

ASRock®

W790 WS

W790 WS

User Manual

Contact Information

If you need to contact ASRock or want to know more about ASRock, you're welcome to visit ASRock's website at <http://www.asrock.com>; or you may contact your dealer for further information. For technical questions, please submit a support request form at <https://event.asrock.com/tsd.asp>

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Chapter 1 Introduction

Thank you for purchasing ASRock W790 WS motherboard, a reliable motherboard produced under ASRock's consistently stringent quality control. It delivers excellent performance with robust design conforming to ASRock's commitment to quality and endurance.



Because the motherboard specifications and the BIOS software might be updated, the content of this documentation will be subject to change without notice. In case any modifications of this documentation occur, the updated version will be available on ASRock's website without further notice. If you require technical support related to this motherboard, please visit our website for specific information about the model you are using. You may find the latest VGA cards and CPU support list on ASRock's website as well. ASRock website <http://www.asrock.com>.

1.1 Package Contents

- ASRock W790 WS Motherboard (EATX Form Factor)
- ASRock W790 WS User Manual
- 4 x Serial ATA (SATA) Data Cables (Optional)
- 1 x ASRock WiFi 2.4/5/6 GHz Antenna (Optional)
- 1 x CPU Carrier for LGA 4677 E1A (Optional)
- 1 x CPU Carrier for LGA 4677 E1B (Optional)
- 4 x Screws for M.2 Sockets (Optional)
- 2 x Standoffs for M.2 Sockets (Optional)

1.2 Specifications

- Platform**
- EATX Form Factor
 - 14 Layer PCB

- CPU**
- Supports 4th Gen Intel® Xeon® W-3400 and W-2400 Processors (LGA4677)
 - Supports Intel® Boot Guard
 - Supports Intel® Trusted Execution Technology (Intel® TXT)
 - Supports Intel® Turbo Boost Technology
 - Supports Intel® Virtualization Technology (Intel® VT)
 - Supports Intel® Hyper-Threading Technology (Intel® HT Technology)
 - Supports Intel® Data Streaming Accelerator (Intel® DSA)
 - Supports CXL (Compute Express Link) 1.1
 - Supports ASRock Hyper BCLK Engine

- Chipset**
- Intel® W790
 - Supports Intel® vPro® Technology
 - Supports Intel® Active Management Technology

- Memory**
- Quad Channel DDR5 Memory Technology
 - 8 x DDR5 DIMM Slots*
 - Supports DDR5 ECC, buffered memory (RDIMM/ RDIMM-3DS/ RDIMM-9x4) up to 6800+(OC)**
 - 1DPC Up to 6800+ MHz (OC), 4800 MHz Natively for Xeon W9, Xeon W7 and Xeon W5.
 - 2DPC Up to 6200+ MHz (OC), 4400 MHz Natively for Xeon W9, Xeon W7 and Xeon W5.
 - Supports 4400 MHz Natively for Xeon W3, W5-3423 and W5-3433. Overclocking is not supported.
- * S3 (Sleep) mode is supported only when 1 / 2 / 4 DIMMs memory modules are installed.
- ** Actual support may vary by CPU
- Max. capacity of system memory: 2TB
- ** Please refer to Memory Support List on ASRock's website for more information. (<http://www.asrock.com/>)

Expansion Slot

CPU:

- 4 x PCIe 5.0 x16 Slots (PCIe1/PCIe3 at x16; PCIe2/PCIe5 at x8)*

Chipset:

- 1 x PCIe 4.0 x16 Slot (PCIe4), supports x4 mode*
- 1 x Vertical M.2 Socket (Key E), supports type 2230 Wi-Fi/BT PCIe Wi-Fi module

* Supports NVMe SSD as boot disks

- 15μ Gold Contact in VGA PCIe Slots

Audio

- 7.1 CH HD Audio (Realtek ALC897 Audio Codec)
- Nahimic Audio

LAN

2 x 10 Gigabit LAN 100/1000/2500/5000/10000 Mb/s (Marvell (Aquantia) AQC113CS)

- Support Wake-On-LAN
- Support PXE

1 x 2.5 Gigabit LAN 10/100/1000/2500 Mb/s (Intel® I225LM)

- Support Wake-On-LAN
- Support PXE
- Supports Intel® vPro® Technology

Wireless LAN

- 802.11ax Wi-Fi 6E Module
- Supports IEEE 802.11a/b/g/n/ac/ax
- Supports Dual-Band 2x2 with extended 6GHz band*
 - * Wi-Fi 6E (6GHz band) will be supported by Microsoft® Windows® 11. The availability will depend on the different regulation status of each country and region. It will be activated (for supported countries) through Windows Update and software updates once available.
- * A 6GHz compatible router is required for 6E functionality.
- 1 antenna to support 2 (Transmit) x 2 (Receive) diversity technology
- Supports Bluetooth 5.3 + High speed class II
- Supports MU-MIMO

USB

- 2 x Thunderbolt 4 Type-C
- 1 x USB 3.2 Gen2x2 Type-C (Front)
- 2 x USB 3.2 Gen2 Type-A (Rear)
- 8 x USB 3.2 Gen1 (4 Rear, 4 Front)
- 3 x USB 2.0 (Front)

* All USB ports support ESD Protection

Rear Panel I/O

- 2 x Antenna Ports
- 1 x Optical SPDIF Out Port
- 2 x Thunderbolt 4 Type-C Ports*
- 2 x USB 3.2 Gen2 Type-A Ports (10 Gb/s)
- 4 x USB 3.2 Gen1 Ports
- 3 x RJ-45 LAN Ports
- 1 x BIOS Flashback Button
- 1 x Line Out Jack (Gold Audio Jack)
- 1 x Microphone Input Jack (Gold Audio Jack)

* Supports USB PD 3.0 up to 9V@3A (27W) / 5V@3A (15W) charging

Storage

CPU:

- 1 x Blazing M.2 Socket (M2_1, Key M), supports type 2230/2242/2260/2280 PCIe Gen5x4 (128 Gb/s) mode*
- 2 x Blazing M.2 Sockets (M2_2 and M2_3, Key M), support type 2260/2280 PCIe Gen5x4 (128 Gb/s) mode*
- 1 x Blazing M.2 Socket (M2_4, Key M), supports type 2260/2280 PCIe Gen5x4 (128 Gb/s) mode*

Chipset:

- 8 x SATA3 6.0 Gb/s Connectors
- 1 x U.2 Connector, supports PCIe Gen4x4 (64 Gb/s) mode

* Supports Intel® Volume Management Device (VMD)

* Supports NVMe SSD as boot disks

RAID

- Supports RAID 0, RAID 1, RAID 5 and RAID 10 for SATA storage devices
- Supports RAID 0, RAID 1, RAID 5 and RAID 10 for M.2 NVMe storage devices*

* Requires additional M.2 NVMe expansion cards to support RAID 10

Connector

- 1 x Virtual RAID On CPU Header
- 1 x SPI TPM Header
- 1 x Chassis Intrusion and Speaker Header
- 1 x CPU Fan Connector (4-pin)*
- 1 x CPU/Water Pump Fan Connector (4-pin) (Smart Fan Speed Control)**
- 3 x Chassis/Water Pump Fan Connectors (4-pin) (Smart Fan Speed Control)***
- 1 x 24 pin ATX Power Connector (Hi-Density Power Connector)
- 2 x 8 pin 12V Power Connectors (Hi-Density Power Connector) (for Motherboard)
- 1 x 6 pin 12V Power Connector (Hi-Density Power Connector) (for Motherboard)****
- 2 x 8 pin 12V Power Connectors (Hi-Density Power Connector) (for PCIe card)*****
- 1 x Front Panel Audio Connector
- 2 x USB 2.0 Headers (Support 3 USB 2.0 ports)
- 2 x USB 3.2 Gen1 Headers (Support 4 USB 3.2 Gen1 ports)
- 1 x Front Panel Type C USB 3.2 Gen2x2 Header (20 Gb/s)
- 1 x Clear CMOS Button
- 1 x Dr. Debug with LED
- 1 x Power Button with LED
- 1 x Reset Button with LED

* CPU_FAN1 supports the fan power up to 1A (12W).

** CPU_FAN2/WP_3A supports the fan power up to 3A (36W).

*** CHA_FAN1~3/WP support the fan power up to 2A (24W).

*** CPU_FAN2/WP_3A and CHA_FAN1~3/WP can auto detect if 3-pin or 4-pin fan is in use.

**** It is optional to connect an ATX 12V 6-pin cable to ATX12V3, which provides more power for overclocking.

***** Use either GTX_12V1 or GTX_12V2 when you install one or two PCIe card(s). Use both connectors when you install more than two PCIe cards. Otherwise, the system may not boot up properly.

**BIOS
Feature**

- AMI UEFI Legal BIOS with GUI support

OS

- Microsoft® Windows® 10 64-bit / 11 64-bit
- Linux

* Linux supported by Intel via the upstreaming of Intel Linux drivers to the Linux Open Source Community. Adoption into individual Linux distributions is dependent upon the OS vendor

Certifications

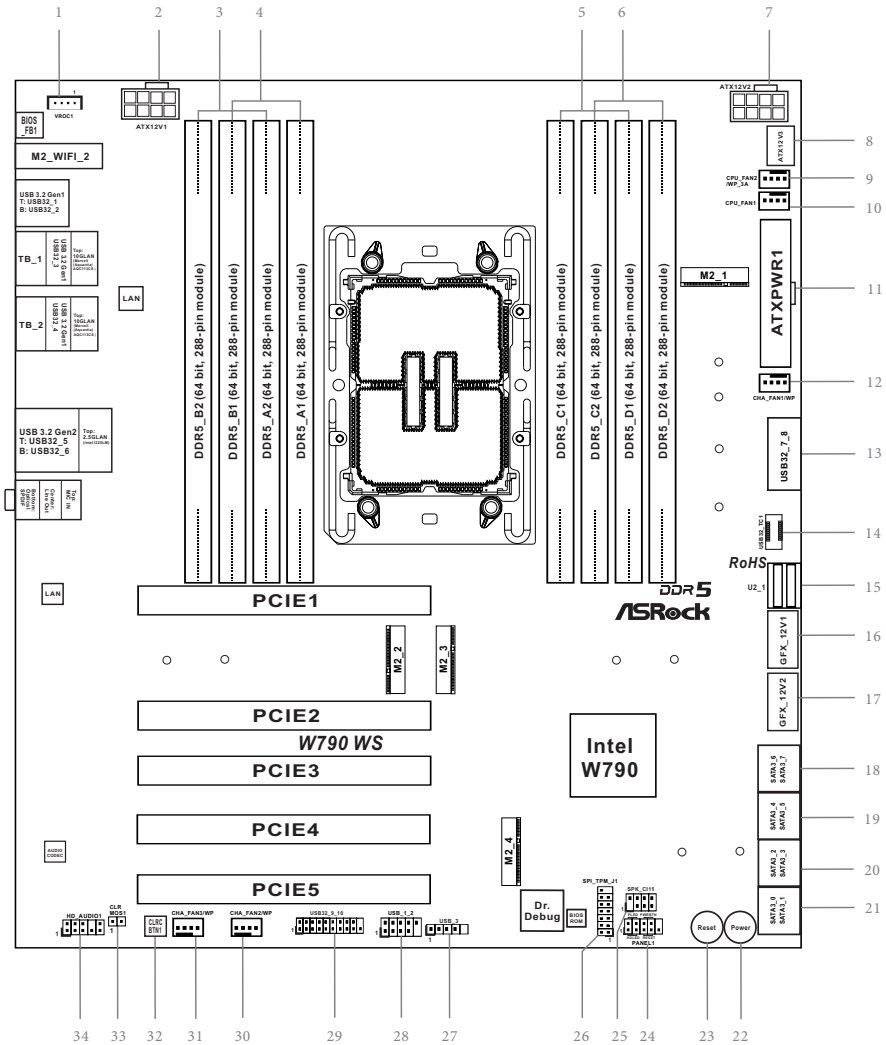
- FCC, CE
- ErP/EuP ready (ErP/EuP ready power supply is required)
- CEC Tier II ready

* For detailed product information, please visit our website: <http://www.asrock.com>



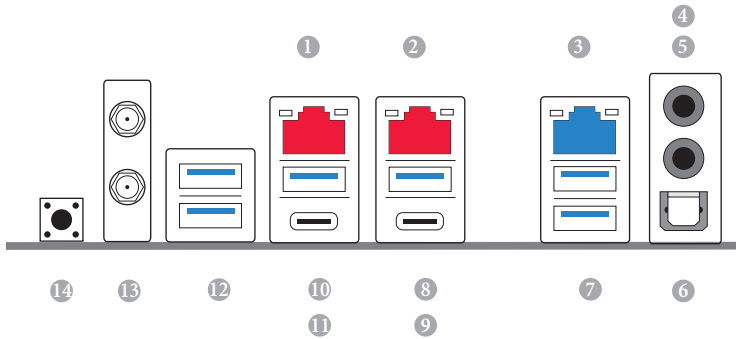
Please realize that there is a certain risk involved with overclocking, including adjusting the setting in the BIOS, applying Untied Overclocking Technology, or using third-party overclocking tools. Overclocking may affect your system's stability, or even cause damage to the components and devices of your system. It should be done at your own risk and expense. We are not responsible for possible damage caused by overclocking.

1.3 Motherboard Layout



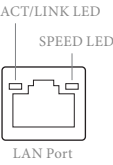
No.	Description
1	Virtual RAID On CPU Header (VROC1)
2	8 pin 12V Power Connector (ATX12V1)
3	2 x 288-pin DDR5 DIMM Slots (DDR5_B2, DDR5_A2)
4	2 x 288-pin DDR5 DIMM Slots (DDR5_B1, DDR5_A1)
5	2 x 288-pin DDR5 DIMM Slots (DDR5_C1, DDR5_D1)
6	2 x 288-pin DDR5 DIMM Slots (DDR5_C2, DDR5_D2)
7	8 pin 12V Power Connector (ATX12V2)
8	6 pin 12V Power Connector (ATX12V3)
9	CPU/Water Pump Fan Connector (CPU_FAN2/WP_3A)
10	CPU Fan Connector (CPU_FAN1)
11	ATX Power Connector (ATXPWR1)
12	Chassis/Water Pump Fan Connector (CHA_FAN1/WP)
13	USB 3.2 Gen1 Header (USB32_7_8)
14	Front Panel Type C USB 3.2 Gen2x2 Header (USB32_TC1)
15	U.2 Connector (U2_1)
16	8 pin 12V Power Connector (GFX_12V1)
17	8 pin 12V Power Connector (GFX_12V2)
18	SATA3 Connectors (SATA3_6)(Upper), (SATA3_7)(Lower)
19	SATA3 Connectors (SATA3_4)(Upper), (SATA3_5)(Lower)
20	SATA3 Connectors (SATA3_2)(Upper), (SATA3_3)(Lower)
21	SATA3 Connectors (SATA3_0)(Upper), (SATA3_1)(Lower)
22	Power Button (PWRBTN1)
23	Reset Button (RSTBTN1)
24	System Panel Header (PANEL1)
25	Chassis Intrusion and Speaker Header (SPK_C11)
26	SPI TPM Header (SPI_TPM_J1)
27	USB 2.0 Header (USB_3)
28	USB 2.0 Header (USB_1_2)
29	USB 3.2 Gen1 Header (USB32_9_10)
30	Chassis/Water Pump Fan Connector (CHA_FAN2/WP)
31	Chassis/Water Pump Fan Connector (CHA_FAN3/WP)
32	Clear CMOS Button (CLRCBTN1)
33	Clear CMOS Jumper (CLRMOS1)
34	Front Panel Audio Header (HD_AUDIO1)

1.4 I/O Panel



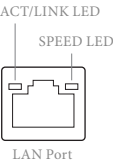
No.	Description	No.	Description
1	10G LAN RJ-45 Port (Marvell (Aquantia) AQC113CS)*	8	USB 3.2 Gen1 Type-A Port (USB32_4)
2	10G LAN RJ-45 Port (Marvell (Aquantia) AQC113CS)*	9	Thunderbolt 4 Type-C Port (TB_2)****
3	2.5G LAN RJ-45 Port (Intel® I225LM)**	10	USB 3.2 Gen1 Type-A Port (USB32_3)
4	Microphone Input Jack***	11	Thunderbolt 4 Type-C Port (TB_1)****
5	Line Out Jack***	12	USB 3.2 Gen1 Type-A Port (USB32_12)
6	Optical SPDIF Out Port	13	Antenna Ports
7	USB 3.2 Gen2 Type-A Ports (USB32_56)	14	BIOS Flashback Button

* There are two LEDs on each LAN port. Please refer to the table below for the LAN port LED indications.



Activity / Link LED		Speed LED	
Status	Description	Status	Description
Off	No Link	Orange	100Mbps/1Gbps/2.5Gbps
Blinking	Data Activity		/5Gbps connection
On	Link	Green	10Gbps connection

**There are two LEDs on each LAN port. Please refer to the table below for the LAN port LED indications.



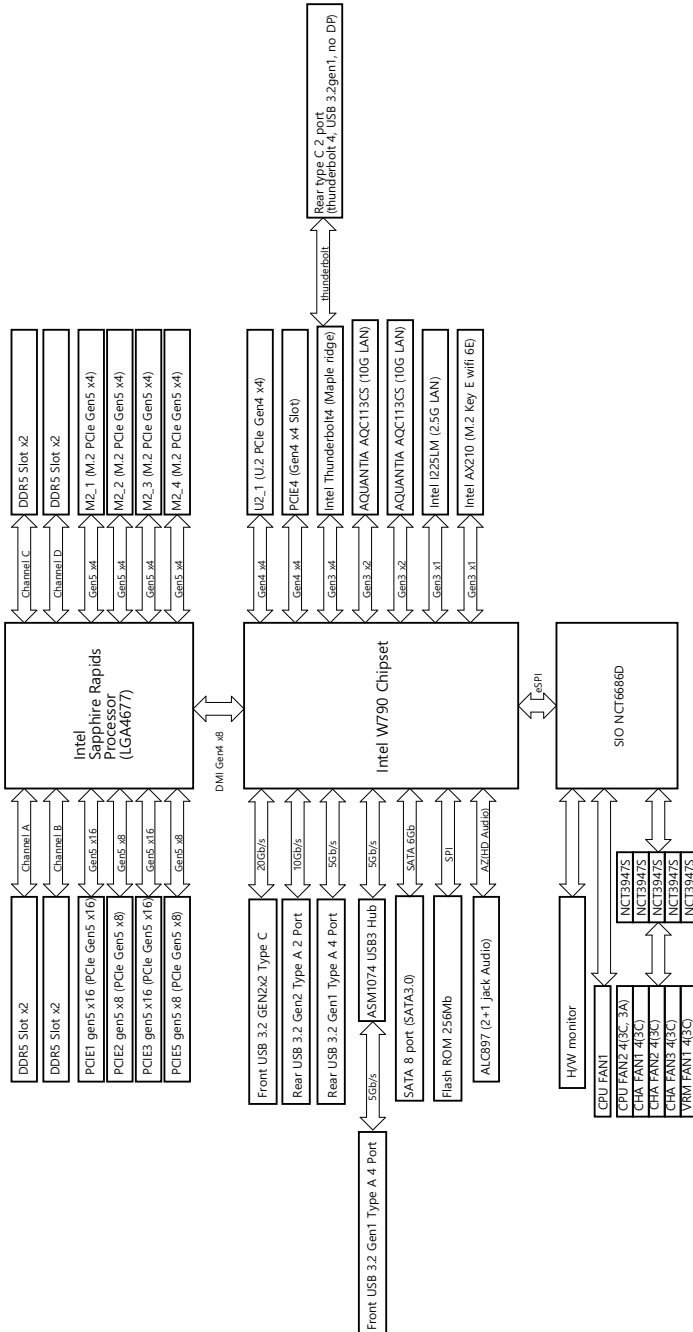
Activity / Link LED		Speed LED	
Status	Description	Status	Description
Off	No Link	Off	10Mbps connection
Blinking	Data Activity	Orange	100Mbps/1Gbps connection
On	Link	Green	2.5Gbps connection

*** Function of the Audio Ports in 2, 4, 5.1 or 7.1-channel Configuration:

Channel	Port	Function
2ch	Line Out Jack (Rear Panel)	Front speaker out
4ch	Pink-Mic (Front Panel)	Rear speaker out
5.1ch	Microphone Input Jack (Rear Panel)	Central/Subwoofer speaker out
7.1ch	Lime-Headphone (Front Panel)	Side Speaker out

****For the Thunderbolt compatibility and limitation, please visit www.asrock.com.

1.5 Block Diagram



1.6 802.11ax Wi-Fi 6E Module and ASRock WiFi 2.4/5/6 GHz Antenna

802.11ax Wi-Fi 6E + BT Module

This motherboard comes with an exclusive 802.11 a/b/g/n/ac/ax Wi-Fi 6E + BT v5.3 module that offers support for 802.11 a/b/g/n/ac/ax Wi-Fi 6E connectivity standards and Bluetooth v5.3. Wi-Fi 6E + BT module is an easy-to-use wireless local area network (WLAN) adapter to support Wi-Fi 6E + BT. Bluetooth v5.3 standard features Smart Ready technology that adds a whole new class of functionality into the mobile devices. BT 5.3 also includes Low Energy Technology and ensures extraordinary low power consumption for PCs.

* The transmission speed may vary according to the environment.

* Wi-Fi 6E (6GHz band) will be supported by Microsoft® Windows® 11. The availability will depend on the different regulation status of each country and region. It will be activated (for supported countries) through Windows Update and software updates once available.

* A 6GHz compatible router is required for 6E functionality.



ASRock WiFi 2.4/5/6 GHz Antenna

Chapter 2 Installation

This is an EATX form factor motherboard. Before you install the motherboard, study the configuration of your chassis to ensure that the motherboard fits into it.

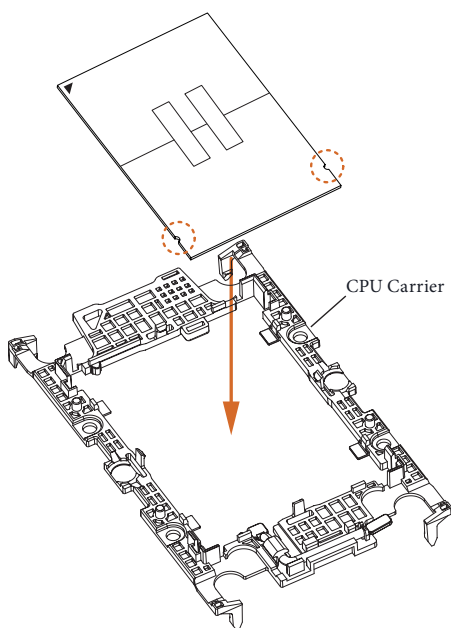
Pre-installation Precautions

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

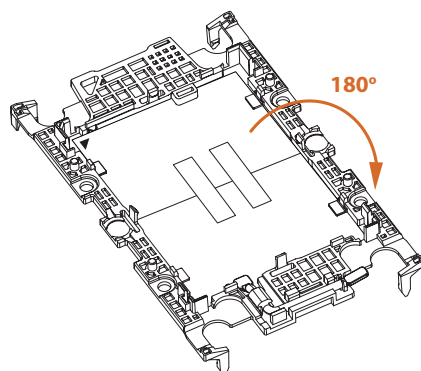
- Make sure to unplug the power cord before installing or removing the motherboard components. Failure to do so may cause physical injuries and damages to motherboard components.
- In order to avoid damage from static electricity to the motherboard's components, NEVER place your motherboard directly on a carpet. Also remember to use a grounded wrist strap or touch a safety grounded object before you handle the components.
- Hold components by the edges and do not touch the ICs.
- Whenever you uninstall any components, place them on a grounded anti-static pad or in the bag that comes with the components.
- When placing screws to secure the motherboard to the chassis, please do not over-tighten the screws! Doing so may damage the motherboard.

2.1 Installing the CPU and Heatsink

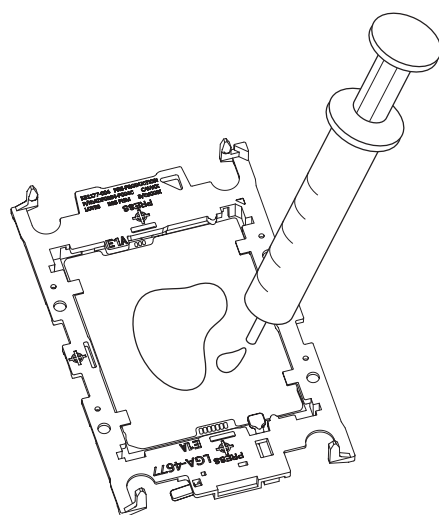
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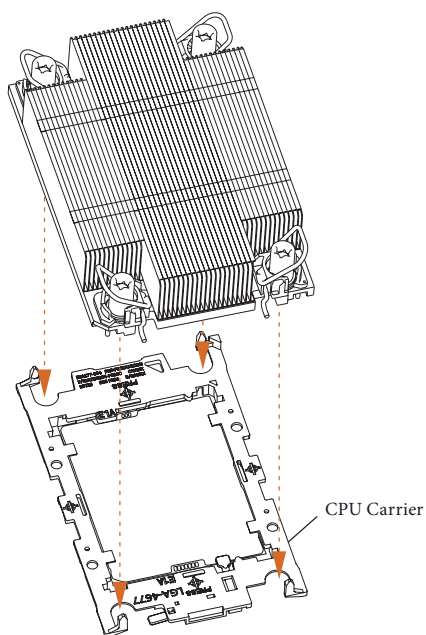
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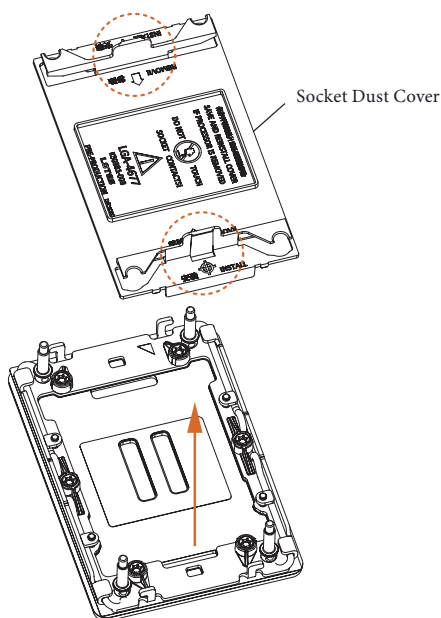


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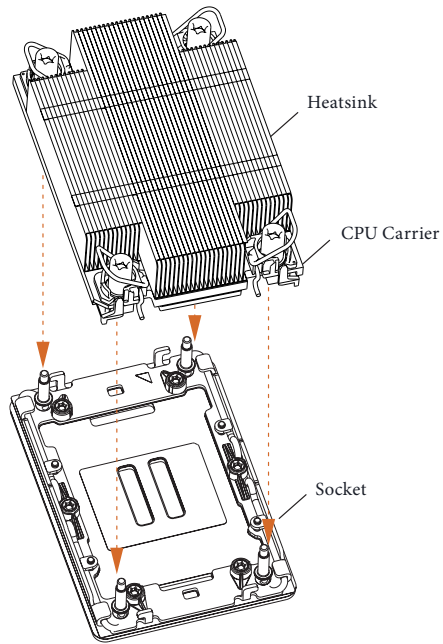
CPU Carrier

5

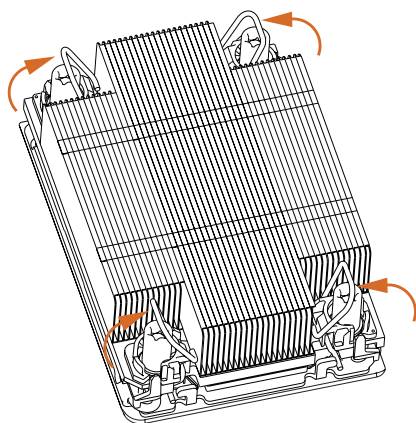


Socket Dust Cover

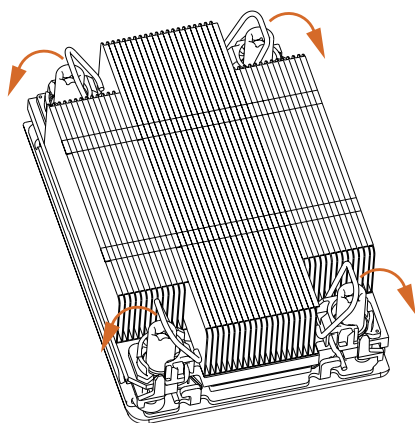
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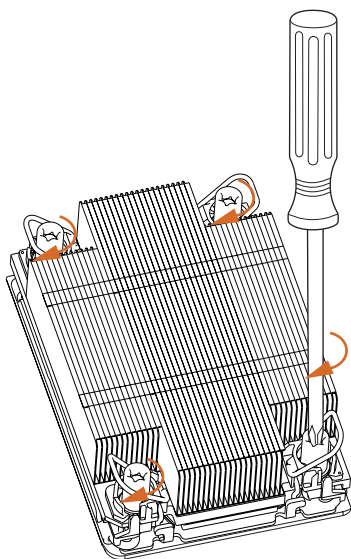
7



8



9



Screwdriver: T30

Recommended Torque Range: 6~12 in-lb

2.2 Installing Memory Modules (DIMM)

This motherboard provides eight 288-pin DDR5 (Double Data Rate 5) DIMM slots in two groups, and supports Quad Channel Memory Technology.

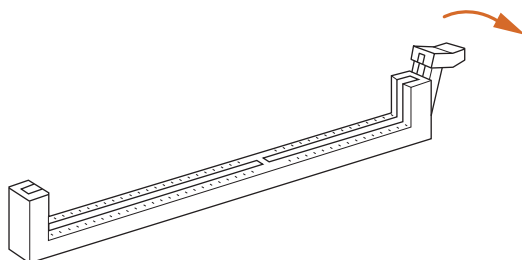


1. For eight channel configuration, you always need to install identical (the same brand, speed, size and chip-type) DDR5 DIMM pairs.
2. It is not allowed to install a DDR, DDR2, DDR3 or DDR4 memory module into a DDR5 slot; otherwise, this motherboard and DIMM may be damaged.
3. The DIMM only fits in one correct orientation. It will cause permanent damage to the motherboard and the DIMM if you force the DIMM into the slot at incorrect orientation.

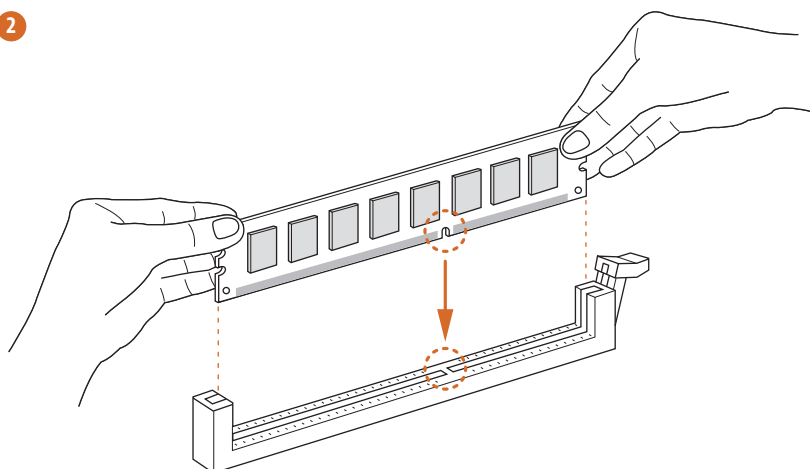
Recommended Memory Configuration

	A1	A2	B1	B2	C1	C2	D1	D2
1 DIMM		V						
2 DIMMS		V		V				
4 DIMMS		V		V		V		V
8 DIMMS	V	V	V	V	V	V	V	V

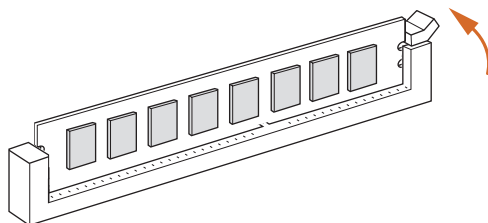
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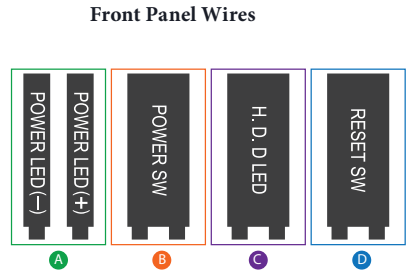
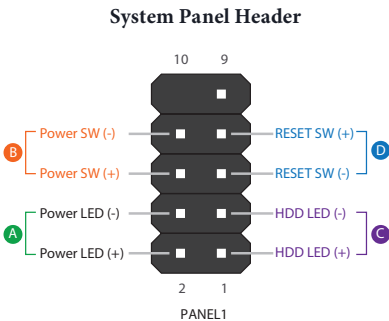
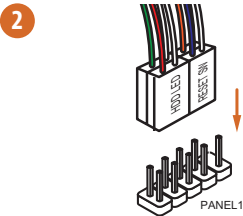
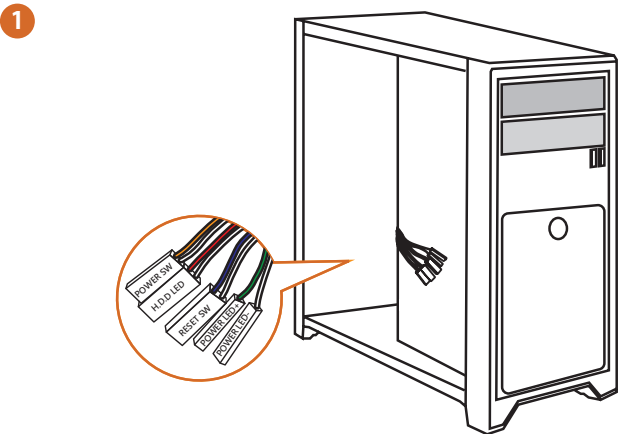
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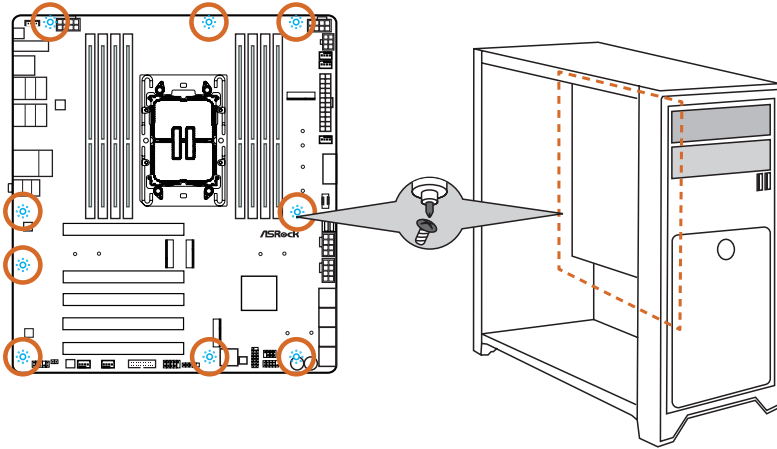
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2.3 Connecting the Front Panel Header

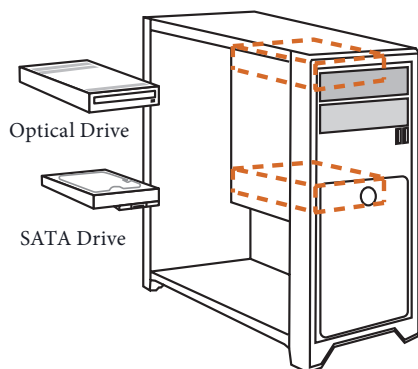


2.4 Installing the Motherboard

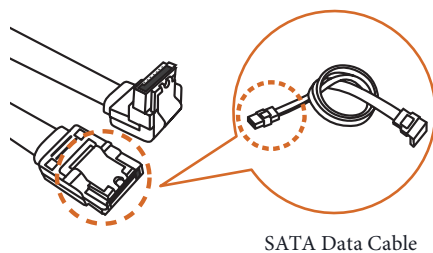


2.5 Installing SATA Drives

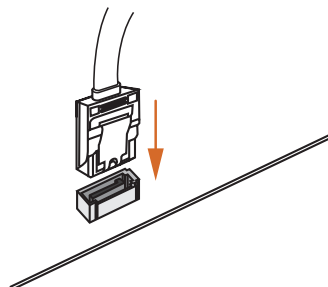
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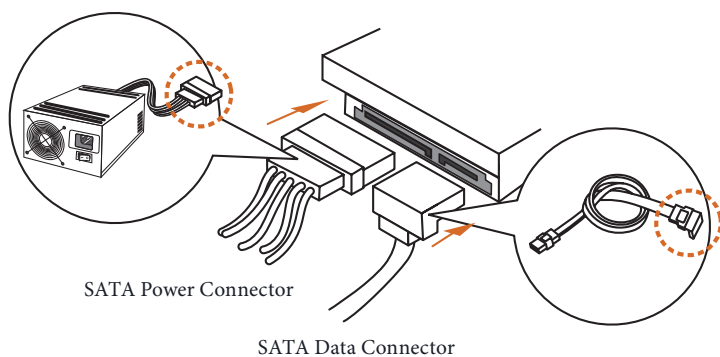
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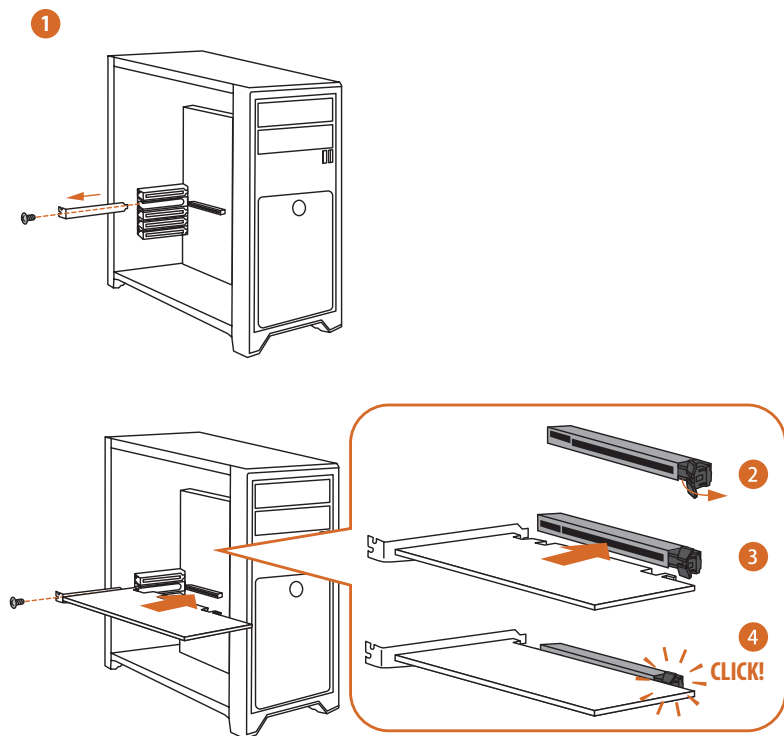
3



4



2.6 Installing a Graphics Card



Expansion Slots (PCIe Slots)

There are 5 PCI Express slots on the motherboard.



Before installing an expansion card, please make sure that the power supply is switched off or the power cord is unplugged. Please read the documentation of the expansion card and make necessary hardware settings for the card before you start the installation.

PCIe slots:

PCIE1 (PCIe 5.0 x16 slot) is used for PCIe x16 lane width graphics cards.

PCIE2 (PCIe 5.0 x16 slot) is used for PCIe x8 lane width graphics cards.

PCIE3 (PCIe 5.0 x16 slot) is used for PCIe x16 lane width graphics cards.

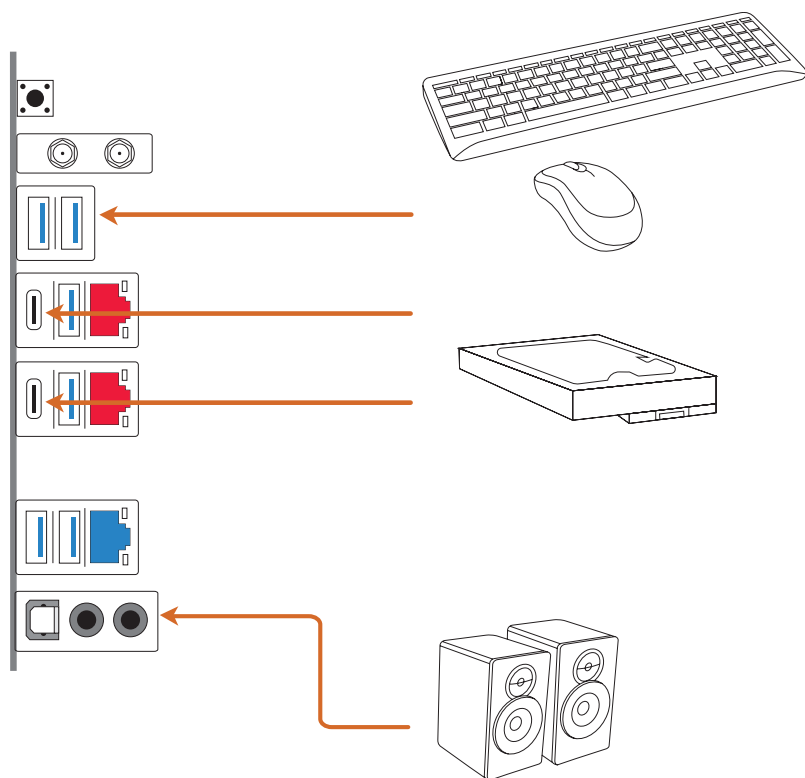
PCIE4 (PCIe 4.0 x16 slot) is used for PCIe x4 lane width graphics cards.

PCIE5 (PCIe 5.0 x16 slot) is used for PCIe x8 lane width graphics cards.

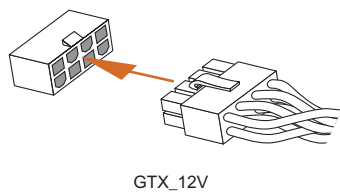
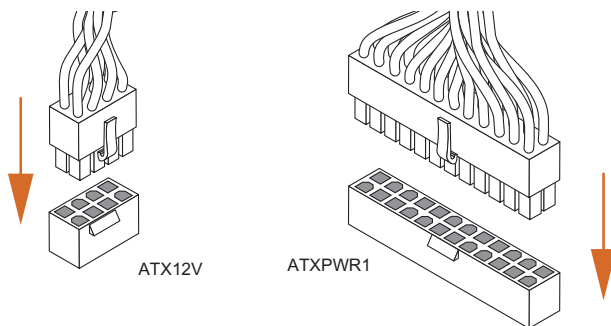
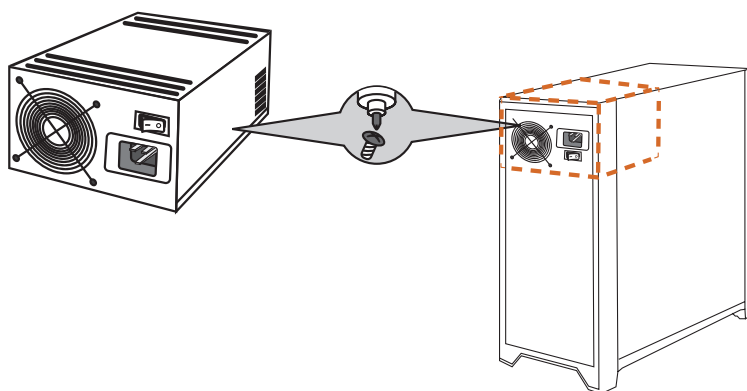


For a better thermal environment, please connect a chassis fan to the motherboard's chassis fan connector (CHA_FAN1~3/WP) when using multiple graphics cards.

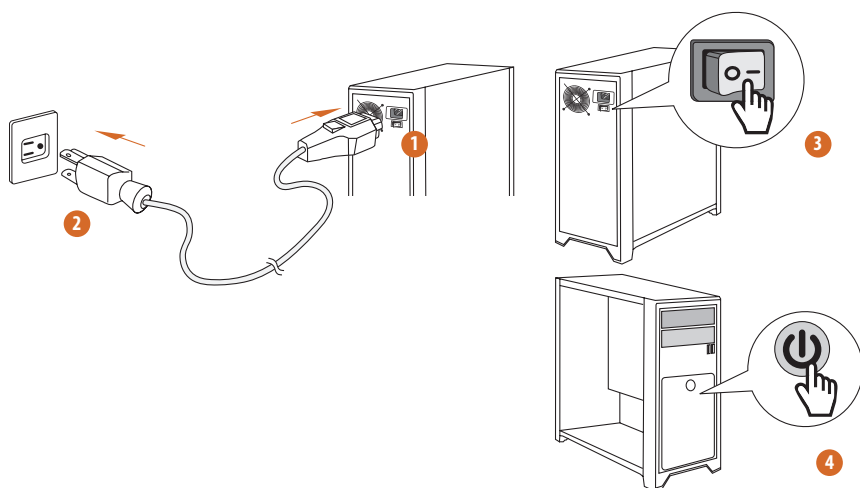
2.7 Connecting Peripheral Devices



2.8 Connecting the Power Connectors

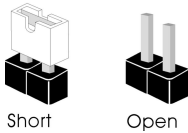


2.9 Power On



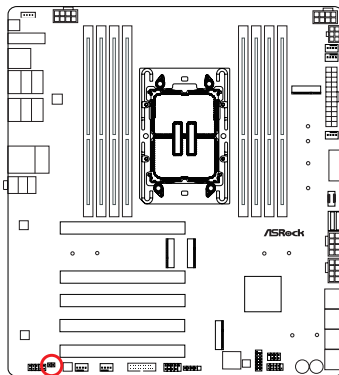
2.10 Jumpers Setup

The illustration shows how jumpers are setup. When the jumper cap is placed on the pins, the jumper is “Short”. If no jumper cap is placed on the pins, the jumper is “Open”.



Clear CMOS Jumper
(CLRMOSt) (see p.7, No. 33)

CLRMOSt allows you to clear the data in CMOS. The data in CMOS includes system setup information such as system password, date, time, and system setup parameters. To clear and reset the system parameters to default setup, please turn off the computer and unplug the power cord, then use a jumper cap to short the pins on CLRMOSt for 3 seconds. Please remember to remove the jumper cap after clearing the CMOS. If you need to clear the CMOS when you just finish updating the BIOS, you must boot up the system first, and then shut it down before you do the clear-CMOS action.



CLRMOSt



2-pin Jumper

Short: Clear CMOS

Open: Default

2.11 Onboard Headers and Connectors

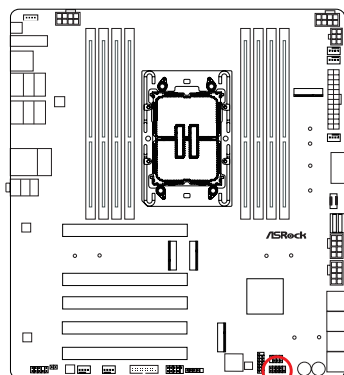


Onboard headers and connectors are NOT jumpers. Do NOT place jumper caps over these headers and connectors. Placing jumper caps over the headers and connectors will cause permanent damage to the motherboard.

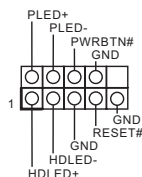
System Panel Header

(9-pin PANEL1) (see p.7, No. 24)

Connect the power button, reset button and system status indicator on the chassis to this header according to the pin assignments below. Note the positive and negative pins before connecting the cables.



PANEL1



PWRBTN (Power Button):

Connect to the power button on the chassis front panel. You may configure the way to turn off your system using the power button.

RESET (Reset Button):

Connect to the reset button on the chassis front panel. Press the reset button to restart the computer if the computer freezes and fails to perform a normal restart.

PLED (System Power LED):

Connect to the power status indicator on the chassis front panel. The LED is on when the system is operating. The LED keeps blinking when the system is in S1/S3 sleep state. The LED is off when the system is in S4 sleep state or powered off (S5).

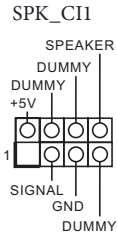
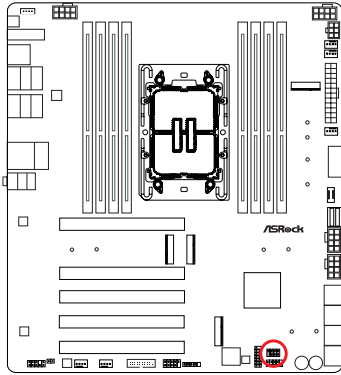
HDLED (Hard Drive Activity LED):

Connect to the hard drive activity LED on the chassis front panel. The LED is on when the hard drive is reading or writing data.

The front panel design may differ by chassis. A front panel module mainly consists of power button, reset button, power LED, hard drive activity LED, speaker and etc. When connecting your chassis front panel module to this header, make sure the wire assignments and the pin assignments are matched correctly.

Chassis Intrusion and Speaker Header (7-pin SPK_CI1) (see p.7, No. 25)

Please connect the chassis intrusion and the chassis speaker to this header.



Serial ATA3 Connectors

Right Angle:

(SATA3_0) (see p.7, No. 21)(Upper)

(SATA3_1) (see p.7, No. 21)(Lower)

(SATA3_2) (see p.7, No. 20)(Upper)

(SATA3_3) (see p.7, No. 20)(Lower)

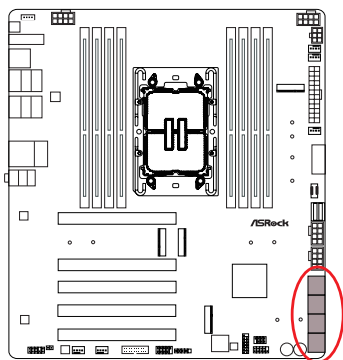
(SATA3_4) (see p.7, No. 19)(Upper)

(SATA3_5) (see p.7, No. 19)(Lower)

(SATA3_6) (see p.7, No. 18)(Upper)

(SATA3_7) (see p.7, No. 18)(Lower)

These eight SATA3 connectors support SATA data cables for internal storage devices with up to 6.0 Gb/s data transfer rate.



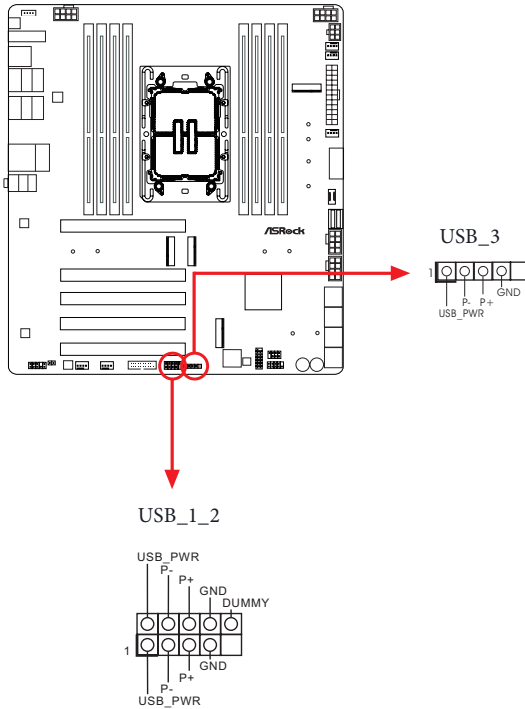
SATA3_0 SATA3_2 SATA3_4 SATA3_6
SATA3_1 SATA3_3 SATA3_5 SATA3_7

USB 2.0 Headers

(9-pin USB_1_2) (see p.7, No. 28)

(5-pin USB_3) (see p.7, No. 27)

There are two headers on this motherboard.

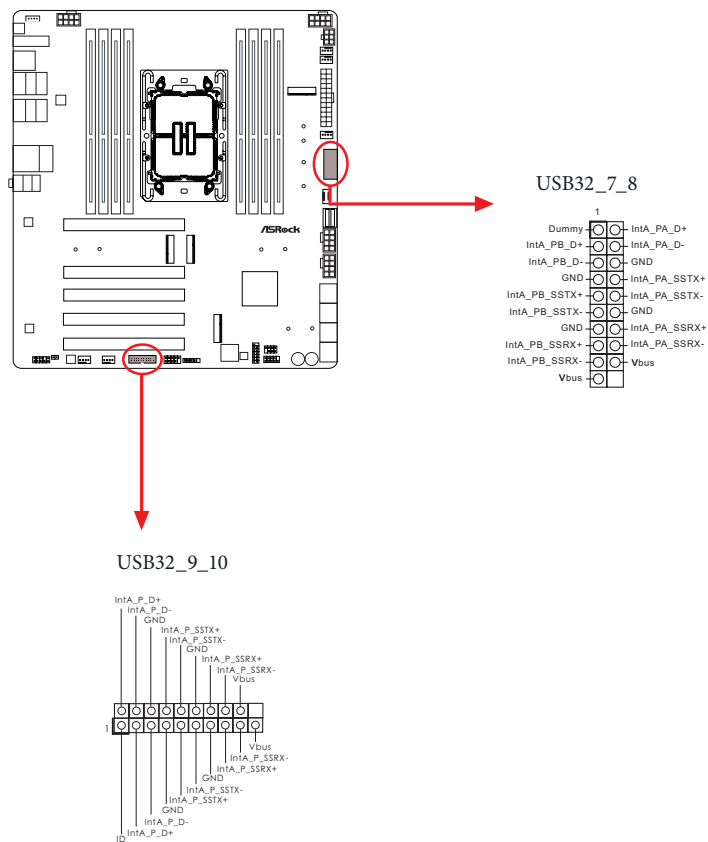


Right Angle:

Vertical:

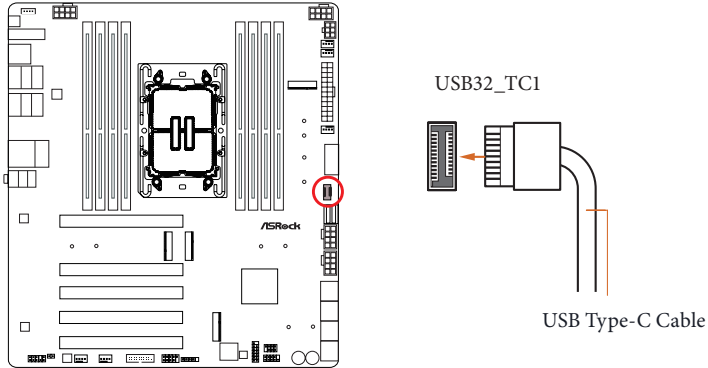
(19-pin USB32_9_10) (see p.7, No. 29)

There are two headers on this motherboard. Each USB 3.2 Gen1 header can support two ports.



Front Panel Type C USB 3.2 Gen2x2 Header
(20-pin USB32_TC1) (see p.7, No. 14)

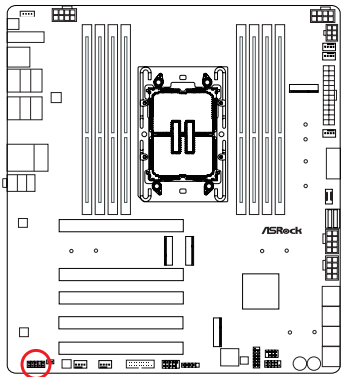
There is one Front Panel Type C USB 3.2 Gen2x2 Header on this motherboard.
This header is used for connecting a USB 3.2 Gen2x2 module for additional USB 3.2 Gen2x2 ports.



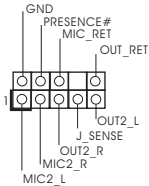
Front Panel Audio Header

(9-pin HD_AUDIO1) (see p.7, No. 34)

This header is for connecting audio devices to the front audio panel.



HD_AUDIO1



High Definition Audio supports Jack Sensing, but the panel wire on the chassis must support HDA to function correctly. Please follow the instructions in our manual and chassis manual to install your system.

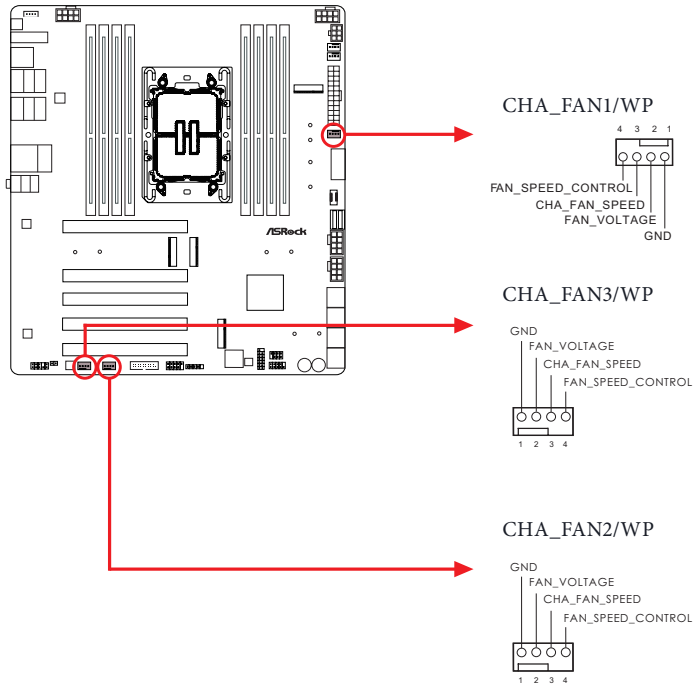
Chassis/Water Pump Fan Connectors

(4-pin CHA_FAN1/WP) (see p.7, No. 12)

(4-pin CHA_FAN2/WP) (see p.7, No. 30)

(4-pin CHA_FAN3/WP) (see p.7, No. 31)

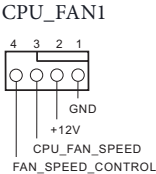
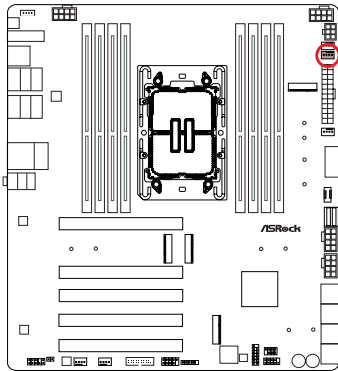
This motherboard provides three 4-Pin water cooling chassis fan connectors. If you plan to connect a 3-Pin chassis water cooler fan, please connect it to Pin 1-3.



CPU Fan Connector

(4-pin CPU_FAN1) (see p.7, No. 10)

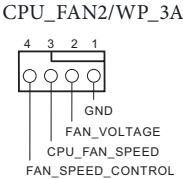
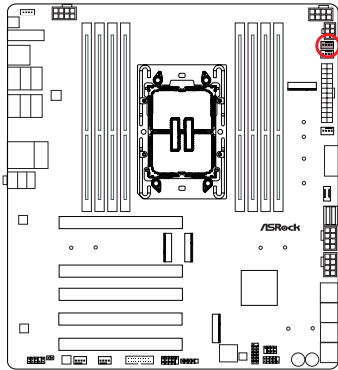
This motherboard provides a 4-Pin CPU fan (Quiet Fan) connector. If you plan to connect a 3-Pin CPU fan, please connect it to Pin 1-3.



CPU/Water Pump Fan Connector

(4-pin CPU_FAN2/WP_3A) (see p.7, No.9)

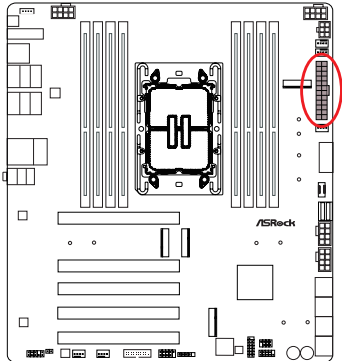
This motherboard provides a 4-Pin water cooling CPU fan connector. If you plan to connect a 3-Pin CPU water cooler fan, please connect it to Pin 1-3.



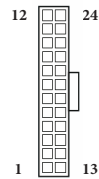
ATX Power Connector

(24-pin ATXPWR1) (see p.7, No. 11)

This motherboard provides a 24-pin ATX power connector. To use a 20-pin ATX power supply, please plug it along Pin 1 and Pin 13.



ATXPWR1



8-pin ATX 12V Power Connectors

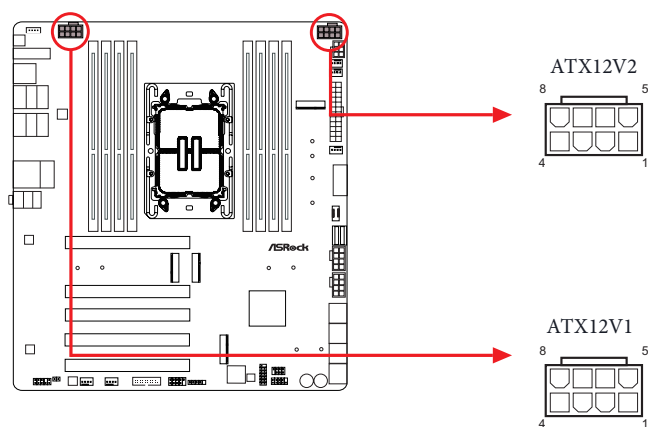
(8-pin ATX12V1) (see p.7, No. 2)

(8-pin ATX12V2) (see p.7, No. 7)

This motherboard provides two 8-pin ATX 12V power connectors. To use a 4-pin ATX power supply, please plug it along Pin 1 and Pin 5.

*Connecting an ATX 12V 8-pin cable to ATX12V2 is optional.

***Warning: Please make sure that the power cable connected is for the CPU and not the graphics card. Do not plug the PCIe power cable to this connector.**



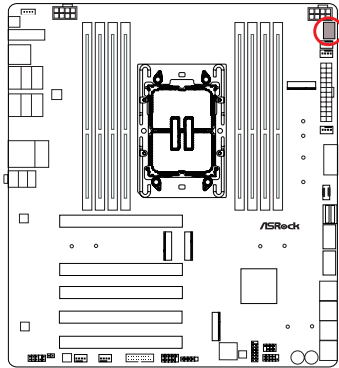
6-pin ATX 12V Power Connector

Right Angle:

(6-pin ATX12V3) (see p.7, No. 8)

This motherboard provides a 6-pin PCIe power connector which supply extra voltage for CPU overclocking.

*It is optional to connect a PCIe cable to ATX12V3.



ATX12V3



Graphics 12V Power Connectors

Right Angle:

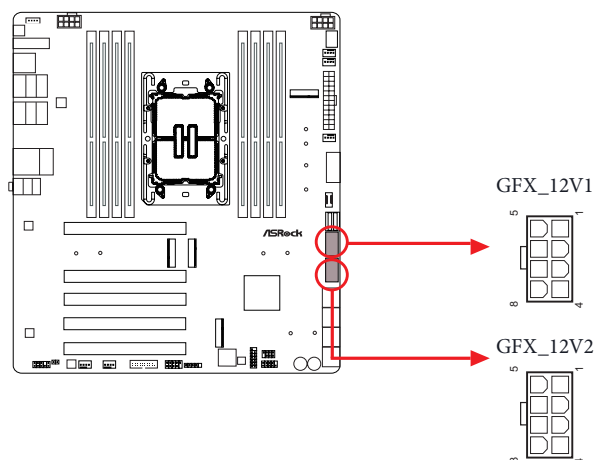
(8-pin GFX_12V1) (see p.7, No. 16)

(8-pin GFX_12V2) (see p.7, No. 17)

This motherboard provides two Graphics 12V 8 pin Power Connectors.

* Be sure to install the PSU's power cable to this connector when PCIe card is installed.

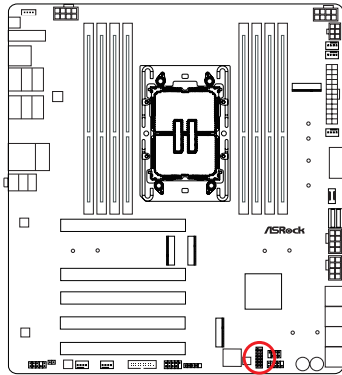
* Use either GTX_12V1 or GTX_12V2 when you install one or two PCIe card(s). Use both connectors when you install more than two PCIe cards. Otherwise, the system may not boot up properly.



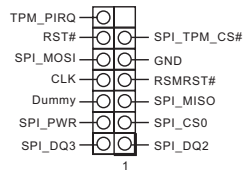
SPI TPM Header

(13-pin SPI_TPM_J1) (see p.7, No. 26)

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



SPI_TPM_J1

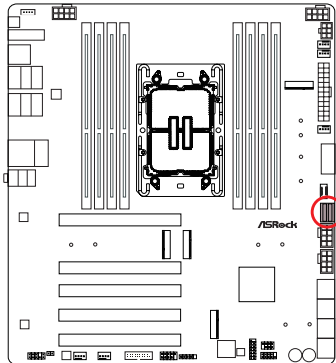


U.2 Connector

Right Angle:

(36-pin U2_1) (see p.7, No. 15)

This connector supports U.2 NVM Express storage devices up to Gen4x4 (64 Gb/s).



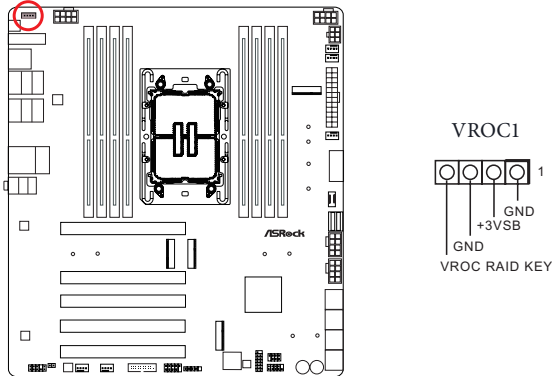
U2_1



Virtual RAID On CPU Header

(4-pin VROC1) (see p.7, No. 1)

This connector supports Intel® Virtual RAID on CPU and NVME/AHCI RAID on CPU PCIE.



With the introduction of the Intel VROC product, there are three modes of operation:

SKU	HW key required	Key features
Pass-thru	Not needed	- Pass-thru only (no RAID) 3rd party NVMe SSD support - LED Management - Hot Plug Support - RAID 0 support for Intel Fultondale NVMe SSDs
Standard	Standard Key	- Pass-thru SKU features - RAID 0, 1, 10 3rd party NVMe SSD support
Premium	Premium Key	- Standard SKU features - RAID 5 - RAID 5 Write Hole Closure 3rd party NVMe SSD support

*For further details on VROC, please refer to the official information released by Intel.

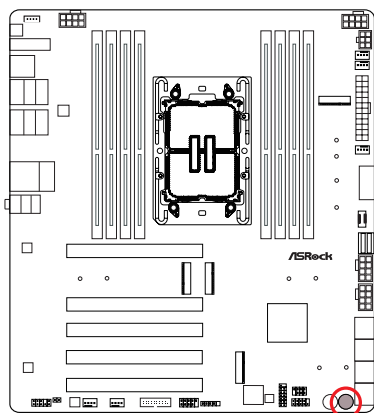
2.12 Smart Buttons

The motherboard has four smart buttons: Power Button, Reset Button, Clear CMOS Button and BIOS Flashback Button, allowing users to quickly turn on/off the system, reset the system, clear the CMOS values or flash the BIOS.

Power Button

(PWRBTN1) (see p.7, No. 22)

Power Button allows users to quickly turn on/off the system.



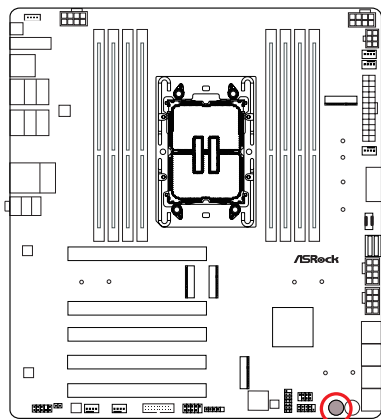
PWRBTN1



Reset Button

(RSTBTN1) (see p.7, No. 23)

Reset Button allows users to quickly reset the system.



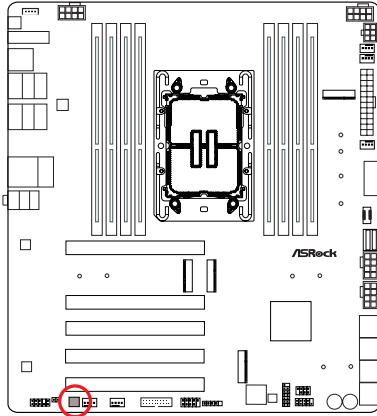
RSTBTN1



Clear CMOS Button

(CLRBTN1) (see p.7, No. 32)

Clear CMOS Button allows users to quickly clear the CMOS values.



CLRBTN1

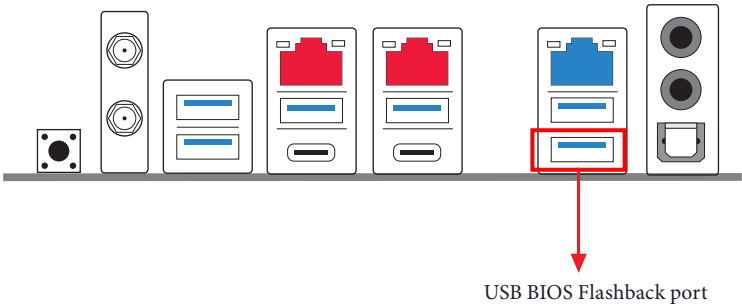
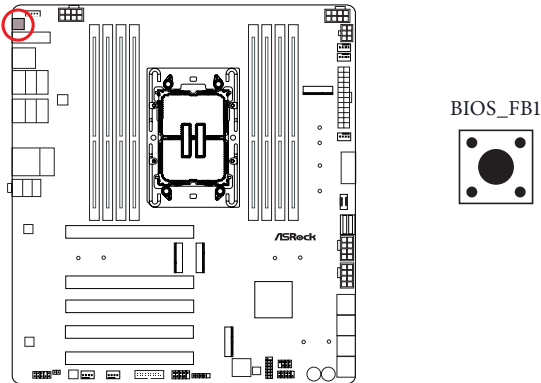


This function is workable only when you power off your computer and unplug the power supply.

BIOS Flashback Button

(BIOS_FBI) (see p.9, No. 14)

BIOS Flashback Button allows users to flash the BIOS.



ASRock BIOS Flashback feature allows you to update BIOS without powering on the system, even without CPU.



Before using the BIOS Flashback function, please suspend BitLocker and any encryption or security relying on the TPM. Make sure that you have already stored and backup-ed the recovery key. If the recovery key is missing while encryption is active, the data will stay encrypted and the system will not boot into the operating system. It is recommended to disable fTPM before updating the BIOS. Otherwise an unpredictable failure may occur.

To use the USB BIOS Flashback function, Please follow the steps below.

1. Download the latest BIOS file from ASRock's website : <http://www.asrock.com>.
2. Copy the BIOS file to your USB flash drive. Please make sure the file system of your USB flash drive must be FAT32.
3. Extract BIOS file from the zip file.
4. Rename the file to "**creative.rom**" and save it to the root directory of X: USB flash drive.
5. Plug the 24 pin power connector to the motherboard. Then turn on the power supply's AC switch.
*There is no need to power on the system.
6. Then plug your USB drive to the USB BIOS Flashback port.
7. Press the BIOS Flashback Switch for about three seconds. Then the LED starts to blink.
8. Wait until the LED stops blinking, indicating that BIOS flashing has been completed.
*If the LED light turns solid green, this means that the BIOS Flashback is not operating properly. Please make sure that you plug the USB drive to the USB BIOS Flashback port.
**If the LED does not light up at all then please disconnect power from the system and remove/disconnect the CMOS battery from the motherboard for several minutes. Reconnect power and battery and try again.

2.13 Dr. Debug

Dr. Debug is used to provide code information, which makes troubleshooting even easier. Please see the diagrams below for reading the Dr. Debug codes.

Code	Description
0x10	PEI_CORE_STARTED
0x11	PEI_CAR_CPU_INIT
0x15	PEI_CAR_NB_INIT
0x19	PEI_CAR_SB_INIT
0x31	PEI_MEMORY_INSTALLED
0x32	PEI_CPU_INIT
0x33	PEI_CPU_CACHE_INIT
0x34	PEI_CPU_AP_INIT
0x35	PEI_CPU_BSP_SELECT
0x36	PEI_CPU_SMM_INIT
0x37	PEI_MEM_NB_INIT
0x3B	PEI_MEM_SB_INIT
0x4F	PEI_DXE_IPL_STARTED
0x60	DXE_CORE_STARTED
0x61	DXE_NVRAM_INIT
0x62	DXE_SBRUN_INIT

0x63	DXE_CPU_INIT
0x68	DXE_NB_HB_INIT
0x69	DXE_NB_INIT
0x6A	DXE_NB_SMM_INIT
0x70	DXE_SB_INIT
0x71	DXE_SB_SMM_INIT
0x72	DXE_SB_DEVICES_INIT
0x78	DXE_ACPI_INIT
0x79	DXE_CSM_INIT
0x90	DXE_BDS_STARTED
0x91	DXE_BDS_CONNECT_DRIVERS
0x92	DXE_PCI_BUS_BEGIN
0x93	DXE_PCI_BUS_HPC_INIT
0x94	DXE_PCI_BUS_ENUM
0x95	DXE_PCI_BUS_REQUEST_RESOURCES
0x96	DXE_PCI_BUS_ASSIGN_RESOURCES
0x97	DXE_CON_OUT_CONNECT
0x98	DXE_CON_IN_CONNECT

0x99	DXE_SIO_INIT
0x9A	DXE_USB_BEGIN
0x9B	DXE_USB_RESET
0x9C	DXE_USB_DETECT
0x9D	DXE_USB_ENABLE
0xA0	DXE_IDE_BEGIN
0xA1	DXE_IDE_RESET
0xA2	DXE_IDE_DETECT
0xA3	DXE_IDE_ENABLE
0xA4	DXE_SCSI_BEGIN
0xA5	DXE_SCSI_RESET
0xA6	DXE_SCSI_DETECT
0xA7	DXE_SCSI_ENABLE
0xA8	DXE_SETUP_VERIFYING_PASSWORD
0xA9	DXE_SETUP_START
0xAB	DXE_SETUP_INPUT_WAIT
0xAD	DXE_READY_TO_BOOT
0xAE	DXE_LEGACY_BOOT

0xAF	DXE_EXIT_BOOT_SERVICES
0xB0	RT_SET_VIRTUAL_ADDRESS_MAP_BEGIN
0xB1	RT_SET_VIRTUAL_ADDRESS_MAP_END
0xB2	DXE_LEGACY_OPROM_INIT
0xB3	DXE_RESET_SYSTEM
0xB4	DXE_USB_HOTPLUG
0xB5	DXE_PCI_BUS_HOTPLUG
0xB6	DXE_NVRAM_CLEANUP
0xB7	DXE_CONFIGURATION_RESET
0xF0	PEI_RECOVERY_AUTO
0xF1	PEI_RECOVERY_USER
0xF2	PEI_RECOVERY_STARTED
0xF3	PEI_RECOVERY_CAPSULE_FOUND
0xF4	PEI_RECOVERY_CAPSULE_LOADED
0xE0	PEI_S3_STARTED
0xE1	PEI_S3_BOOT_SCRIPT
0xE2	PEI_S3_VIDEO_REPOST

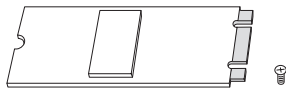
0xE3	PEI_S3_OS_WAKE
0x50	PEI_MEMORY_INVALID_TYPE
0x53	PEI_MEMORY_NOT_DETECTED
0x55	PEI_MEMORY_NOT_INSTALLED
0x57	PEI_CPU_MISMATCH
0x58	PEI_CPU_SELF_TEST_FAILED
0x59	PEI_CPU_NO_MICROCODE
0x5A	PEI_CPU_ERROR
0x5B	PEI_RESET_NOT_AVAILABLE
0xD0	DXE_CPU_ERROR
0xD1	DXE_NB_ERROR
0xD2	DXE_SB_ERROR
0xD3	DXE_ARCH_PROTOCOL_NOT_AVAILABLE
0xD4	DXE_PCI_BUS_OUT_OF_RESOURCES
0xD5	DXE_LEGACY_OPROM_NO_SPACE
0xD6	DXE_NO_CON_OUT
0xD7	DXE_NO_CON_IN

0xD8	DXE_INVALID_PASSWORD
0xD9	DXE_BOOT_OPTION_LOAD_ERROR
0xDA	DXE_BOOT_OPTION_FAILED
0xDB	DXE_FLASH_UPDATE_FAILED
0xDC	DXE_RESET_NOT_AVAILABLE
0xE8	PEI_MEMORY_S3_RESUME_FAILED
0xE9	PEI_S3_RESUME_PPI_NOT_FOUND
0xEA	PEI_S3_BOOT_SCRIPT_ERROR
0xEB	PEI_S3_OS_WAKE_ERROR

2.14 M.2 SSD Module Installation Guide (M2_1)

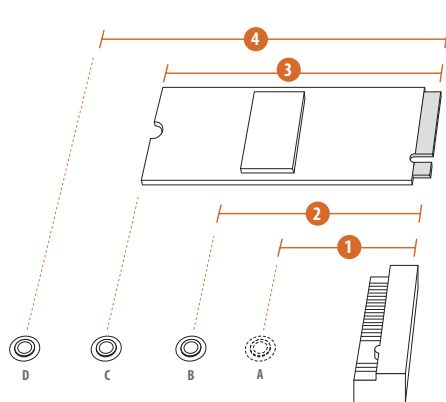
The M.2 is a small size and versatile card edge connector that aims to replace mPCIe and mSATA. The Blazing M.2 Socket (M2_1, Key M) supports type 2230/2242/2260/2280 PCIe Gen5x4 (128 Gb/s) mode.

Installing the M.2 SSD Module



Step 1

Prepare a M.2 SSD module and the screw.



Step 2

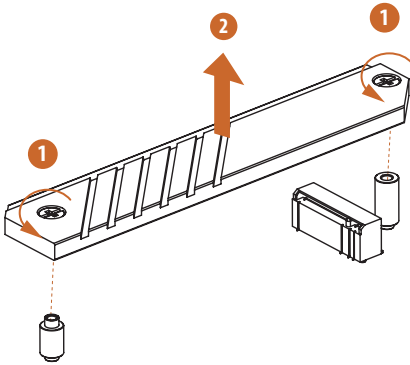
Depending on the PCB type and length of your M.2 SSD module, find the corresponding nut location to be used.

No.	1	2	3	4
Nut Location	A	B	C	D
PCB Length	3cm	4.2cm	6cm	8cm
Module Type	Type2230	Type 2242	Type2260	Type 2280

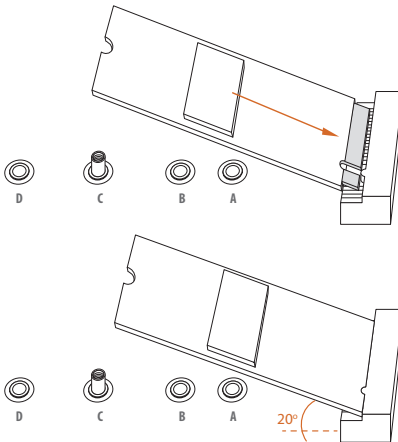
Step 3

Before installing a M.2 SSD module, please loosen the screws to remove the M.2 heatsink.

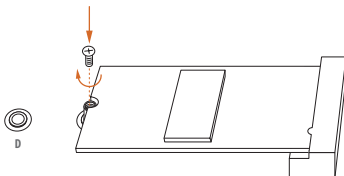
*Please remove the protective films on the bottom side of the M.2 heatsink before you install a M.2 SSD module.

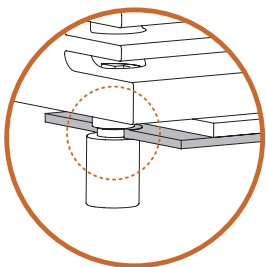
**Step 4**

Prepare the M.2 standoff that comes with the package. Then hand tighten the standoff into the desired nut location on the motherboard. Align and gently insert the M.2 SSD module into the M.2 slot. Please be aware that the M.2 SSD module only fits in one orientation.

**Step 5**

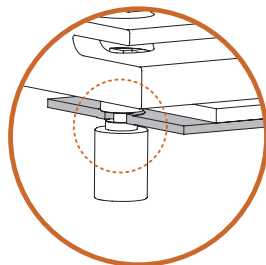
Tighten the screw that comes with the package with a screwdriver to secure the module into place. Skip Step 5 if your M.2 SSD module is Type 2280.





Correct Installation:

The SSD's PCB is in proper place, and the M.2 heatsink can be screwed in.



Incorrect Installation:

The SSD's PCB sits between M.2 heatsink and standoff. Do not continue.

Step 6

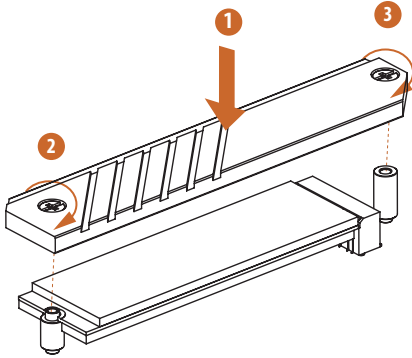
Before securing the M.2 heatsink, make sure to align the notch on the SSD to the standoff on the motherboard if you use a Type 2280 SSD module; otherwise, the SSD module may be damaged.

*The illustrations here are for reference only.

Step 7

Tighten the screw with a screwdriver to secure the M.2 heatsink into place in the order shown. Tighten screw opposite the M.2 connector first (2), and then tighten the one next to the M.2 connector (3).

*Please do not overtighten the screw as this might damage the module and M.2 heatsink.

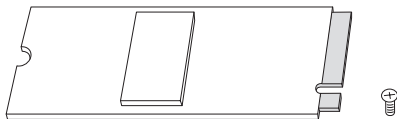


For the latest updates of M.2 SSD module support list, please visit our website for details:
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2.15 M.2_SSD (NGFF) Module Installation Guide (M2_2 and M2_3)

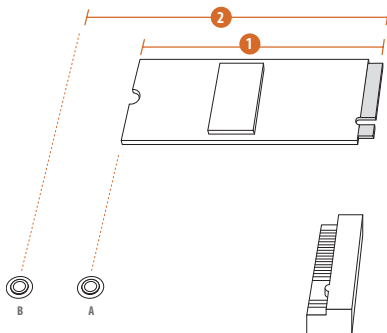
The M.2 is a small size and versatile card edge connector that aims to replace mPCIe and mSATA. The Blazing M.2 Sockets (M2_2 and M2_3, Key M) support type 2260/2280 PCIe Gen5x4 (128 Gb/s) mode.

Installing the M.2_SSD (NGFF) Module



Step 1

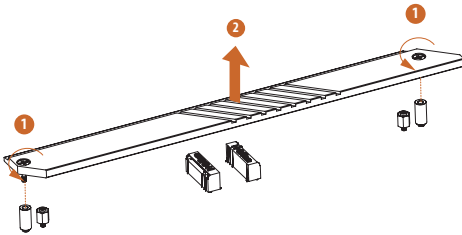
Prepare a M.2_SSD (NGFF) module and the screw.



Step 2

Depending on the PCB type and length of your M.2_SSD (NGFF) module, find the corresponding nut location to be used.

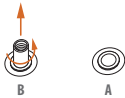
No.	1	2
Nut Location	A	B
PCB Length	6cm	8cm
Module Type	Type2260	Type 2280



Step 3

Before installing a M.2 SSD module, please loosen the screws to remove the M.2 heatsink.

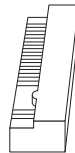
*Please remove the protective films on the bottom side of the M.2 heatsink before you install a M.2 SSD module.



Step 4

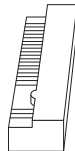
Move the standoff based on the module type and length.

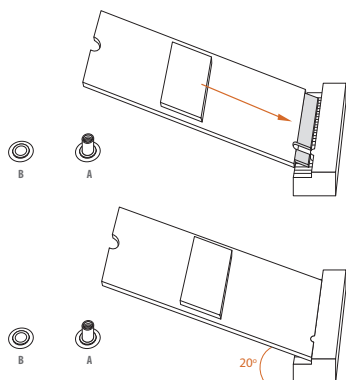
The standoff is placed at the nut location B by default. Skip Step 4 and 5 and go straight to Step 6 if you are going to use the default nut.



Step 5

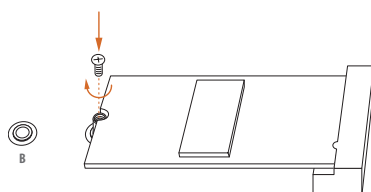
Peel off the yellow protective film on the nut to be used. Hand tighten the standoff into the desired nut location on the motherboard.





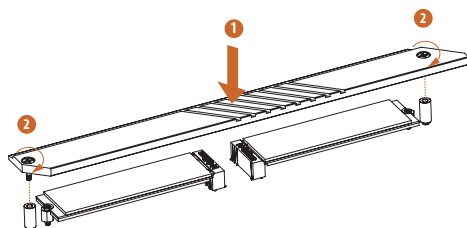
Step 6

Align and gently insert the M.2 SSD module into the M.2 slot. Please be aware that the M.2 SSD module only fits in one orientation.



Step 7

Tighten the screw with a screwdriver to secure the module into place. Please do not overtighten the screw as this might damage the module.



Step 8

Tighten the screw with a screwdriver to secure the M.2 heatsink into place. Please do not overtighten the screw as this might damage the M.2 heatsink.

For the latest updates of M.2 SSD module support list, please visit our website for details:
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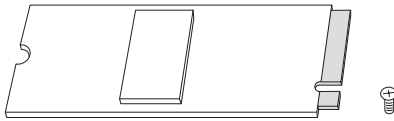
2.16 M.2_SSD (NGFF) Module Installation Guide (M2_4)

The M.2, also known as the Next Generation Form Factor (NGFF), is a small size and versatile card edge connector that aims to replace mPCIe and mSATA. The Blazing M.2 Socket (M2_4, Key M) supports type 2260/2280 PCIe Gen5x4 (128 Gb/s) mode.

Installing the M.2_SSD (NGFF) Module

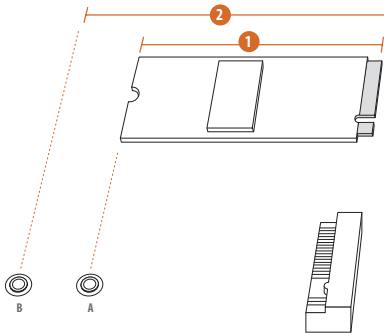
Step 1

Prepare a M.2_SSD (NGFF) module and the screw.



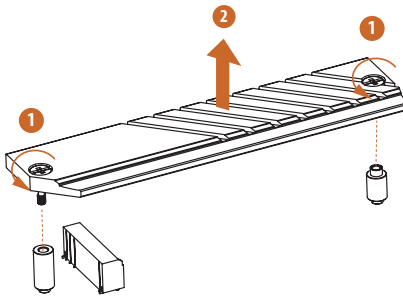
Step 2

Depending on the PCB type and length of your M.2_SSD (NGFF) module, find the corresponding nut location to be used.



No.	1	2
Nut Location	A	B
PCB Length	6cm	8cm
Module Type	Type2260	Type 2280

Step 3



Before installing a M.2 SSD module, please loosen the screws to remove the M.2 heatsink.

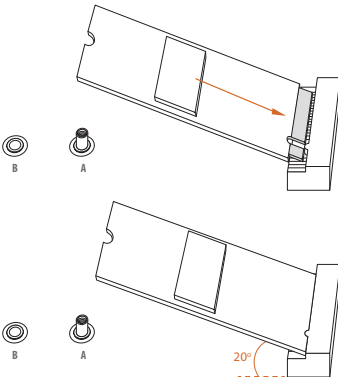
Please remove the protective films on the bottom side of the M.2 heatsink before you install a M.2 SSD module.

Step 4

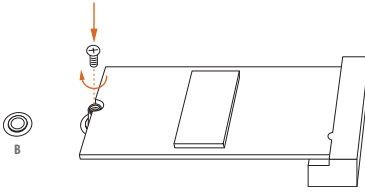


Peel off the yellow protective film on the nut A. Prepare the M.2 standoff that comes with the package, and hand tighten it into the nut. Skip Step 4 if your M.2 SSD module is Type 2280.

Step 5

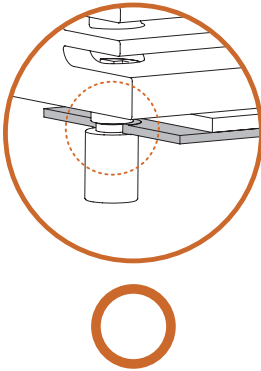


Align and gently insert the M.2 SSD module into the M.2 slot. Please be aware that the M.2 SSD module only fits in one orientation.



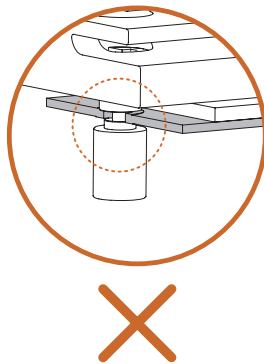
Step 6

Tighten the screw with a screwdriver to secure the module into place. Please do not overtighten the screw as this might damage the module. Skip Step 6 if your M.2 SSD module is Type 2280.



Correct Installation:

The SSD's PCB is in proper place, and the M.2 heatsink can be screwed in.



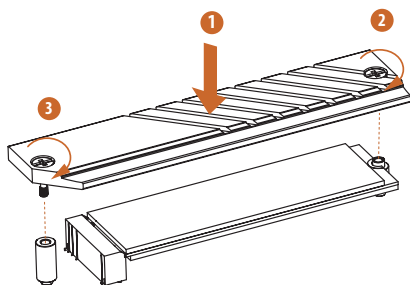
Incorrect Installation:

The SSD's PCB sits between M.2 heatsink and standoff. Do not continue.

Step 7

Before securing the M.2 heatsink, make sure to align the notch on the SSD to the standoff on the motherboard if you use a Type 2280 SSD module; otherwise, the SSD module may be damaged.

*The illustrations here are for reference only.



Step 8

Tighten the screws with a screwdriver to secure the module (if your M.2 SSD module is Type 2280) and M.2 heatsink into place in the order shown. Tighten screw opposite the M.2 connector first (2), and then tighten the one next to the M.2 connector (3).

*Please do not overtighten the screw as this might damage the module and M.2 heatsink.

For the latest updates of M.2 SSD module support list, please visit our website for details:
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Version 1.0

Published February 2023

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- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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Please keep batteries out of sight or reach of children.

CALIFORNIA, USA ONLY

The Lithium battery adopted on this motherboard contains Perchlorate, a toxic substance controlled in Perchlorate Best Management Practices (BMP) regulations passed by the California Legislature. When you discard the Lithium battery in California, USA, please follow the related regulations in advance.

“Perchlorate Material-special handling may apply, see www.dtsc.ca.gov/hazardouswaste/perchlorate”

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CE Warning

This device complies with directive 2014/53/EU issued by the Commission of the European Community.

This equipment complies with EU radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Operations in the 5.15-5.35GHz band are restricted to indoor usage only.

	AT	BE	BG	CH	CY	CZ	DE
	DK	EE	EL	ES	FI	FR	HR
	HU	IE	IS	IT	LI	LT	LU
	LV	MT	NL	NO	PL	PT	RO
	SE	SI	SK	TR			



Radio transmit power per transceiver type

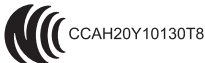
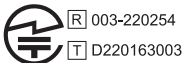
Function	Frequency	Maximum Output Power (EIRP)
WiFi	2400-2483.5 MHz	18.5 + / -1.5 dbm
	5150-5250 MHz	21.5 + / -1.5 dbm
	5250-5350 MHz	18.5 + / -1.5 dbm (no TPC)
		21.5 + / -1.5 dbm (TPC)
	5470-5725 MHz	25.5 + / -1.5 dbm (no TPC)
		28.5 + / -1.5 dbm (TPC)
Bluetooth	5725-5850 MHz	11 + / -1.5 dbm
	5945-6425 MHz	21 + / -1.5 dbm
	2400-2483.5 MHz	8.5 + / -1.5 dbm

ASRock Incorporation
Contains Wi-Fi 6E module with Bluetooth

Intel® Wi-Fi 6E AX210
Model: AX210NGW

FCC ID: PD9AX210NG

IC: 1000M-AX210NG



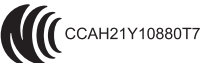
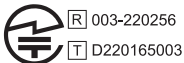
5.15~5.35/6GHz indoor use only

ASRock Incorporation
Contains Wi-Fi 6E module with Bluetooth

Intel® Wi-Fi 6E AX211
Model: AX211NGW

FCC ID: PD9AX211NG

IC: 1000M-AX211NG



5.15~5.35/6GHz indoor use only