/3866(O.C.)*/3733(O.C.)*/3600(O.C.)*/3466(O.C.)*/3400(O.C.)*/3333(O.C.)*/3300(O.C.)*/3200(O.C.)*/3000(O.C.)*/2800(O.C.)*/2666 /2400 /2133 MHz Non-ECC, Un-buffered Memory**</p> <p>Dual-channel memory architecture</p> <p>Supports Intel® Extreme Memory Profile (XMP)</p> <p>* The maximum memory frequency supported varies by processor.</p> <p>** Refer to www.asus.com for the latest Memory QVL (Qualified Vendors List).</p>
Expansion slots	<p>1 x PCI Express 3.0/2.0 x16 slot (support x16, x8+x4+x4*)</p> <p>1 x PCI Express 3.0/2.0 x16 slot (max. at x4 mode, compatible with PCIe x1, x2 and x4 devices)</p> <p>4 x PCI Express 3.0/2.0 x1 slots</p> <p>1 x M.2 Socket (Key E), supports type 2230 Wi-Fi/BT and Intel® CNVi (Integrated Wi-Fi/BT) module**</p> <p>* For 3 Intel® SSDs on CPU support, install a Hyper M.2 X16 card (sold separately) into the PCIeX16_1 slot, and enable this card in BIOS.</p> <p>** The Wi-Fi/BT module is purchased separately.</p>
Multi-GPU Support	Supports AMD CrossFireX™ Technology
Graphics	<p>Integrated graphics processor - Intel® UHD Graphics support</p> <p>Multi-VGA output support: HDMI, DisplayPort ports</p> <ul style="list-style-type: none"> - Supports HDMI 1.4b output with a maximum resolution of 4096 x 2160 @30Hz, 24bpp - Supports DisplayPort* with max. resolution 4096 x 2304@60Hz <p>Supports Intel® InTru™ 3D, Quick Sync Video, Intel® Clear Video HD Technology, and Intel® Insider™</p>

(continued on the next page)

PRIME Z390-P specifications summary

Storage	<p>Intel® CPU support with Intel® Rapid Storage Technology (RAID 0 & RAID 1)</p> <ul style="list-style-type: none"> - PCIeX16_1 slot supports up to 3 Intel® PCIe NVME SSDs via a Hyper M.2 X16 series Card* <p>Intel® Z390 Chipset with RAID 0, 1, 5, 10 and Intel® Rapid Storage Technology support</p> <ul style="list-style-type: none"> - 1 x M.2 Socket 3 with M Key, type 2242/2260/2280 storage devices support (SATA mode & X4 PCIe mode)** - 1 x M.2 Socket 3 with M Key, type 2242/2260/2280 storage devices support (SATA mode & X2 PCIe mode) - 4 x SATA 6.0 Gb/s ports (gray) - Intel® Optane™ Memory Ready <p>* Hyper M.2X16 series card is sold separately. Install a Hyper M.2 X16 series card and enable this card under BIOS settings.</p> <p>** When a device in SATA mode is installed on the M.2_1 socket, SATA_2 port cannot be used.</p>
LAN	Realtek® 8111H Gigabit LAN controller supports ASUS LANGuard
Audio	<p>Realtek® ALC887 8-channel* high definition audio CODEC</p> <ul style="list-style-type: none"> - LED-illuminated design: Brighten up your build with the gorgeous illuminated audio trace path - Audio Shielding: Ensures precision analog/digital separation and greatly reduces multi-lateral interference - Dedicated audio PCB layers: Separate layers for left and right channels to guard the quality of the sensitive audio signals - Premium Japanese audio capacitors: Provide warm, natural and immersive sound with exceptional clarity and fidelity - Supports jack-detection and front panel jack-retasking <p>* Use a chassis with HD audio module in the front panel to support an 8-channel audio output.</p>
USB	<p>Intel® Z390 Chipset</p> <ul style="list-style-type: none"> - 2 x USB 3.1 Gen 2 ports up to 10Gbps at back panel (Type-A) - 8 x USB 3.1 Gen 1 ports (4 ports @mid-board; 4 ports @back panel, blue, Type A) - 3 x USB 2.0/1.1 ports (3 ports @mid-board)
ASUS unique features	<p>ASUS 5X PROTECTION III</p> <ul style="list-style-type: none"> - ASUS SafeSlot Core: Fortified PCIe with solid soldering - ASUS LANGuard: Protects against LAN surges, lightning strikes and static-electricity discharges - ASUS Overvoltage Protection: World-class circuit-protecting power design - ASUS Stainless-Steel Back I/O: 3X corrosion-resistance for greater durability! - ASUS DIGI+ VRM <p>Superb Performance</p> <p>OptiMem II</p> <ul style="list-style-type: none"> - Improved DDR4 stability <p>M.2 onboard</p> <ul style="list-style-type: none"> - The latest transfer technologies with up to 32Gb/s data transfer speeds <p>ASUS Fan Xpert 4</p> <ul style="list-style-type: none"> - Advanced fan and liquid controls for ultimate cooling and quietness

(continued on the next page)

PRIME Z390-P specifications summary

ASUS unique features	ASUS EPU <ul style="list-style-type: none"> - EPU
	ASUS Exclusive Features <ul style="list-style-type: none"> - ASUS Ai Charger - ASUS AI Suite 3
	EZ DIY UEFI BIOS EZ Mode <ul style="list-style-type: none"> - Featuring friendly graphics user interface - ASUS O.C. Tuner - ASUS CrashFree BIOS 3 - ASUS EZ Flash 3 - PC Cleaner
ASUS quiet thermal solution	Q-Design <ul style="list-style-type: none"> - ASUS Q-DIMM - ASUS Q-Slot
	Quiet Thermal Design <ul style="list-style-type: none"> - ASUS ASUS Fan Xpert 4 - Stylish Fanless Design: PCH Heat-sink & 2*MOS Heat-sink
ASUS Exclusive Overclocking Features	Precision Tweaker 2: <ul style="list-style-type: none"> - vCore: Adjustable CPU Core voltage at 0.005V increment - iGPU: Adjustable CPU Graphics voltage at 0.005V increment - vCCIO: Adjustable Analog and Digital I/O voltage at 0.005V increment - vCCSA: Adjustable CPU System Agent voltage at 0.1V increment - vDRAM Bus: Adjustable DRAM Voltage at 0.005V increment - vPCH: Adjustable PCH Core Voltage at 0.01V increment
	SFS (Stepless Frequency Selection) <ul style="list-style-type: none"> - BCLK/PCIe frequency tuning from 98MHz up to 538MHz at 0.1MHz increment
	Overclocking Protection <ul style="list-style-type: none"> - ASUS C.P.R.(CPU Parameter Recall)
Rear panel I/O ports	1 x PS/2 keyboard port 1 x PS/2 mouse port 1 x DisplayPort 1 x HDMI port 1 x LAN (RJ45) port 2 x USB 3.1 Gen 2 Type A ports 4 x USB 3.1 Gen 1 Type A ports 3 x Audio jacks support 8-channel audio output* * Use a chassis with HD audio module in the front panel to support a 8-channel audio output.

(continued on the next page)

PRIME Z390-P specifications summary

Internal connectors	<p>2 x USB 3.1 Gen 1 connectors support additional 4 USB 3.1 Gen 1 ports (19-pin)</p> <p>1 x USB 2.0 connectors support additional 2 USB ports (9-pin)</p> <p>1 x USB 2.0 connectors support additional 1 USB ports (4-pin)</p> <p>4 x SATA 6.0 Gb/s connectors (gray)</p> <p>2 x M.2 Socket 3 (for M Key)</p> <p>1 x M.2 Socket 3 (for E Key)</p> <p>1 x 4-pin CPU Fan connector for both 3-pin (DC mode) and 4-pin (PWM mode) CPU coolers control*</p> <p>2 x 4-pin Chassis Fan connectors for 3-pin (DC mode) and 4-pin (PWM mode) coolers control*</p> <p>1 x AIO PUMP connector</p> <p>1 x RGB Header</p> <p>1 x MemOK! II Switch</p> <p>1 x Front panel audio connector (AAFP)</p> <p>1 x System panel connector</p> <p>1 x S/PDIF out header</p> <p>1 x 24-pin EATX Power connector</p> <p>1 x 8-pin EATX 12V Power connector</p> <p>1 x Clear CMOS jumper</p> <p>1 x COM Header</p> <p>* By default, the CPU/Chassis Q-Fan control setting is set to Auto mode, which detects the CPU and chassis fans installed and changes the control mode automatically.</p>
BIOS features	<p>128 Mb Flash ROM, UEFI AMI BIOS, PnP, SM BIOS 3.1, ACPI 6.1, Multi-language BIOS, ASUS EZ Flash 3, CrashFree BIOS 3, F11 EZ Tuning Wizard, F6 Qfan Control, F3 My Favorites, Last Modified log, F9 Search, F12 PrintScreen, and ASUS DRAM SPD (Serial Presence Detect) memory information</p>
Manageability	<p>WOL by PME, PXE</p>
Support DVD	<p>Drivers</p> <p>ASUS utilities</p> <p>EZ Update</p> <p>Anti-virus software (OEM version)</p>
OS support	<p>Windows® 10 (64-bit)</p>
Form factor	<p>ATX form factor: 12.0 in. x 9.2 in. (30.5 cm x 23.4cm)</p>



Specifications are subject to change without notice.



Product introduction

1

1.1 Before you proceed

Take note of the following precautions before you install motherboard components or change any motherboard settings.



-
- Unplug the power cord from the wall socket before touching any component.
 - Before handling components, use a grounded wrist strap or touch a safely grounded object or a metal object, such as the power supply case, to avoid damaging them due to static electricity.
 - Hold components by the edges to avoid touching the ICs on them.
 - Whenever you uninstall any component, place it on a grounded antistatic pad or in the bag that came with the component.
 - Before you install or remove any component, ensure that the ATX power supply is switched off or the power cord is detached from the power supply. Failure to do so may cause severe damage to the motherboard, peripherals, or components.
-

1.2 Motherboard overview

Before you install the motherboard, study the configuration of your chassis to ensure that the motherboard fits.



Unplug the power cord before installing or removing the motherboard. Failure to do so can cause you physical injury and damage to motherboard components.

1.2.1 Placement direction

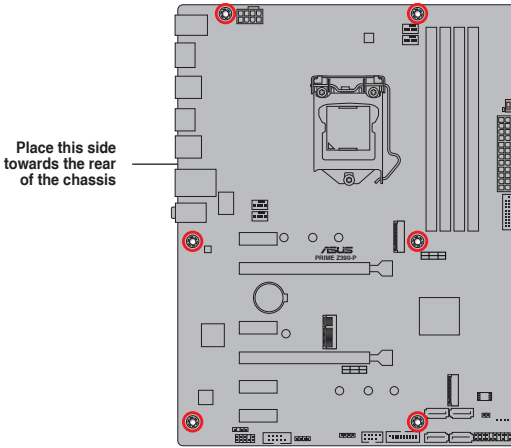
When installing the motherboard, place it into the chassis in the correct orientation. The edge with external ports goes to the rear part of the chassis as indicated in the image.

1.2.2 Screw holes

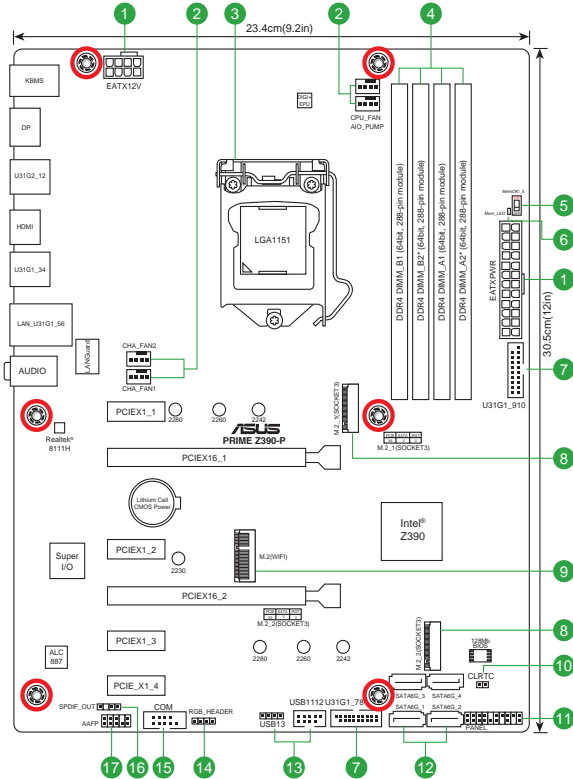
Place six screws into the holes indicated by circles to secure the motherboard to the chassis.



Do not overtighten the screws! Doing so can damage the motherboard.



1.2.3 Motherboard layout

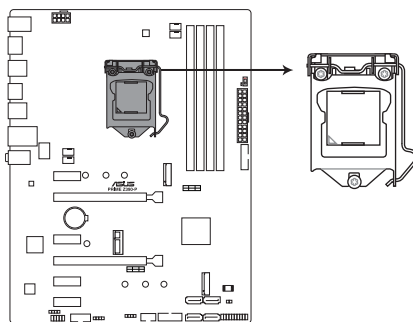


1.2.4 Layout contents

Connectors/Jumpers/Slots/LED	Page
1. ATX power connectors (24-pin EATXPWR, 8-pin EATX12V)	1-18
2. CPU, AIO pump, and chassis fan connectors (4-pin CPU_FAN, 4-pin AIO_PUMP, and 4-pin CHA_FAN1/2)	1-21
3. Intel® LGA1151 CPU socket	1-3
4. DDR4 DIMM slots	1-7
5. MemOK_II Switch	1-12
6. MemOK_II LED	1-13
7. USB 3.1 Gen 1 connectors (20-1 pin U31G1_78, 910)	1-17
8. M.2 Socket 3 [M.2_1(Socket 3)]	1-20
9. M.2 Socket 3 [M.2 (WIFI)]	1-19
10. Clear RTC RAM (2-pin CLRTC)	1-10
11. System panel connector (20-5 pin PANEL)	1-22
12. Intel® Z390 SATA 6.0 Gb/s connectors (7-pin SATA6G_1-4)	1-19
13. USB 2.0 connectors (10-1 pin USB1112, USB13)	1-16
14. RGB header (4-pin RGB_HEADER)	1-11
15. Serial port connectors (10-1 pin COM)	1-15
16. Digital audio connector (4-1 pin SPDIF_OUT)	1-17
17. Front panel audio connector (10-1 pin AAFP)	1-16

1.3 Central Processing Unit (CPU)

This motherboard comes with a surface mount LGA1151 socket designed for Intel® Core™ 9000 series, 8th Generation Core™ i7/ i5/ i3, Pentium® and Celeron® processors



PRIME Z390-P CPU socket LGA1151

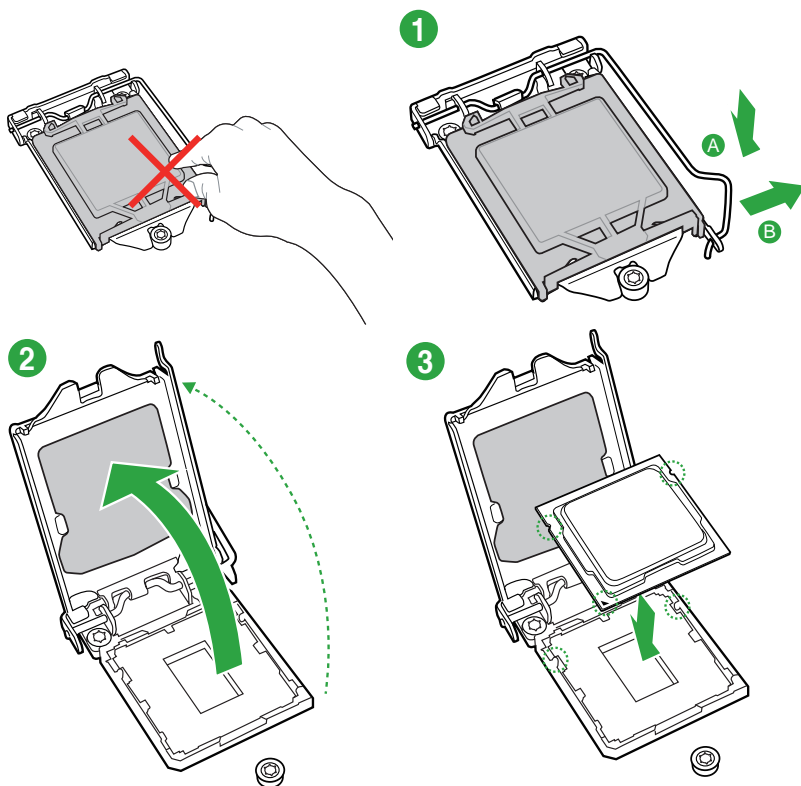


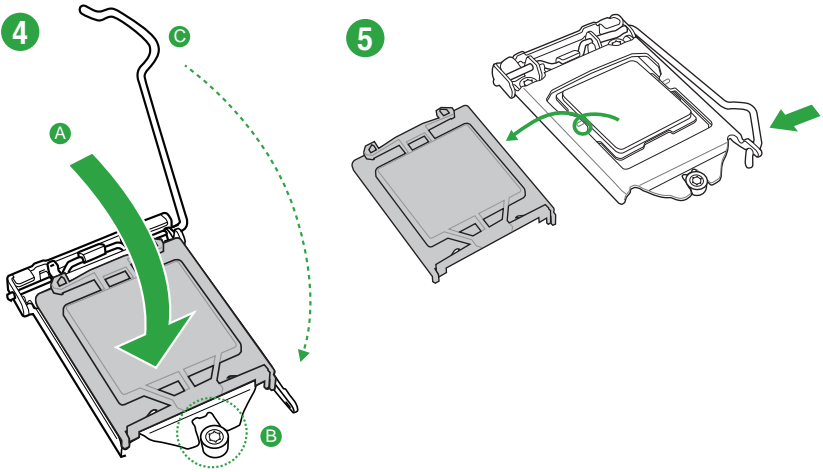
Unplug all power cables before installing the CPU.



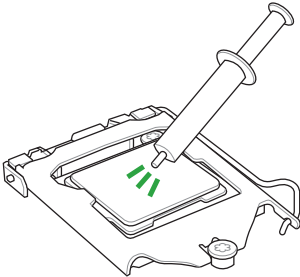
- Ensure that you install the correct CPU designed for the LGA1151 socket only. DO NOT install a CPU designed for LGA1150, LGA1155 and LGA1156 sockets on the LGA1151 socket.
- Upon purchase of the motherboard, ensure that the PnP cap is on the socket and the socket contacts are not bent. Contact your retailer immediately if the PnP cap is missing, or if you see any damage to the PnP cap/socket contacts/motherboard components.
- Keep the cap after installing the motherboard. ASUS will process Return Merchandise Authorization (RMA) requests only if the motherboard comes with the cap on the LGA1151 socket.
- The product warranty does not cover damage to the socket contacts resulting from incorrect CPU installation/removal, or misplacement/loss/incorrect removal of the PnP cap.

1.3.1 Installing the CPU



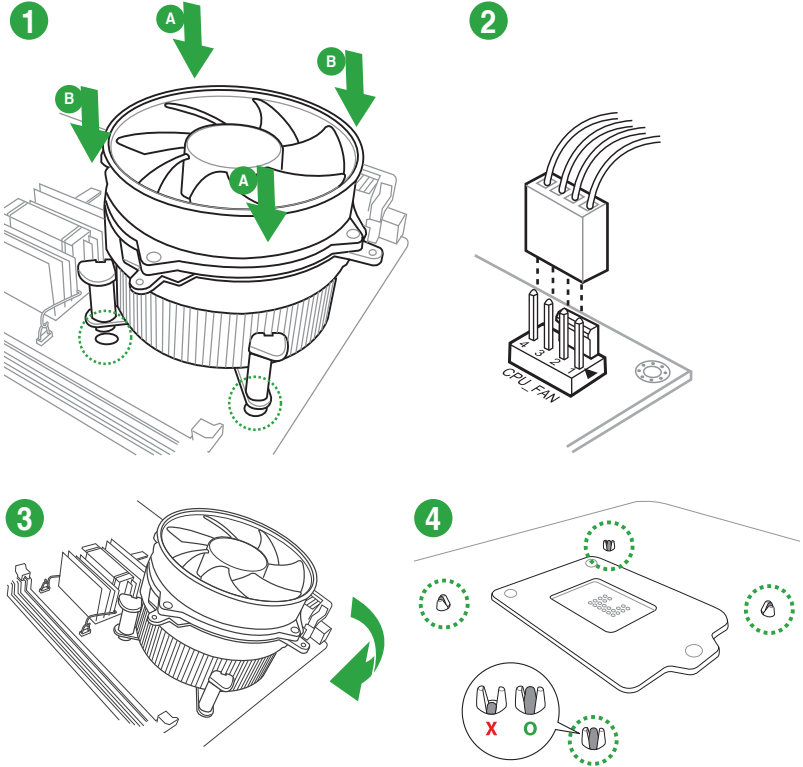


1.3.2 CPU heatsink and fan assembly installation

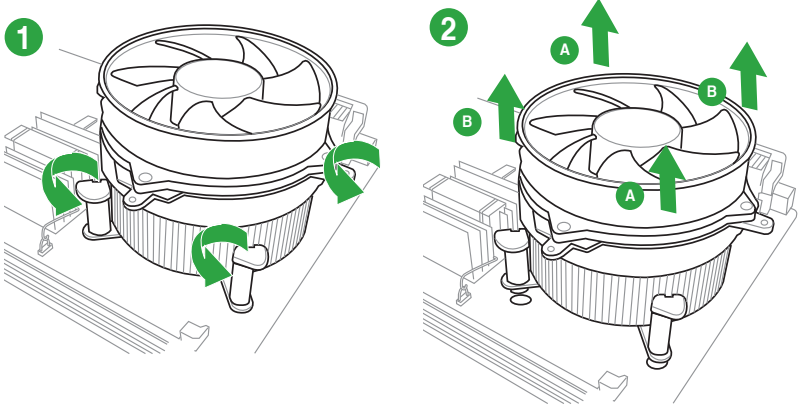


Apply the Thermal Interface Material to the CPU heatsink and CPU before you install the heatsink and fan if necessary.

To install the CPU heatsink and fan assembly



To uninstall the CPU heatsink and fan assembly



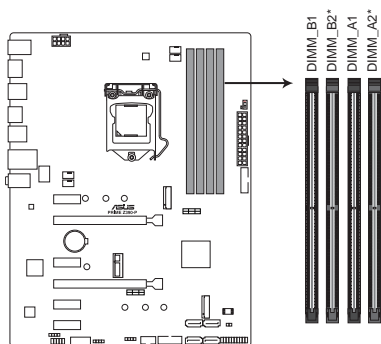
1.4 System memory

1.4.1 Overview

This motherboard comes with four Double Data Rate 4 (DDR4) Dual Inline Memory Module (DIMM) sockets. A DDR4 module is notched differently from a DDR, DDR2, or DDR3 module. DO NOT install a DDR, DDR2, or DDR3 memory module to the DDR4 slot.



According to Intel® CPU spec, DIMM voltage below 1.35 V is recommended to protect the CPU.

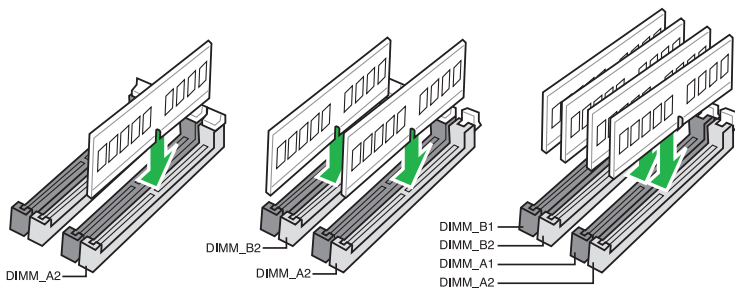


PRIME Z390-P 288-pin DDR4 DIMM sockets

1.4.2 Memory configurations

You may install 2 GB, 4 GB, 8 GB, and 16 GB unbuffered non-ECC DDR4 DIMMs into the DIMM sockets. You can refer to the recommended memory population below.

Recommended memory configurations



- You may install varying memory sizes in Channel A and Channel B. The system maps the total size of the lower-sized channel for the dual-channel configuration. Any excess memory from the higher-sized channel is then mapped for single-channel operation.
- According to Intel® CPU spec, DIMM voltage below 1.35V is recommended to protect the CPU.
- When using one DIMM, install it into slot A2 for better memory compatibility and performance



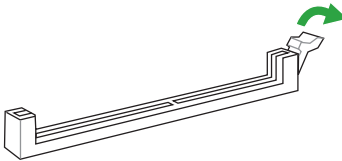
- The default memory operation frequency is dependent on its Serial Presence Detect (SPD), which is the standard way of accessing information from a memory module. Under the default state, some memory modules for overclocking may operate at a lower frequency than the vendor-marked value. To operate at the vendor-marked or at a higher frequency, refer to section **2.5 Ai Tweaker menu** for manual memory frequency adjustment.
- Always install the DIMMS with the same CAS Latency. For an optimum compatibility, we recommend that you install memory modules of the same version or data code (D/C) from the same vendor. Check with the vendor to get the correct memory modules.
- For system stability, use a more efficient memory cooling system to support a full memory load (4 DIMMs) or overclocking condition.



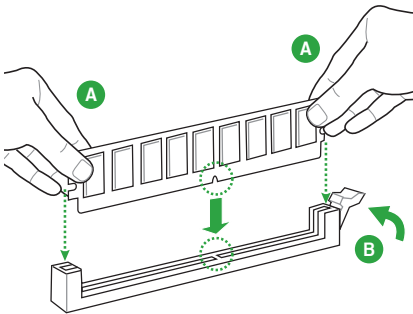
Visit the ASUS website at www.asus.com for the latest QVL.

1.4.3 Installing a DIMM

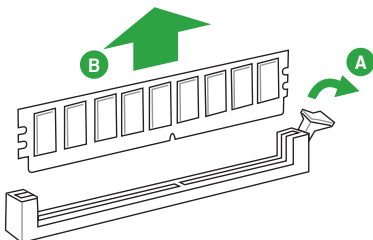
1



2



To remove a DIMM



1.5 Expansion slots

In the future, you may need to install expansion cards. The following sub-sections describe the slots and the expansion cards that they support.



Unplug the power cord before adding or removing expansion cards. Failure to do so may cause you physical injury and damage motherboard components.

1.5.1 Installing an expansion card

To install an expansion card:

1. Before installing the expansion card, read the documentation that came with it and make the necessary hardware settings for the card.
2. Remove the system unit cover (if your motherboard is already installed in a chassis).
3. Remove the bracket opposite the slot that you intend to use. Keep the screw for later use.
4. Align the card connector with the slot and press firmly until the card is completely seated on the slot.
5. Secure the card to the chassis with the screw you removed earlier.
6. Replace the system cover.

1.5.2 Configuring an expansion card

After installing the expansion card, configure it by adjusting the software settings.

1. Turn on the system and change the necessary BIOS settings, if any. See Chapter 2 for information on BIOS setup.
2. Assign an IRQ to the card.
3. Install the software drivers for the expansion card.



When using PCI cards on shared slots, ensure that the drivers support "Share IRQ" or that the cards do not need IRQ assignments. Otherwise, conflicts will arise between the two PCI groups, making the system unstable and the card inoperable.

1.5.3 PCI Express 3.0 x1 slots

This motherboard supports PCI Express 3.0 x1 network cards, SCSI cards, and other cards that comply with the PCI Express specifications.

1.5.4 PCI Express 3.0 x16 slots

This motherboard has two PCI Express 3.0 x16 slots (x16 + x4 mode) that support PCI Express 3.0 x16 graphic cards complying with the PCI Express specifications.

VGA configuration	PCI Express operating mode	
	PCIe 3.0 x16_1 (gray)	PCIe 3.0 x16_2 (black, x4 mode)
Single VGA/PCIe card	x16 (Recommended for single VGA card)	N/A
Dual VGA/PCIe cards	x16	x4



- In single VGA card mode, use the PCIe 3.0 x16_1 slot (gray) for a PCI Express x16 graphics card to get better performance.
- We recommend that you provide sufficient power when running CrossFireX™ mode.
- Connect a chassis fan to the motherboard connector labeled CHA_FAN1/2 when using multiple graphics cards for better thermal environment.

Hyper M.2 X16 card configuration	PCI Express 3.0 operating mode	
	PCIe 3.0 x16_1 (gray)	PCIe 3.0 x16_2 (black)
3 Intel® SSDs on CPU support	x8+x4+x4	N/A

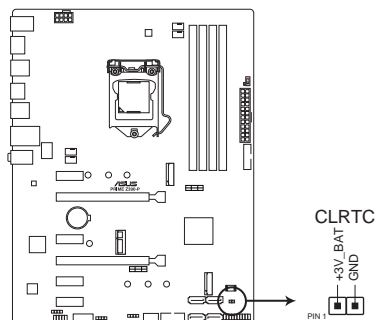


- Hyper M.2 X16 card is purchased separately.
- Enable the Hyper M.2 X16 card under BIOS settings.

1.6 Headers

1. Clear RTC RAM (2-pin CLRRTC)

This header allows you to clear the Real Time Clock (RTC) RAM in CMOS. You can clear the CMOS memory of date, time, and system setup parameters by erasing in CMOS RTC RAM data. The onboard button cell battery powers the RAM data in CMOS, which include system setup information such as system passwords.



PRIME Z390-P Clear RTC RAM

To erase the RTC RAM:

1. Turn OFF the computer and unplug the power cord.
2. Use a metal object such as a screwdriver to short the two pins.
3. Plug the power cord and turn on the computer.
4. Hold down the key during the boot process and enter BIOS setup to re-enter data.



If the steps above do not help, remove the onboard battery and short the two pins again to clear the CMOS RTC RAM data. After clearing the CMOS, reinstall the battery.

2. RGB header (4-pin RGB_HEADER)

This header is for RGB LED strips.



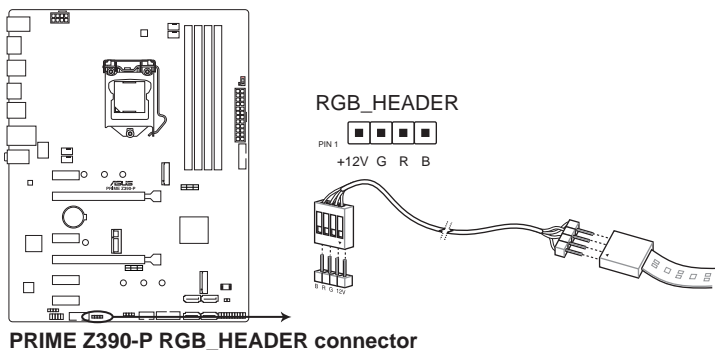
The RGB header supports 5050 RGB multi-color LED strips (12V/G/R/B), with a maximum power rating of 3A (12V), and no longer than 3 m.



Before you install or remove any component, ensure that the ATX power supply is switched off or the power cord is detached from the power supply. Failure to do so may cause severe damage to the motherboard, peripherals, or components.



- Actual lighting and color will vary with LED strip.
- If your LED strip does not light up, check if the RGB LED extension cable and the RGB LED strip is connected in the correct orientation, and the 12V connector is aligned with the 12V header on the motherboard.
- The LED strip will only light up when the system is operating.
- The LED strips are purchased separately.

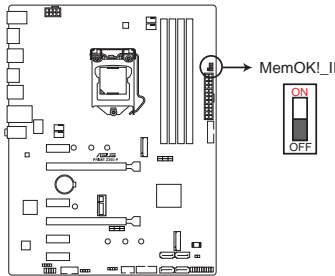


Onboard switches

Onboard switches allow you to fine-tune performance when working on a bare or open-case system. This is ideal for overclockers and gamers who continually change settings to enhance system performance.

1. MemOK! II switch (MemOK!_II)

Installing DIMMs that are not compatible with the motherboard may cause system boot failure. The switch is enabled by default, allowing memory re-training when the motherboard is unresponsive due to memory problems. The Mem_LED will light up while re-training, and turn off when the re-training is complete.



PRIME Z390-P MemOK! switch

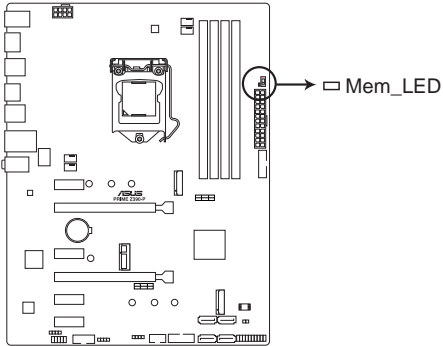


- Refer to section **1.1.8 Onboard LEDs** for the exact location of the Mem_LED.
- The DRAM LED also lights up when the DIMM is not properly installed. Turn off the system and reinstall the DIMM before using the MemOK! II function.
- The MemOK! II switch does not function under Windows® OS environment.
- During the tuning process, the system loads and tests pretest profiles. It takes about 30 seconds for the system to test one set of profiles. If the test fails, the system reboots and tests the next set of profiles. The system will reboot multiple times when training, once the system has completed the training process the Mem_LED will turn off, please refrain from doing anything before the Mem_LED turns off.
- Due to memory tuning requirement, the system automatically reboots when each profile is tested. If the installed DIMMs still fail to boot after the whole tuning process, and the Mem_LED is turned off, please refer to the Q-code LED and Q-code table for more details on the error.
- If you turn off the computer and replace DIMMs during the tuning process, the system continues memory tuning after turning on the computer. To stop memory tuning, turn off the computer and unplug the power cord for about 5–10 seconds, then set the MemOK! II switch to disabled.
- Installing DIMMs that are not compatible with the motherboard may cause system boot failure. The switch is enabled by default, allowing memory re-training when the motherboard is unresponsive due to memory problems. The Mem_LED will light up while re-training, and turn off when the re-training is complete.
- Ensure to replace the DIMMs with ones recommended in the Memory QVL (Qualified Vendors Lists) at www.asus.com.
- The computer will reboot multiple times during the tuning process,
- We recommend that you download and update to the latest BIOS version from www.asus.com after using the MemOK! II function.

Onboard LEDs

1. Memory LED (Mem_LED)

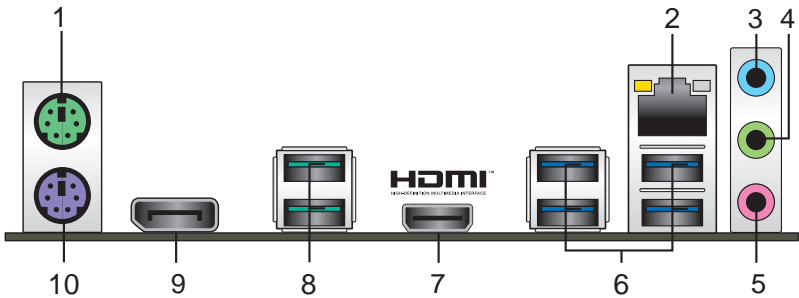
The Mem_LED will light up and remain lit while the MemOK! II function is in use. When the re-training is complete, the Mem_LED will turn off.



PRIME Z390-P MemOK!_LED

1.7 Connectors

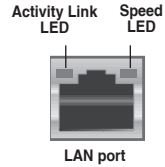
1.7.1 Rear panel connectors



1. **PS/2 mouse port (green).** This port is for a PS/2 mouse.
2. **LAN (RJ-45) port.** This port allows Gigabit connection to a Local Area Network (LAN) through a network hub.

LAN port LED indications

Activity/Link LED		Speed LED	
Status	Description	Status	Description
Off	No link	OFF	10Mbps connection
Orange	Linked	ORANGE	100Mbps connection
Orange (Blinking)	Data activity	GREEN	1Gbps connection
Orange (Blinking then steady)	Ready to wake up from S5 mode	–	–



- Line In port (light blue).** This port connects to the tape, CD, DVD player, or other audio sources.
- Line Out port (lime).** This port connects to a headphone or a speaker. In the 4.1, 5.1 and 7.1-channel configurations, the function of this port becomes Front Speaker Out.
- Microphone port (pink).** This port connects to a microphone.



Refer to the audio configuration table for the function of the audio ports in 2.1, 4.1, 5.1, or 7.1-channel configuration.

Audio 2.1, 4.1, 5.1, or 7.1-channel configuration

Port	Headset 2.1-channel	4.1-channel	5.1-channel	7.1-channel
Light Blue (Rear panel)	Line In	Rear Speaker Out	Rear Speaker Out	Rear Speaker Out
Lime (Rear panel)	Line Out	Front Speaker Out	Front Speaker Out	Front Speaker Out
Pink (Rear panel)	Mic In	Mic In	Bass/Center	Bass/Center
Lime (Front panel)	-	-	-	Side Speaker Out



To configure a 7.1-channel audio output:

Use a chassis with HD audio module in the front panel to support a 7.1-channel audio output.

- USB 3.1 Gen 1 ports (Blue, Type A).** These 9-pin Universal Serial Bus (USB) ports are for USB 3.1 Gen 1 devices.



- We strongly recommend that you connect USB 3.1 Gen 1 devices to USB 3.1 Gen 1 ports for faster and better performance from your USB 3.1 Gen 1 devices.
- Due to the design of the Intel® 300 series chipset, all USB devices connected to the USB 2.0 and USB 3.1 Gen 1 ports are controlled by the xHCI controller. Some legacy USB devices must update their firmware for better compatibility.

- HDMI port.** This port is for a High-Definition Multimedia Interface (HDMI) connector, and is HDCP compliant allowing playback of HD DVD, Blu-ray, and other protected content.

8. **USB 3.1 Gen 2 (up to 10Gbps) ports (teal blue, Type A).** These 9-pin Universal Serial Bus 3.1 (USB 3.1) Gen 2 ports are for USB 3.1 Gen 2 devices.



- USB 3.1 Gen 2 / Gen 1 devices can only be used for data storage.
- Due to the design of the Intel® 300 series chipset, all USB devices connected to the USB 2.0 and USB 3.1 Gen 2 / Gen 1 ports are controlled by the xHCI controller. Some legacy USB devices must update their firmware for better compatibility.
- We strongly recommend that you connect USB 3.1 Gen 2 devices to USB 3.1 Gen 2 ports for faster and better performance from your USB 3.1 Gen 2 devices.

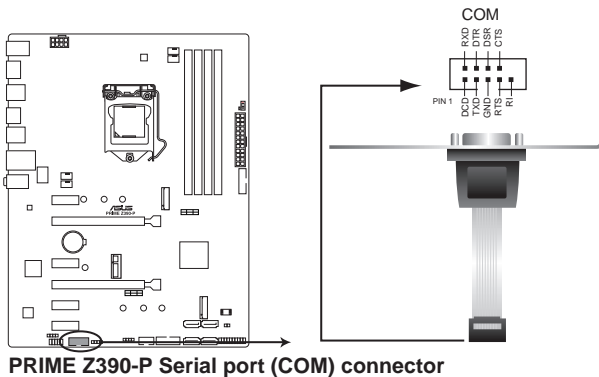
9. **DisplayPorts.** These ports are for DisplayPort-compatible devices.

10. **PS/2 keyboard port (purple).** This port is for a PS/2 keyboard.

1.7.2 Internal connectors

1. **Serial port connector (10-1 pin COM)**

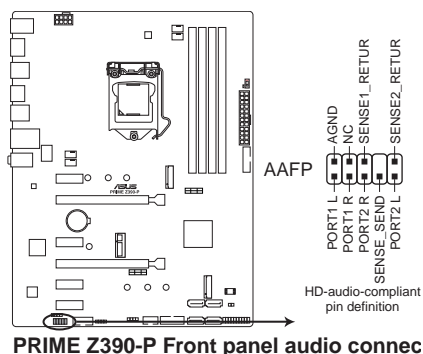
This connector is for a serial (COM) port. Connect the serial port module cable to this connector, then install the module to a slot opening at the back of the system chassis.



The COM module is purchased separately.

2. Front panel audio connector (10-1 pin AAFP)

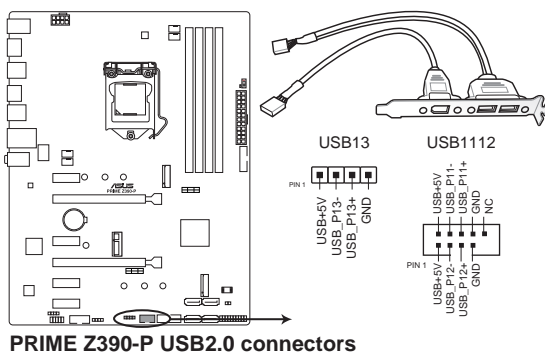
This connector is for a chassis-mounted front panel audio I/O module that supports HD Audio standard. Connect one end of the front panel audio I/O module cable to this connector.



We recommend that you connect a high-definition front panel audio module to this connector to avail of the motherboard's high-definition audio capability.

3. USB 2.0 connectors (10-1 pin USB1112, 4 pin USB13)

These connectors are for USB 2.0 ports. Connect the USB module cable to any of these connectors, then install the module to a slot opening at the back of the system chassis. These USB connectors comply with USB 2.0 specifications and supports up to 480Mbps connection speed.



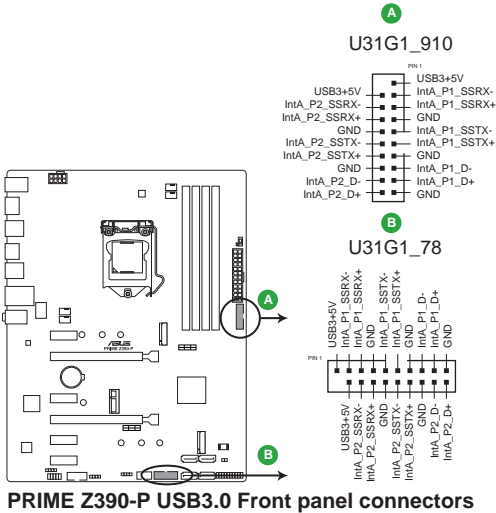
Never connect a 1394 cable to the USB connectors. Doing so will damage the motherboard!



The USB 2.0 module is purchased separately.

4. USB 3.1 Gen 1 connectors (20-1 pin U31G1_78, U31G1_910)

These connectors allow you to connect a USB 3.1 Gen 1 module for additional USB 3.1 Gen 1 front or rear panel ports. With an installed USB 3.1 Gen 1 module, you can enjoy all the benefits of USB 3.1 Gen 1 including faster data transfer speeds of up to 5 Gbps, faster charging time for USB-chargable devices, optimized power efficiency, and backward compatibility with USB 2.0.



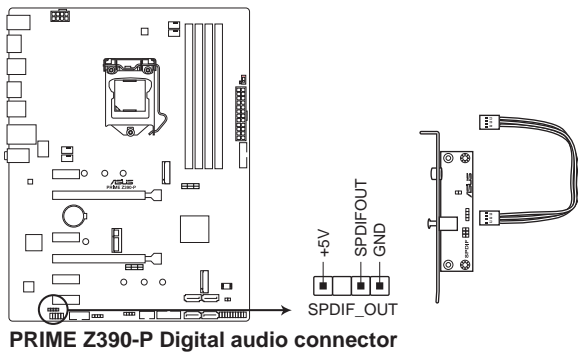
PRIME Z390-P USB 3.0 Front panel connectors



The USB 3.1 Gen 1 module is purchased separately.

5. Digital audio connector (4-1 pin SPDIF_OUT)

This connector is for an additional Sony/Philips Digital Interface (S/PDIF) port. Connect the S/PDIF Out module cable to this connector, then install the module to a slot opening at the back of the system chassis.



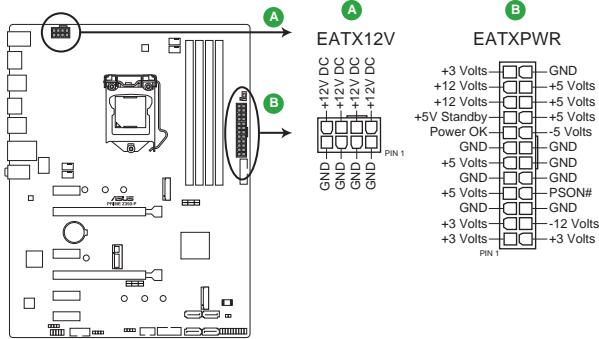
PRIME Z390-P Digital audio connector



The S/PDIF module is purchased separately.

6. ATX power connectors (24-pin EATXPWR, 8-pin ATX12V)

These connectors are for ATX power supply plugs. The power supply plugs are designed to fit these connectors in only one orientation. Find the proper orientation and push down firmly until the connectors completely fit.



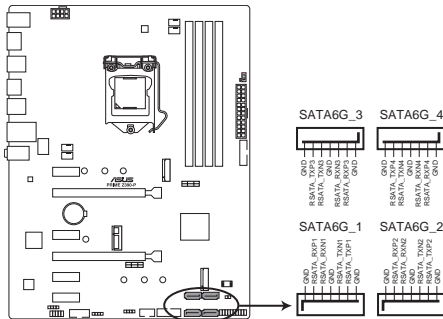
PRIME Z390-P ATX power connectors



- For a fully configured system, we recommend that you use a power supply unit (PSU) that complies with ATX 12 V Specification 2.0 (or later version) and provides a minimum power of 350 W.
- DO NOT forget to connect the 4-pin/8-pin ATX +12V power plug. Otherwise, the system will not boot up.
- We recommend that you use a PSU with higher power output when configuring a system with more power-consuming devices or when you intend to install additional devices. The system may become unstable or may not boot up if the power is inadequate.
- If you are uncertain about the minimum power supply requirement for your system, refer to the Recommended Power Supply Wattage Calculator at <http://support.asus.com/PowerSupplyCalculator/PSCalculator.aspx?SLanguage=en-us> for details.

7. Intel® Z390 SATA 6.0Gb/s connectors (7-pin SATA6G_1~4)

These connectors connect to SATA 6.0 Gb/s hard disk drives via SATA 6.0 Gb/s signal cables.



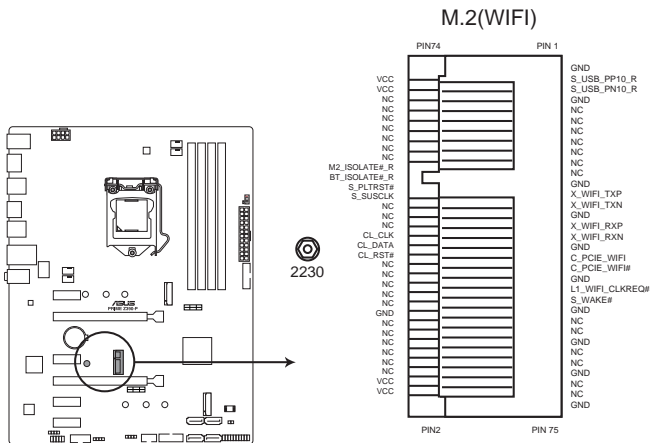
PRIME Z390-P Intel® SATA 6.0Gb/s connectors



When using hot-plug and NCQ, set the **SATA Mode Selection** item in the BIOS to [AHCI]. See section 2.6.5 PCH Storage Configuration for details.

9. M.2 WiFi

This socket allows you to install an M.2 (WiFi) module.



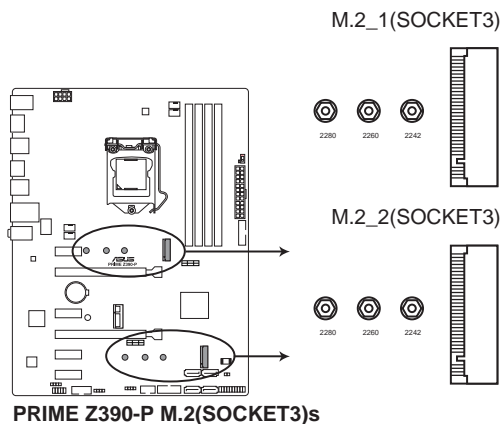
PRIME Z390-P M.2 WIFI socket



The M.2 (NGFF) SSD module is purchased separately.

8. M.2 socket 3 [M.2_1(Socket 3); M.2_2(Socket 3)]

These sockets allow you to install M.2 (NGFF) SSD modules.



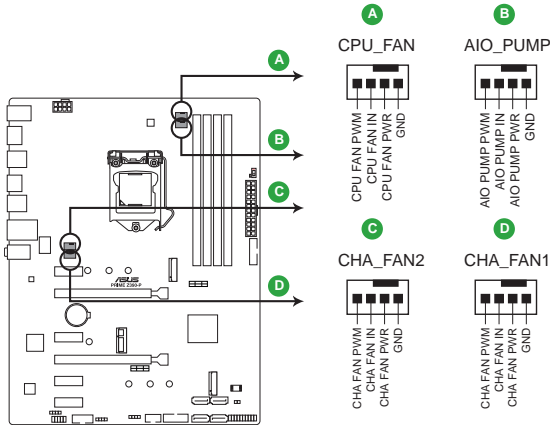
- These M.2 sockets support M Key and type 2242/2260/2280 storage devices.
- When using Intel® Desktop Responsiveness technologies with PCIe/SATA M.2 device, ensure to set up the Windows® UEFI operating system under RAID mode.
- These M.2 sockets support data transfer speed up to 32Gb/s.
- When a device in SATA mode is installed on the M.2_1 socket, SATA6G_2 port cannot be used.



The M.2 (NGFF) SSD module is purchased separately.

10. CPU, AIO pump, and chassis fan connectors (4-pin CPU_FAN, 4-pin AIO_PUMP, and 4-pin CHA_FAN1/2)

Connect the fan cables to the fan connectors on the motherboard, ensuring that the black wire of each cable matches the ground pin of the connector



PRIME Z390-P Fan connectors



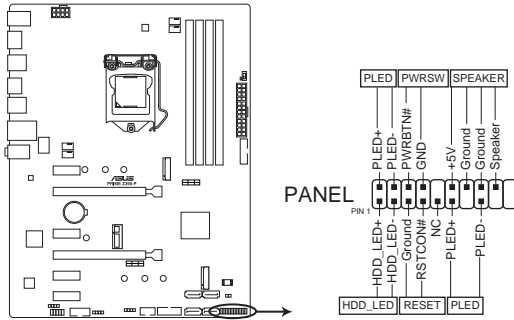
- Do not forget to connect the fan cables to the fan connectors. Insufficient air flow inside the system may damage the motherboard components. These are not jumpers! Do not place jumper caps on the fan connectors!
- Ensure that the CPU fan cable is securely installed to the CPU fan connector.



- The CPU_FAN connector supports a CPU fan of maximum 1A (12 W) fan power.
- Connect the fan of your water cooling kit to the AIO_PUMP connector.

11. System panel connector (20-5 pin PANEL)

This connector supports several chassis-mounted functions.



PRIME Z390-P System panel connector

- **System power LED (4-pin +PWR_LED-)**

This 4-pin connector is for the system power LED. Connect the chassis power LED cable to this connector. The system power LED lights up when you turn on the system power, and blinks when the system is in sleep mode.

- **Hard disk drive activity LED (2-pin +HDD_LED-)**

This 2-pin connector is for the HDD Activity LED. Connect the HDD Activity LED cable to this connector. The HDD LED lights up or flashes when data is read from or written to the HDD.

- **System warning speaker (4-pin SPEAKER)**

This 4-pin connector is for the chassis-mounted system warning speaker. The speaker allows you to hear system beeps and warnings.

- **ATX power button/soft-off button (2-pin PWR_SW)**

This connector is for the system power button. Pressing the power button turns the system on or puts the system in sleep or soft-off mode depending on the operating system settings. Pressing the power switch for more than four seconds while the system is ON turns the system OFF.

- **Reset button (2-pin RESET)**

This 2-pin connector is for the chassis-mounted reset button for system reboot without turning off the system power.

1.8 Software support

1.8.1 Installing an operating system

This motherboard supports Windows® 10 (64-bit) Operating Systems (OS). Always install the latest OS version and corresponding updates to maximize the features of your hardware.



Motherboard settings and hardware options vary. Refer to your OS documentation for detailed information.

1.8.2 Support DVD information

The Support DVD that comes with the motherboard package contains the drivers, software applications, and utilities that you can install to avail all motherboard features.



The contents of the Support DVD are subject to change at any time without notice. Visit the ASUS website at www.asus.com for updates.

To run the Support DVD

Place the Support DVD into the optical drive. If Autorun is enabled in your computer, the DVD automatically displays the lists of the unique features of your ASUS motherboard. Click the **Driver**, **Utilities**, **Manual**, or **Special** tabs to display their respective menus.



The following screen is for reference only.

The screenshot shows the 'Automatic Installation' window. On the left, there are four tabs: Driver, Utilities, Manual, and Special. The 'Driver' tab is selected. The main area displays a table of software items with checkboxes in the first column. A red box highlights the 'Driver' tab and the table. Another red box highlights the 'Install' button at the bottom right. A red arrow points from the 'Install' button to the text 'Click to install'.

Driver	Status	Available Version	Installed Version	Restart
Special Offers				
<input checked="" type="checkbox"/> Google Chrome Browser	Not installed	38.0.2125.92	None	No
<input checked="" type="checkbox"/> Google Toolbar	Not installed	7.5.4501.1952	None	No
<input checked="" type="checkbox"/> Driver				
<input checked="" type="checkbox"/> Microsoft .NET Framework	Updated	4.5.51650	4.5.51650	No
<input checked="" type="checkbox"/> Intel Chipset Driver	Updated	10.0.27	10.0.27	No
<input checked="" type="checkbox"/> Realtek Audio Driver	Updated	6.0.1.7503	6.0.1.7503	No
<input checked="" type="checkbox"/> Intel Graphics Accelerator Driver	Updated	10.18.15.4225	10.18.15.4225	No
<input checked="" type="checkbox"/> Management Engine Interface	Updated	11.0.0.1137	11.0.0.1137	No
<input checked="" type="checkbox"/> Intel Rapid Storage Technology Driver so...	Updated	14.5.0.1059	14.5.0.1059	No
<input checked="" type="checkbox"/> Intel USB 3.0 Host Controller Adaptation ...	Updated	1.0.0.42	1.0.0.42	No
<input checked="" type="checkbox"/> Realtek LAN Driver	Updated	8.38.115.2015	8.38.115.2015	No
<input checked="" type="checkbox"/> APRP Utility	Not installed	1.0.026	None	No
<input checked="" type="checkbox"/> Norton Internet Security	Not installed	21.6.0.32	None	No

Click a tab to display Support DVD information

Select an item/ subitem that you want to install



If Autorun is NOT enabled in your computer, browse the contents of the Support DVD to locate the file Setup.exe in the root folder. Double-click the Setup.exe to run the DVD.

BIOS information

2

2.1 Managing and updating your BIOS



Save a copy of the original motherboard BIOS file to a USB flash disk in case you need to restore the BIOS in the future. Copy the original motherboard BIOS using the ASUS Update utility. (BIOS version template: PRIME Z390-P 0313 version)

2.1.1 EZ Update

EZ Update is a utility that allows you to automatically update your motherboard's softwares, drivers and the BIOS version easily. With this utility, you can also manually update the saved BIOS and select a boot logo when the system goes into POST.

To launch EZ Update, click **EZ Update** on the AI Suite 3 main menu bar.

The screenshot shows the ASUS EZ Update utility window. It features a dark blue background with white text. At the top, it says 'ASUS EZ Update'. Below that, there is a paragraph explaining the utility's purpose. There are two main sections: 'Check updates from internet' with a 'Check Now' button, and 'Manually update Boot logo or BIOS' with a file selection button. On the right side, there is a 'Current BIOS' section showing details like Model Name, Version, and Release Date, and a 'Selected BIOS' section. Three red callout boxes with arrows point to the 'Check Now' button, the file selection button, and the 'Update' button at the bottom right.

Click to automatically update your motherboard's driver, software and firmware

Click to find and select the BIOS from file

Click to select a boot logo

Click to update the BIOS



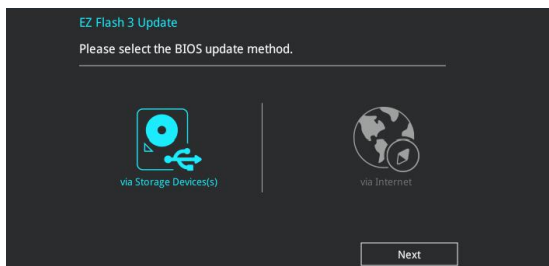
EZ Update requires an Internet connection either through a network or an ISP (Internet Service Provider).

2.1.2 ASUS EZ Flash 3

The ASUS EZ Flash 3 feature allows you to update the BIOS without using an OS-based utility.



- Ensure to load the BIOS default settings to ensure system compatibility and stability. Select the Load Optimized Defaults item under the Exit menu. See section **2.10 Exit Menu** for details.
- Check your local Internet connection before updating through the Internet.



To update the BIOS using EZ Flash 3:

1. Enter the **Advanced Mode** of the BIOS setup program. Go to the **Tool** menu to select ASUS EZ Flash 3 and press <Enter> to enable it.
2. Follow the steps below to update the BIOS via a storage device or Internet.

Via Storage Device(s)

- a) Insert the USB flash disk that contains the latest BIOS file to the USB port, then select **via Storage Device(s)**.
- b) Press <Tab> to switch to the **Drive** field.
- c) Press the Up/Down arrow keys to find the USB flash disk that contains the latest BIOS, and then press <Enter>.
- d) Press <Tab> to switch to the **Folder Info** field.
- e) Press the Up/Down arrow keys to find the BIOS file, and then press <Enter> to perform the BIOS update process.

Via the Internet

- a) Select **via Internet**.
 - b) Press the Left/Right arrow keys to select an Internet connection method, and then press <Enter>.
 - c) Follow the onscreen instructions to complete the update.
3. Reboot the system when the update process is done.



-
- ASUS EZ Flash 3 supports USB devices, such as a USB flash disk, with FAT 32/16 format and single partition only.
 - DO NOT shut down or reset the system while updating the BIOS to prevent system boot failure!
-

2.1.3 ASUS CrashFree BIOS 3 utility

The ASUS CrashFree BIOS 3 is an auto recovery tool that allows you to restore the BIOS file when it fails or gets corrupted during the updating process. You can restore a corrupted BIOS file using the motherboard support DVD or a USB flash drive that contains the updated BIOS file.



-
- Before using this utility, rename the BIOS file in the removable device into **PZ390P.CAP**.
 - The BIOS file in the support DVD may not be the latest version. Download the latest BIOS file from the ASUS website at www.asus.com.
-

Recovering the BIOS

To recover the BIOS:

1. Turn on the system.
2. Insert the support DVD to the optical drive or the USB flash drive that contains the BIOS file to the USB port.
3. The utility automatically checks the devices for the BIOS file. When found, the utility reads the BIOS file and enters ASUS EZ Flash 3 utility automatically.
4. The system requires you to enter BIOS Setup to recover BIOS settings. To ensure system compatibility and stability, we recommend that you press <F5> to load default BIOS values.



DO NOT shut down or reset the system while updating the BIOS! Doing so can cause system boot failure!

2.1.4 ASUS BIOS Updater

ASUS BIOS Updater allows you to update the BIOS in DOS environment.



The screen captures used in this section are for reference only and may not be exactly the same as actually shown on your computer screen.

Before updating BIOS

- Prepare the motherboard support DVD and a USB flash drive.
- Download the latest BIOS file and BIOS Updater from <https://www.asus.com/support> and save them in your USB flash drive.



NTFS is not supported under FreeDOS environment. Ensure that your USB flash drive is in single partition and in FAT32/16 format.

- Turn off the computer.
- Ensure that your computer has a DVD optical drive.

Booting the system in DOS environment

To boot the system in DOS:

1. Insert the USB flash drive with the latest BIOS file and BIOS Updater to the USB port.
2. Boot your computer then press <F8> to launch the select boot device screen.
3. When the select boot device screen appears, insert the Support DVD into the optical drive then select the optical drive as the boot device.

Please select boot device:

↑ and ↓ to move selection
ENTER to select boot device
ESC to boot using defaults

P2: ST3808110AS (76319MB)
aigo miniking (250MB)
UEFI: (FAT) ASUS DRW-2014L1T(4458MB)
P1: ASUS DRW-2014L1T(4458MB)
UEFI: (FAT) aigo miniking (250MB)
Enter Setup

4. When the booting message appears, press <Enter> within five (5) seconds to enter FreeDOS prompt.

```
ISOLINUX 3.20 2006-08-26 Copyright (C) 1994-2005 H. Peter Anvin
A Bootable DVD/CD is detected. Press ENTER to boot from the DVD/CD.
If no key is pressed within 5 seconds, the system will boot next priority
device automatically. boot:
```

5. On the FreeDOS prompt, type **d:** then press <Enter> to switch the disk from Drive C (optical drive) to Drive D (USB flash drive).

```
Welcome to FreeDOS (http://www.freedos.org)!
C: /> d:
D: />
```

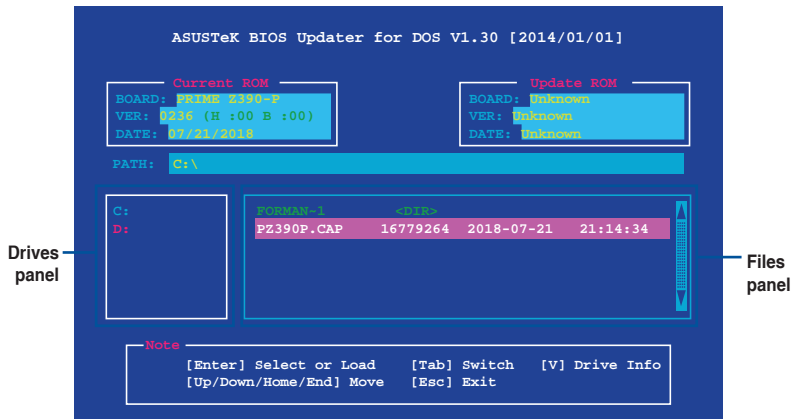
Updating the BIOS file

To update the BIOS file:

1. On the FreeDOS prompt, type **bupdater /g** and press <Enter>.

```
D: /> bupdater /g
```

2. On the BIOS Updater screen, press <Tab> to switch from Files panel to Drives panel then select **D:**.



3. Press <Tab> to switch from Drives panel to Files panel then press <Up/Down or Home/End> keys to select the BIOS file and press <Enter>.
4. After the BIOS Updater checks the selected BIOS file, select **Yes** to confirm the BIOS update.



The BIOS Backup feature is not supported due to security regulations.

5. Press any key to reboot the system to automatically launch EZ Flash 3. Wait until the BIOS update is completed.



DO NOT shut down or reset the system while updating the BIOS to prevent system boot failure.



Ensure to load the BIOS default settings to ensure system compatibility and stability. Select the **Load Optimized Defaults** item under the **Exit BIOS Menu** for details.

2.2 BIOS setup program

Use the BIOS Setup program to update the BIOS or configure its parameters. The BIOS screens include navigation keys and brief online help to guide you in using the BIOS Setup program.

Entering BIOS Setup at startup

To enter BIOS Setup at startup:

Press <Delete> or <F2> during the Power-On Self Test (POST). If you do not press <Delete> or <F2>, POST continues with its routines.

Entering BIOS Setup after POST

To enter BIOS Setup after POST:

- Press <Ctrl>+<Alt>+ simultaneously.
- Press the reset button on the system chassis.
- Press the power button to turn the system off then back on. Do this option only if you failed to enter BIOS Setup using the first two options.



Using the power button, reset button, or the <Ctrl>+<Alt>+ keys to force reset from a running operating system can cause damage to your data or system. We recommend you always shut down the system properly from the operating system.



- The BIOS setup screens shown in this section are for reference purposes only, and may not exactly match what you see on your screen.
 - Visit the ASUS website at www.asus.com to download the latest BIOS file for this motherboard.
 - Ensure that a USB mouse is connected to your motherboard if you want to use the mouse to control the BIOS setup program.
 - If the system becomes unstable after changing any BIOS setting, load the default settings to ensure system compatibility and stability. Select the **Load Optimized Defaults** item under the Exit menu or press hotkey F5. See section 2.10 **Exit Menu** for details.
 - If the system fails to boot after changing any BIOS setting, try to clear the CMOS and reset the motherboard to the default value. See section 1.6 **Headers** for information on how to erase the RTC RAM.
-

BIOS menu screen

The BIOS setup program can be used under two modes: **EZ Mode** and **Advanced Mode**. Press <F7> to change between the two modes.

2.2.1 EZ Mode

By default, the EZ Mode screen appears when you enter the BIOS setup program. The EZ Mode provides you an overview of the basic system information, and allows you to select the display language, system performance mode, fan profile and boot device priority. To access the Advanced Mode, click **Advanced Mode(F7)** or press <F7>.



The default screen for entering the BIOS setup program can be changed. Refer to the **Setup Mode** item in section 2.8 **Boot menu** for details.

Displays the CPU/
motherboard
temperature, CPU
voltage output, CPU/
chassis fan speed, and
SATA information

Selects the display
language of
the BIOS setup
program

Creates storage
RAID and
configures
system
overclocking

Displays the system properties of
the selected mode. Click <Enter>
to switch EZ System Tuning
modes

Searches by BIOS item name,
enter the item name to find
the related item listing

ASUS UEFI BIOS Utility - EZ Mode
07/25/2018 Wednesday 11:35 English EZ Tuning Wizard(F11) Search(F9)

Information
PRIME Z390-P BIOS Ver. 0236
Genuine Intel(R) CPU 0000 @ 2.90GHz
Speed: 2900 MHz
Memory: 4096 MB (DDR4 2133MHz)

Information CPU Temperature **38°C**
CPU Core Voltage **0.524 V**
Motherboard Temperature **28°C**

EZ System Tuning
Click the icon below to apply a pre-configured profile for improved system performance or energy savings.
Normal

DRAM Status
DIMM_A1: N/A
DIMM_A2: N/A
DIMM_B1: SK Hynix 4096MB 2133MHz
DIMM_B2: N/A

Storage Information
Intel Rapid Storage Technology
On Off

X.M.P.
Disabled

FAN Profile
CPU FAN 1252 RPM
CHA1 FAN N/A
CHA2 FAN N/A
AIO PUMP N/A

CPU FAN
QFan Control

Boot Priority
Choose one and drag the items. Switch all
3SYSTEM USB Flash Disk 1.00 (7639MB)
UEFI: 3SYSTEM USB Flash Disk 1.00 (7639MB)

Boot Menu(F8)

Default(F5) Save & Exit(F10) Advanced Mode(F7) Search on FAQ

Enables or disables the Intel
Rapid Storage Technology

Displays the CPU Fan's speed.
Click the button to manually
tune the fans
Loads optimized
default settings

Saves the changes
and resets the
system

Shows the
bootable
devices

Displays the
Advanced mode
menus
Searches FAQ
Selects the boot
device priority



The boot device options vary depending on the devices you installed to the system.

2.2.2 Advanced Mode

The Advanced Mode provides advanced options for experienced end-users to configure the BIOS settings. The figure below shows an example of the **Advanced Mode**. Refer to the following sections for the detailed configurations.



To access the EZ Mode, click **EzMode(F7)** or press <F7>.

The screenshot shows the ASUS BIOS Advanced Mode interface. The top bar includes the date and time (07/25/2018 11:44), language (English), and navigation icons for MyFavorite (F3), Qfan Control (F6), EZ Tuning Wizard (F11), and Search (F9). The main menu bar contains: My Favorites, Main, AI Tweaker, **Advanced**, Monitor, Boot, Tool, and Exit. The left sidebar lists menu items such as L2 Cache, L3 Cache, L4 Cache, Intel VT-x Technology, Intel SMX Technology, Software Guard Extensions (SGX), Tcc Offset Time Window, Hardware Prefetcher, Adjacent Cache Line Prefetch, Intel (VMX) Virtualization Technology, Active Processor Cores, and Hyper-Threading. The CPU - Power Management Control section is expanded, showing a sub-menu item and a popup window with a general help message: "Allows a hyper-threading processor to appear as two logical processors, allowing the operating system to schedule two threads or processes simultaneously. [Enabled] for two threads per activated core. [Disabled] for only one thread per activated core." The right side features a Hardware Monitor panel with CPU (Frequency: 2900 Mhz, Temperature: 39°C, BCLK: 100.00 Mhz, Core Voltage: 0.524 V, Ratio: 29x) and Memory (Frequency: 2133 Mhz, Capacity: 4096 MB) sections. The bottom status bar shows "Last Modified", "EzMode(F7)", "Hot Keys", and "Search on FAQ".

Labels pointing to the screenshot include:

- MyFavorite
- Q-Fan control
- EZ Tuning Wizard
- Language
- Menu bar
- Search
- Sub-menu item
- General help
- Scroll bar
- Menu items
- Popup window
- Configuration fields
- Last modified settings
- Goes back to EZ Mode
- Searches FAQ
- Displays the CPU/motherboard temperature, CPU and memory voltage output

Menu bar

The menu bar on top of the screen has the following main items:

My Favorites	For saving the frequently-used system settings and configuration
Main	For changing the basic system configuration
Ai Tweaker	For changing the overclocking settings
Advanced	For changing the advanced system settings
Monitor	For displaying the system temperature, power status, and changing the fan settings
Boot	For changing the system boot configuration
Tool	For configuring options for special functions
Exit	For selecting the exit options and loading default settings

Menu items

The highlighted item on the menu bar displays the specific items for that menu. For example, selecting **Main** shows the Main menu items.

The other items (My Favorites, Ai Tweaker, Advanced, Monitor, Boot, Tool, and Exit) on the menu bar have their respective menu items.

Submenu items

A greater than sign (>) before each item on any menu screen means that the item has a submenu. To display the submenu, select the item and press <Enter>.

Language

This button above the menu bar contains the languages that you can select for your BIOS. Click this button to select the language that you want to display in your BIOS screen.

MyFavorites (F3)

This button above the menu bar shows all BIOS items in a Tree Map setup. Select frequently-used BIOS settings and save it to MyFavorites menu.



Refer to section **2.3 My Favorites** for more information.

Q-Fan Control (F6)

This button above the menu bar displays the current settings of your fans. Use this button to manually tweak the fans to your desired settings.



Refer to section **2.2.3 QFan Control** for more information.

EZ Tuning Wizard (F11)

This button above the menu bar allows you to view and tweak the overclocking* settings of your system. It also allows you to change the motherboard's SATA mode from AHCI to RAID mode.



Refer to section **2.2.4 EZ Tuning Wizard** for more information.

Hot keys

This button above the menu bar contains the navigation keys for the BIOS setup program. Use the navigation keys to select items in the menu and change the settings.

Scroll bar

A scroll bar appears on the right side of a menu screen when there are items that do not fit on the screen. Press the Up/Down arrow keys or <Page Up> / <Page Down> keys to display the other items on the screen.

General help

At the top right corner of the menu screen is a brief description of the selected item. Use <F12> key to capture the BIOS screen and save it to the removable storage device.

Configuration fields

These fields show the values for the menu items. If an item is user-configurable, you can change the value of the field opposite the item. You cannot select an item that is not user-configurable.

A configurable field is highlighted when selected. To change the value of a field, select it and press <Enter> to display a list of options.

Last Modified button

This button shows the items that you last modified and saved in BIOS Setup.

2.2.3 QFan Control

The QFan Control allows you to set a fan profile or manually configure the operating speed of your CPU and chassis fans.

The screenshot shows the ASUS Q-Fan Control utility in the BIOS. At the top, it says "ASUS UEFI BIOS Utility - Advanced Mode" with a date of 07/25/2018, time 11:36, and language set to English. The main title is "Q-Fan Control". Below the title, there is a description: "Select your target fan and then move the slider to select any of these profiles (Standard, Silent, Turbo and Full Speed). You can also move the slider to Manual and manually configure the fan's operating speed." There are two tabs: "PWM" (selected) and "DC". A graph shows fan speed (%) on the y-axis (0 to 100) and temperature (°C) on the x-axis (0 to 100). A yellow line represents the fan speed profile, which is flat at approximately 25% until 30°C, then rises to 75% at 70°C, and finally reaches 100% at 100°C. Below the graph is a slider with five positions: Standard, Silent, Turbo, Full Speed, and Manual. The "Standard" position is currently selected. At the bottom, there are three buttons: "Undo", "Apply", and "Exit (ESC)".

Click to select a fan to be configured

- Optimize All
- CPU FAN
- CHA1 FAN
- CHA2 FAN

Select a profile to apply to your fans

- Standard
- Silent
- Turbo
- Full Speed
- Manual

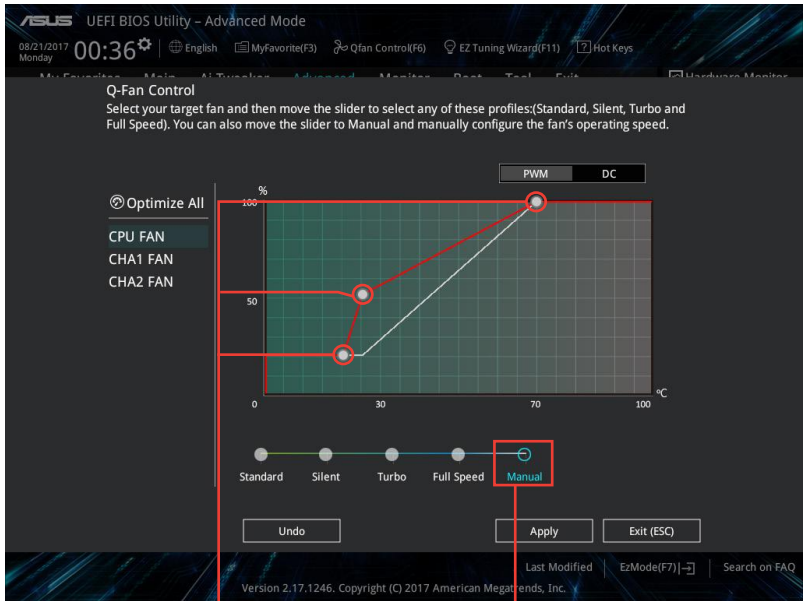
Click to undo the changes

Click to apply the fan setting

Click to go back to main menu

Configuring fans manually

Select **Manual** from the list of profiles to manually configure your fans' operating speed.



Speed points

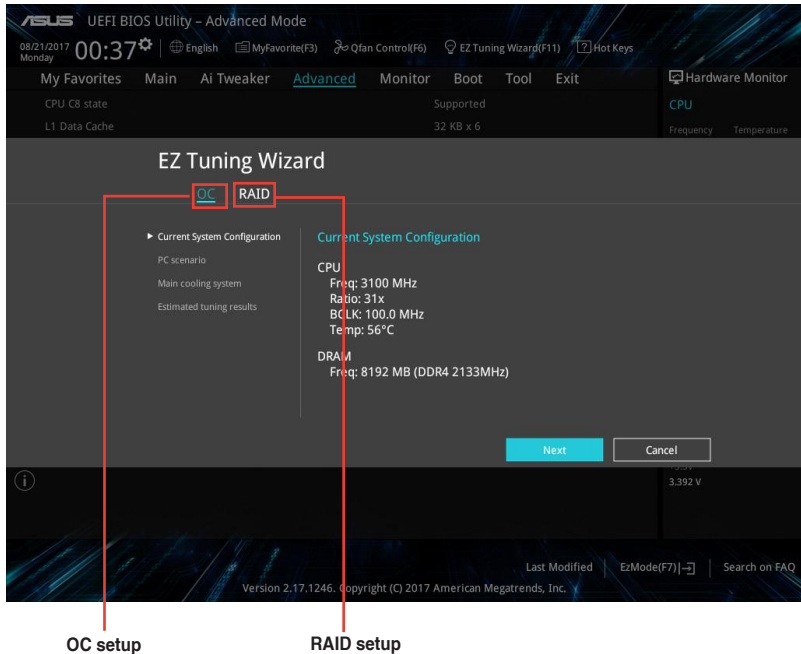
Click to manually configure your fans

To configure your fans:

1. Select the fan that you want to configure and to view its current status.
2. Click and drag the speed points to adjust the fans' operating speed.
3. Click **Apply** to save the changes then click **Exit (ESC)**.


2.2.4 EZ Tuning Wizard

EZ Tuning Wizard allows you to overclock your CPU and DRAM, computer usage, and CPU fan to their best settings. You can also easily set RAID in your system using this feature.



Tuning your system settings

To tune your settings:

1. Press <F11> on your keyboard or click  from the BIOS screen to open EZ Tuning Wizard screen, then click **Next**.
2. Select a PC scenario **Daily Computing** or **Gaming/Media Editing**, then click **Next**.
3. Select the CPU fan type (**Box cooler**, **Tower cooler**, or **Water cooler**) that you installed then click **Next**.

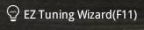


If you are not sure of the CPU fan type, click **I'm not sure**. The system automatically detects the CPU fan type.

4. Click **Next** then click **Yes** to confirm auto-tuning.

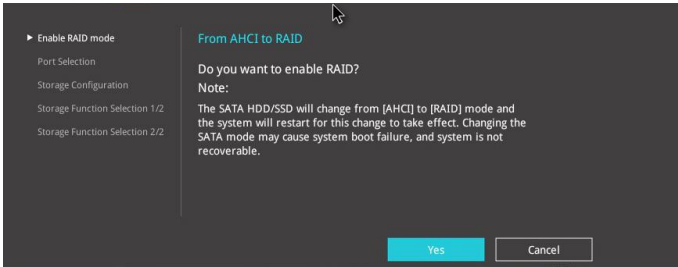
Creating RAID

To create RAID:

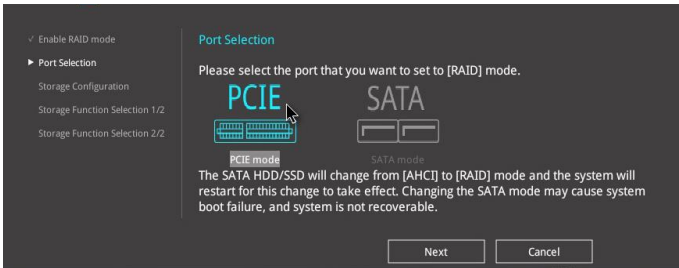
1. Press <F11> on your keyboard or click  from the BIOS screen to open EZ Tuning Wizard screen.
2. Click **RAID** then click **Yes** to enable RAID.



- Ensure that your HDDs have no existing RAID volumes.
- Ensure to connect your HDDs to Intel® SATA connectors or PCIE ports.



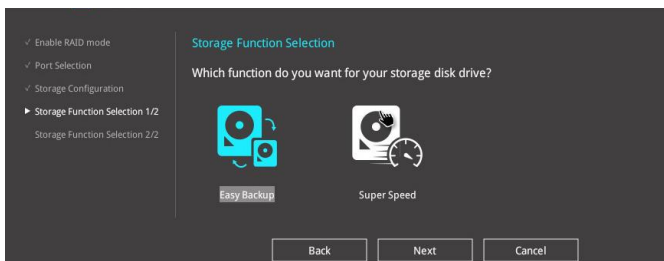
3. Select **PCIE** or **SATA** then click **Next** to continue.



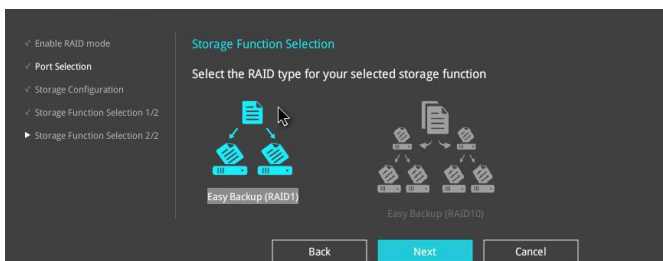
4. The available HDDs are displayed. Click Next to continue.



5. Select the type of storage for your RAID **Easy Backup** or **Super Speed**, then click **Next**.

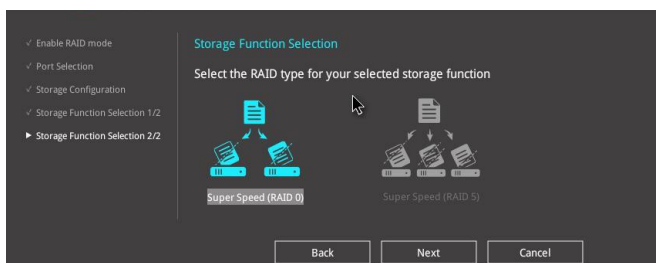


- a. For Easy Backup, select from **Easy Backup (RAID1)** or **Easy Backup (RAID10)** then click **Next**.



You can only select Easy Backup (RAID 10) if you connect four (4) HDDs.

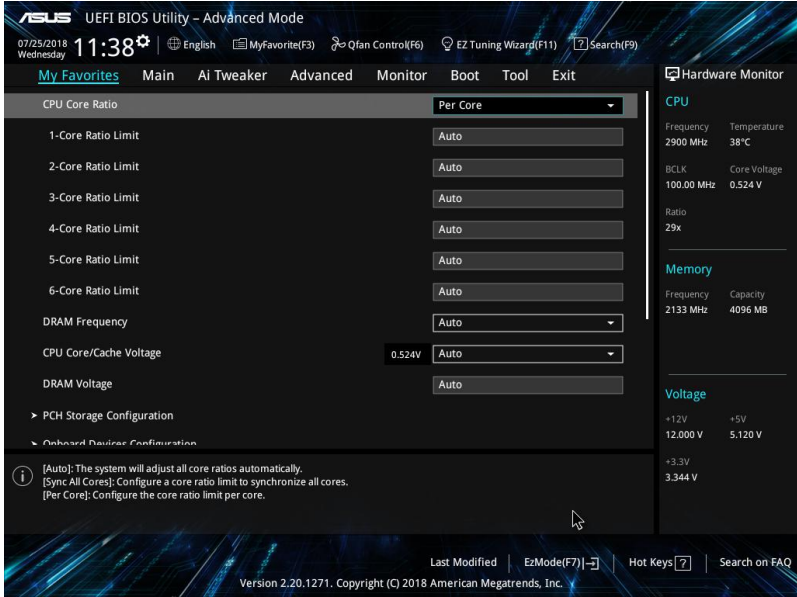
- b. For Easy Backup, select from **Super Speed (RAID0)** or **Super Speed (RAID5)** then click **Next**.



6. After selecting the type of RAID, click **Yes** to continue the RAID setup.
7. After the RAID setup is done, click **Yes** to exit the setup then click **OK** to reset your system.


2.3 My Favorites

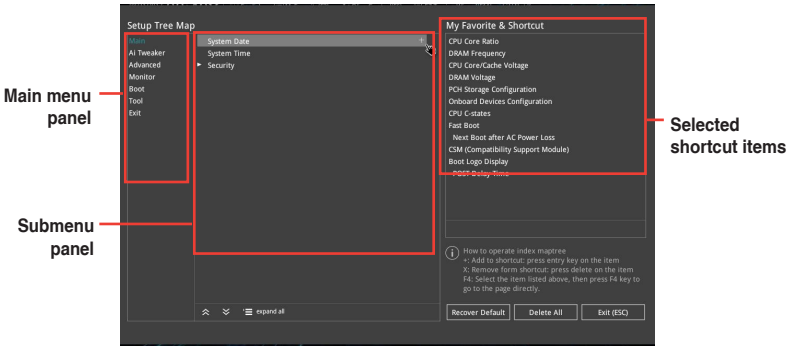
MyFavorites is your personal space where you can easily save and access your favorite BIOS items.




Adding items to My Favorites

To add BIOS items:

1. Press <F3> on your keyboard or click  from the BIOS screen to open Setup Tree Map screen.
2. On the Setup Tree Map screen, select the BIOS items that you want to save in MyFavorites screen.



3. Select an item from main menu panel, then click the submenu that you want to save as favorite from the submenu panel and click .

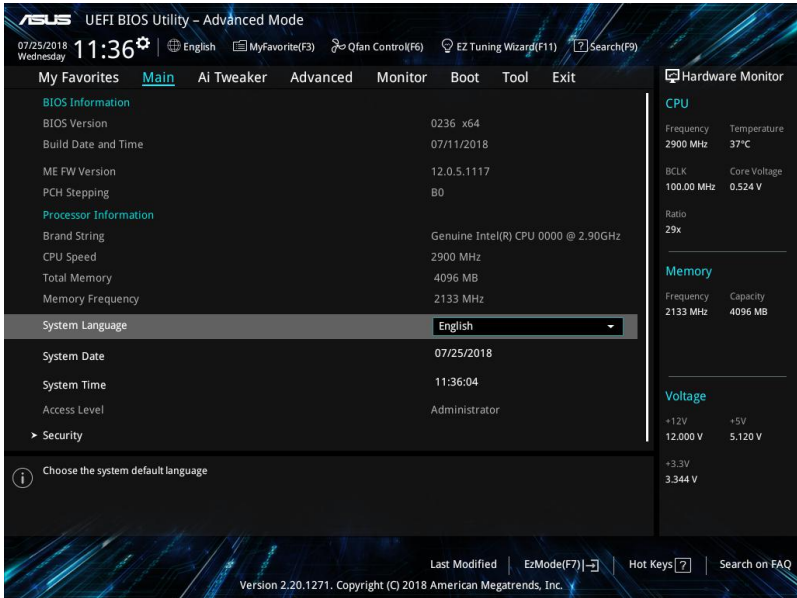


You cannot add user-managed items such as language and boot order to My Favorites.

4. Click **Exit (ESC)** or press <esc> key to close Setup Tree Map screen.
5. Go to My Favorites menu to view the saved BIOS items.

2.4 Main menu

The Main menu screen appears when you enter the Advanced Mode of the BIOS Setup program. The Main menu provides you an overview of the basic system information, and allows you to set the system date, time, language, and security settings.



2.4.1 Language [English]

Allows you to choose the BIOS language version from the options. Configuration options: [English] [Français] [Deutsch] [简体中文] [繁體中文] [日本語] [Español] [Русский] [Korean]

2.4.2 Security

The Security menu items allow you to change the system security settings.



- If you have forgotten your BIOS password, erase the CMOS Real Time Clock (RTC) RAM to clear the BIOS password. See section 1.6 Headers for information on how to erase the RTC RAM.
- The **Administrator** or **User Password** items on top of the screen show the default **Not Installed**. After you set a password, these items show **Installed**.

Administrator Password

If you have set an administrator password, we recommend that you enter the administrator password for accessing the system.

To set an administrator password:

1. Select the **Administrator Password** item and press <Enter>.
2. From the **Create New Password** box, key in a password, then press <Enter>.
3. Confirm the password when prompted.

To change an administrator password:

1. Select the **Administrator Password** item and press <Enter>.
2. From the **Enter Current Password** box, key in the current password, then press <Enter>.
3. From the **Create New Password** box, key in a new password, then press <Enter>.
4. Confirm the password when prompted.

To clear the administrator password, follow the same steps as in changing an administrator password, but press <Enter> when prompted to create/confirm the password. After you clear the password, the **Administrator Password** item on top of the screen shows **Not Installed**.

User Password

If you have set a user password, you must enter the user password for accessing the system. The **User Password** item on top of the screen shows the default **Not Installed**. After you set a password, this item shows **Installed**.

To set a user password:

1. Select the **User Password** item and press <Enter>.
2. From the **Create New Password** box, key in a password, then press <Enter>.
3. Confirm the password when prompted.

To change a user password:

1. Select the **User Password** item and press <Enter>.
2. From the **Enter Current Password** box, key in the current password, then press <Enter>.
3. From the **Create New Password** box, key in a new password, then press <Enter>.
4. Confirm the password when prompted.

To clear the user password, follow the same steps as in changing a user password, but press <Enter> when prompted to create/confirm the password. After you clear the password, the **User Password** item on top of the screen shows **Not Installed**.

2.5 Ai Tweaker menu

The Ai Tweaker menu items allow you to configure overclocking-related items.

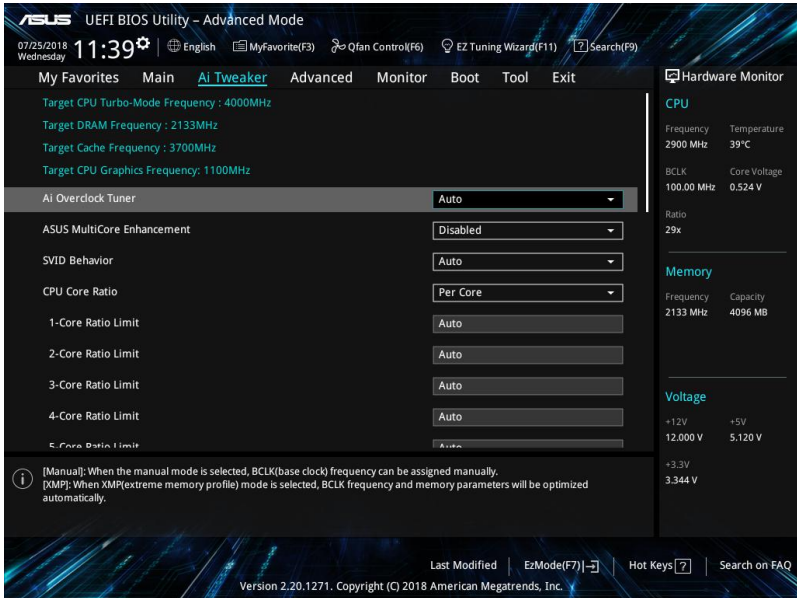


Be cautious when changing the settings of the Ai Tweaker menu items. Incorrect field values can cause the system to malfunction.



The configuration options for this section vary depending on the CPU and DIMM model you installed on the motherboard.

Scroll down to display other BIOS items.



2.5.1 Ai Overclock Tuner [Auto]

This item allows you to select the CPU overclocking options to achieve the desired CPU internal frequency. Select any of these preset overclocking configuration options:

- [Auto] Loads the optimal settings for the system automatically.
- [Manual] Allows you to assign the BCLK (base clock) frequency manually.
- [XMP I] When XMP I (Extreme Memory Profile) mode is selected, BCLK frequency and memory parameters will be optimized automatically.
- [XMP II] When XMP II (Extreme Memory Profile) mode is selected, BCLK frequency and memory parameters will be optimized automatically.



The following items appear only when you set the Ai Overclocking Tuner to **[Manual]**.

BCLK Frequency [100.0000]

This item allows you to set the BCLK (base clock) frequency to enhance the system performance. Use the <+> or <-> to adjust the value. The values range from 98.0 MHz to 538.0 MHz.



We recommend you to set the value based on the CPU specification, as high BCLK frequencies may damage the CPU permanently.

BCLK Spread Spectrum [Auto]

This item allows you to enable or disable the BCLK spread spectrum. Configuration options: [Auto] [Enabled] [Disabled].

2.5.2 ASUS MultiCore Enhancement [Auto]

[Auto] This item allows you to maximize the overlocking performance optimized by ASUS core ratio settings.

[Disabled] This item allows you to set to default core ratio settings.

2.5.3 SVID Behavior [Auto]

This item allows you to program the CPU's SVID behavior base on CPU's quality. Configuration options: [Auto] [Best-Case Scenario] [Typical Scenario] [Worst-Case Scenario] [Intel's Fail Safe].

2.5.4 CPU Core Ratio [Auto]

This item allows you to set the CPU core ratio limit per core or synchronize automatically to all cores. Configuration options: [Auto] [Sync All Cores] [Per Core]



When the CPU Core Ratio is set to [Sync All Cores] or [Per Core], the following items appear.

1-Core/ 2-Core/ 3-Core/ 4-Core/ 5-Core/ 6-Core Ratio Limit [Auto]

Select [Auto] to apply the CPU default Turbo Ratio setting or manually assign a core Limit value.

The N-core ratio limit must be higher than or equal to the (N+1)-core ratio limit. (N stands for the number of CPU cores.)

The core ratio limit cannot be set to Auto when the core number is lower than N.

The biggest core's ratio limit must be lower than or equal to the second biggest core's ratio limit.

2.5.5 DRAM Odd Ratio Mode [Enabled]

Allows you to enable or disable the DRAM Odd Ratio Mode, which provides better granularity. Configuration options: [Disabled] [Enabled]

2.5.6 DRAM Frequency [Auto]

This item allows you to set the memory operating frequency. The configurable options vary with the BCLK (base clock) frequency setting. Select the auto mode to apply the optimized setting. Configuration options: [Auto] [DDR4-800MHz] [DDR4-933MHz] [DDR4-1066MHz] [DDR4-1200MHz] [DDR4-1333MHz] ~ [DDR4-8400MHz] [DDR4-8533MHz]



Selecting a very high memory frequency may cause the system to become unstable! If this happens, revert to the default setting.

2.5.7 OC Tuner [Keep Current Settings]*

This item allows you to automatically overclock the CPU and DRAM frequencies and voltage for an enhanced system performance. It also accelerates the CPU graphics performance to the extreme depending on the CPU graphics loading. Configuration options: [Keep Current Settings] [OC Tuner I] [OC Tuner II]



Ensure that you installed an efficient CPU fan for CPU and graphics loading before selecting either [OC Tuner I] or [OC Tuner II]. To keep the current overclocking tuner status, select [Keep Current Settings].

2.5.8 Power-saving & Performance Mode [Auto]

[Auto] Automatically adjusts the power usage based on the system load.

[Max Power-Saving Mode] Enables all power-saving settings for maximum energy-saving condition.

[Performance Mode] Disables all power-saving settings for a high system performance.

2.5.9 DRAM Timing Control

The subitems in this menu allow you to set the DRAM timing control features. Use the <+> and <-> keys to adjust the value. To restore the default setting, type [auto] using the keyboard and press the <Enter> key.



Changing the values in this menu may cause the system to become unstable! If this happens, revert to the default settings.

2.5.10 DIGI+ VRM

CPU Load-Line Calibration [Auto]

Load-line is defined by Intel VRM specification and affects the CPU power voltage. The CPU working voltage will decrease proportionally depending on the CPU loading. Higher levels of the load-line calibration can get a higher voltage and a better overclocking performance but increases the CPU and VRM thermal. Configuration options: [Auto][Level 1] [Level 2] ~ [Level 6] [Level 7]



The boosted performance may vary depending on the CPU specification. Do not remove the thermal module.

Synch ACDC Loadline with VRM Loadline [Disabled]

Allows you to enable or disable synch ACDC loadline with VRM loadline. Configuration options: [Disabled] [Enabled]

CPU Current Capability [Auto]

Allows you to configure the total power range, and extends the overclocking frequency range simultaneously. Configuration options: [Auto] [100%] [110%] [120%] [130%] ~ [170%]



Choose a higher value when overclocking, or under a high CPU loading for extra power support.

CPU VRM Switching Frequency [Auto]

This item affects the VRM transient response speed and the component thermal production. Select [Manual] to configure a higher frequency for a quicker transient response speed.

Configuration options: [Auto] [Manual]



DO NOT remove the thermal module. The thermal conditions should be monitored.



The following item appears only when you set the CPU VRM Switching Frequency to [Manual].

Fixed CPU VRM Switching Frequency (KHz) [250]

This item allows you to set a higher frequency for a quicker transient response speed. Use the <+> and <-> keys to adjust the value. The values range from 250KHz to 500KHz with a 50KHz interval.

CPU Power Duty Control [T.Probe]

DIGI + VRM Duty control adjusts the current and thermal conditions of every component's phase.

[T. Probe] Select to maintain the VRM thermal balance.

[Extreme] Select to maintain the current VRM balance.

CPU Power Phase Control [Auto]

This item allows you to set the power phase control of the CPU. Configuration options: [Auto] [Standard] [Extreme]

CPU Graphics Load-Line Calibration [Auto]

Load-line is defined by Intel VRM specification and affects the GT power voltage. The GT working voltage will decrease proportionally depending on the GT loading. Higher levels of the load-line calibration can get a higher voltage and a better overclocking performance but increases the GT and VRM thermal. Select from level 1 to 7 to adjust the GT power voltage from 0% to 100%. Configuration options: [Auto] [Level 1] [Level 2] ~ [Level 6] [Level 7]



The boosted performance may vary depending on the GT specification. Do not remove the thermal module.

CPU Graphics Current Capability [Auto]

Allows you to configure the total power range, and extends the overclocking frequency range simultaneously. Configuration options: [Auto] [100%] [110%] [120%] [130%] [140%]



Choose a higher value when overclocking, or under a high GT loading for extra power support.

CPU Graphics VRM Switching Frequency [Auto]

The switching frequency will affect the GT transient response speed and the component thermal production. Select [Manual] to configure a higher frequency for a quicker transient response speed. Configuration options: [Auto] [Manual]



DO NOT remove the thermal module. The thermal conditions should be monitored.



The following item appears only when you set the GT VRM Switching Frequency to **[Manual]**.

Fixed VCCGT Switching Frequency (KHz) [250]

This item allows you to set a higher frequency for a quicker transient response speed. Use the <+> and <-> keys to adjust the value. The values range from 250KHz to 500KHz with a 50KHz interval.

CPU Graphics Power Duty Control [T.Probe]

The GT power duty control adjusts the current and thermal conditions of every component's phase.

[T. Probe] Select to maintain the VRM thermal balance.

[Extreme] Select to maintain the current VRM balance.

CPU Graphics Power Phase Control [Auto]

This item allows you to set the power phase control of GT. Configuration options: [Auto] [Standard] [Optimized] [Extreme]

2.5.11 Internal CPU Power Management

The subitems in this menu allow you to set the CPU ratio and their features.

Intel(R) SpeedStep(tm) [Auto]

This item allows the operating system to dynamically adjust the processor voltage and cores frequency, resulting to a decreased average power consumption and decreased average heat production. Configuration options: [Auto] [Disabled] [Enabled]

Turbo Mode [Enabled]

This item allows you to automatically set the CPU cores to run faster than the base operating frequency when it is below the operating power, current and temperature specification limit. Configuration options: [Enabled] [Disabled]

-
- Turbo Mode is only available on selected CPU models only.
 - The following three items appear only when you set **Turbo Mode** to [enabled].
-

Turbo Mode Parameters

Long Duration Package Power Limit [Auto]

Allows you to limit the Turbo Ratio's time duration that exceeds the TDP (Thermal Design Power) for maximum performance. Use the <+> or <-> keys to adjust the value. The values range from 1 W to 4095 W.

Package Power Time Window [Auto]

Also known as Power Limit 1, this item allows you to maintain the time window for Turbo Ratio over TDP (Thermal Design Power). Use the <+> or <-> keys to adjust the value. The values range from 1 to 127 in seconds.

Short Duration Package Power Limit [Auto]

Also known as Power Limit 2, this item allows you to provide rapid protection when the package power exceeds the Power Limit 1. Use the <+> or <-> keys to adjust the value. The values range from 1 W to 4095 W.

IA AC Load Line [Auto]

This item allows you to set the AC loadline defined in 1/100 mOhms. Use the <+> and <-> keys to adjust the value. Configuration options: [Auto] [0.01] - [62.49]

IA DC Load Line [Auto]

This item allows you to set the DC loadline defined in 1/100 mOhms. Use the <+> and <-> keys to adjust the value. Configuration options: [Auto] [0.01] - [62.49]

2.5.12 Tweaker's Paradise

The subitems in this menu allow you to set the FCLK frequency and internal PLL voltage.

Realtime Memory Timing [Disabled]

When enabled, the system will allow to perform realtime memory timing changes after MRC_DONE. Configuration options: [Disabled] [Enabled]

FCLK Frequency [Auto]

Allows you to set the value of FCLK Frequency. Configuration options: [Auto] [Normal (800Mhz)] [1GHz] [400MHz].

VPPDDR Voltage [Auto]

Allows you to configure the voltage for the VPPDDR. Use the <+> or <-> keys to adjust the value. The values range from 1.800V to 3.200V with a 0.010V interval.

Internal PLL Voltage [Auto]

Allows you to configure the offset for the Core PLL VCC Trim. Use the <+> or <-> keys to adjust the value. The values range from 0.900V to 1.845V with a 0.015V interval.

GT PLL Voltage [Auto]

Allows you to configure the offset for the GT PLL VCC Trim. Use the <+> or <-> keys to adjust the value. The values range from 0.900V to 1.845V with a 0.015V interval.

Ring PLL Voltage [Auto]

Allows you to configure the offset for the Ring PLL VCC Trim. Use the <+> or <-> keys to adjust the value. The values range from 0.900V to 1.845V with a 0.015V interval.

System Agent PLL Voltage [Auto]

Allows you to configure the offset for the System Agent PLL VCC Trim. Use the <+> or <-> keys to adjust the value. The values range from 0.900V to 1.845V with a 0.015V interval.

Memory Controller PLL Voltage [Auto]

Allows you to configure the offset for the Memory Controller PLL VCC Trim. Use the <+> or <-> keys to adjust the value. The values range from 0.900V to 1.845V with a 0.015V interval.

2.5.13 CPU Core/Cache Current Limit Max. [Auto]

This item allows you to configure a higher current limit to prevent a frequency or power throttling when overclocking. Use the <+> and <-> keys to adjust the value. Configuration options: [Auto] [0.00] - [255.50]

2.5.14 CPU Graphics Current Limit [Auto]

This item allows you to configure a higher current limit to prevent a frequency or power throttling when overclocking. Use the <+> and <-> keys to adjust the value. Configuration options: [Auto] [0.00] - [255.50]

2.5.15 Min. CPU Cache Ratio [Auto]

This item allows you to set the minimum possible CPU cache ratio. Use the <+> and <-> keys to adjust the value. Configuration options: [Auto] [8] - [42]

2.5.16 Max CPU Cache Ratio [Auto]

This item allows you to set the maximum possible CPU cache ratio. Use the <+> and <-> keys to adjust the value. Configuration options: [Auto] [8] - [42]

2.5.17 Max. CPU Graphics Ratio [Auto]

This item allows you to set the maximum possible CPU graphics ratio. Use the <+> and <-> keys to adjust the value. Configuration options: [Auto] [1] - [22]

2.5.18 CPU Core/Cache Voltage [Auto]

This item allows you to configure the amount of voltage fed to the CPU cores. Increase the voltage when setting a high Core Frequency value. Configuration options: [Auto] [Manual Mode] [Offset Mode]



The following item appears only when you set the CPU Core Voltage to **[Manual Mode]**.

CPU Core Voltage Override [Auto]

Allows you to set the CPU Core Voltage override. Use the <+> or <-> keys to adjust the value. The values range from 0.600V to 1.700V with a 0.005V interval.



The following items appear only when you set the CPU Core Voltage to **[Offset Mode]**.

Offset Mode Sign [+]

- [+] To offset the voltage by a positive value.
- [-] To offset the voltage by a negative value.

CPU Core Voltage Offset

Use the <+> or <-> keys to adjust the value. The values range from 0.005V to 0.635V with a 0.005V interval.

2.5.19 DRAM Voltage [Auto]

This item allows you to set the voltage for the DRAM. Use the <+> and <-> keys to adjust the value. The values range from 1.000V to 1.800V with a 0.005 interval.

2.5.20 CPU VCCIO Voltage [Auto]

This item allows you to set the voltage for the CPU VCCIO. Use the <+> and <-> keys to adjust the value. The values range from 0.700V to 1.585V with a 0.010V interval.

2.5.21 CPU System Agent Voltage [Auto]

This item allows you to set the voltage for the CPU System Agent. Use the <+> and <-> keys to adjust the value. The values range from 1.050V to 1.750V with a 0.100V interval.

2.5.22 CPU Graphics Voltage Mode [Auto]

This item allows you to configure the mode of voltage fed to the CPU Graphics Voltage. Manual mode allows user-defined values. Offset mode modifies values by SVID. Configuration options: [Auto] [Manual Mode] [Offset Mode]



The following item appears only when you set the CPU Graphics Voltage Mode to **[Manual Mode]**.

CPU Graphics Voltage Override [Auto]

This item allows you to configure the CPU Graphics Voltage Override. Use the <+> or <-> keys to adjust the value. The values range from 0.600V to 1.700V with a 0.005V interval.



The following item appears only when you set the CPU Core Voltage Mode to **[Offset Mode]**.

Offset Mode Sign [+]

[+] To offset the voltage by a positive value.

[-] To offset the voltage by a negative value.

CPU Graphics Voltage Offset [Auto]

This item allows you to configure the CPU Graphics Voltage Offset. Use the <+> or <-> keys to adjust the value. The values range from 0.005V to 0.635V with a 0.005V interval.

2.5.23 PCH Core Voltage [Auto]

This item allows you to set the PCH core voltage. Use the <+> and <-> keys to adjust the value. The values range from 1.000V to 1.150V with a 0.05V interval.

2.5.24 CPU Standby Voltage [Auto]

This item allows you to set the CPU Standby voltage. Use the <+> and <-> keys to adjust the value. The values range from 0.800V to 1.600V with a 0.01V interval.

2.5.25 DRAM REF Voltage Control [Auto]

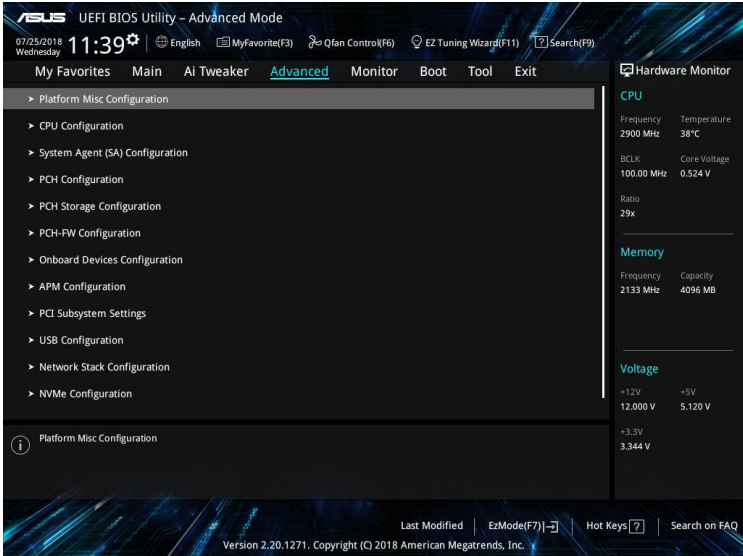
The subitems in this menu allows you to set the DRAM reference voltage on the control lines from the memory bus. You can use the <+> or <-> keys to adjust the value.

2.6 Advanced menu

The Advanced menu items allow you to change the settings for the CPU and other system devices.



Be cautious when changing the settings of the Advanced menu items. Incorrect field values can cause the system to malfunction.



2.6.1 Platform Misc Configuration

The items in this menu allow you to configure the platform-related features.

PCI Express Native Power Management [Disabled]

This item allows you to enhance the power saving feature of PCI Express and perform ASPM operations in the operating system. Configuration options: [Disabled] [Enabled]



The following item appears only when you set the PCI Express Native Power Management to **[Enabled]**.

Native ASPM [Disabled]

- [Enabled] Windows® Vista OS controls the ASPM (active state power management) support for devices.
- [Disabled] BIOS controls the ASPM support for the device.
- [Auto] Automatic configuration.

PCH - PCI Express options

PCH DMI ASPM [Disabled]

This item allows you to control the Active State Power Management on both NB (NorthBridge) side and SB (SouthBridge) side of the DMI Link. Configuration options: [Disabled] [Enabled]

ASPM [Disabled]

This item allows you to select the ASPM state for energy-saving conditions. Configuration options: [Disabled] [L0s] [L1] [L0sL1] [Auto]

L1 Substates [Disabled]

This item allows you to specify the PCIe L1 Substates. Configuration options: [Disabled] [L1.1] [L1.2] [L1.1 & L1.2]

PCI Express Clock Gating [Enabled]

This item allows you to enable or disable PCI Express Clock Gating for each root port. Configuration options: [Disabled] [Enabled]

SA - PCI Express options

DMI Link ASPM Control [Disabled]

This item allows you to control the Active State Power Management on both CPU and PCH (platform controller hub) Both DMI link ASPM control items of the CPU and PCH sides must be enabled for the ASPM to take effect. Configuration options: [Disabled] [L1]

PEG - ASPM [Disabled]

This item allows you to select the ASPM state for energy-saving conditions, or use the ASUS optimized energy saving profile. Configuration options: [Disabled] [Auto] [ASPM L0s] [ASPM L1] [ASPM L0sL1]

2.6.2 CPU Configuration

The items in this menu show the CPU-related information that the BIOS automatically detects.



The items shown in submenu may be different due to the CPU you installed.

Software Guard Extensions (SGS) [Software Controlled]

This item enables/disables the Software Guard Extensions (SGX). Configuration options: [Disabled] [Software Controlled]

Tcc Offset Time Window [Auto]

This item allows you to specify the time window for the Running Average Temperature Limit (RATL) feature. Configuration options: [Auto] [Disabled] [5 ms] [10 ms] [55 ms] [156 ms] [375 ms] [500 ms] ~ [384 sec] [448 sec]

Hardware Prefetcher [Enabled]

This item allows the CPU to prefetch commands and data in the L2 cache, reduces the DRAM loading time and improves the system performance. Configuration options: [Disabled] [Enabled]

Adjacent Cache Line Prefetch [Enabled]

This item allows the mid level cache (L2) to prefetch adjacent cache lines, reducing the DRAM loading time and improves the system performance. Configuration options: [Disabled] [Enabled]

Intel (VMX) Virtualization Technology [Disabled]

When set to [Enabled], a VMM can utilize the additional hardware capabilities provided by Vanderpool Technology. Configuration options: [Disabled] [Enabled]

Active Processor Cores [All]

This item allows you to select the number of CPU cores to activate in each processor package. Configuration options: [All] [1] [2] [3] [4] [5]

Hyper-threading [Enabled]

The Intel Hyper-Threading Technology allows a hyper-threading processor to appear as two logical processors to the operating system, allowing the operating system to schedule two threads or processes simultaneously.

[Enabled] Two threads per activated core are enabled.

[Disabled] Only one thread per activated core is enabled.

CPU - Power Management Control

This item allows you to manage and configure the CPU's power.

Intel(R) SpeedStep(tm) [Auto]

This item allows your system to support more than two frequency ranges. Configuration options: [Auto] [Disabled] [Enabled]

Intel(R) Speed Shift Technology [Auto]

This item allows you to enable or disable the Intel(R) Speed Shift Technology support. Configuration options: [Auto] [Disabled] [Enabled]

Turbo Mode [Enabled]

This item allows you to automatically set the CPU cores to run faster than the base operating frequency when it is below the operating power, current and temperature specification limit. Configuration options: [Enabled] [Disabled]



Turbo Mode is only available on selected CPU models only.

CPU C-States [Auto]

This item allows you to set the power saving of the CPU states. Configuration options: [Auto] [Disabled] [Enabled]



The following items appear only when you set the CPU C-States to [Enabled].

Enhanced C-States [Disabled]

When enabled, CPU will switch to minimum speed when all cores enter C-State.

Configuration options: [Enabled] [Disabled]

CPU C3 Report [Enabled]

This item allows you to disable or enable the CPU C3 report to the operating system. Configuration options: [Enabled] [Disabled]

CPU C6 Report [Enabled]

This item allows you to disable or enable the CPU C6 report to the operating system. Configuration options: [Enabled] [Disabled]

CPU C7 Report [CPU C7s]

This item allows you to disable or enable the CPU C7 report to the operating system. Configuration options: [Disabled] [CPU C7] [CPU C7s]

CPU C8 Report [Enabled]

This item allows you to disable or enable the CPU C8 report to the operating system. Configuration options: [Enabled] [Disabled]

CPU C9 Report [Enabled]

This item allows you to disable or enable the CPU C9 report to the operating system. Configuration options: [Enabled] [Disabled]

CPU C10 Report [Enabled]

This item allows you to disable or enable the CPU C10 report to the operating system. Configuration options: [Enabled] [Disabled]

Package C State limit [Auto]

This item allows you to set the a C--state support for the CPU package.

Configuration options: [C0/C1] [C2] [C3] [C6] [C7] [C7s] [C8] [C9] [C10] [CPU Default] [Auto]

CFG Lock [Enabled]

This item allows you to disable or enable the CFG Lock. Configuration options: [Enabled] [Disabled]

2.6.3 System Agent (SA) Configuration

VT-d [Disabled]

Allows you to enable or disable VT-d function on MCH. Configuration options: [Enabled] [Disabled]

Above 4G Decoding [Disabled]

Allows you to enable or disable the 4G decoding for 64-bit devices when the system supports the 64-bit PCI decoding. Configuration options: [Enabled] [Disabled]

Memory Configuration

Allows you to configure the memory configuration parameters.

Memory Remap [Enabled]

Allows you to enable or disable memory remap above 4GB. Configuration options: [Enabled] [Disabled]

Graphics Configuration

Allows you to select a primary display from CPU, PCIE and PCI graphical devices.

Primary Display [Auto]

Allows you to select the primary display from CPU, PCIE and PCI graphics devices. Configuration options: [Auto] [CPU Graphics] [PCIE]

iGPU Multi-Monitor [Disabled]

This item allows you to empower both integrated and discrete graphics devices for the multi-monitor output. The CPU graphics shared system memory size is fixed at 64 MB. Configuration options: [Disabled] [Enabled]

DVMT Pre-Allocated [64M]

Allows you to select the DVMT 5.0 pre-allocated (fixed) graphics memory size used by the internal graphics device. Configuration options: [32M] [64M] [96M] [128M] [160M] [192M] [224M] [256M] [288M] [320M] ~ [512M] [1024M]

RC6(Render Standby) [Enabled]

Allows you to enable or disable render standby support. Configuration options: [Disabled] [Enabled]

PEG Port Configuration

Allows you to configure the PEG Port settings.

PCIEx16_1 Link Speed [Auto]

Allows you to configure the PCIEx16 speed for slot 1. Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

2.6.4 PCH Configuration

This item allows you to configure the PCI Express configuration settings.

PCI Express Configuration

PCIe Speed [Auto]

Allows you to configure the speed for the PCIe slots. Configuration options: [Auto] [Gen1] [Gen2] [Gen3]

IOAPIC 24-119 Entries [Enabled]

Allows you to enable or disable IOAPIC 24/119 entries. Configuration options: [Enabled] [Disabled]

2.6.5 PCH Storage Configuration

While entering Setup, the BIOS automatically detects the presence of SATA devices. The SATA Port items show **Empty** if no SATA device is installed to the corresponding SATA port.

SATA Controller(s) [Enabled]

Enables or disables onboard the SATA device. Configuration options: [Disabled] [Enabled]



The following items appear only when you set the SATA Controller(s) to **[Enabled]**.

SATA Mode Selection [AHCI]

Allows you to set the SATA configuration.

[AHCI] Set to [AHCI] when you want the SATA hard disk drives to use the AHCI (Advanced Host Controller Interface). The AHCI allows the onboard storage driver to enable advanced SATA features that increases storage performance on random workloads by allowing the drive to internally optimize the order of commands.

[Intel® RST Premium With Intel® Optane System Acceleration (RAID)]* Set to [Intel® RST Premium With Intel® Optane System Acceleration (RAID)] when you want the SATA hard disk drives to use Intel® RST Premium interface or you want to create a RAID configuration from the SATA hard disk device.

Aggressive LPM Support [Disabled]

This item is designed for LPM (link power management) support with a better energy saving conditions. When disabled, the hot plug function of SATA ports are disabled. Configuration options: [Disabled] [Enabled]

SMART Self Test [On]

SMART (Self--Monitoring, Analysis and Reporting Technology) is a monitoring system that shows a warning message during POST (Power--on Self Test) when an error occurs in the hard disks. Configuration options: [On] [Off]

SATA6G_1~4(Gray)

SATA6G_1~4(Gray) [Enabled]

Allow you to enable/disable the SATA6G_1~4 port. Configuration options: [Disabled] [Enabled]

SATA6G_1~4 Hot Plug [Disabled]

These items allow you to enable/disable SATA Hot Plug Support. Configuration options: [Disabled] [Enabled]

2.6.6 PCH-FW Configuration

ME State [Auto]

This item allows you to enable or disable the ME State. Configuration options: [Enabled] [Disabled] [Auto]

Intel Platform Trust Technology [Disabled]

This item allows you to enable or disable the Intel Platform Trust Technology (PTT). Configuration options: [Enabled] [Disabled]

2.6.7 Onboard Devices Configuration

Hyper M.2X16 [Enabled][Disabled]

[Disabled] Only one SSD installed onto the Hyper M.2 X16 card can be detected.

[Enabled] Two or three SSDs installed onto the Hyper M.2 X16 card can be detected.



The number of SSDs that can be detected varies with the configurations of the PCIe X16 slots.

HD Audio [Enabled]

- [Enabled] Enables the HD Audio Device.
- [Disabled] Disables the HD Audio Device.



The following two items appear only when you set the **HD Audio Controller** item to [Enabled].

LED Lighting [Breathing Mode]

This item allows you to set the audio shielding LED mode. Configuration options: [Disabled] [Still Mode] [Breathing Mode]

Super IO LED Control Switch [On]

This item allows you to turn on/off the super IO LED control switch. Configuration options: [Off] [On]

Realtek LAN Controller [Enabled]

- [Enabled] Enables the Realtek LAN controller.
- [Disabled] Disables the controller.

Realtek PXE OPROM [Disabled]

This item appears only when you set the previous item to [Disabled] and allows you to enable or disable the PXE OPROM of the Realtek LAN controller. Configuration options: [Enabled] [Disabled]

USB power delivery in Soft Off state (S5) [Enabled]

- [Enabled] The USB port will provide power to your devices even when the system is in Power State S5.
- [Disabled] Disables this function.

Connectivity mode (Wi-Fi & Bluetooth) [Enabled]

This item allows you to enable or disable the Wi-Fi and Bluetooth connectivity module. Configuration options: [Disabled] [Enabled]

M.2_1 Configuration [Auto]

M.2_1 shares SATA mode with SATA6G_2.

- [Auto] Auto detects the M.2_1 device mode. If a SATA device is detected, SATA6G_2 will be disabled.
- [SATA] Only supports M.2_1 SATA devices. SATA6G_2 cannot be used in this mode.
- [PCIE] Only supports M.2_1 PCIE devices.

Serial Port Configuration

The sub-items in this menu allow you to set the serial port configuration.

Serial Port 1 [On]

Allows you to enable or disable the serial port (COM). Configuration options: [On] [Off]

Change Settings [IO=3F8h; IRQ=4]

This item appears only when you set the **Serial Port** to [On] and allows you to select the Serial Port base address. Configuration options: [IO=3F8h; IRQ=4] [IO=2F8h; IRQ=3] [IO=3E8h; IRQ=4] [IO=2E8h; IRQ=3]

2.6.8 APM Configuration

ErP Ready [Disabled]

Allows BIOS to switch off some power at S5 to get the system ready for ErP requirement. When set to [Enabled], all other PME options will be switched off. Configuration options: [Enabled] [Disabled]

CEC Ready [Disabled]

Enable this option to allow your system to comply with CEC (California Energy Commission) regulations and save more power under S0 state. Configuration options: [Enabled] [Disabled]

Restore AC Power Loss [Power Off]

- [Power On] The system goes into on state after an AC power loss.
- [Power Off] The system goes into off state after an AC power loss.
- [Last State] The system goes into either off or on state, whatever the system state was before the AC power loss.

Power On By PS/2 Keyboard [Disabled]

- [Disabled] Disables the Power On by a PS/2 keyboard.
- [Space Bar] Sets the Space Bar on the PS/2 keyboard to turn on the system.
- [Ctrl-Esc] Sets the Ctrl+Esc key on the PS/2 keyboard to turn on the system.
- [Power Key] Sets Power key on the PS/2 keyboard to turn on the system. This feature requires an ATX power supply that provides at least 1A on the +5VSB lead.

Power On By PS/2 Mouse [Disabled]

- [Disabled] Disables the Power On by a PS/2 mouse.
- [Enabled] Enables the Power On by a PS/2 mouse. This feature requires an ATX power supply that provides at least 1A on the +5VSB lead.

Power On By PCI-E [Disabled]

This item allows you to enable or disable the Wake-on-LAN function of the onboard LAN controller or other installed PCIe LAN cards. Configuration options: [Disabled] [Enabled]

Power On By RTC [Disabled]

This item allows you to enable or disable the RTC (Real-Time Clock) to generate a wake event and configure the RTC alarm date. When enabled, you can set the days, hours, minutes, or seconds to schedule an RTC alarm date. Configuration options: [Disabled] [Enabled]

2.6.9 PCI Subsystem Settings

SR-IOV Support [Disabled]

This item allows you to enable or disable the Single Root IO Virtualization support if your system has SR-IOV capable PCIe devices. Configuration options: [Disabled] [Enabled]

2.6.10 USB Configuration

The items in this menu allow you to change the USB-related features.



The **USB Devices** item shows the auto-detected values. If no USB device is detected, the item shows None.

Legacy USB Support [Enabled]

- [Enabled] Your system supports the USB devices in legacy operating systems.
- [Disabled] Your USB devices can be used for BIOS setup only and cannot be recognized in the boot devices list.
- [Auto] Your system automatically detects the presence of USB devices at startup. If any USB devices are detected, the legacy USB support is enabled.

XHCI Hand-off

- [Enabled] Enables the support for operating systems without an XHCI hand-off feature.
- [Disabled] Disables the XHCI Hand-off support.

USB single port control

The subitems in this menu allow you to set the USB Port Disable Override features.

U31G1_1~10 [Enabled]

Allows you to enable or disable the USB3.0 ports individually. Configuration options: [Disabled] [Enabled]

USB11~13 [Enabled]

Allows you to enable or disable the USB2.0 ports individually. Configuration options: [Disabled] [Enabled]

2.6.11 Network Stack Configuration

Network Stack [Disabled]

This item allows user to disable or enable the UEFI network stack. Configuration options: [Disabled] [Enabled]



The following two items appear only when you set the previous item to [Enabled].

Ipv4 / Ipv6 PXE Support [Disabled]

This item allows you to enable or disable the Ipv4/Ipv6 PXE wake event. Configuration options: [Disabled] [Enabled]

2.6.12 NVMe Configuration

The items in this menu allow you to configure the NVMe device.

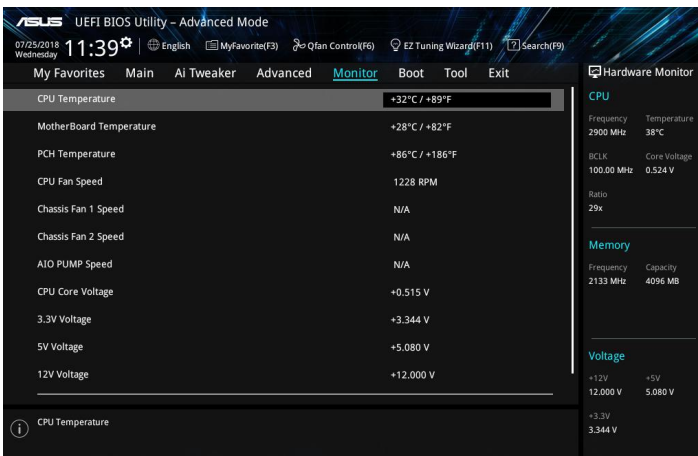
2.6.13 HDD/SSD SMART Information

This menu displays the SMART information of the connected devices.

2.7 Monitor menu

The Monitor menu displays the system temperature/power status, and allows you to change the fan settings.

Scroll down to display the other BIOS items.



2.7.1 CPU/ Motherboard/PCH Temperature [xxx°C/xxx°F]/ [Monitor]

The onboard hardware monitor automatically detects and displays the CPU, motherboard and PCH temperatures. Select **[Ignore]** if you do not wish to display the detected temperatures.

2.7.2 CPU Fan, Chassis Fan 1/2, AIO PUMP Speed [xxxx RPM]/ [Monitor]/ [N/A]

The onboard hardware monitor automatically detects and displays the CPU, chassis and AIO PUMP fan speeds in rotations per minute (RPM). If the fan is not connected to the motherboard, the field shows N/A. Select **[Ignore]** if you do not wish to display the detected speed.

2.7.3 CPU Core Voltage, 3.3V Voltage, 5V Voltage, 12V Voltage

The onboard hardware monitor automatically detects the voltage output through the onboard voltage regulators. Select **[Ignore]** if you do not want to detect this item.

2.7.4 Q-Fan Configuration

The subitems in this menu allows you to configure the Q-Fan features.

Q-Fan Tuning

Click **[OK]** button to detect the lowest speed and configure the minimum duty circle for each fan. Do not shut down or reset your system during the tuning progress. Configuration options: **[Ok]** **[Cancel]**

CPU Q-Fan Control **[PWM Mode]**

- [Auto]** Enables the CPU Q-Fan control for 4-pin CPU fan.
- [Disabled]** Disables the CPU Q-Fan control feature.
- [PWM Mode]** Enable the CPU Q-Fan control in PWM mode for 4-pin CPU fan.
- [DC Mode]** Enable the CPU Q-Fan control in DC mode for 3-pin CPU fan.

CPU Fan Step Up **[0 sec]**

This item appears only when you enable the CPU Q-Fan Control feature and allows you to select the value of CPU Fan Step Up. Configuration options: **[0 sec]** **[2.1 sec]** **[2.8 sec]** **[3.6 sec]** **[4.2 sec]** **[5.0 sec]** **[6.3 sec]** **[8.5 sec]** **[12 sec]** **[25 sec]**

CPU Fan Step Down **[0 sec]**

This item appears only when you enable the CPU Q-Fan Control feature and allows you to select the value of CPU Fan Step Down. Configuration options: **[0 sec]** **[2.1 sec]** **[2.8 sec]** **[3.6 sec]** **[4.2 sec]** **[5.0 sec]** **[6.3 sec]** **[8.5 sec]** **[12 sec]** **[25 sec]**

CPU Fan Speed Lower Limit **[200 RPM]**

This item appears only when you enable the CPU Q-Fan Control feature and allows you to disable or set the CPU fan warning speed. Configuration options: **[Ignore]** **[200RPM]** **[300RPM]** **[400 RPM]** **[500 RPM]** **[600 RPM]**

CPU Fan Profile **[Standard]**

This item appears only when you enable the CPU Q-Fan Control feature and allows you to set the appropriate performance level of the CPU fan.

- [Standard]** Sets to **[Standard]** to make the CPU fan automatically adjust depending on the CPU temperature.
- [Silent]** Sets to **[Silent]** to minimize the fan speed for quiet CPU fan operation.
- [Turbo]** Sets to **[Turbo]** to achieve maximum CPU fan speed.
- [Manual]** Sets to **[Manual]** to assign detailed fan speed control parameters.



The following four items appear only when you set **CPU Fan Profile** to **[Manual]**.

CPU Upper Temperature **[70]**

Use the **<+>** and **<->** keys to adjust the upper limit of the CPU temperature. The values range from 25°C to 75°C.

CPU Fan Max. Duty Cycle(%) [100]

Use the <+> and <-> keys to adjust the maximum CPU fan duty cycle. The values range from 20% to 100%. When the CPU temperature reaches the upper limit, the CPU fan will operate at the maximum duty cycle.

CPU Middle Temperature [25]

Use the <+> or <-> keys to set the value for CPU Middle Temperature. The range of the values depends on the CPU installed.

CPU Fan Middle Duty Cycle(%) [20]

Use the <+> or <-> keys to adjust the CPU fan middle duty cycle. The values range from 20% to 100%. When the CPU temperature reaches the upper limit, the CPU fan operates at the maximum duty cycle.

CPU Lower Temperature [20]

Use the <+> or <-> keys to adjust the CPU fan's lower temperature. The values range from 0°C to 75°C.

CPU Fan Min. Duty Cycle(%) [20]

Use the <+> and <-> keys to adjust the minimum CPU fan duty cycle. The values range from 20% to 100%. When the CPU temperature is under the lower limit, the CPU fan will operate at the minimum duty cycle.

Chassis Fan(s) Configuration

Chassis Fan(s) Q-Fan Control [Auto]

[Auto]	Detects the type of chassis fan installed and automatically switch the control modes.
[PWM mode]	Enables the chassis Q-Fan control in PWM mode for 4-pin chassis fan.
[DC mode]	Enables the chassis Q-Fan control in DC mode for 3-pin chassis fan.
[Disabled]	Disables the chassis Q-Fan control feature.



The following items appear only when you set the Chassis Fan 1/2 Q-Fan Control to **[PWM Mode]** or **[DC Mode]**.

Chassis Fan 1/2 Q-Fan Source [CPU]

This item controls the assigned fan according to the selected temperature source. Configuration options: [CPU] [Motherboard]

Chassis Fan 1/2 Step Up [0 sec]

This item allows you to select the value of Chassis Fan 1/2 Step Up. Configuration options: [0 sec] [12 sec] [25 sec] [51 sec] [76 sec] [102 sec] [127 sec] [153 sec] [178 sec] [204 sec]

Chassis Fan 1/2 Step Down [0 sec]

This item allows you to select the value of Chassis Fan 1/2 Step Down. Configuration options: [0 sec] [12 sec] [25 sec] [51 sec] [76 sec] [102 sec] [127 sec] [153 sec] [178 sec] [204 sec]

Chassis Fan 1/2 Speed Low Limit [200 RPM]

This item allows you to disable or set the chassis fan warning speed. Configuration options: [Ignore] [200RPM] [300 RPM] [400 RPM] [500 RPM] [600 RPM]

Chassis Fan 1/2 Profile [Standard]

This item allows you to set the appropriate performance level of the chassis fan.

- | | |
|------------|---|
| [Standard] | Sets to [Standard] to make the chassis fan automatically adjust depending on the chassis temperature. |
| [Silent] | Sets to [Silent] to minimize the fan speed for quiet chassis fan operation. |
| [Turbo] | Sets to [Turbo] to achieve maximum chassis fan speed. |
| [Manual] | Sets to [Manual] to assign detailed fan speed control parameters. |



The following four items appear only when you set **Chassis Fan 1/2 Profile** to [Manual].

Chassis Fan 1/2 Upper Temperature [70]

Use the <+> or <-> keys to adjust the upper limit of the chassis fan. The values range from 45°C to 75°C.

Chassis Fan 1/2 Max. Duty Cycle(%) [100]

Use the <+> or <-> keys to adjust the maximum chassis fan duty cycle. The values range from 60% to 100%. When the chassis temperature reaches the upper limit, the chassis fan will operate at the maximum duty cycle.

Chassis Fan 1/2 Middle Temperature [45]

Use the <+> or <-> keys to set the value for Chassis Fan Middle Temperature.

Chassis Fan 1/2 Middle Duty Cycle(%) [60]

Use the <+> or <-> keys to adjust the chassis fan middle duty cycle. The values range from 60% to 100%.

Chassis Fan 1/2 Lower Temperature [40]

Use the <+> or <-> keys to adjust the chassis fans' lower temperature. The values range from 0°C to 75°C.

Chassis Fan 1/2 Min. Duty Cycle(%) [60]

Use the <+> or <-> keys to adjust the minimum chassis fan duty cycle. The values range from 60% to 100%. When the CPU temperature is under the lower limit, the chassis fan operates at the minimum duty cycle.

2.7.5 AIO PUMP Control [Disabled]

- | | |
|------------|--|
| [Auto] | Detects the type of AIO PUMP fan installed and automatically switch the control modes. |
| [PWM mode] | Enables the AIO PUMP Q-Fan control in PWM mode for 4-pin AIO PUMP fan. |
| [DC mode] | Enables the AIO PUMP Q-Fan control in DC mode for 3-pin AIO PUMP fan. |
| [Disabled] | Disables the AIO PUMP Q-Fan control feature. |



The following items appear only when you set the AIO PUMP Fan Control to [PWM Mode] or [DC Mode].

AIO PUMP Upper Temperature [70]

Use the <+> or <-> keys to adjust the upper temperature limit of the AIO PUMP fan. The values range from 45°C to 75°C.

AIO PUMP Max. Duty Cycle(%) [100]

Use the <+> or <-> keys to adjust the maximum AIO PUMP fan duty cycle. The values range from 60% to 100%. When the CPU temperature reaches the upper limit, the AIO PUMP fan will operate at the maximum duty cycle.

AIO PUMP Middle Temperature [45]

Use the <+> or <-> keys to set the value for AIO PUMP Fan Middle Temperature.

AIO PUMP Middle Duty Cycle(%) [100]

Use the <+> or <-> keys to adjust the AIO PUMP fan middle duty cycle. The values range from 60% to 100%.

AIO PUMP Lower Temperature [40]

Use the <+> or <-> keys to adjust the AIO PUMP fan' lower temperature. The values range from 0°C to 75°C.

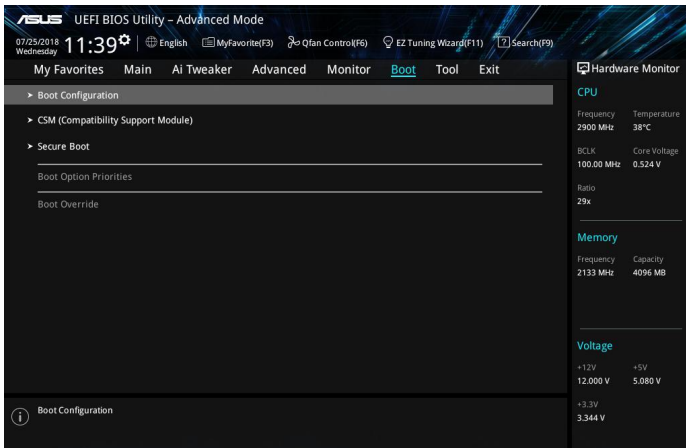
AIO PUMP Min. Duty Cycle(%) [100]

Use the <+> or <-> keys to adjust the minimum AIO PUMP fan duty cycle. The values range from 60% to 100%. When the CPU temperature is under the lower limit, the AIO PUMP fan operates at the minimum duty cycle.

2.8 Boot menu

The Boot menu items allow you to change the system boot options.

Scroll down to display the other BIOS items.



2.8.1 Boot Configuration

Fast Boot [Enabled]

- [Enabled] Select to accelerate the boot speed.
- [Disabled] Select to go back to normal boot speed.



The following item appears only when you set **Fast Boot** to [Enabled].

Next Boot after AC Power Loss [Normal Boot]

- [Normal Boot] Returns to normal boot on the next boot after AC power loss.
- [Fast Boot] Accelerates the boot speed on the next boot after AC power loss.

Boot Logo Display [Auto]

- [Auto] Adjusts logo automatically based on Windows® display requirements.
- [Full Screen] Maximize the boot logo size.
- [Disabled] Hide the logo during POST.

POST Delay Time [3 sec]

This item appears only when you set Boot Logo Display to [Auto] and [Full Screen]. This item allows you to select the desired additional POST waiting time to easily enter the BIOS setup. You can only execute the POST delay time during Normal Boot. The values range from 0 to 10 seconds.



This feature will only work under normal boot.

Post Report [5 sec]

This item appears only when you set Boot Logo Display to [Disabled]. This item allows you to select a desired post report waiting time. Configuration options: [1 sec] ~ [10 sec] [Until Press ESC].

Bootup NumLock State [On]

This item allows you to enable or disable power-on state of the NumLock. Configuration options: [On] [Off]

Wait for 'F1' If Error [Enabled]

When this item is set to [Enabled], the system waits for the F1 key to be pressed when error occurs. Configuration options: [Disabled] [Enabled]

Option ROM Messages [Force BIOS]

- [Force BIOS] The third-party ROM messages will be forced to display during the boot sequence.
- [Keep Current] The third-party ROM messages will be displayed only if the third-party manufacturer had set the add-on device to do so.

Interrupt 19 Capture [Disabled]

This item allows you to trap Interrupt 19 by the option ROMs. Configuration options: [Disabled] [Enabled]

AMI Native NVMe Driver Support [On]

This item allows you to enable/disable all NVMe device native OpROM. Configuration options: [On] [Off]

Setup Mode [EZ Mode]

[Advanced Mode] This item allows you to go to Advanced Mode of the BIOS after POST.

[EZ Mode] This item allows you to go to EZ Mode of the BIOS after POST.

2.8.2 CSM (Compatibility Support Module)

Allows you to configure the CSM (Compatibility Support Module) items to fully support the various VGA, bootable devices and add-on devices for better compatibility.

Launch CSM [Enabled]

[Auto] The system automatically detects the bootable devices and the add-on devices.

[Enabled] For better compatibility, enable the CSM to fully support the non-UEFI driver add-on devices or the Windows® UEFI mode.

[Disabled] Disable the CSM to fully support the Windows® Security Update and Security Boot.



The following four items appear when you set Launch CSM to [Enabled].

Boot Device Control [UEFI and Legacy OPROM]

Allows you to select the type of devices that you want to boot up. Configuration options: [UEFI and Legacy OPROM] [Legacy OPROM only] [UEFI only]

Boot from Network Devices [Legacy only]

Allows you to select the type of network devices that you want to launch. Configuration options: [Ignore] [Legacy only] [UEFI driver first]

Boot from Storage Devices [Legacy Only]

Allows you to select the type of storage devices that you want to launch. Configuration options: [Ignore] [Legacy only] [UEFI driver first]

Boot from PCI-E/PCI Expansion Devices [Legacy Only]

Allows you to select the type of PCI-E/PCI expansion devices that you want to launch. Configuration options: [Legacy only] [UEFI driver first]

2.8.3 Secure Boot

Allows you to configure the Windows® Secure Boot settings and manage its keys to protect the system from unauthorized access and malwares during POST.

OS Type [Other OS]

Allows you to select your installed operating system.

[Windows UEFI mode] This item allows you to select your installed operating system. Execute the Microsoft® Secure Boot check. Only select this option when booting on Windows® UEFI mode or other Microsoft® Secure Boot compliant OS.

[Other OS]

Get the optimized function when booting on Windows® non-UEFI mode. Microsoft® Secure Boot only supports Windows® UEFI mode.

Key Management

This allows you to manage the Secure Boot keys.

Clear Secure Boot keys

This item allows you to clear all default Secure Boot keys.

Save all Secure Boot Variables

This item allows you to save all the secure boot keys to a USB storage device.

PK Management

The Platform Key (PK) locks and secures the firmware from any non-permissible changes. The system verifies the PK before your system enters the OS.

Save To File

This item allows you to save PK to a file.

Set New Key

This item allows you to load the downloaded PK from a USB storage device.



The PK file must be formatted as a UEFI variable structure with time-based authenticated variable.

Delete Key

This item allows you to delete the PK from your system. Once the PK is deleted, all the system's Secure Boot keys will not be active.

KEK Management



Key-exchange Key (KEK) refers to Microsoft® Secure Boot Key-Enrollment Key (KEK).

Save To File

This item allows you to save KEK to a file.

Delete Key

Allows you to delete the KEK from your system.

Configuration options: [Yes] [No]

Set New Key

Allows you to load the downloaded KEK from a USB storage device.

Append Key

Allows you to load the additional KEK from a storage device for an additional db and dbx loaded management.



The KEK file must be formatted as a UEFI variable structure with time-based authenticated variable.

DB Management

Save To File

This item allows you to save DB to a file.

Set New Key

Allows you to load the downloaded db from a USB storage device.

Delete Key

Allows you to delete the db file from your system.

Configuration options: [Yes] [No]

Append Key

Allows you to load the additional db from a storage device so that more images can be loaded securely.



The db file must be formatted as a UEFI variable structure with time-based authenticated variable. DBX Management

DBX Management**Save To File**

This item allows you to save DBX to a file.

Delete Key

Allows you to delete the dbx file from your system.

Set New Key

Allows you to load the downloaded dbx from a USB storage device.

Configuration options: [Yes] [No]

Append Key

Allows you to load the additional dbx from a storage device so that more db's images cannot be loaded.



The dbx file must be formatted as a UEFI variable structure with time-based authenticated variable.

2.8.5 Boot Option Priorities

These items specify the boot device priority sequence from the available devices. The number of device items that appears on the screen depends on the number of devices installed in the system.



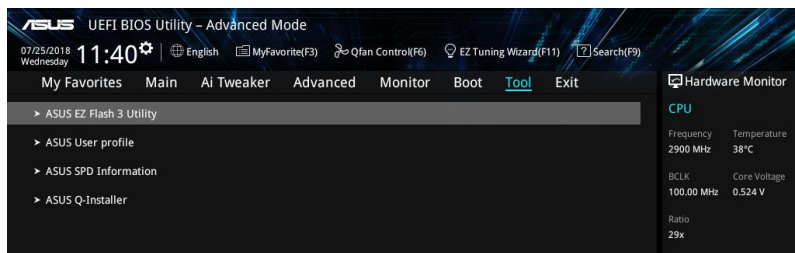
- To access Windows® OS in Safe Mode, press <F8 > after POST (Windows® 8 not supported).
 - To select the boot device during system startup, press <F8> when ASUS Logo appears.
-

2.8.6 Boot Override

These items displays the available devices. The number of device items that appears on the screen depends on the number of devices installed in the system. Click an item to start booting from the selected device.

2.9 Tool menu

The Tool menu items allow you to configure options for special functions. Select an item then press <Enter> to display the submenu.



2.9.1 ASUS EZ Flash 3 Utility

Allows you to run ASUS EZ Flash 3. Press [Enter] to launch the ASUS EZ Flash 3 screen.



For more details, see section 2.1.2 **ASUS EZ Flash 3**.

2.9.2 ASUS User Profile

This item allows you to store or load multiple BIOS settings.



The **Overclocking Profile** items show **Not assigned** if no profile is created.

Load from Profile

Allows you to load the previous BIOS settings saved in the BIOS Flash. Key in the profile number that saved your CMOS settings, press <Enter>, and then select Yes.



- DO NOT shut down or reset the system while updating the BIOS to prevent the system boot failure!
 - We recommend that you update the BIOS file only coming from the same memory/ CPU configuration and BIOS version.
-

Profile Name

Allows you to create a name for the profile you want to save.

Save to Profile

Allows you to save the current BIOS settings to the BIOS Flash, and create a profile. Key in a profile number from one to eight, press <Enter>, and then select Yes.

Load/Save Profile from/to USB Drive

This item allows you to load or save profile from your USB drive, load and save profile to your USB drive.

2.9.3 ASUS SPD Information

DIMM Slot number [DIMM_A2]

Displays the Serial Presence Detect (SPD) information of the DIMM module installed on the selected slot. Configuration options: [DIMM_A1] [DIMM_A2] [DIMM_B1] [DIMM_B2]

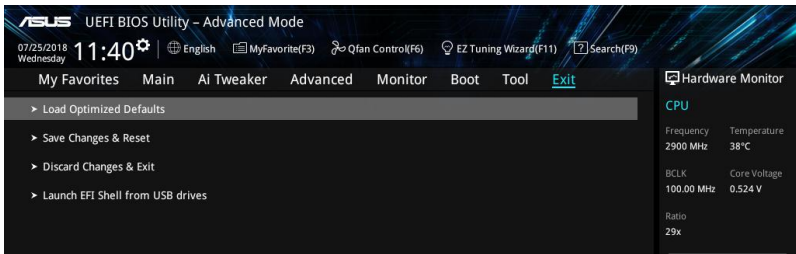
2.9.4 ASUS Q-Installer

ASUS Q-Installer [Enabled]

This item allows you to enable or disable ASUS Q-Installer . Configuration options: [Disabled] [Enabled]

2.10 Exit menu

The Exit menu items allow you to load the optimal default values for the BIOS items, and save or discard your changes to the BIOS items.



Load Optimized Defaults

This option allows you to load the default values for each of the parameters on the Setup menus. When you select this option or if you press <F5>, a confirmation window appears. Select OK to load the default values.

Save Changes & Reset

Once you are finished making your selections, choose this option from the Exit menu to ensure the values you selected are saved. When you select this option or if you press <F10>, a confirmation window appears. Select OK to save changes and exit.

Discard Changes & Exit

This option allows you to exit the Setup program without saving your changes. When you select this option or if you press <Esc>, a confirmation window appears. Select OK to discard changes and exit.

Launch EFI Shell from USB drives

This option allows you to attempt to launch the EFI Shell application (shellx64.efi) from one of the available USB devices.

Appendices

Notices

FCC Compliance Information

Responsible Party: Asus Computer International

Address: 48720 Kato Rd., Fremont, CA 94538, USA

Phone / Fax No: (510)739-3777 / (510)608-4555

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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 can radiate 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 guarantee 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.
- Consult the dealer or an experienced radio/TV technician for help.

Compliance Statement of Innovation, Science and Economic Development Canada (ISED)

This device complies with Innovation, Science and Economic Development Canada licence exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

CAN ICES-3(B)/NMB-3(B)

Déclaration de conformité de Innovation, Sciences et Développement économique Canada (ISED)

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CAN ICES-3(B)/NMB-3(B)

VCCI: Japan Compliance Statement

Class B ITE

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取扱説明書に従って正しい取り扱いをして下さい。

VCCI-B

KC: Korea Warning Statement

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DO NOT throw the mercury-containing button cell battery in municipal waste. This symbol of the crossed out wheeled bin indicates that the battery should not be placed in municipal waste.

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ASUS recycling and takeback programs come from our commitment to the highest standards for protecting our environment. We believe in providing solutions for you to be able to responsibly recycle our products, batteries, other components as well as the packaging materials. Please go to <http://csr.asus.com/english/Takeback.htm> for detailed recycling information in different regions.

Regional notice for California



WARNING

Cancer and Reproductive Harm -
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