

**ROG STRIX
X470-F GAMING**

ASUS®

Motherboard

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Contents

Safety information.....	v
About this guide.....	vi
ROG STRIX X470-F GAMING specifications summary.....	viii
Package contents.....	xii
Installation tools and components.....	xiii

Chapter 1: Product Introduction

1.1	Motherboard overview.....	1-1
1.1.1	Before you proceed.....	1-1
1.1.2	Motherboard layout.....	1-2
1.1.3	Central Processing Unit (CPU).....	1-4
1.1.4	System memory.....	1-4
1.1.5	Expansion slots.....	1-6
1.1.6	Onboard LEDs.....	1-8
1.1.7	Headers.....	1-9
1.1.8	Internal connectors.....	1-10

Chapter 2: Basic Installation

2.1	Building your PC system.....	2-1
2.1.1	Motherboard installation.....	2-1
2.1.2	CPU installation.....	2-3
2.1.3	CPU heatsink and fan assembly installation.....	2-4
2.1.4	DIMM installation.....	2-6
2.1.5	ATX power connection.....	2-7
2.1.6	SATA device connection.....	2-7
2.1.7	Front I/O connector.....	2-8
2.1.8	Expansion card installation.....	2-9
2.1.9	M.2 installation.....	2-10
2.2	Motherboard rear and audio connections.....	2-13
2.2.1	Rear I/O connection.....	2-13
2.2.2	Audio I/O connections.....	2-15
2.3	Starting up for the first time.....	2-17
2.4	Turning off the computer.....	2-17

Chapter 3: BIOS Setup

3.1	Knowing BIOS.....	3-1
3.2	BIOS setup program.....	3-2
3.2.1	Advanced Mode.....	3-3
3.2.2	EZ Mode.....	3-6

3.2.3	Q-Fan Control	3-7
3.2.4	EZ Tuning Wizard	3-9
3.3	My Favorites	3-10
3.4	Main menu	3-12
3.5	Ai Tweaker menu.....	3-12
3.6	Advanced menu	3-13
3.6.1	AMD fTPM Configuration	3-13
3.6.2	CPU Configuration	3-13
3.6.3	NB Configuration.....	3-14
3.6.4	SATA Configuration	3-14
3.6.5	Onboard Devices Configuration.....	3-15
3.6.6	APM Configuration.....	3-16
3.6.7	PCI Subsystem Settings	3-17
3.6.8	Network Stack Configuration.....	3-17
3.6.9	HDD/SSD SMART Information	3-17
3.6.10	USB Configuration	3-17
3.7	Monitor menu	3-17
3.8	Boot menu	3-18
3.9	Tool menu.....	3-19
3.9.1	ASUS EZ Flash 3 Utility	3-19
3.9.2	Secure Erase	3-19
3.9.3	ASUS Overclocking Profile	3-20
3.9.4	ASUS SPD Information.....	3-21
3.9.5	Graphics Card Information.....	3-21
3.10	Exit menu.....	3-21
3.11	Updating BIOS.....	3-22
3.11.1	EZ Update.....	3-22
3.11.2	ASUS EZ Flash 3.....	3-23
3.11.3	ASUS CrashFree BIOS 3.....	3-25

Chapter 4: RAID Support

4.1	AMD RAID Array configurations.....	4-1
4.1.1	RAID definitions	4-1

Appendix

Notices	A-1
ASUS contact information.....	A-5

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 devices on it, 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 become wet.
- 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 description of the switches, jumpers, and connectors on the motherboard.
- **Chapter 2: Basic Installation**
This chapter lists the hardware setup procedures that you have to perform when installing system components.
- **Chapter 3: BIOS Setup**
This chapter tells how to change system settings through the BIOS Setup menus. Detailed descriptions of the BIOS parameters are also provided.
- **Chapter 4: RAID Support**
This chapter describes the RAID configurations.

Where to find more information

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

1. **ASUS website**
The ASUS website (www.asus.com) provides updated information on ASUS hardware and software products.
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 trying to complete a task.



CAUTION: Information to prevent damage to the components when trying to complete 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 (+).

ROG STRIX X470-F GAMING specifications summary

CPU	<p>AM4 socket for AMD Ryzen™ 2nd Generation/ Ryzen™ with Radeon™ Vega Graphics/ Ryzen™ 1st Generation/ 7th Generation A-Series/ Athlon X4 Processors</p> <p>Support CPU up to 8 cores*</p> <p>* Due to CPU limitation, CPU cores supported varies by processor. ** Refer to www.asus.com for the AMD CPU support list.</p>
Chipset	AMD X470 Chipset
Memory	<p>AMD Ryzen™ 2nd Generation Processors</p> <p>- 4 x DIMM, max. 64GB, DDR4 3466(O.C.)/ 3200(O.C.)/ 3000(O.C.)/ 2933(O.C.)/ 2800(O.C.)/ 2666/ 2400/ 2133 MHz, un-buffered memory</p> <p>AMD Ryzen™ with Radeon™ Vega Graphics/ Ryzen™ 1st Generation Processors</p> <p>- 4 x DIMM, max. 64GB, DDR4 3200(O.C.)/ 3000(O.C.)/ 2933(O.C.)/ 2800(O.C.)/ 2666/ 2400/ 2133 MHz, un-buffered memory</p> <p>AMD 7th Generation A-Series/ Athlon X4 Processors</p> <p>- 4 x DIMM, max. 64GB, DDR4 2400/ 2133 MHz, un-buffered memory</p> <p>Dual channel memory architecture</p> <p>* Refer to www.asus.com for the Memory QVL (Qualified Vendors List).</p>
Expansion slots	<p>AMD Ryzen™ 2nd Generation/ Ryzen™ 1st Generation Processors</p> <p>2 x PCIe 3.0 x16 SafeSlots (supports x16, x8/x8 mode)</p> <p>AMD Ryzen™ with Radeon™ Vega Graphics/ 7th Generation A-Series/ Athlon X4 Processors</p> <p>1 x PCIe 3.0 x16 SafeSlot (supports x8 mode)</p> <p>AMD X470 chipset</p> <p>- 1 x PCIe 2.0 x16 slot (max. at x4 mode)*</p> <p>- 3 x PCIe 2.0 x1 slots</p> <p>* The PCIe x16_3 slot shares bandwidth with PCIe x1_1 and PCIe x1_3.</p>
Graphics	<p>Integrated Graphics in the AMD Ryzen™ with Radeon™ Vega Graphics/ 7th Generation A-Series Processors</p> <p>Multi-VGA output support: HDMI and DisplayPort ports</p> <p>- Supports HDMI 1.4b with maximum resolution of 4096 x 2160 @24Hz/ 2560 x 1600 @60Hz</p> <p>- Supports DisplayPort 1.2 with maximum resolution of 4096 x 2160 @60Hz</p> <p>- Maximum shared memory of 2048 MB</p>
Multi-GPU support	<p>AMD Ryzen™ 2nd Generation/ Ryzen™ 1st Generation Processors</p> <p>- Supports NVIDIA® 2-Way SLI™ Technology</p> <p>- Supports AMD 3-way CrossFire™ Technology</p> <p>AMD Ryzen™ with Radeon™ Vega Graphics/ 7th Generation A-Series/ Athlon X4 Processors</p> <p>- Supports AMD 2-way CrossFireX™ Technology</p>

(continued on the next page)

ROG STRIX X470-F GAMING specifications summary

<p>Storage</p>	<p>AMD Ryzen™ 2nd Generation/ Ryzen™ with Radeon™ Vega Graphics/ Ryzen™ 1st Generation Processors</p> <ul style="list-style-type: none"> - M.2_1 socket 3 with M Key, Type 2242/ 2260/ 2280/ 22110(PCle 3.0 x4 mode and SATA mode) storage devices support <p>AMD 7th Generation A-Series/ Athlon X4 Processors</p> <ul style="list-style-type: none"> - M.2_1 socket 3 with M Key, Type 2242/ 2260/ 2280/ 22110(SATA mode) storage devices support <p>AMD X470 Chipset:</p> <ul style="list-style-type: none"> - M.2_2 socket 3* with M Key, Type 2242/ 2260/ 2280 (PCle 3.0 x2 mode and SATA mode) storage devices support - 6 x Serial ATA 6 Gb/s connectors <p>* The M.2_2 socket shares PCIe clock with PCIe x1_1. When PCIe x1_1 or PCIe x1_3 is occupied, the M.2_2 socket can only support SATA mode.</p>
<p>LAN</p>	<p>Intel® Ethernet Controller I211-AT</p> <p>Anti-surge LANGuard</p> <p>ROG GameFirst Technology</p>
<p>Audio</p>	<p>SupremeFX S1220A 8-Channel high-definition CODEC</p> <ul style="list-style-type: none"> - Supports up to 32-Bit/192kHz playback* - Impedance sense for front and rear headphone outputs - High quality 120 dB SNR stereo playback output and 113 dB SNR recording input - SupremeFX Shielding Technology - Dual OP Amplifiers - Jack-detection, Multi-streaming, and Front Panel Jack-retasking - Optical S/PDIF out port at back panel <p>Audio Features</p> <ul style="list-style-type: none"> - Sonic Studio III + Sonic Studio Link - Sonic Radar III <p>* Due to limitations in the HDA bandwidth, 32-Bit/192kHz is not supported for 8-Channel audio.</p>
<p>USB</p>	<p>AMD Ryzen™ 2nd Generation/ Ryzen™ with Radeon™ Vega Graphics/ Ryzen™ 1st Generation/ 7th Generation A-Series/ Athlon X4 Processors</p> <ul style="list-style-type: none"> - 4 x USB 3.1 Gen 1 ports (4 ports at back panel [blue]) <p>AMD X470 chipset</p> <ul style="list-style-type: none"> - 1 x USB 3.1 Gen 2 front panel connector - 4 x USB 3.1 Gen 1 ports (2 ports at back panel [1 x Type-A and 1 x Type C], 2 ports at mid-board) - 4 x USB 2.0 ports at mid-board <p>ASMedia USB 3.1 controller</p> <ul style="list-style-type: none"> - 2 x USB 3.1 Gen 2 ports (2 ports at back panel [red])

(continued on the next page)

ROG STRIX X470-F GAMING specifications summary

ROG Exclusive Features	ROG RAMCache II ROG GameFirst IV* ROG Overwolf ROG CPU-Z * ROG GameFirst IV is only available for Windows® 10 64-bit.
Special Features	<p>Performance Optimization</p> <p>5-Way Optimization</p> <ul style="list-style-type: none"> - Whole system optimization with a single click! Perfectly consolidates better CPU performance, power saving, digital power control, system cooling and app usages. <p>Digi+VRM</p> <p>EPU</p> <ul style="list-style-type: none"> - EPU <p>TPU</p> <ul style="list-style-type: none"> - Auto Tuning, TurboV, GPU Boost <p>Fan Xpert 4</p> <ul style="list-style-type: none"> - featuring Fan Auto Tuning function and multiple thermistors selection for optimized system cooling control <p>ASUS EZ DIY</p> <ul style="list-style-type: none"> - ASUS CrashFree BIOS 3 - ASUS EZ Flash 3 <p>ASUS Q-Design</p> <ul style="list-style-type: none"> - Q-LED (CPU, DRAM, VGA, Boot Device LED) - Q-Slot - Q-DIMM <p>Gamer's Guardian</p> <ul style="list-style-type: none"> - SafeSlot - Digi+ VRM - DRAM Overcurrent Protection - ESD Guards on LAN, Audio, KBMS and USB ports - Highly Durable Components - Pre-mounted I/O Shield <p>ASUS Exclusive Features</p> <ul style="list-style-type: none"> - AURA Lighting Control - AI Suite 3 - AI Charger
Back I/O Ports	1 x PS/2 keyboard/ mouse combo port 1 x HDMI port 1 x DisplayPort 2 x USB 3.1 Gen 2 ports (2 x Type-A [red]) 6 x USB 3.1 Gen 1 ports (5 x Type-A [blue] and 1 x Type C)

(continued on the next page)

ROG STRIX X470-F GAMING specifications summary

Back I/O Ports	<ul style="list-style-type: none"> 1 x Anti-surge LAN (RJ45) port 1 x Optical S/PDIF out 5 x Audio jacks
Internal I/O Ports	<ul style="list-style-type: none"> 1 x USB 3.1 Gen 2 front panel connector 1 x USB 3.1 Gen 1 connector supports additional 2 USB 3.1 Gen 1 ports 2 x USB 2.0 connectors support additional 4 USB 2.0 ports 1 x TPM connector 6 x SATA 6 Gb/s connectors 1 x M.2_1 Socket 3 for M Key, type 2242/ 2260/ 2280/ 22110 storage devices support 1 x M.2_2 Socket 3 for M Key, type 2242/ 2260/ 2280 storage devices support 1 x 4-pin CPU fan connector 1 x 4-pin CPU_OPT fan connector 1 x 4-pin AIO_PUMP connector 1 x 4-pin W_PUMP+ connector 3 x 4-pin Chassis fan connectors 1 x Thermal sensor connector 2 x AURA RGB headers 1 x AURA Addressable header 1 x 24-pin EATX power connector 1 x 8-pin EATX 12V power connector 1 x System panel connector 1 x Front panel audio connector (AAFP) 1 x COM connector 1 x Clear CMOS jumper (2-pin)
BIOS	256 Mb Flash ROM, UEFI AMI BIOS, PnP, WfM2.0, SM BIOS 3.0, ACPI 6.0, Multi-language BIOS, ASUS EZ Flash 3, CrashFree BIOS 3, F11 EZ Tuning Wizard, F6 Q-fan Control, F3 My Favorites, Last Modified log, F12 PrintScreen, Secure Erase, User Profile, F4 AURA ON/OFF, F9 Search, and ASUS DRAM SPD (Serial Presence Detect) memory information
Manageability	WOL, WOR, PXE
Support DVD contents	<ul style="list-style-type: none"> Drivers ASUS Utilities Anti-virus software (OEM version)
Operating System Support	Windows® 10 64-bit
Form Factor	ATX Form Factor, 12"x 9.6" (30.5 cm x 24.4 cm)



Specifications are subject to change without notice.

Package contents

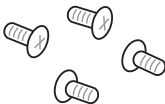


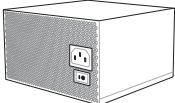
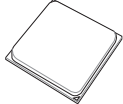
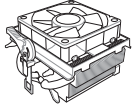
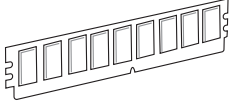
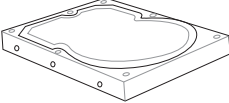
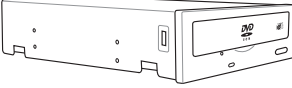
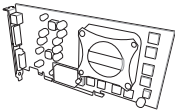
Check your motherboard package for the following items.

Motherboard	ROG STRIX X470-F GAMING
Cables	4 x SATA 6 Gb/s cables
	1 x SLI™ HB Bridge(2-WAY-M)
	1 x RGB LED extension cable
	1 x RGB Addressable LED extension cable
Accessories	1 x ROG STRIX door hanger
	1 x ROG Strix sticker
	1 x M.2 Screw Package
	1 x Cable Tie Package
	1 x ROG thank you card
Application DVD	ROG motherboard support DVD
Documentation	User guide



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

Installation tools and components

	
1 Bag of screws	Phillips (cross) screwdriver
	
PC chassis	Power supply unit
	
AMD AM4 CPU	AMD AM4/AM3 compatible CPU Fan
	
DDR4 DIMM	SATA hard disk drive
	
SATA optical disc drive (optional)	Graphics card (optional)



The tools and components in the table above are not included in the motherboard package.

Product Introduction

1

1.1 Motherboard overview

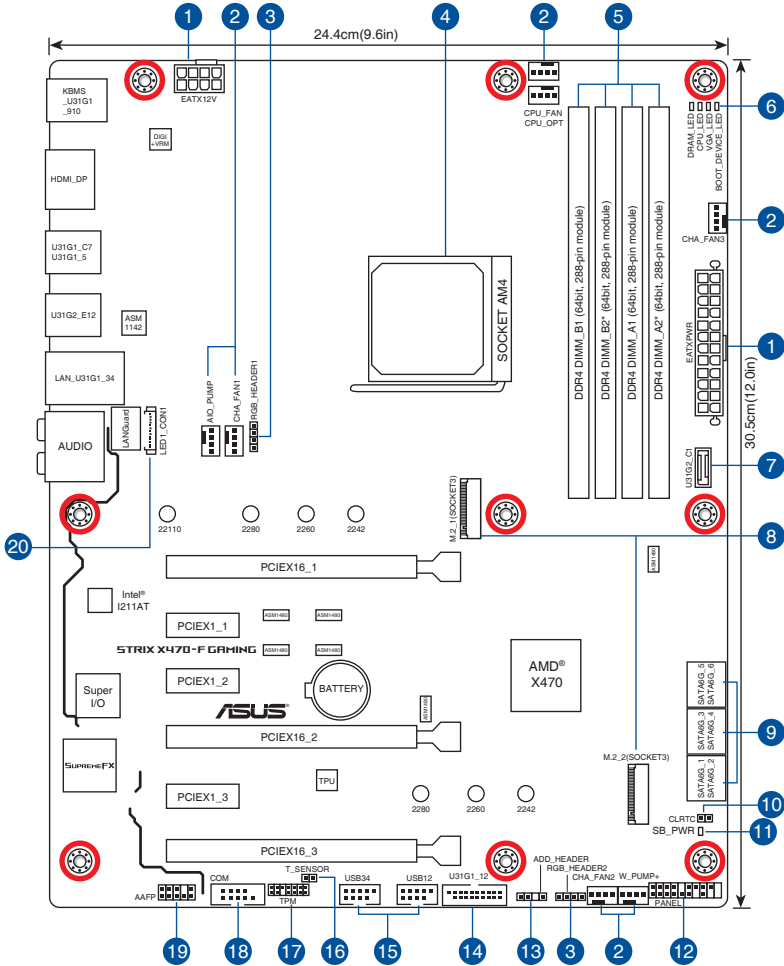
1.1.1 Before you proceed

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.
-

1.1.2 Motherboard layout



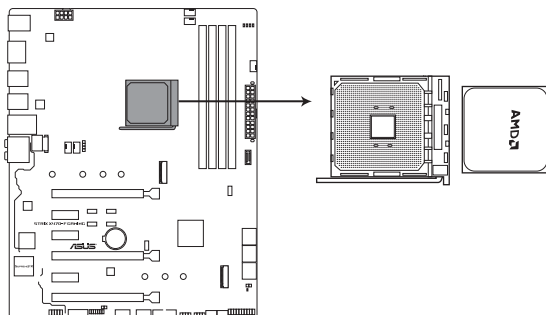
Refer to **1.1.8 Internal connectors** and **2.2.1 Rear I/O connection** for more information about rear panel connectors and internal connectors.

Layout contents

Connectors/Jumpers/Buttons and switches/Slots	Page
1. ATX power connectors (24-pin EATXPWR; 8-pin EATX12V)	1-16
2. CPU, CPU optional, and chassis fan connectors; water pump+, and AIO pump connectors (4-pin CPU_FAN, 4-pin CPU_OPT, 4-pin CHA_FAN1-3; 4-pin W_PUMP+, 4-pin AIO_PUMP)	1-15
3. AURA RGB headers (4-pin RGB_HEADER1-2)	1-17
4. AM4 CPU socket	1-4
5. DDR4 DIMM slots	1-4
6. Q LEDs (DRAM, CPU, VGA, BOOT)	1-8
7. USB 3.1 Gen 2 front panel connector (U31G2_C1)	1-12
8. M.2 Socket 3	1-18
9. AMD Serial ATA 6 Gb/s connectors (7-pin SATA6G_1-6)	1-11
10. Clear RTC RAM jumper (2-pin CLRTC)	1-9
11. Standby power LED (SB_PWR)	1-8
12. System panel connectors (20-5 pin PANEL)	1-14
13. Addressable RGB header (4-1 pin ADD_HEADER)	1-19
14. USB 3.1 Gen 1 connector (20-1 pin U31G1_12)	1-12
15. USB 2.0 connectors (10-1 pin USB12, USB34)	1-13
16. Thermal sensor connector (2-pin T_SENSOR)	1-13
17. TPM connector (14-1 pin TPM)	1-10
18. Serial port connector (10-1 pin COM)	1-20
19. Front panel audio connector (10-1 pin AAFP)	1-10
20. LED connector (13-pin LED1_CON1)	1-16

1.1.3 Central Processing Unit (CPU)

The motherboard comes with an AM4 socket designed for AMD Ryzen™ 2nd Generation/ Ryzen™ with Radeon™ Vega Graphics/ Ryzen™ 1st Generation/ 7th Generation A-Series/ Athlon X4 processors up to 8 cores.



ROG STRIX X470-F GAMING CPU socket AM4



The AM4 socket has a different pinout design. Ensure that you use a CPU designed for the AM4 socket. The CPU fits in only one correct orientation. **DO NOT** force the CPU into the socket to prevent bending the connectors on the socket and damaging the CPU!



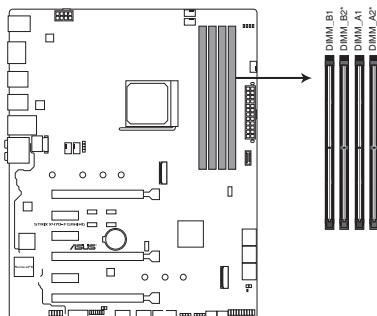
Ensure that all power cables are unplugged before installing the CPU.

1.1.4 System memory

The motherboard comes with four Double Data Rate 4 (DDR4) Dual Inline Memory Modules (DIMM) slots.

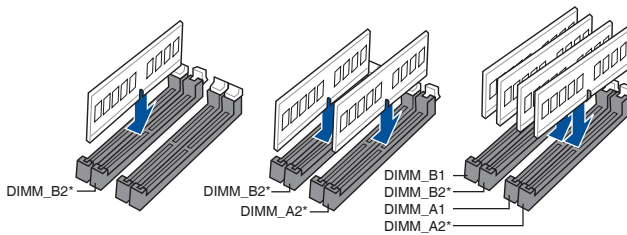


A DDR4 module is notched differently from a DDR, DDR2, or DDR3 module. **DO NOT** install a DDR, DDR2, or DDR3 memory module to the DDR4 slot.



ROG STRIX X470-F GAMING 288-pin DDR4 DIMM sockets

Recommended memory configurations



Memory configurations

You may install 2 GB, 4 GB, 8 GB, and 16 GB unbuffered DDR4 DIMMs into the DIMM sockets.



- 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.
- This motherboard does not support DIMMs made up of 512 Mb (64 MB) chips or less (Memory chip capacity counts in Megabit, 8 Megabit/Mb = 1 Megabyte/MB).

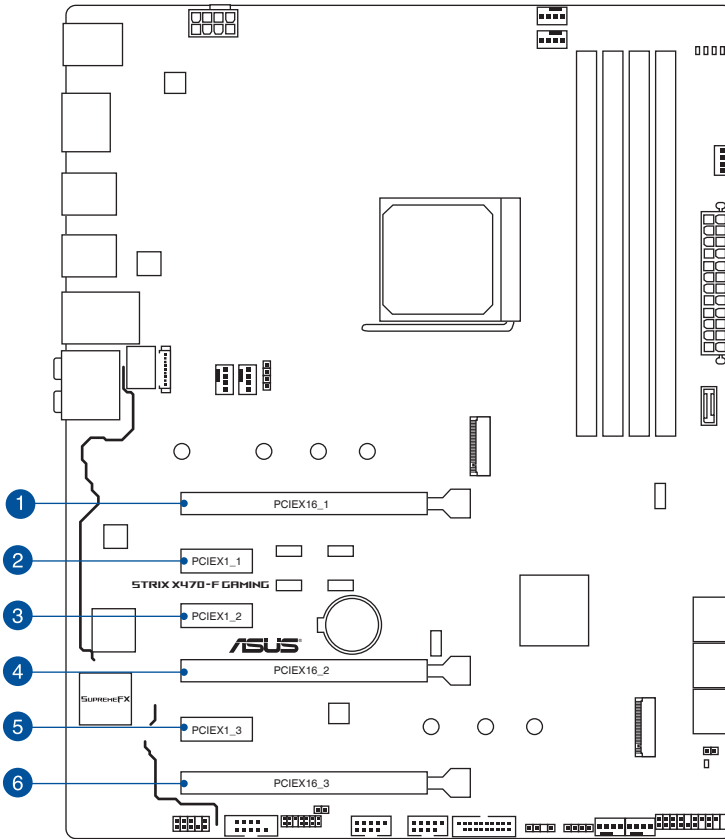


- The default memory operation frequency is dependent on its Serial Presence Detect (SPD), which is the standard way of accessing information from a memory module. Under the default state, some memory modules for overclocking may operate at a lower frequency than the vendor-marked value.
- For system stability, use a more efficient memory cooling system to support a full memory load (4 DIMMs) or overclocking condition.
- 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.

1.1.5 Expansion slots



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



Slot No.	Slot Description
1	PCIe 3.0 x16_1 slot
2	PCIe 2.0 x1_1 slot
3	PCIe 2.0 x1_2 slot
4	PCIe 3.0 x16_2 slot
5	PCIe 2.0 x1_3 slot
6	PCIe 2.0 x16_3 slot

AMD Ryzen™ 2nd Generation/ Ryzen™ 1st Generation Processors

VGA Configuration	PCIe operating mode	
	PCIe 3.0 x16_1	PCIe 3.0 x16_2
Single VGA/PCIe card	x16	N/A
Dual VGA/PCIe card	x8	x8

AMD Ryzen™ with Radeon™ Vega Graphics/ 7th Generation A-Series/ Athlon X4 Processors

VGA Configuration	PCIe operating mode		
	PCIe 3.0 x16_1	PCIe 3.0 x16_2	PCIe 2.0 x16_3
Single VGA/PCIe card	x8	N/A	N/A
Dual VGA/PCIe card	x8	N/A	x4 (PCIe 2.0, from chipset)

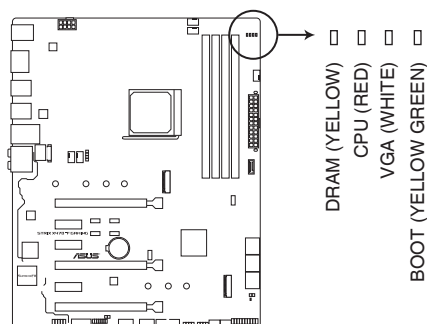


- We recommend that you provide sufficient power when running CrossFireX or SLI® mode.
- Connect chassis fans to the motherboard chassis fan connectors when using multiple graphics cards for better thermal environment.

1.1.6 Onboard LEDs

1. Q LEDs (DRAM, CPU, VGA, BOOT)

Q LEDs check key components (DRAM, CPU, VGA card, and booting devices) in sequence during motherboard booting process. If an error is found, the corresponding LED remains lit until the problem is solved. This user-friendly design provides an intuitive way to locate the root problem within seconds.



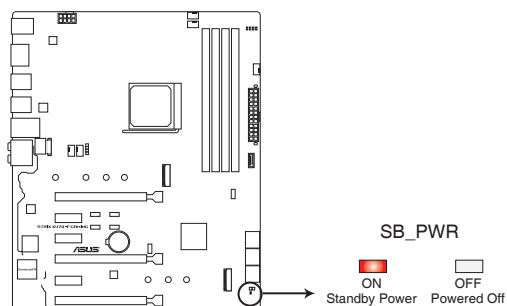
ROG STRIX X470-F GAMING DRAM/CPU/VGA/BOOT_DEVICE LED



The order which the LEDs light up may vary per CPU.

2. Standby Power LED (SB_PWR)

The motherboard comes with a standby power LED. The LED lights up to indicate that the system is ON, in sleep mode, or in soft-off mode. This is a reminder that you should shut down the system and unplug the power cable before removing or plugging in any motherboard component. The illustration below shows the location of the onboard LED.

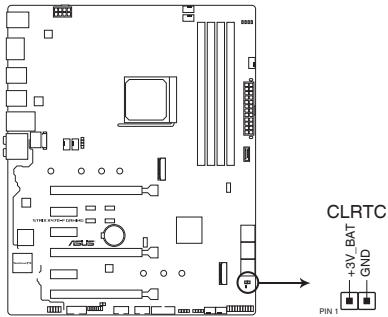


ROG STRIX X470-F GAMING Standby power LED

1.1.7 Headers

1. Clear RTC RAM jumper (2-pin CLRRTC)

This jumper allows you to clear the CMOS RTC RAM data of the system setup information such as date, time, and system passwords.



ROG STRIX X470-F GAMING 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.

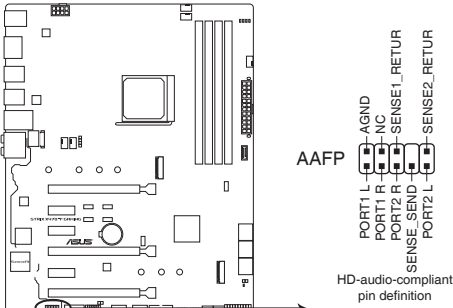


If the steps above do not help, remove the onboard battery and short the two pins again to clear the CMOS RTC RAM data. After clearing the CMOS, reinstall the battery.

1.1.8 Internal connectors

1. 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. Connect one end of the front panel audio I/O module cable to this connector.



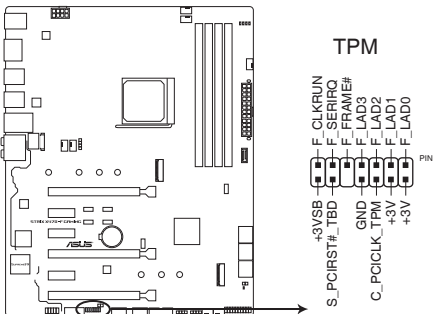
ROG STRIX X470-F GAMING Front panel audio connector



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.

2. TPM connector (14-1 pin TPM)

This connector supports a Trusted Platform Module (TPM) system, which securely stores keys, digital certificates, passwords and data. A TPM system also helps enhance network security, protect digital identities, and ensures platform integrity.



ROG STRIX X470-F GAMING TPM connector

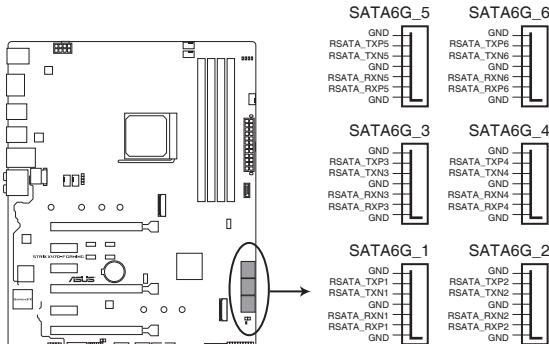


The TPM module is purchased separately.

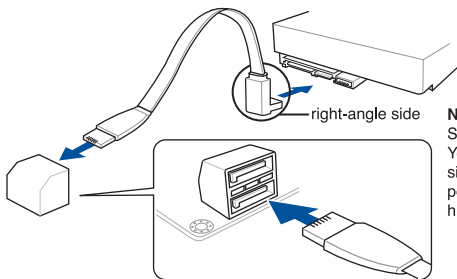
3. AMD Serial ATA 6 Gb/s connectors (7-pin SATA6G_1-6)

These connectors connect to Serial ATA 6 Gb/s hard disk drives via Serial ATA 6 Gb/s signal cables.

If you installed Serial ATA hard disk drives, you can create a RAID 0, RAID 1, and RAID 10 configuration through the onboard AMD X470 chipset.



ROG STRIX X470-F GAMING Intel® SATA 6 Gb/s connectors



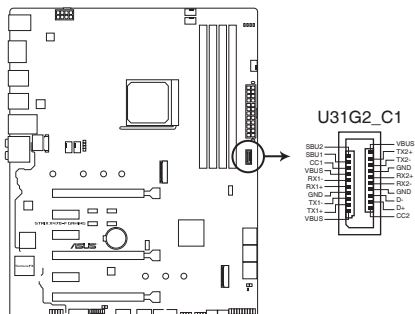
NOTE: Connect the right-angle side of SATA signal cable to SATA device. You may also connect the right-angle side of SATA cable to the onboard SATA port to avoid mechanical conflict with huge graphics cards.



- These connectors are set to **[AHCI]** by default. If you intend to create a Serial ATA RAID set using these connectors, set the SATA Mode Selection item in the BIOS to **[RAID]**.
- Before creating a RAID set, refer to section **RAID configurations** or the manual bundled in the motherboard support DVD.
- When using NCQ, set the SATA Mode in the BIOS to **[AHCI]**. Refer to section **SATA Configuration** for details.

4. USB 3.1 Gen 2 front panel connector (U31G2_C1)

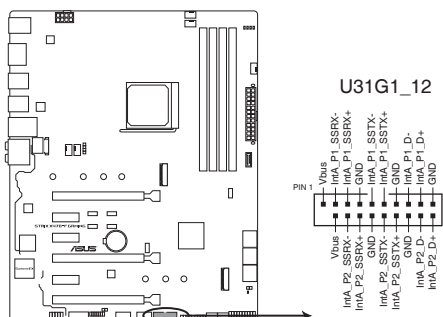
This connector allows you to connect a USB 3.1 Gen 2 module for additional USB 3.1 Gen 2 ports. The latest USB 3.1 Gen 2 connectivity provides data transfer speeds of up to 10 Gbps. The next-generation standard is completely backward-compatible with your existing USB devices.



**ROG STRIX X470-F GAMING
USB 3.1 Gen 2 front panel connector**

5. USB 3.1 Gen 1 connector (20-pin U31G1_12)

This connector allows 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 Gb/s, faster charging time for USB-chargeable devices, optimized power efficiency, and backward compatibility with USB 2.0.



ROG STRIX X470-F GAMING USB 3.1 Gen 1 connector



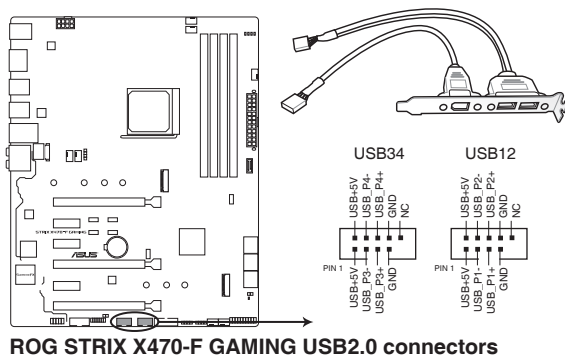
The USB 3.1 Gen 1 module is purchased separately.



The plugged USB 3.1 Gen 1 device may run on xHCI or EHCI mode depending on the operating system's setting.

6. USB 2.0 connectors (10-1 pin USB12; USB34)

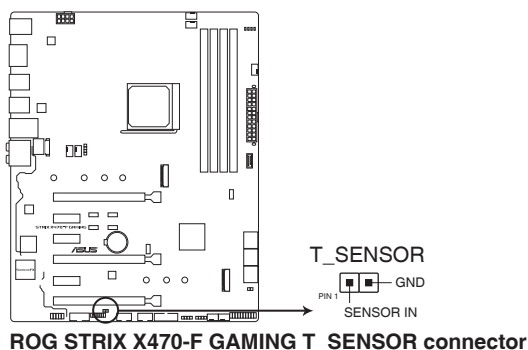
These connectors are for USB 2.0 ports. Connect the USB module cable to any of these connectors, then install the module to a slot opening at the back of the system chassis. These USB connectors comply with USB 2.0 specification that supports up to 480 Mb/s connection speed.



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

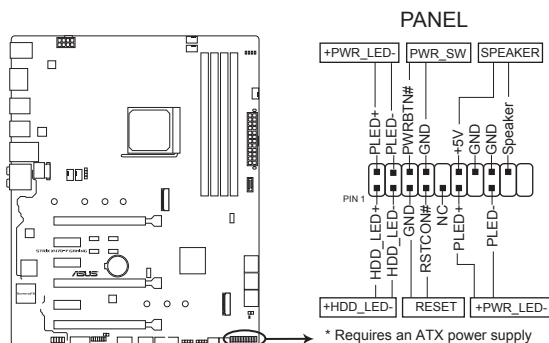
7. Thermal sensor connector (2-pin T_SENSOR)

This connector is for the thermistor cable that allows you to monitor the temperature of your motherboard's critical components and connected devices.



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

This connector supports several chassis-mounted functions.



ROG STRIX X470-F GAMING System panel connector

- **System power LED (2-pin or 3-1 pin PLED)**

The 2-pin or 3-1 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 PWRSW)**

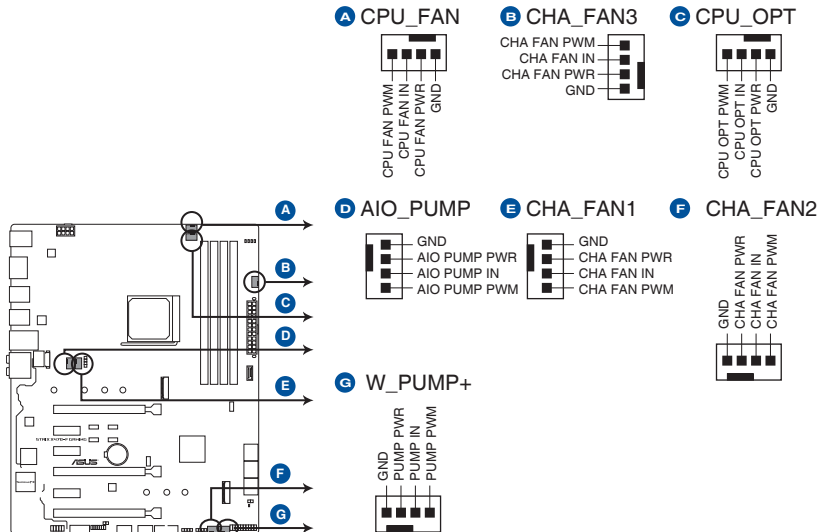
This connector is for the system power button. Pressing the power button turns the system on or puts the system in sleep or soft-off mode depending on the operating system settings. Pressing the power switch for more than four seconds while the system is ON turns the system OFF.

- **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.

9. CPU, CPU optional, and chassis fan connectors; water pump+, and AIO pump connectors (4-pin CPU_FAN, 4-pin CPU_OPT, 4-pin CHA_FAN1-3; 4-pin W_PUMP+, 4-pin AIO_PUMP)

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.



ROG STRIX X470-F GAMING 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 to fully insert the 4-pin CPU fan cable to the CPU fan connector.

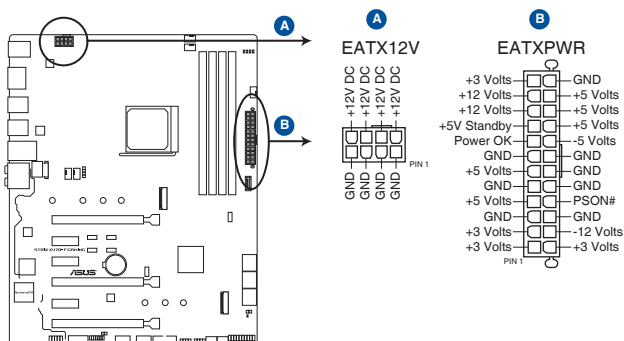


- Connect the pump cable from the all-in-one cooler (AIO cooler) to the AIO_PUMP header, and connect the fan cables to the CPU_FAN and/or CPU_OPT header(s).
- W_PUMP+ function support depends on water cooling device.

Header	Max. Current	Max. Power	Default Speed	Shared Control
CPU_FAN	1A	12W	Q-Fan Controlled	A
CPU_OPT	1A	12W	Q-Fan Controlled	A
CHA_FAN1	1A	12W	Q-Fan Controlled	-
CHA_FAN2	1A	12W	Q-Fan Controlled	-
CHA_FAN3	1A	12W	Q-Fan Controlled	-
AIO_PUMP	1A	12W	Full Speed	B
W_PUMP+	3A	36W	Full Speed	B

10. ATX power connectors (24-pin EATXPWR; 8-pin EATX12V)

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.



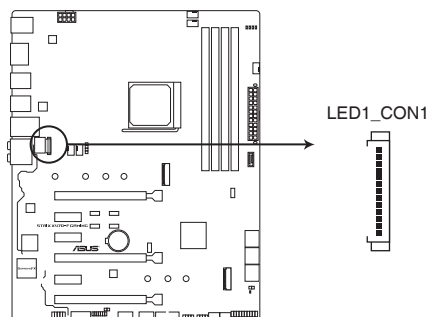
ROG STRIX X470-F GAMING ATX power connectors



- 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 8-pin EATX12 V power plug. Otherwise, the system will not boot.
- We recommend that you use a PSU with a higher power output when configuring a system with more power-consuming devices. The system may become unstable or may not boot up if the power is inadequate.
- If you want to use two or more high-end PCIe x16 cards, use a PSU with 1000W power or above to ensure the system stability.

11. LED connector (13-pin LED1_CON1)

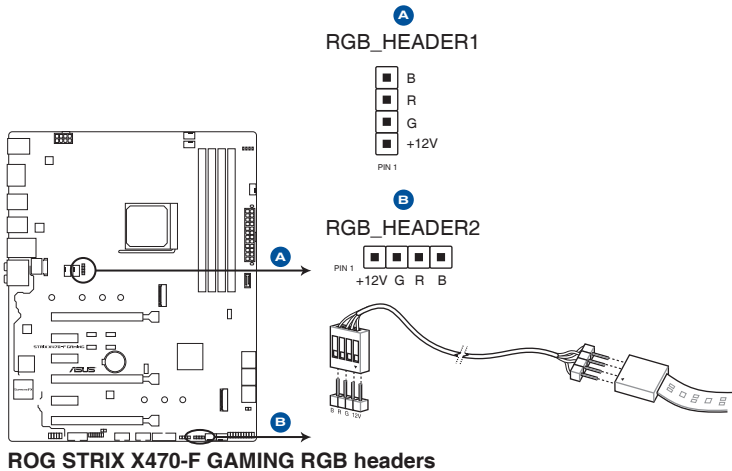
This connector is for connecting the LED strip on your back I/O cover.



ROG STRIX X470-F GAMING LED_CON

12. AURA RGB headers (4-pin RGB_HEADER1-2)

These connectors are 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.



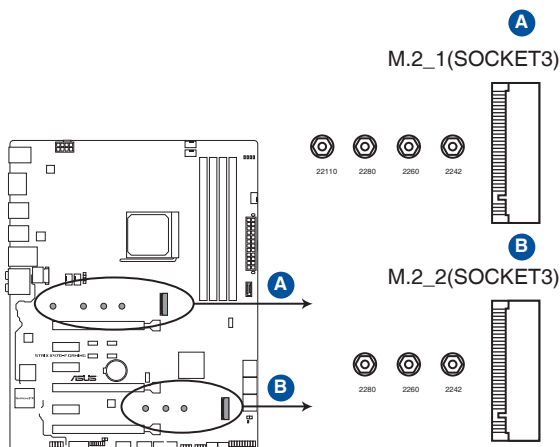
Before you install or remove any component, ensure that the ATX power supply is switched off or the power cord is detached from the power supply. Failure to do so may cause severe damage to the motherboard, peripherals, or components.



- 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 strip is purchased separately.

13. M.2 sockets (M.2_1; M.2_2)

These sockets allow you to install M.2 SSD modules.



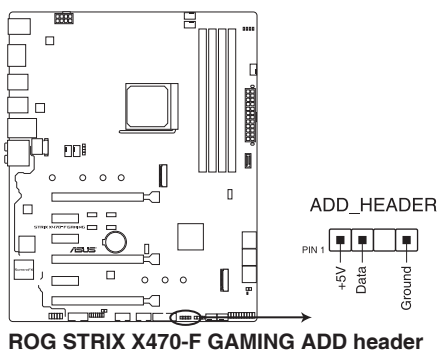
ROG STRIX X470-F GAMING M.2 sockets

- For AMD Ryzen™ 2nd Generation/ Ryzen™ with Radeon™ Vega Graphics/ Ryzen™ 1st Generation processors, the M.2_1 socket supports PCIe 3.0 x4 mode and SATA mode M Key design and type 2242 / 2260 / 2280 / 22110 storage devices.
- For AMD 7th Generation A-Series/ Athlon X4 processors, the M.2_1 socket supports SATA mode M Key design and type 2242 / 2260 / 2280 / 22110 storage devices.
- The M.2_2 socket supports PCIe 3.0 x2 mode and SATA mode M Key design and type 2242/ 2260/ 2280 storage devices.
- The M.2_2 socket shares PCIe clock with PCIe x1_1. When PCIe x1_1 or PCIe x1_3 is occupied, the M.2_2 socket can only support SATA mode.

The M.2 SSD module is purchased separately.

13. Addressable RGB header (4-1 pin ADD_HEADER)

This connector is for individually addressable RGB WS2812B LED strips or WS2812B based LED strips.



The addressable RGB header supports WS2812B addressable RGB LED strips (5V/Data/Ground), with a maximum power rating of 3A (5V) and a maximum of 60 LEDs.



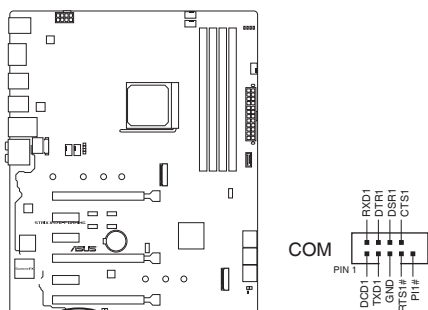
Before you install or remove any component, ensure that the ATX power supply is switched off or the power cord is detached from the power supply. Failure to do so may cause severe damage to the motherboard, peripherals, or components.



- Actual lighting and color will vary with LED strip.
- If your LED strip does not light up, check if the addressable RGB LED strip is connected in the correct orientation, and the 5V connector is aligned with the 5V header on the motherboard.
- The addressable RGB LED strip will only light up under the operating system.
- The addressable RGB LED strip is purchased separately.

14. 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.



ROG STRIX X470-F GAMING Serial port connector



The COM module is purchased separately.

Basic Installation

2

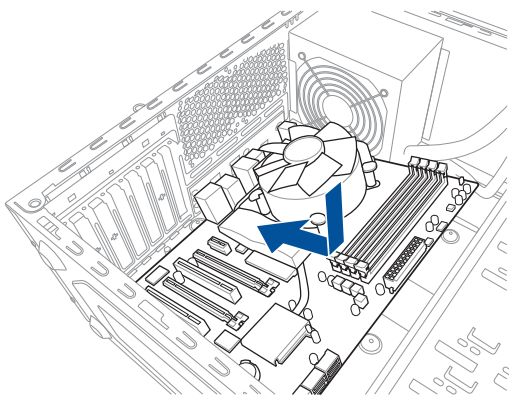
2.1 Building your PC system



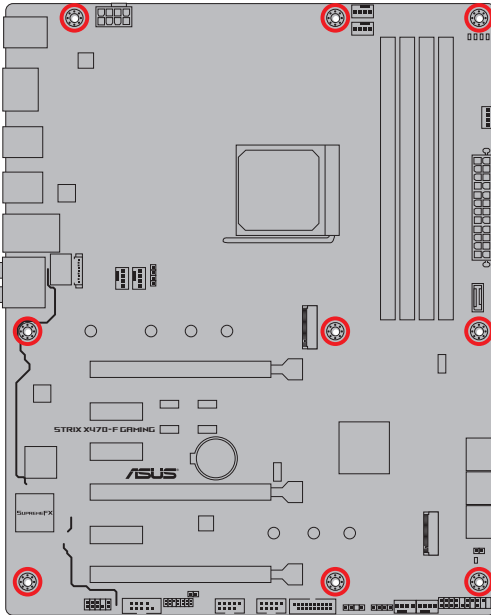
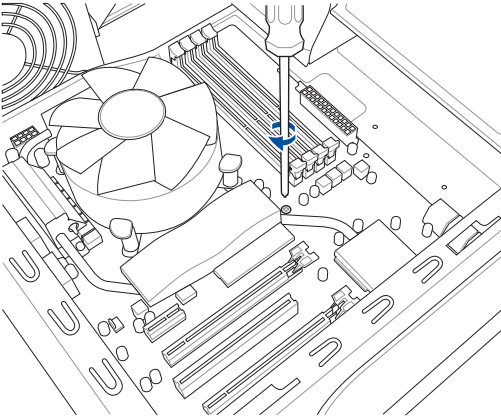
The diagrams in this section are for reference only. The motherboard layout may vary with models, but the installation steps are the same for all models.

2.1.1 Motherboard installation

1. Place the motherboard into the chassis, ensuring that its rear I/O ports are aligned to the chassis' rear I/O panel.



2. Place nine (9) screws into the holes indicated by circles to secure the motherboard to the chassis.

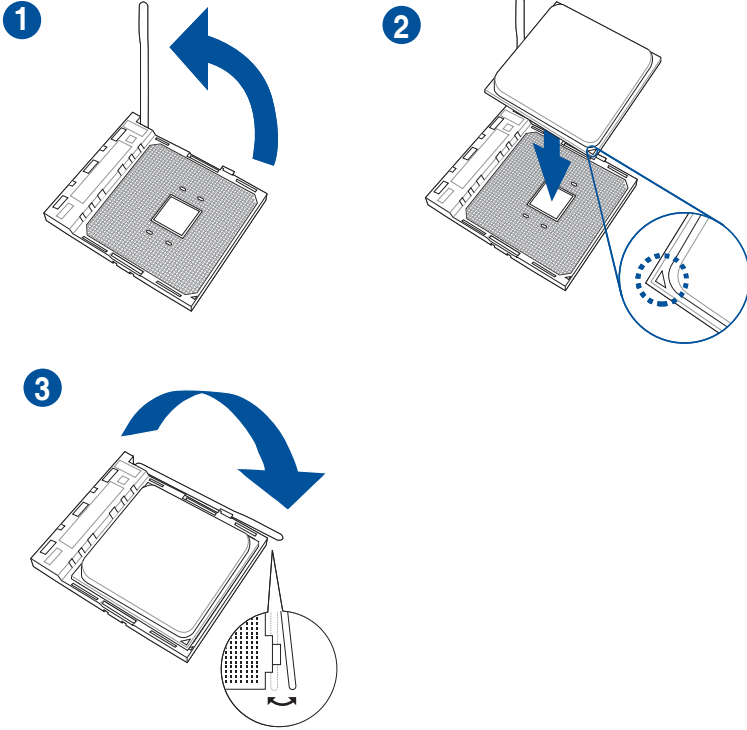


DO NOT over tighten the screws! Doing so can damage the motherboard.

2.1.2 CPU installation



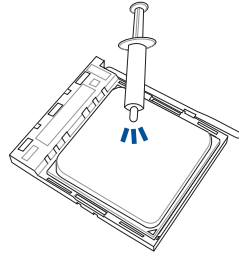
The AMD AM4 socket is compatible with AMD AM4 processors. Ensure you use a CPU designed for the AM4 socket. The CPU fits in only one correct orientation. **DO NOT** force the CPU into the socket to prevent bending the connectors on the socket and damaging the CPU!



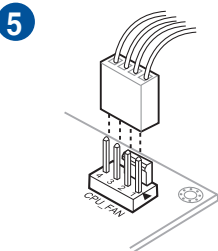
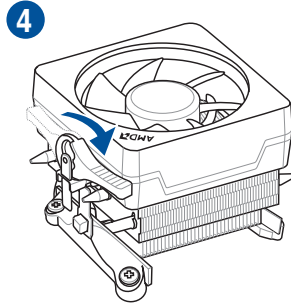
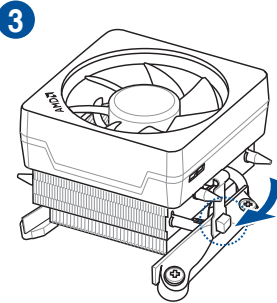
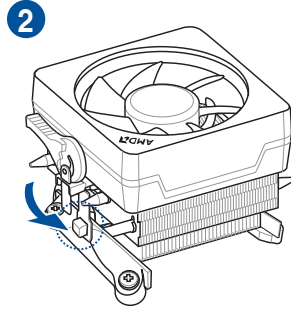
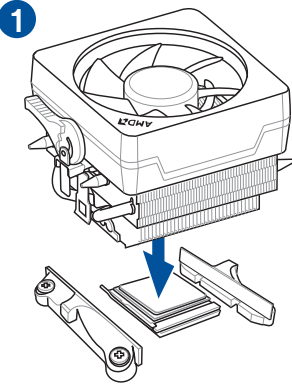
2.1.3 CPU heatsink and fan assembly installation



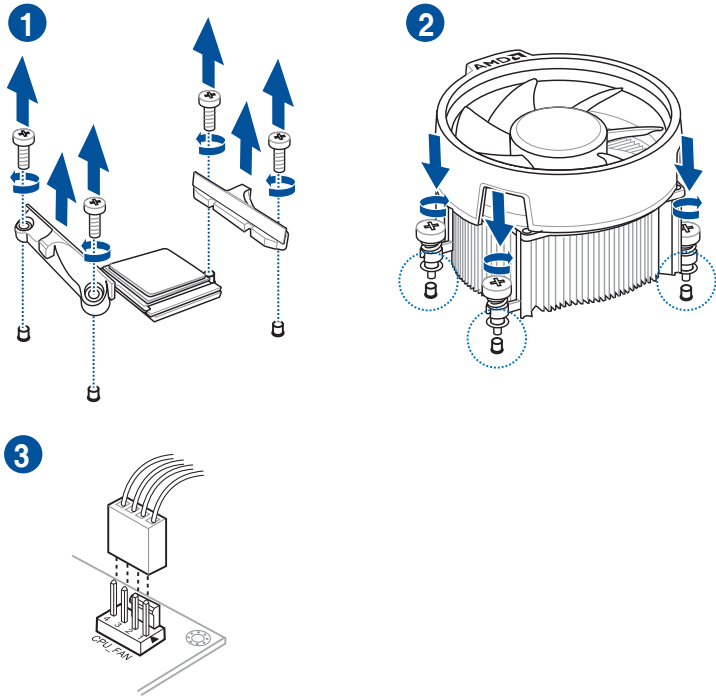
Apply the Thermal Interface Material to the CPU heatsink and CPU before you install the heatsink and fan if necessary.



Type 1



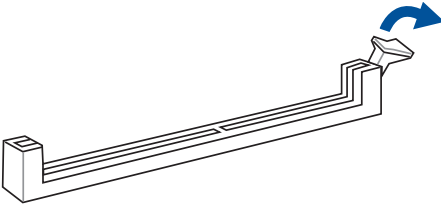
Type 2



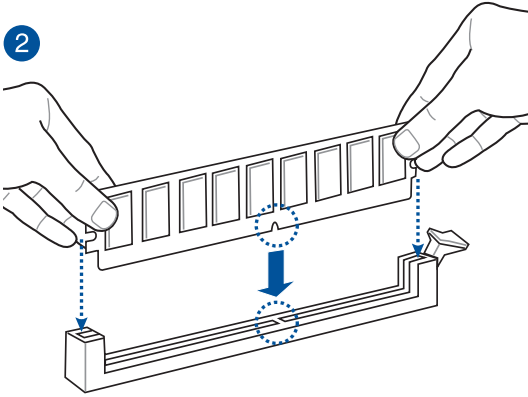
When using this type of CPU fan, remove the screws and the retention module only. Do not remove the plate on the bottom.

2.1.4 DIMM installation

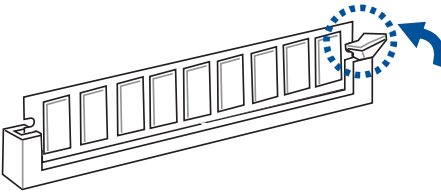
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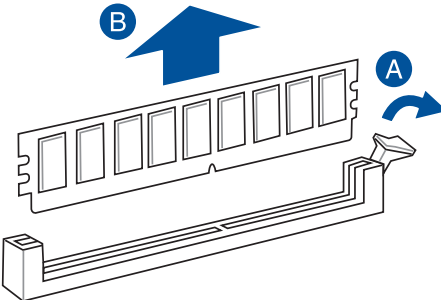
2



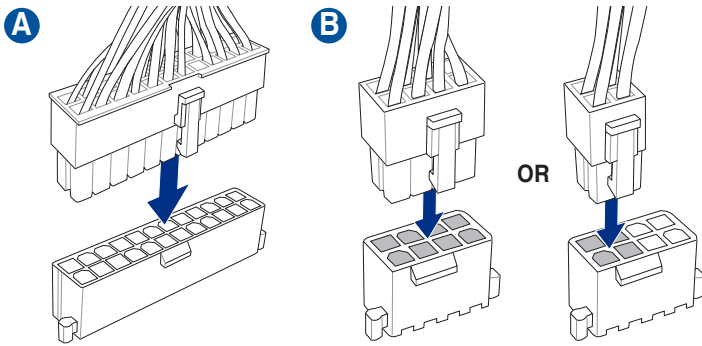
3



To remove a DIMM

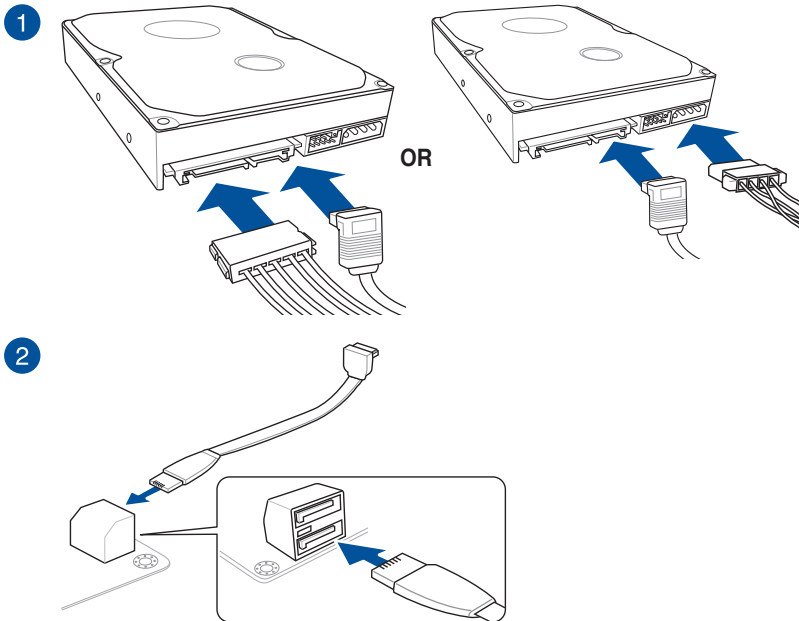


2.1.5 ATX power connection



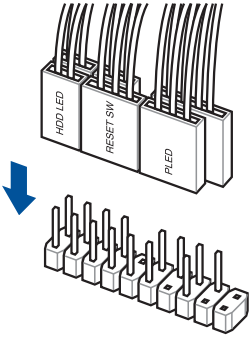
Ensure to connect the 8-pin power plug.

2.1.6 SATA device connection

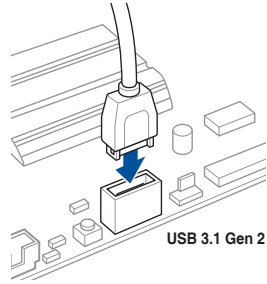


2.1.7 Front I/O connector

To install the front panel connector

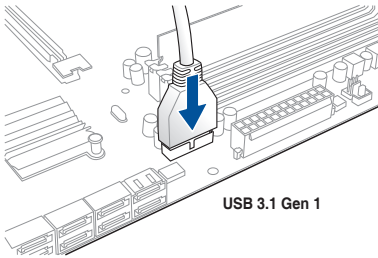


To install USB 3.1 Gen 2 connector

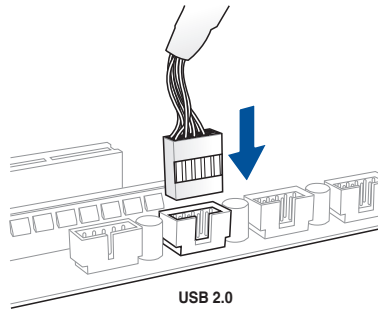


This connector will only fit in one orientation. Push the connector until it clicks into place.

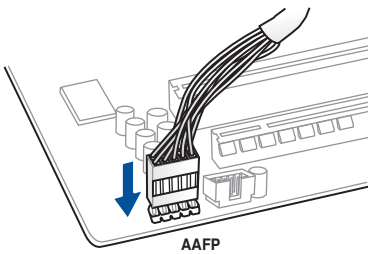
To install USB 3.1 Gen 1 connector



To install USB 2.0 connector

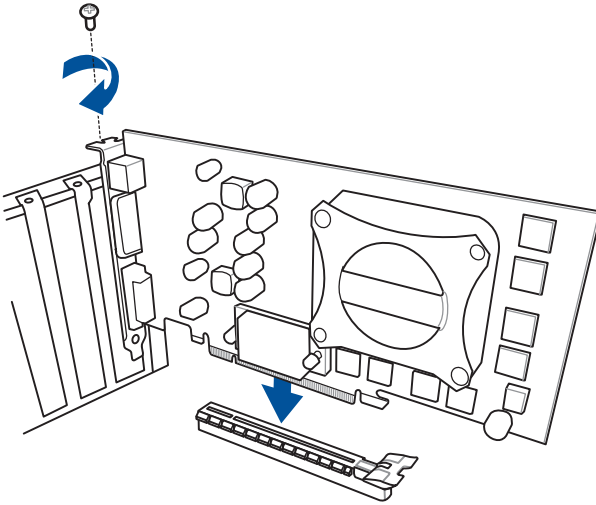


To install front panel audio connector

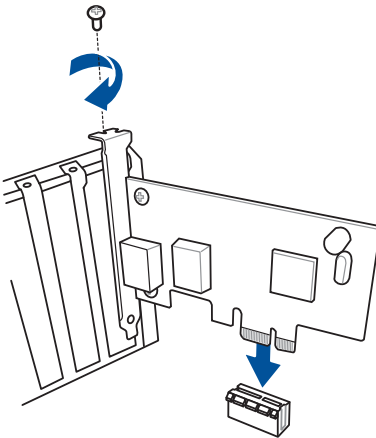


2.1.8 Expansion card installation

To install PCIe x16 cards



To install PCIe x1 cards



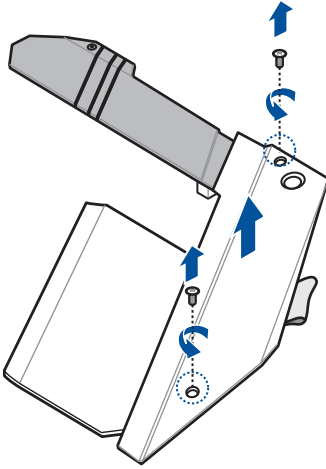
2.1.9 M.2 installation



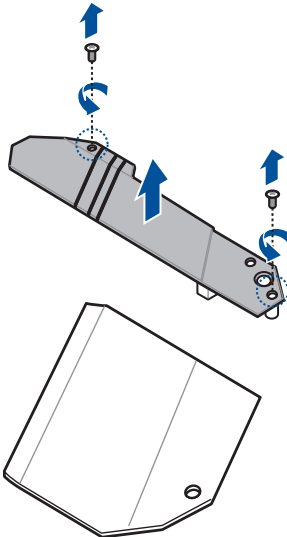
Supported M.2 type varies per motherboard.

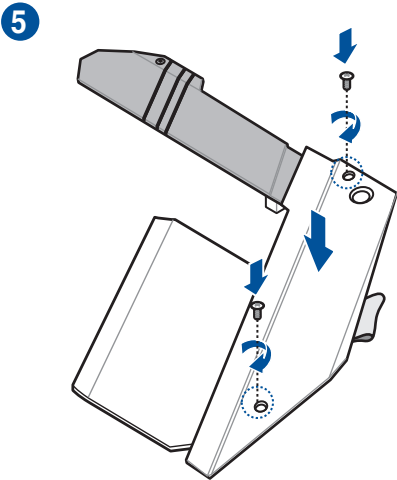
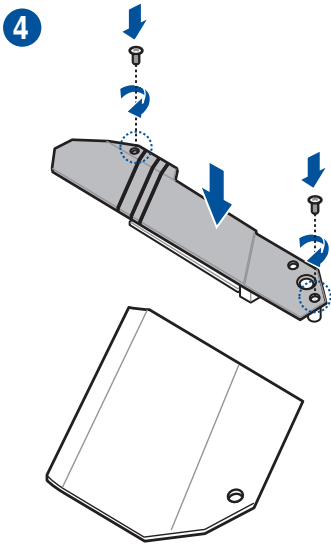
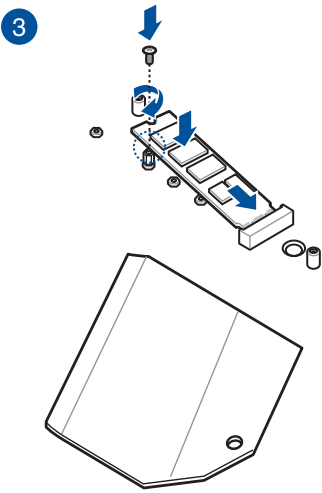
M.2_1 installation

1



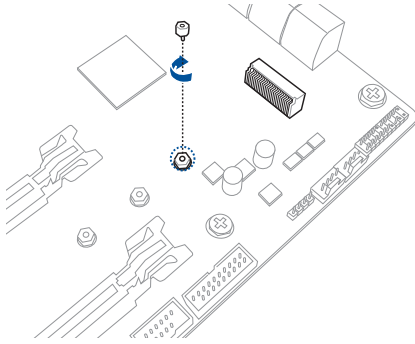
2



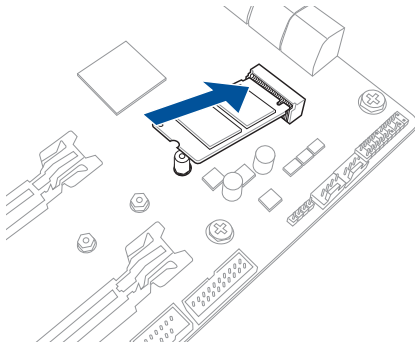


M.2_2 installation

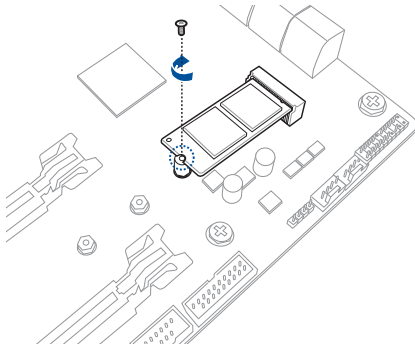
1



2

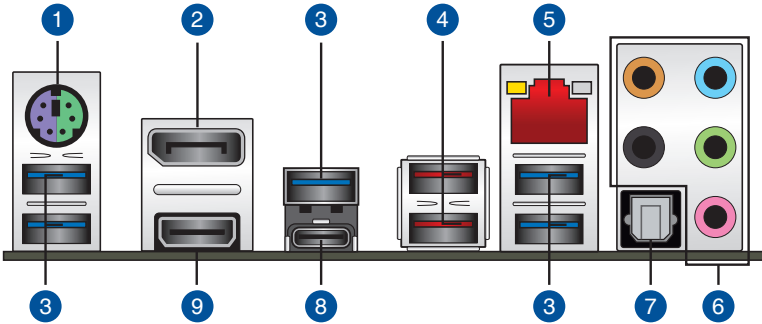


3



2.2 Motherboard rear and audio connections

2.2.1 Rear I/O connection



Rear panel connectors

1.	PS/2 keyboard/ mouse combo port
2.	DisplayPort
3.	USB 3.1 Gen 1 ports
4.	USB 3.1 Gen 2 ports
5.	LAN (RJ-45) port*
6.	Audio I/O ports**
7.	Optical S/PDIF OUT port
8.	USB 3.1 Gen 1 port (Type-C)
9.	HDMI port

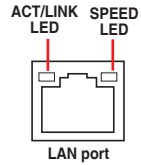
* and **: Refer to the tables on the next page for LAN port LEDs, and audio port definitions.



- USB 3.1 Gen 2 / Gen 1 devices can only be used for data storage.
- Due to the design of AMD AM4 series chipset, all USB devices connected to the USB 2.0 and USB 3.1 Gen 1 / Gen 2 ports are controlled by the xHCI controller.
- 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.

*** LAN ports LED indications**

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

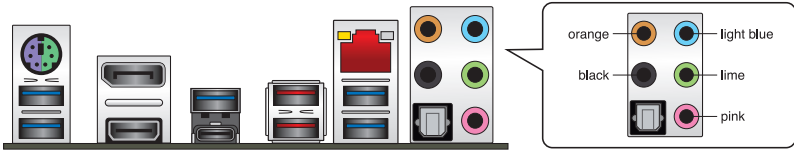


**** Audio 2, 4, 6 or 8-channel configuration**

Port	Headset 2-channel	4-channel	6-channel	8-channel
Light Blue	Line In	Line In	Line In	Side Speaker Out
Lime	Line Out	Front Speaker Out	Front Speaker Out	Front Speaker Out
Pink	Mic In	Mic In	Mic In	Mic In
Orange	–	–	Center/Sub woofer	Center/Sub woofer
Black	–	Rear Speaker Out	Rear Speaker Out	Rear Speaker Out

2.2.2 Audio I/O connections

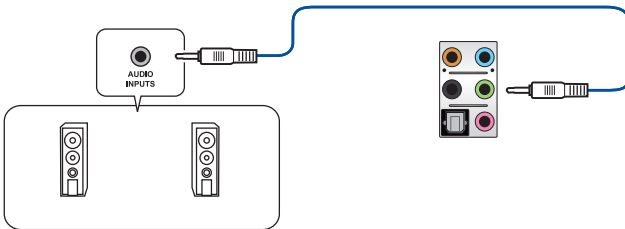
Audio I/O ports



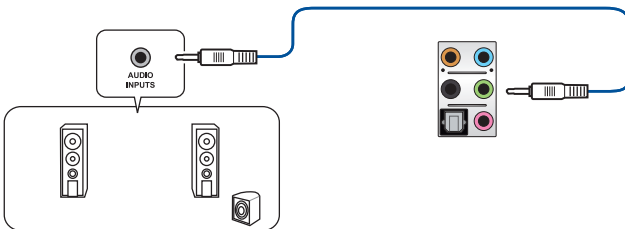
Connect to Headphone and Mic



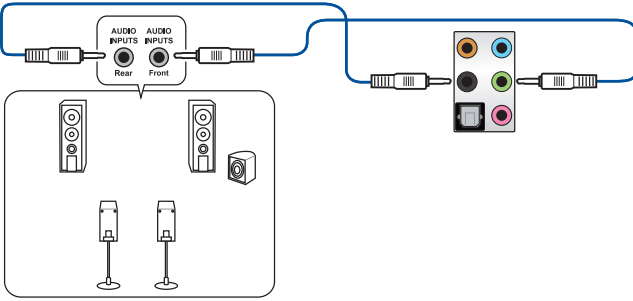
Connect to Stereo Speakers



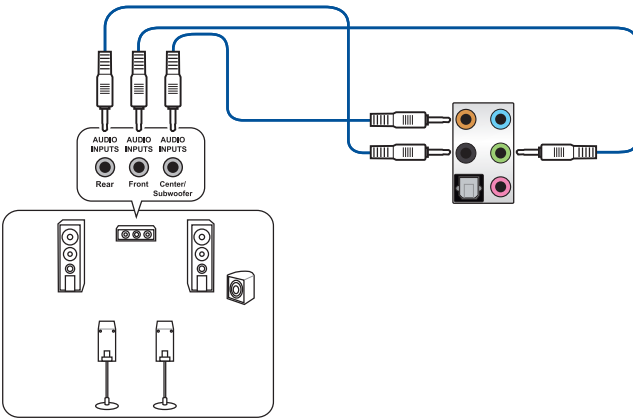
Connect to 2-channel Speakers



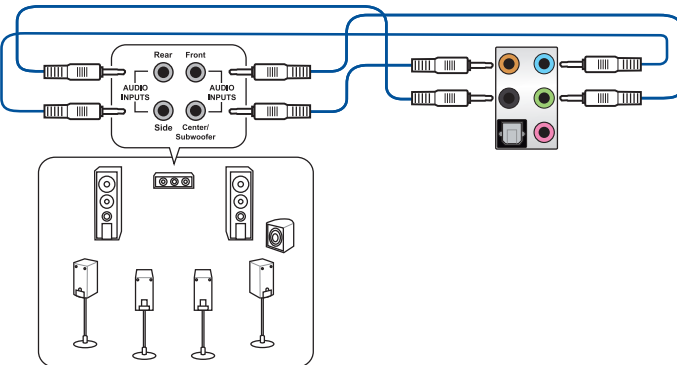
Connect to 4-channel Speakers



Connect to 6-channel Speakers



Connect to 8-channel Speakers



2.3 Starting up for the first time

1. After making all the connections, replace the system case cover.
2. Ensure that all switches are off.
3. Connect the power cord to the power connector at the back of the system chassis.
4. Connect the power cord to a power outlet that is equipped with a surge protector.
5. Turn on the devices in the following order:
 - a. Monitor
 - b. External SCSI devices (starting with the last device on the chain)
 - c. System power
6. After applying power, the system power LED on the system front panel case lights up. For systems with ATX power supplies, the system LED lights up when you press the ATX power button. If your monitor complies with the “green” standards or if it has a “power standby” feature, the monitor LED may light up or change from orange to green after the system LED turns on.

The system then runs the power-on self tests (POST). While the tests are running, the BIOS beeps (refer to the BIOS beep codes table) or additional messages appear on the screen. If you do not see anything within 30 seconds from the time you turned on the power, the system may have failed a power-on test. Check the jumper settings and connections or call your retailer for assistance.

BIOS Beep	Description
One short beep	VGA detected Quick boot set to disabled No keyboard detected
One continuous beep followed by two short beeps then a pause (repeated)	No memory detected
One continuous beep followed by three short beeps	No VGA detected
One continuous beep followed by four short beeps	Hardware component failure

7. At power on, hold down the <Delete> key to enter the BIOS Setup. Follow the instructions in Chapter 3.

2.4 Turning off the computer

While the system is ON, press the power button for less than four seconds to put the system on sleep mode or soft-off mode, depending on the BIOS setting. Press the power button for more than four seconds to let the system enter the soft-off mode regardless of the BIOS setting.

BIOS Setup

3

3.1 Knowing BIOS



The new ASUS UEFI BIOS is a Unified Extensible Interface that complies with UEFI architecture, offering a user-friendly interface that goes beyond the traditional keyboard-only BIOS controls to enable a more flexible and convenient mouse input. You can easily navigate the new UEFI BIOS with the same smoothness as your operating system. The term “BIOS” in this user manual refers to “UEFI BIOS” unless otherwise specified.

BIOS (Basic Input and Output System) stores system hardware settings such as storage device configuration, overclocking settings, advanced power management, and boot device configuration that are needed for system startup in the motherboard CMOS. In normal circumstances, the default BIOS settings apply to most conditions to ensure optimal performance. **DO NOT change the default BIOS settings** except in the following circumstances:

- An error message appears on the screen during the system bootup and requests you to run the BIOS Setup.
- You have installed a new system component that requires further BIOS settings or update.



Inappropriate BIOS settings may result to instability or boot failure. **We strongly recommend that you change the BIOS settings only with the help of a trained service personnel.**



When downloading or updating the BIOS file, rename it as **SX470FG.CAP** for this motherboard.

3.2 BIOS setup program

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

Entering BIOS 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>+<Delete> 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.

After doing either of the three options, press <Delete> key to enter BIOS.



-
- The BIOS setup screens shown in this section are for reference purposes only, and may not exactly match what you see on your screen.
 - 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 3.10 **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 1.1.7 **Headers** for information on how to erase the RTC RAM via the Clear CMOS button.
 - The BIOS setup program does not support the Bluetooth devices.
-



Please visit ASUS website for the detailed BIOS content manual.

BIOS menu screen

The BIOS Setup program can be used under two modes: **EZ Mode** and **Advanced Mode**. You can change modes from **Setup Mode** in **Boot menu** or by pressing the <F7> hotkey.

3.2.1 Advanced Mode

By default, the Advanced Mode screen appears when you enter the BIOS setup program. 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 default screen for entering the BIOS setup program can be changed. Refer to the **Setup Mode** item in section **Boot menu** for details.

The screenshot shows the ASUS UEFI BIOS Advanced Mode interface. The top bar includes 'UEFI BIOS Utility - Advanced Mode', the date '01/09/2018 Tuesday', the time '00:02', and various utility icons like 'Language', '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 'AI Tweaker' section is expanded, showing submenus like 'AI Overdock Tuner', 'Memory Frequency', 'APU Multiplier', 'EPU Power Saving Mode', and 'TPU'. The 'Advanced' section shows 'VDDCR CPU Voltage' and 'VDDCR SOC Voltage' settings. The 'Hardware Monitor' panel on the right displays CPU and memory status. Red lines and boxes highlight specific features, with labels such as 'Menu items', 'Menu bar', 'Language', 'MyFavorite(F3)', 'Qfan Control(F6)', 'EZ Tuning Wizard(F11)', 'Search(F9)', 'Scroll bar', 'AURA ON/OFF(F4)', 'Submenu items', 'General help', 'Configuration fields', 'Pop-up Menu', 'Last modified settings', 'Go back to EZ Mode', 'Hot Keys', and 'Search on the FAQ'. A note at the bottom right states: 'Displays the CPU 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.

My Favorites(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 **3.3 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 **3.2.3 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.



Refer to section **3.2.4 EZ Tuning Wizard** for more information.

Search (F9)

This button allows you to search by BIOS item name, enter the item name to find the related item listing.

AURA (F4)

This button allows you to turn the RGB LED lighting on or off.

[ON] All AURA effects will be enabled. (Default mode)

[OFF] All AURA effects will be disabled.

Search on FAQ

Move your mouse over this button to show a QR code, scan this QR code on your mobile device to connect to the BIOS FAQ web page of the ASUS support website. You can also scan the following QR code:



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 bottom 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.

3.2.2 EZ Mode

The EZ Mode provides you an overview of the basic system information, and allows you to select the display language, system performance, mode and boot device priority.



To switch from Advanced Mode to EZ Mode, click **EZ Mode(F7)** or press the <F7> hotkey.

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

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

The screenshot shows the 'UEFI BIOS Utility - EZ Mode' interface. At the top, it displays the date '01/09/2018 Tuesday', a timer '00:04', and language 'English'. Below this are several sections: 'Information' (BIOS Ver. 0211, AMD A8-9600, etc.), 'CPU Temperature' (40°C), 'VDDCR CPU Voltage' (0.675 V), and 'Motherboard Temperature' (29°C). There are also sections for 'DRAM Status', 'SATA Information', 'D.O.C.P.' (Disabled), 'FAN Profile', and 'EZ System Tuning' (Normal). A 'Boot Priority' section is visible at the bottom right. At the very bottom, navigation options are listed: 'Default(F5)', 'Save & Exit(F10)', 'Advanced Mode(F7)', and 'Search on FAQ'.

Selects the display language of the BIOS setup program

Creates storage RAID and configures system overclocking

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

Turns the RGB LED lighting or functional LED on or off

Displays the CPU Fan's speed. Click the button to manually tune the fans

Saves the changes and resets the system

Loads optimized default settings

Click to go to Advanced mode

Search on the FAQ

Click to display boot devices

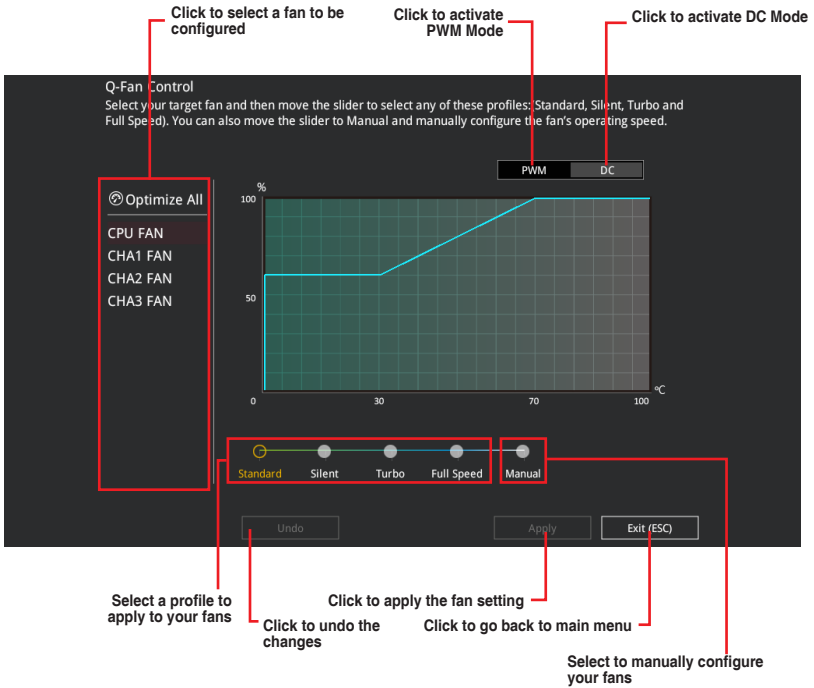
Selects the boot device priority



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

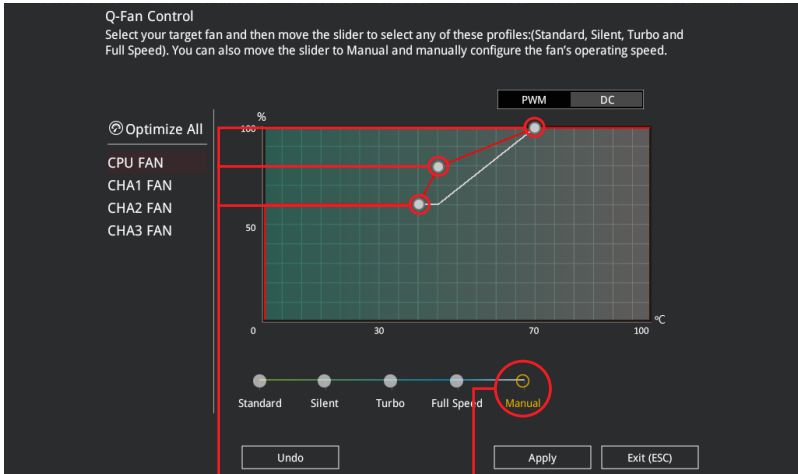
3.2.3 Q-Fan Control

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



Configuring fans manually

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



Speed points

Select 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)**.

3.2.4 EZ Tuning Wizard

EZ Tuning Wizard allows you to easily overclock your CPU and DRAM, computer usage, and CPU fan to their best settings.

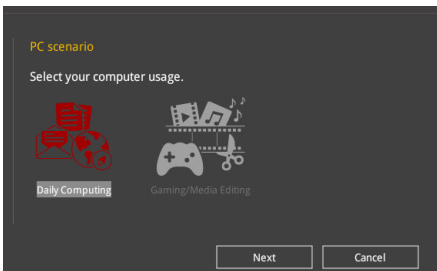


OC setup

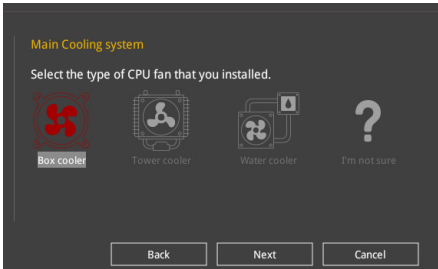
OC Tuning

To start OC Tuning:

1. Press <F11> on your keyboard or click **EZ Tuning Wizard(F11)** from the BIOS screen to open EZ Tuning Wizard screen, and then click **Next**.
2. Select a PC scenario **Daily Computing** or **Gaming/Media Editing**, and then click **Next**.



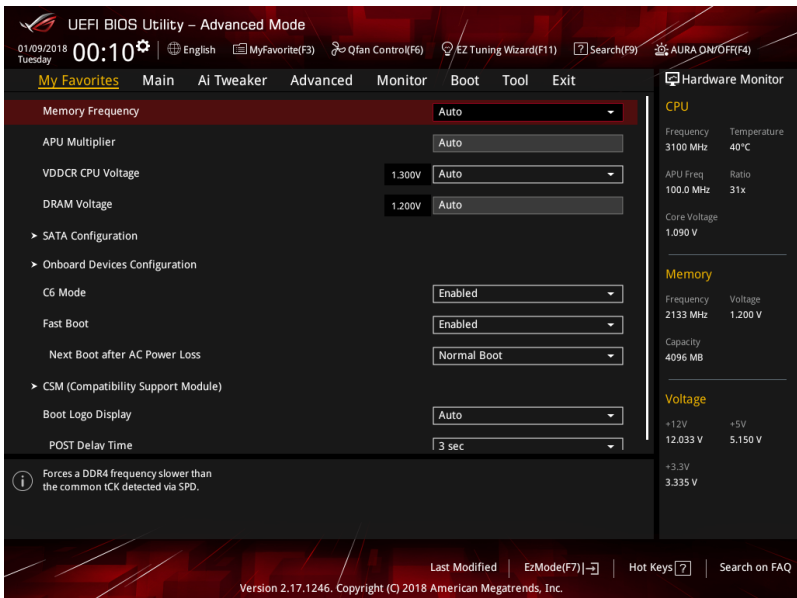
3. Select a Main Cooling System **BOX cooler**, **Tower cooler**, **Water cooler**, or **I'm not sure**, and then click **Next**.



4. After selecting the Main Cooling System, click **Next** then click **Yes** to start the OC Tuning.

3.3 My Favorites


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

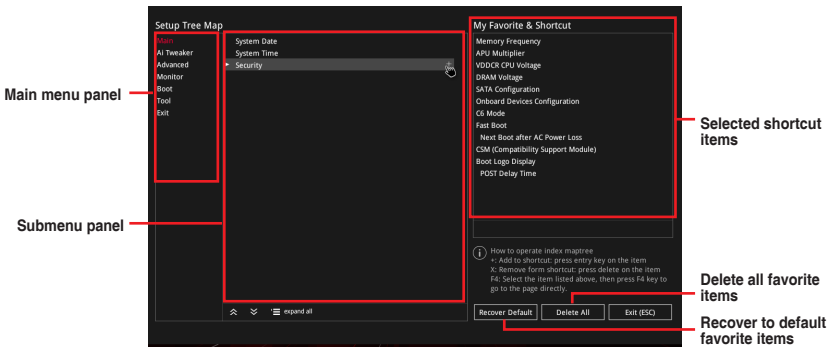



My Favorites comes with several performance, power saving, and fast boot related items by default. You can personalize this screen by adding or removing items.

Adding items to My Favorites

To add BIOS items:

1. Press <F3> on your keyboard or click  (F3)MyFavorite 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 My Favorites 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  or press <Enter> on your keyboard.



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.

3.4 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.

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 1.1.7 **Headers** for information on how to erase the RTC RAM via the Clear CMOS button.
- 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]**.

3.5 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.

Ai Overclock Tuner

Allows you to select the CPU overclocking options to achieve the desired CPU internal frequency. Configuration options:

- [Auto] Loads the optimal settings for the system.
[Manual] Allows you to individually set overclocking parameters.

Memory Frequency

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] [DDR4-1333MHz] - [DDR4-4200MHz]



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

EPU Power Saving Mode

The ASUS EPU (Energy Processing Unit) sets the CPU in its minimum power consumption settings. Enable this item to set lower CPU core/cache voltage and achieve the best energy saving condition. Configuration options: [Disabled] [Enabled]

TPU

This item allows you to automatically overclock the CPU and DRAM frequencies and voltage for an enhanced system performance.

[Keep Current Settings] Keep the current settings without changing anything.

[TPU I] Applies air cooling overclocking conditions.

[TPU II] Applies water cooling overclocking conditions.



Ensure to use water cooling device before selecting [TPU II].

3.6 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.

3.6.1 AMD fTPM Configuration

The items in this menu allow you to configure the AMD fTPM settings.

3.6.2 CPU Configuration

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



The items in this menu may vary based on the CPU installed.

PSS Support

This item allows you enable or disable the generation of ACPI_PPC, _PSS, and _PCT objects.

Configuration options: [Disabled] [Enabled]

NX Mode

This item allows you enable or disable no-execute page protection function.

Configuration options: [Disabled] [Enabled]

SVM Mode

This item allows you enable or disable CPU Virtualization.

Configuration options: [Disabled] [Enabled]

Core Leveling Mode

This item allows you to change the number of compute unit in the system.

Configuration options: [Automatic mode] [One Computer Unit]

3.6.3 NB Configuration



NB Configuration function is not support when using an AMD Ryzen processor.

IGFX Multi-Monitor

Enables or disables the Internal Graphics Device Multi-Monitor support for add-on VGA devices. And the memory size of Internal Graphics Device will keep memory reserved. Configuration options: [Disabled] [Enabled]



The **IGFX Multi-Monitor** item must be enabled before using AMD Dual Graphics technology.

Primary Video Device

Selects the primary display device. Configuration options: [IGFX Video] [PCIE Video]

UMA Frame Buffer Size [Auto]

Configuration options: [Auto] [32M] [64M] [128M] [256M] [512M] [1G] [2G]

3.6.4 SATA 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 Port Enable

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

SATA Mode

This item 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 Serial ATA features that increases storage performance on random workloads by allowing the drive to internally optimize the order of commands.
- [RAID] Set to [RAID] when you want to create a RAID configuration from the SATA hard disk drives.

NVMe RAID mode

This item allows you enable or disable the NVMe RAID mode. Configuration options: [Disabled] [Enabled]

SMART Self Test

S.M.A.R.T. (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_1~6 (Gray), M.2_1 (Gray), M.2_2 (Gray)

Select one item and click Enter to assign a new name for the item.

Hot Plug

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

3.6.5 Onboard Devices Configuration

The items in this menu allow you to switch between PCIe Lanes and configure onboard devices.

HD Audio Controller

This item allows you to use the Azalia High Definition Audio Controller. Configuration options: [Disabled] [Enabled]

PCIEX16_1 Bandwidth

This item displays on AMD Ryzen™ with Radeon™ Vega Graphics/ 7th Generation A-Series/ Athlon X4 processors.

[X8 Mode] The PCIe x16_1 slot runs at x8 mode.

[PCIe RAID Mode] The Hyper M.2 x16 card and other add-on M.2 devices all run at x4 mode, which allows you to create a PCIe RAID array.



Use PCIe RAID Mode when installing the Hyper M.2 x16 card or other M.2 adapter cards. Installing other devices when using PCIe RAID Mode may cause your PC to fail to boot up.

PCIEX16_2 Bandwidth

This item displays on AMD Ryzen™ 2nd Generation/ Ryzen™ 1st Generation processors.

[X8 Mode] The PCIe x16_2 slot runs at x8 mode.

[PCIe RAID Mode] The Hyper M.2 x16 card and other add-on M.2 devices all run at x4 mode, which allows you to create a PCIe RAID array.

PCIEX16_3 4X-2X Switch

This item allows you to set the PCIEX16_3 Mode. Configuration options: [Auto] [2X] [4X]

[Auto] Automatic configuration.

If PCIe mode M.2 device is inserted to M.2_2, switches PCIEx16_3 to X4 mode;

Else if no device or SATA mode M.2 device is inserted to M.2_2, whenever PCIEx1_1 or PCIEx1_3 is occupied, switches PCIEx16_3 to X2 mode;

When a device (with bandwidth >= 4X) is inserted into PCIEX16_3 and no device is inserted into both PCIEx1_1 and PCIEx1_3, switches PCIEX16_3 to X4 mode.

[X2] Forces PCIEX16_3 to run at X2 mode.

[X4] Forces PCIEX16_3 to run at X4 mode.

Asmedia USB 3.1 Controller

[Disabled] Disables the controller.

[Enabled] Enables the rear USB 3.1 controller.

RGB LED lighting

When system is in working state

This item allows you to turn the RGB LED lighting on or off when the system is in the working state. Configuration options: [On] [Off]

When system is in sleep, hibernate or soft off states

This item allows you to turn the RGB LED lighting on or off when the system is in the sleep, hibernate or soft off states. Configuration options: [On] [Off]

Intel LAN Controller

This item allows you to enable or disable the Intel LAN controllers. Configuration options: [On] [Off]

Intel LAN OPROM

This item allows you to enable or disable the Intel PXE OPROM. Configuration options: [On] [Off]

Charging USB devices in Power State S5

This item allows you to charge USB devices even when the system is at Power State S5. Configuration options: [Disabled] [Enabled]

3.6.6 APM Configuration

The items in this menu allow you to set system wake and sleep settings.

ErP Ready [Disabled]

This item allows you to switch off some power at S4+S5 or S5 to get the system ready for ErP requirement. When set to **[Enabled]**, all other PME options are switched off. Configuration options: [Disabled] [Enable(S4+S5)] [Enable(S5)]

Restore On AC Power Loss

This item allows your system to go to ON state, OFF state, or both states after an AC power loss. When setting your system to [Last State], it goes to the previous state before the AC power loss. Configuration options: [Power Off] [Power On] [Last State]

Power On By PCI-E

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

Power On By Ring

[Disabled] Disables Ring to generate a wake event.

[Enabled] Enables Ring to generate a wake event.

Power On By RTC

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]

3.6.7 PCI Subsystem Settings

SR-IOV Support

This item allows you to enable or disable the Single Root IO Virtualization support if your system has SR-IOV capable PCIe devices.

3.6.8 Network Stack Configuration

The items in this menu allow you to enable or disable the UEFI network stack

3.6.9 HDD/SSD SMART Information

This menu displays the SMART information of the connected devices.



NVM Express devices do not support SMART information.

3.6.10 USB Configuration

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



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

USB Single Port Control

This item allows you to enable or disable the individual USB ports.



Refer to section **1.1.2 Motherboard layout** for the location of the USB ports.

3.7 Monitor menu

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

Q-Fan Configuration

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

Qfan Tuning

Click this item to automatically detect the lowest speed and configure the minimum duty cycle for each fan.

3.8 Boot menu

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

Fast Boot

- [Disabled] Allows your system to go back to its normal boot speed.
- [Enabled] Allows your system to accelerate the boot speed.



The following items appear only when you set the Fast Boot to **[Enabled]**.

Next Boot after AC Power Loss

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

Boot Configuration

Setup 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.

CSM (Compatibility Support Module)

This item 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

- [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® the Windows secure update and secure boot.



The following items appear only when you set the Launch CSM to **[Enabled]**.

Boot Devices Control [UEFI and Legacy OPROM]

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

Boot from Network Devices [Legacy only]

This item 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]

This item 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 Expansion Devices [Legacy only]

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

Secure Boot

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

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.
- To select the boot device during system startup, press <F8> when the ASUS Logo appears.

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.

3.9 Tool menu

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

3.9.1 ASUS EZ Flash 3 Utility

This item allows you to run ASUS EZ Flash 3. When you press <Enter>, a confirmation message appears. Use the left/right arrow key to select between [Yes] or [No], then press <Enter> to confirm your choice.



For more details, refer to section 3.11.2 **ASUS EZ Flash 3**.

3.9.2 Secure Erase

SSD speeds may lower over time as with any storage medium due to data processing. Secure Erase completely and safely cleans your SSD, restoring it to factory performance levels.



Secure Erase is only available in AHCI mode. Ensure to set the SATA mode to AHCI. Click **Advanced > SATA Configuration > SATA Mode > AHCI**.

To launch Secure Erase, click **Tool > Secure Erase** on the Advanced mode menu.

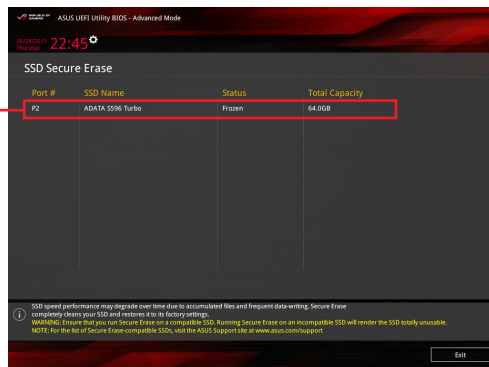


Secure Erase is only supported on selected SATA SSDs, and cannot erase NVMe storage devices.



The time to erase the contents of your SSD may take a while depending on its size. Do not turn off the system during the process.

Displays the available SSDs



Status definition:

- **Frozen.** The frozen state is the result of a BIOS protective measure. The BIOS guards drives that do not have password protection by freezing them prior to booting. If the drive is frozen, a power off or hard reset of your PC must be performed to proceed with the Secure Erase.
- **Locked.** SSDs might be locked if the Secure Erase process is either incomplete or was stopped. This may be due to a third party software that uses a different password defined by ASUS. You have to unlock the SSD in the software before proceeding with Secure Erase.

3.9.3 ASUS Overclocking Profile

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

Load from Profile

This item allows you to load the previous BIOS settings saved in the BIOS Flash. Key in the profile number that saved your BIOS 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

This item allows you to key in a profile name.

Save to Profile

This item 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.

3.9.4 ASUS SPD Information

This item allows you to view the DRAM SPD information.

3.9.5 Graphics Card Information

This item displays the information about the graphics card installed in your system.

GPU Post

This item displays the information and recommended configuration for the PCIe slots that the graphics card is installed in your system.



This feature is only supported on selected ASUS graphics cards.

3.10 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. You can access the EZ Mode from the Exit menu.

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 **Yes** to discard changes and exit.

Launch EFI Shell from USB drives

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

3.11 Updating BIOS

The ASUS website publishes the latest BIOS versions to provide enhancements on system stability, compatibility, and performance. However, BIOS updating is potentially risky. If there is no problem using the current version of BIOS, DO NOT manually update the BIOS. Inappropriate BIOS updating may result to system's failure to boot. Carefully follow the instructions in this chapter to update your BIOS when necessary.



Visit <http://www.asus.com> to download the latest BIOS file for this motherboard.

The following utilities allow you to manage and update the motherboard BIOS setup program.

1. EZ Update: Updates the BIOS in Windows® environment.
2. ASUS EZ Flash 3: Updates the BIOS using a USB flash drive.
3. ASUS CrashFree BIOS 3: Restores the BIOS using the motherboard support DVD or a USB flash drive when the BIOS file fails or gets corrupted.

3.11.1 EZ Update

The EZ Update is a utility that allows you to update the motherboard BIOS in Windows® environment.



-
- EZ Update requires an Internet connection either through a network or an ISP (Internet Service Provider).
 - This utility is available in the support DVD that comes with the motherboard package.
-

3.11.2 ASUS EZ Flash 3

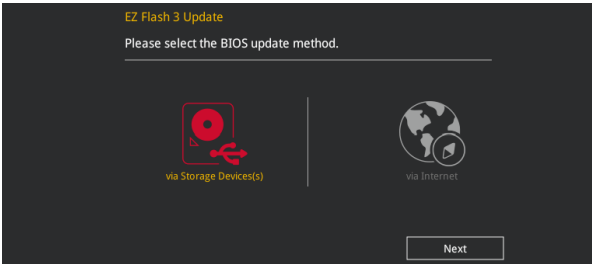
ASUS EZ Flash 3 allows you to download and update to the latest BIOS through the Internet without having to use a bootable floppy disk or an OS-based utility.



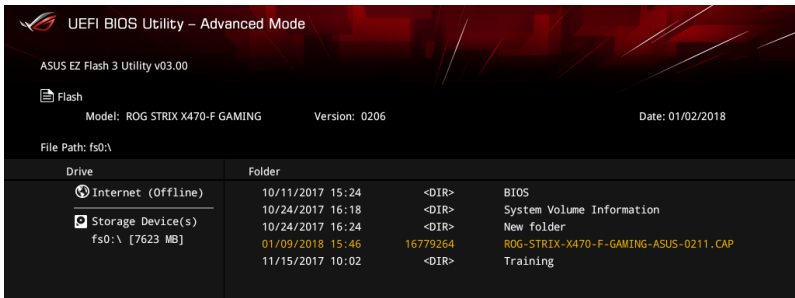
Updating through the Internet varies per region and Internet conditions. Check your local Internet connection before updating through the Internet.

To update the BIOS by USB:

1. Enter the Advanced Mode of the BIOS setup program. Go to the Tool menu to select **ASUS EZ Flash Utility** and press <Enter>.
2. Insert the USB flash disk that contains the latest BIOS file to the USB port.
3. Select **via Storage Devices**.



4. Press <Tab> to switch to the Drive field.
5. Press the Up/Down arrow keys to find the USB flash disk that contains the latest BIOS, and then press <Enter>.
6. Press <Tab> to switch to the Folder Info field.
7. Press the Up/Down arrow keys to find the BIOS file, and then press <Enter> to perform the BIOS update process. Reboot the system when the update process is done.





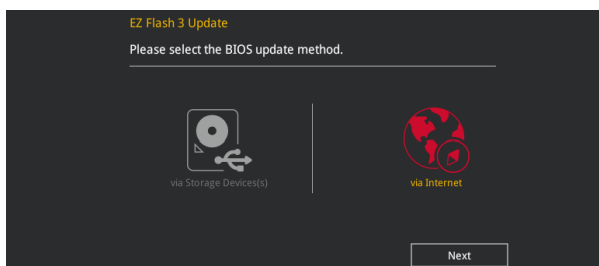
- This function can support devices such as a USB flash disk with FAT 32/16 format and single partition only.
- DO NOT shut down or reset the system while updating the BIOS to prevent system boot failure!



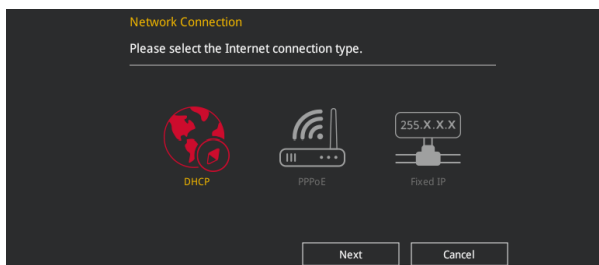
Ensure to load the BIOS default settings to ensure system compatibility and stability. Select the Load Optimized Defaults item under the Exit menu. See section 3.10 **Exit Menu** for details.

To update the BIOS by Internet:

1. Enter the Advanced Mode of the BIOS setup program. Go to the Tool menu to select **ASUS EZ Flash Utility** and press <Enter>.
2. Select **via Internet**.



3. Press the Left/Right arrow keys to select an Internet connection method, and then press <Enter>.



4. Follow the onscreen instructions to complete the update.
5. Reboot the system when the update process is done.



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 3.10 **Exit Menu** for details.

3.11.3 ASUS CrashFree BIOS 3

The ASUS CrashFree BIOS 3 utility 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 BIOS file.



The BIOS file in the motherboard support DVD may be older than the BIOS file published on the ASUS official website. If you want to use the newer BIOS file, download the file at <https://www.asus.com/support/> and save it to a USB flash drive.

Recovering the BIOS

To recover the BIOS:

1. Turn on the system.
2. Insert the motherboard support DVD to the optical drive, or the USB flash drive containing 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 automatically.
4. The system requires you to enter BIOS Setup to recover the BIOS setting. 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!

RAID Support

4

4.1 AMD RAID Array configurations

The motherboard comes with the RaidXpert2 Configuration Utility that supports Volume, RAIDABLE, RAID 0, RAID 1, and RAID 10 (depends on system licensing) configurations.



For more information on configuring your RAID sets, please refer to the RAID Configuration Guide which you can find at <https://www.asus.com/support>.

4.1.1 RAID definitions

Volume provides the ability to link-together storage from one or several disks, regardless of the size of the space on those disks. This configuration is useful in scavenging space on disks unused by other disks in the array. This configuration does not provide performance benefits or data redundancy, disk failure will result in data loss.

RAIDABLE arrays (also known as RAID Ready) are a special type of Volume (JBOD) that allows the user to add more storage space or create a redundant array after a system is installed. RAIDABLE arrays are created using Option ROM, UEFI, or roadm.



The ability to create RAIDABLE arrays may vary per system.

RAID 0 (Data striping) optimizes two identical hard disk drives to read and write data in parallel, interleaved stacks. Two hard disks perform the same work as a single drive but at a sustained data transfer rate, double that of a single disk alone, thus improving data access and storage. Use of two new identical hard disk drives is required for this setup.

RAID 1 (Data mirroring) copies and maintains an identical image of data from one drive to a second drive. If one drive fails, the disk array management software directs all applications to the surviving drive as it contains a complete copy of the data in the other drive. This RAID configuration provides data protection and increases fault tolerance to the entire system. Use two new drives or use an existing drive and a new drive for this setup. The new drive must be of the same size or larger than the existing drive.

RAID 10 is data striping and data mirroring combined without parity (redundancy data) having to be calculated and written. With the RAID 10 configuration you get all the benefits of both RAID 0 and RAID 1 configurations. Use four new hard disk drives or use an existing drive and three new drives for this setup.

Appendix

Notices

Federal Communications Commission Statement

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

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

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 manufacturer's 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 to 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.



The use of shielded cables for connection of the monitor to the graphics card is required to assure compliance with FCC regulations. Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

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)

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

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Class B ITE

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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.

ASUS Recycling/Takeback Services

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 -
www.P65Warnings.ca.gov

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ASUS COMPUTER INTERNATIONAL (America)

Address 800 Corporate Way, Fremont, CA 94539, USA
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Fax +1-510-608-4555
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Technical Support

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ASUS COMPUTER GmbH (Germany and Austria)

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Fax +49-2102-959931
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Technical Support

Telephone +49-2102-5789555
Support Fax +49-2102-959911
Online support <http://qr.asus.com/techserv>

DECLARATION OF CONFORMITY

Per FCC Part 2 Section 2. 1077(a)



Responsible Party Name: Asus Computer International

Address: 800 Corporate Way, Fremont, CA 94539.

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

hereby declares that the product

Product Name : Motherboard

Model Number : ROG STRIX X470-F GAMING

Conforms to the following specifications:

- FCC Part 15, Subpart B, Unintentional Radiators

Supplementary Information:

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.

Representative Person's Name : Steve Chang / President

Signature :

Date : Feb. 28, 2018

Ver. 170324