University of Moratuwa
Department of Electronic and Telecommunication Engineering

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EN2031 - Fundamentals of Computer Organization and Design

Motherboard Dissection Report
Team Ciscers-Riscers

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1 Abstract

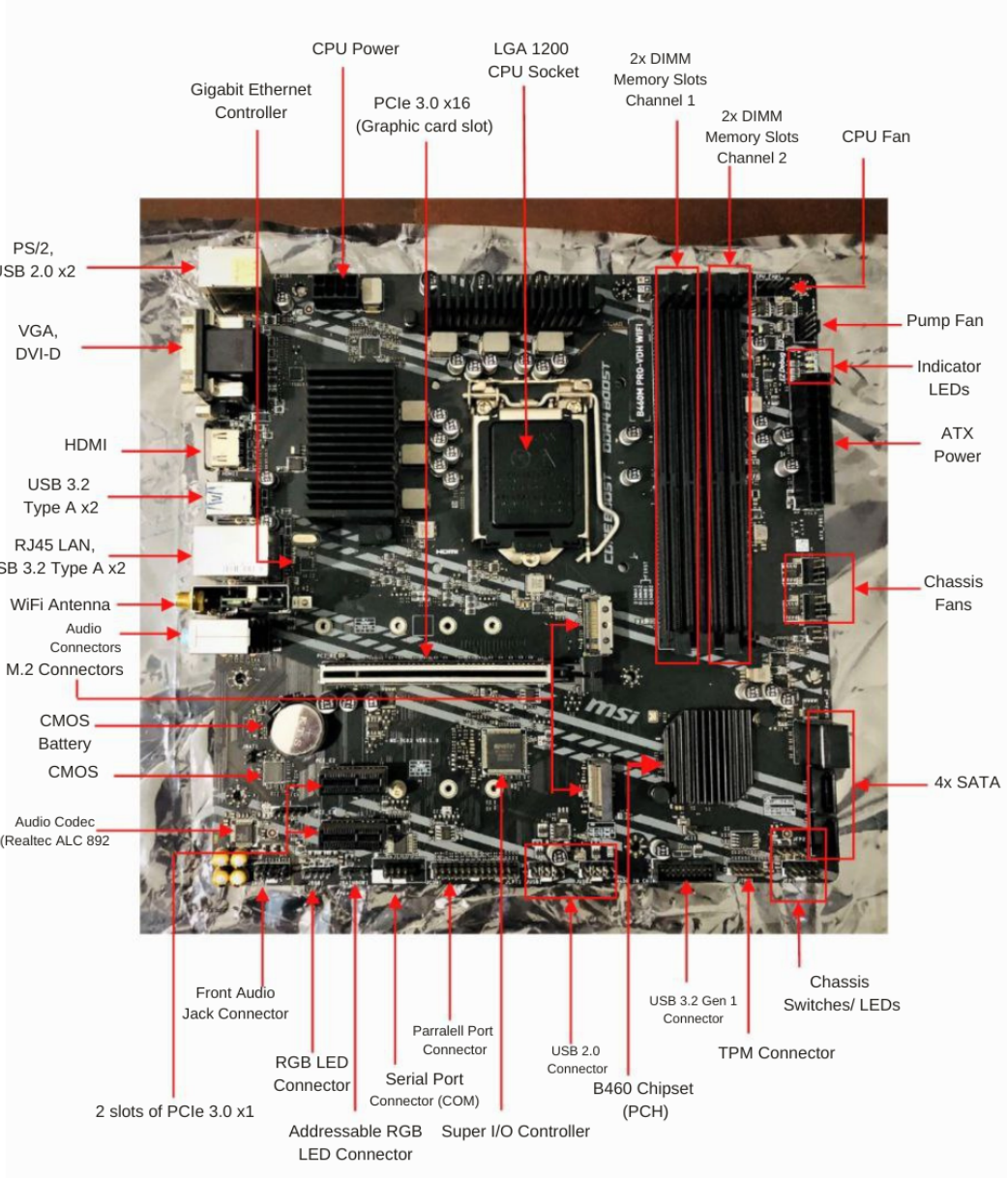
Our dissection report is based on the MSI B460M PRO-VDH WIFI motherboard and the main inceptions are Identification of main components and their key specifications, Cooling Options, Connectivity options with their key specifications, IO component classification based on their access speeds, and Functional Block Diagram indicating all the main components and their inter-connectivity.

2 Introduction

One of the standout features of this motherboard is its integrated Wi-Fi 6 technology, which offers faster and more reliable wireless connectivity compared to previous generations. This makes it an excellent choice for users who require stable internet connections for gaming, streaming, or professional work. Additionally, the motherboard includes a variety of connectivity options such as USB 3.2 Gen 1 ports, HDMI, and DisplayPort outputs, ensuring compatibility with a wide range of peripherals and displays. The B460M PRO-VDH WIFI also emphasizes cooling and thermal management, featuring multiple fan headers and comprehensive controls via the MSI Dragon Center software. This allows users to optimize their cooling setup to maintain optimal

temperatures under various workloads. The motherboard's layout is designed to facilitate easy installation and upgrades, with ample space for memory modules, storage devices, and expansion cards.Furthermore, the motherboard supports dual-channel DDR4 memory, with speeds up to 2933 MHz, providing ample bandwidth for multitasking and demanding applications. The

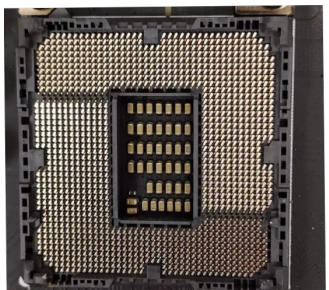
3 Motherboard Layout



4 Main Components

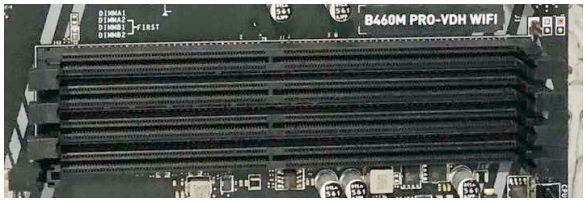
4.1 Processor

MSI B460M PRO-VDH WIFI motherboard supports 10th Gen Intel Core (i3, i5, i7, i9) and Pentium Gold / Celeron processors for LGA 1200 socket (Socket H5). Unfortunately, This motherboard does not support overclocking (For Intel we need a Z or X series Motherboard) and the dissected computer had a Intel i5-10600K,



which is a unlocked processor.
Processor socket allows the CPU to be mounted on the motherboard with the locking mechanism. The socket is designed for variety of cooling solutions to be mounted on the processor such as full fan heat-sinks or custom pump fan cooling solutions with a dedicated header pin. MSI software allows the user to monitor the temperature and control the fan speed at different levels.

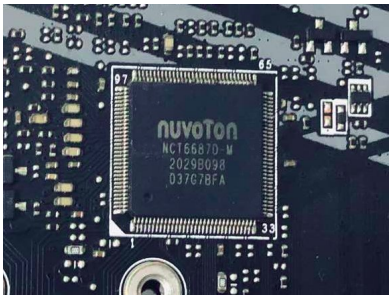
4.2 Memory (RAM)



This motherboard features four DDR4 memory slots and maximum of 128GB memory. It is compatible with Intel i7 and i9 processors, supporting 2933 MHz bus speed, and with Intel i5 and below, supporting 2666 MHz bus speed. The motherboard supports dual-channel mode, non-ECC(Error Correcting Code), un-buffered memory, and Intel Extreme Memory Profile enabled. (XMP is a memory profile that allows the user to overclock the memory to higher speeds).

4.3 Super I/O Controller

The motherboard includes an I/O controller (NUVOTON NCT6687D Controller Chip), which manages the input and output connections on the motherboard. The I/O controller provides a range of connectivity options, including USB ports, audio jacks, and network connections. It also includes features such as fan control and temperature monitoring to help manage the system's cooling and performance.



- No of USB Ports: 12
- No of SATA Ports: 6
- No of PCIe Lanes: 16
- Max Display : 3

4.4 Storage

MSI B460M PRO-VDH WIFI motherboard supports 4 SATA ports and 2 M.2 slots for storage. The SATA ports are used to connect traditional hard drives and solid-state drives to the motherboard.The M.2 slots are used to connect high-speed NVMe solid-state drives, which offer faster data transfer speeds compared to traditional SATA drives. The motherboard also supports RAID 0, RAID 1, RAID 5, and RAID 10 configurations. The M.2 slots support both PCIe and SATA-based M.2 drives and very important to mention that the M.2 SATA SSD will disable SATA 1 port. Maximum speed of SATA is 6Gb/s and M.2 is 32Gb/s.

4.5 Platform Controller Hub (PCH)

The MSI B460M PRO-VDH WIFI motherboard uses the Intel B460 chipset (PCH - Platform Controller Hub), which is part of Intel's mid-range offering for 10th Gen Intel Core processors. This supports up to 6 SATA ports, PCIe 3.0 lanes for expansion, and 12 USB ports. While it lacks overclocking capabilities (which are only available in Intel's Z-series chipsets), the B460 chipset offers dual-channel memory support and the ability to connect various peripherals. It also integrates functions like Gigabit Ethernet in conjunction with a dedicated Ethernet controller(Realtek RTL8111H) and other I/O management features to enhance system connectivity. Additionally, the chipset handles audio I/O with the support of dedicated audio codec like Realtek ALC892.

5 Other Integrated Circuits

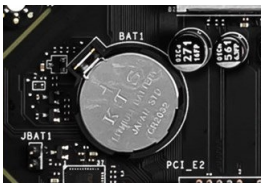
5.1 Ethernet Controller

The Realtek RTL8111H IC is used to provide Gigabit LAN ethenet conenction to this motherboard. This supports 10/100/1000 Mbps high speed networking with low latency. This also includes Green Ethernet for power-saving modes and support features like Wake-on-LAN(WoL), jumbo frame support, and hardware checksum offloading.

5.2 Audio Codec

The Realtek ALC892 is a High Definition Audio (HDA) codec chip, introduce 8-channel audio support, for 7.1 sound setup. It features a 96kHz/24-bit DAC with 97db SNR and ADC with 90dB SNR for all channels. Also this includes line-in, line-out, mic-in, and SPDIF output options. Also ALC892 supports jack detection and stereo input and output re-tasking, along with technologies such as EAX, Dolby, and DTS for enhanced sound quality. This IC communicates with the PCH (Intel B460M) to provide inputs and outputs to both the front and back panel audio jacks.

6 CMOS and Battery



CMOS stands for Complementary Metal-Oxide-Semiconductor and the main purpose is to store system settings, boot order and date and time. The CMOS battery is about 3V and The CMOS battery is used to power the CMOS chip when the computer is turned off, allowing it to retain the system settings and other information. If we remove it and put it back, the system will reset to default settings.

7 Interface Standards

7.1 PCI (Peripheral Component Interconnect)

Newer motherboards have PCI Express slots, which are faster than the older PCI slots. It is a high speed serial computer expansion bus standard. It can be used to add network cards, sound cards and graphics cards. This motherboard has 1 PCIe 3.0 x16 slots and 2 PCIe 3.0 x1 slot. The x16 slot is used for the graphics cards (Dissected computer had a Nvidia GTX 1660 Super graphics card.) and controlled by the CPU, and the x1 slots are used for other expansion cards and controlled by the PCH(Platform Controller Hub).

[h] 1x PCI-e x16 slot and 2x PCI-e x1 slots

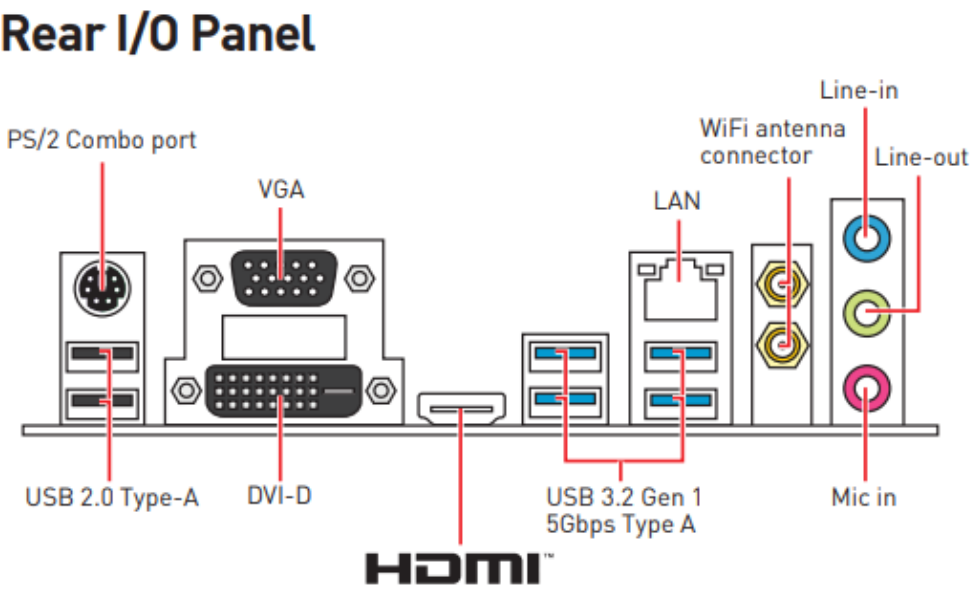
7.2 SATA

7.3 DMI 3.0

8 Functional Block Diagram

9 I/O Components

9.1 Back Panel I/O Ports



9.1.1 USB

9.1.2 VGA

9.1.3 DVI

9.1.4 HDMI

9.1.5 LAN

9.1.6 WiFi

9.2 Internal Connectors

10 Connectivity Options

11 Cooling Options

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