



Department of Electronic and Telecommunication Engineering

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Dissection of a Motherboard

Team Halo

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Abstract

This report provides an analysis of main components, input/output component classification, connectivity options and cooling options available in a GIGABYTE™ GA-G31M-ES2L motherboard. The layout of the motherboard is included as the reference.

1. Introduction

Motherboard, also known as mainboard, mboard, backplane board is the major printed-circuit board available in the computers. It plays a major role in every computer system. It holds and allows communication between the main components of the system including the central processing unit of the system (CPU), connectors which interconnects input and output devices, and memory. A typical motherboard includes several subsystems such as central processing unit, input and output of the chipset's, memory controllers, interface connectors and other elements which are commonly used for general purposes.

For the dissection and analysis of the above-mentioned factors, we use GIGABYTE™ GA-G31M-ES2L motherboard which is manufactured by GIGABYTE™. This motherboard supports several processor families.

- Intel® Core™ 2 Quad processor
- Intel® Core™ 2 Duo processor
- Intel® Core™ 2 Extreme processor
- Intel® Pentium® processor
- Intel® Celeron® processor

2. Layout

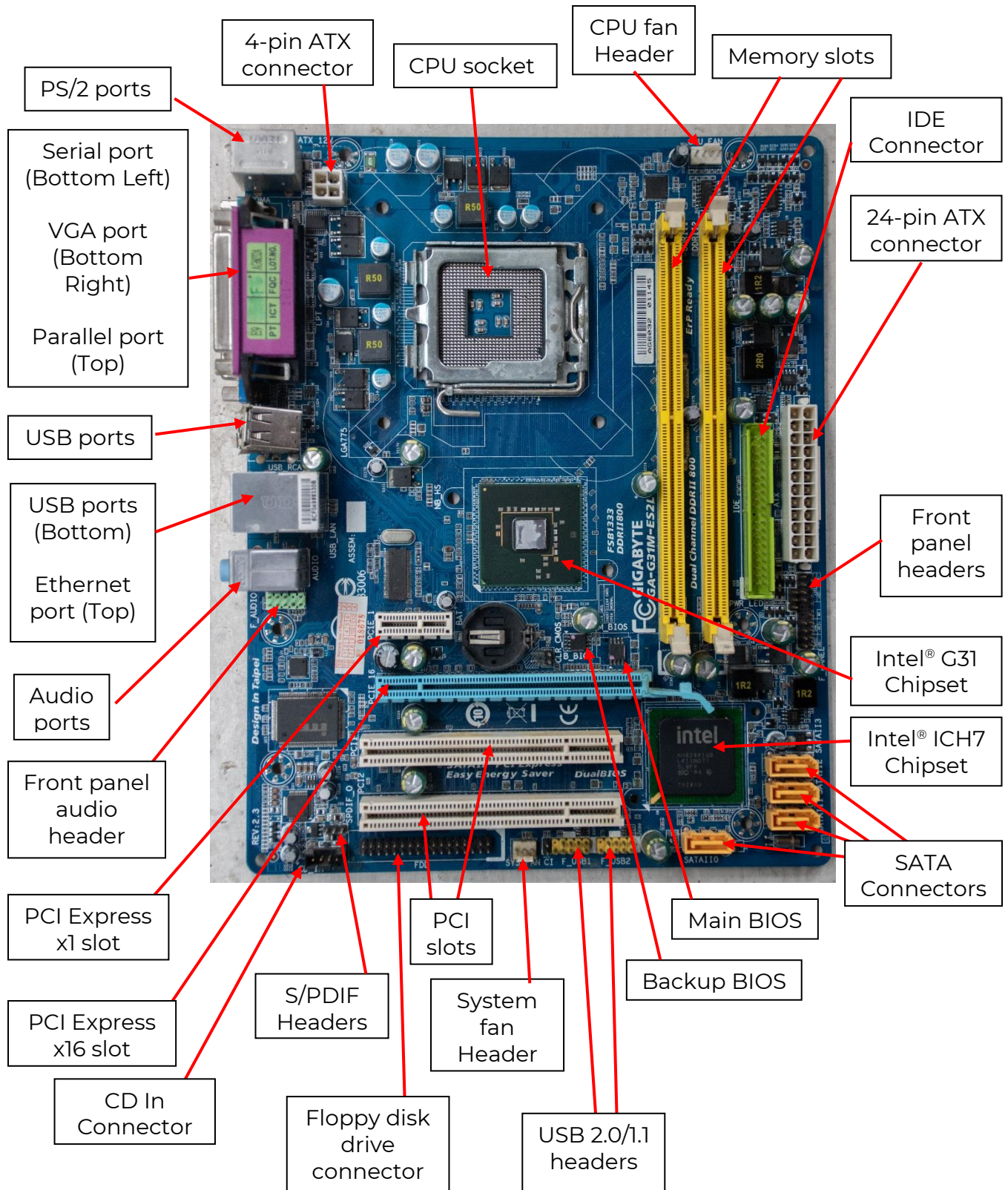


Figure 1 - Layout of GIGABYTE™ GA-G31M-ES2L motherboard

3. Functional Block Diagram

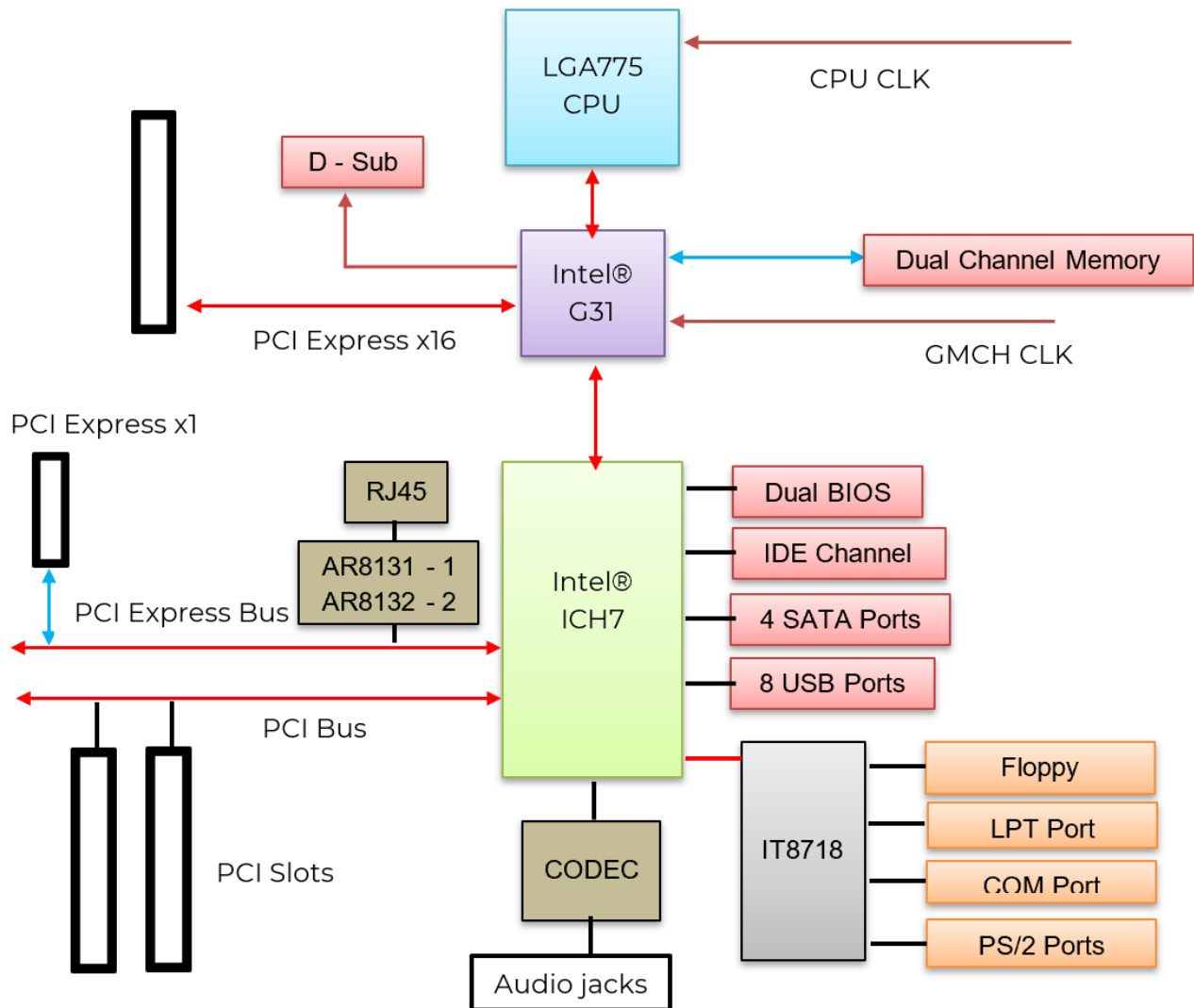


Figure 2 - Functional Block Diagram of GIGABYTE™ GA-G31M-ES2L motherboard

4. Main components and their key specifications

4.1 Identifying the Motherboard Revision

The revision of this GA-G31M-ES2L GIGABYTE® motherboard is "REV: 2.3". Revision of any motherboard is important when it comes to updating BIOS/ Drivers.

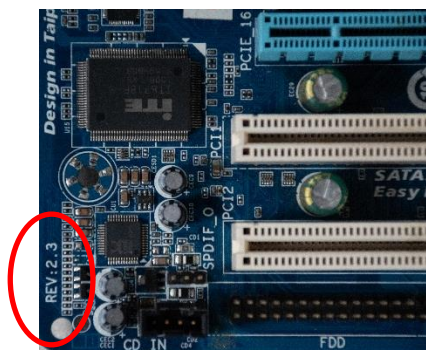


Figure 3 - Revision of the GIGABYTE™ GA-G31M-ES2L motherboard

4.2 CPU Socket

This board includes LGA775 CPU socket. As the name implies, this socket has 775 protruding pins to make contact with the contact points on the underside of the processor. (*LGA = Land Grid Array)

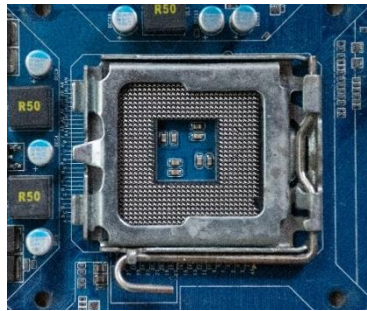


Figure 4 – LGA775 CPU Socket

4.3 Memory

The memory architecture on this motherboard is dual-channel, with two 1.8V DDR2 (dual data rate 2) DIMM (dual in-line memory module) sockets. It takes the PC2-6400 DDR2-800 240-pin SDRAM DIMM memory type and comes installed with 0 MB of memory, and it takes up to the maximum memory capacity of 4 GB of memory.



Figure 5 – Memory Slots

4.4 Chipset

A chipset in a motherboard manages the dataflow between the processor, memory, and peripherals. This motherboard includes two chipsets.

- North Bridge: Intel® G31 Express Chipset
- South Bridge: Intel® ICH7 Chipset

North Bridge includes the faster chipset (Intel® G31 Express - approx. 10.6 GB/s), which connects 2 DDR2 6.4 GB/s RAM units, Intel Graphics Media Accelerator 3100, display support for DVI, HDCP, MEC, ADD2, and PCI Express x16 graphics. The south bridge (Intel® ICH7 – approx. 2 GB/s) manages Intel® high-definition audio, 4 serial ATA ports, 6 hi-speed USB 2.0: EHCI, 4 PCI Express* x1, Intel® integrated 10/100 MAC and BIOS support.

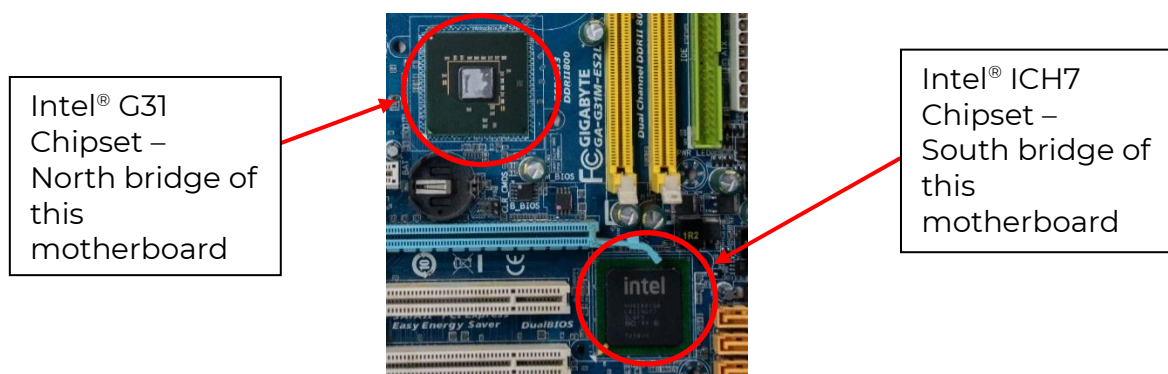


Figure 6 – Chipset

4.5 Basic Input Output System (BIOS)

This motherboard supports the licensed AWARD dual BIOS system, which is known as M. BIOS (Main BIOS, which the system primarily uses during boot up) and B. BIOS (Backup BIOS, which takes over the system booting process if the Main BIOS fails).

These are stored in two 4Mbit flash memories and support PnP 1.0a (Plug and Play), DMI 2.0 (Direct Media Interface), SM BIOS 2.4 (System Management BIOS) and ACPI 1.0b (Advanced Configuration and Power Interface)

4.6 Audio Subsystem

This motherboard has the Realtek ALC883/888B codec for high-definition audio (2/4, 5.1, and 7.1 channels), which supports S/PDIF (Sony/Philips Digital Interface) out and CD in.

5 Input Output component classification based on their access rates.

Component	Access Speed
PS/2	7 – 12 kbps
D - Sub	6.75 Gbps
USB 1.1	12 Mbps
USB 2.0	480 Mbps
Ethernet	up to 1 Gbps

Table 1

6 Connectivity options with their key specifications

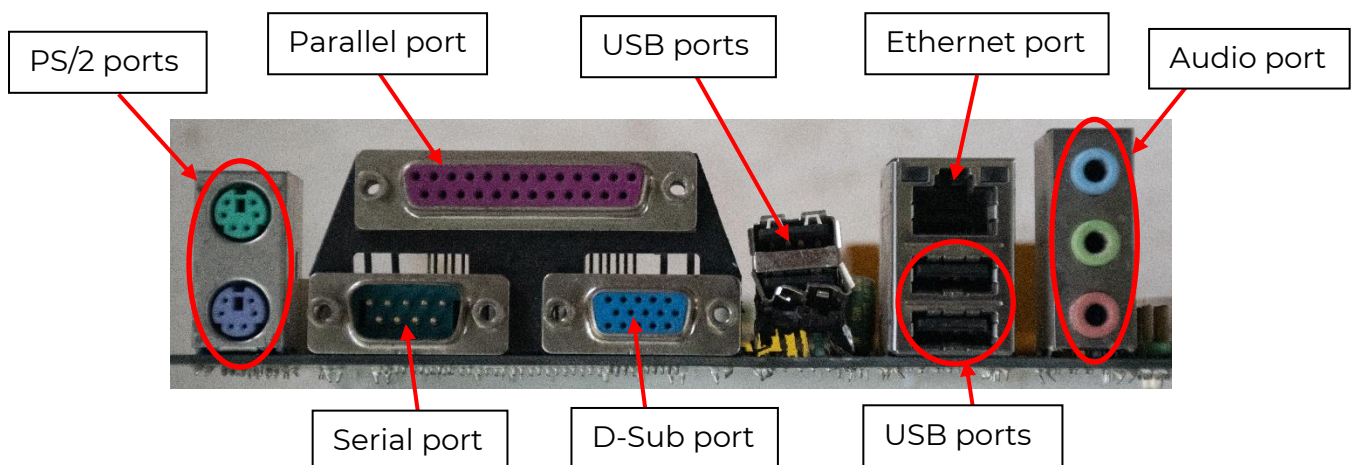


Figure 7 – Back Panel Ports

6.3 Personal System 2 (PS/2) Port

PS/2 is a connector designed by IBM to connect a mouse and a keyboard to a computer. Each port has 6 pins and belongs to mini-DIN connector family. PS/2 supports bidirectional serial synchronous protocol. The green colour port is

used to connect a PS/2 mouse and the purple colour port is used to connect a PS/2 keyboard.

6.4 Parallel Port

This connector (also known as the printer port) is widely used to connect printers (old types) and scanners. It consists with 25 pins and no less than 150 kB/s data rate. But newer EPPs (Enhanced Parallel Ports) have an 8-bit data bus, the same pin configuration, and it reaches up to 2 MB/s data rate.

6.5 Serial / Communication (COM) Port

Serial port is a serial communication interface. The data transfer in or out sequentially and one bit at a time and is used to connect external devices such as modem, mouse, terminals, and other useful peripherals.

6.6 Universal Serial Bus (USB) Port

The USB ports on this motherboard supports the USB 2.0/1.1 specifications and it can be used for devices such as USB keyboard/ mouse, USB printer, USB flash drive etc.

All the USB ports are controlled by the south bridge, and this mother board can have up to 8 USB 2.0/1.1 ports (4 on the back panel and remaining 4 via brackets connected to the USB headers in the motherboard).

6.7 Ethernet Port

The Ethernet LAN port of this motherboard provide an internet connection up to 1 Gbps data rate and consists with two built-in LEDs.

1. Connection/ Speed LED: indicates the data rate of the LAN port by its colour.
 - Orange – 1 Gbps data rate
 - Green – 100 Mbps data rate
 - Off – 10 Mbps data rate
2. Activity LED: states whether the data transmission or receiving is occurring or not. (Blinking or Off state)

This ethernet connection is controlled by Qualcomm Atheros AR8131-AL1E chip.

6.8 D-Sub Port

The D-sub (D-sub miniature) port also known as the VGA port is used to connect D-sub connection supported monitors.

6.9 Audio Ports

It consists with three 3.5 mm wide connectors which are generally considered as audio jacks.

- I. Line In (Blue): used for devices such as an optical drive, Walkman.
- II. Line Out (Green): used for a headphone or a 2 – channel speaker. Also, it can be used to connect front speakers in a 4/5.1 – channel audio configuration.

III. Mic In (Pink): Used to connect microphones.

6.10 Integrated Drive Electronics (IDE) Connector

The IDE (Integrated Drive Electronics) connector is a standard interface that connects a bus on the motherboard to disk storage devices. This connector supports ATA-100/66/33 and up to two IDE devices, such as hard drives and optical drives.

6.11 Expansion Slots

To expand the motherboard by mounting external circuitries, this motherboard has 2 PCI (Peripheral Component Interconnect) slots, 1 PCI Express x1 slot and 1 PCI Express x16 slot.

PCI is a computer bus which connects hardware devices while PCI Express which is an advanced version of PCI, connects graphic ports, Wi-Fi, and other devices. PCI has speed up to 533 MB/s while PCI Express has speed up to 126 GB/s and comes with hot plugging capabilities.

6.12 Serial Advanced Technology Attachment (SATA) Ports

The SATA port is a transport protocol that defines how data is transferred between the motherboard of a computer and mass storage devices (HDDs, optical drives, and SSDs). This motherboard has four SATA connectors with a 3 Gb/s data rate (also compatible with the SATA 1.5 Gb/s standard), supporting up to four storage devices.

6.13 Floppy Connector

The FDD (Floppy Disk Drive) connector on this motherboard supports floppy disk drives with 360 KB, 720 KB, 1.2 MB, 1.44 MB, and 2.88 MB of storage.

7 Cooling Options - Heat Sinks, Fans, Temperature sensors for monitoring

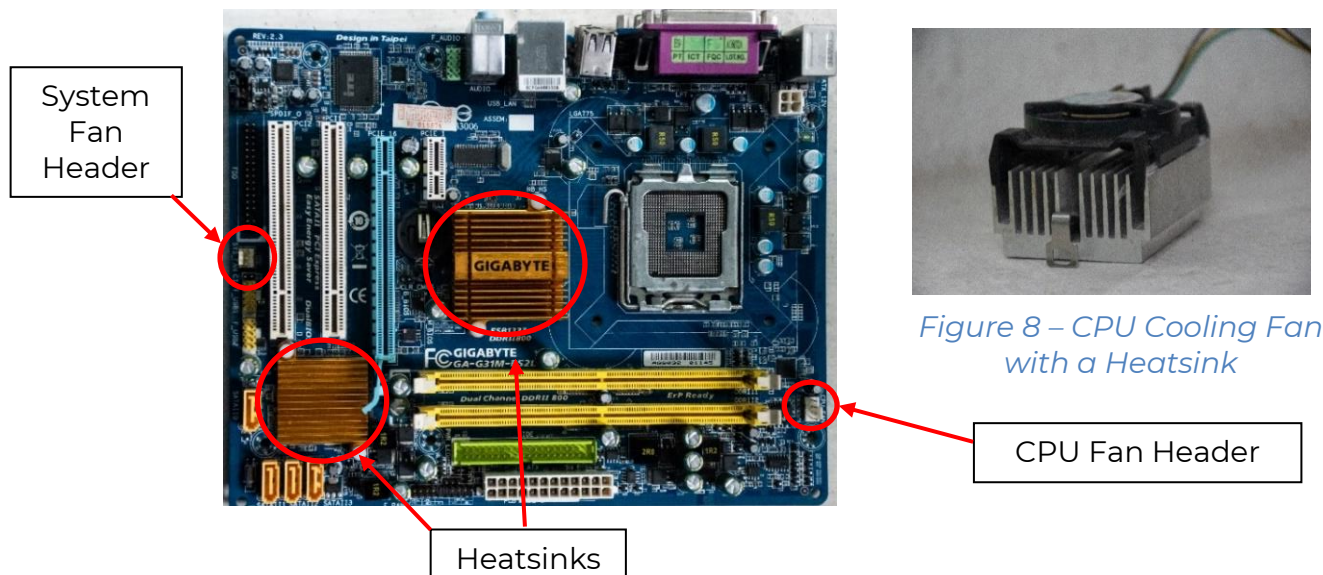


Figure 8 – Locations of Heatsinks and Fan

Heat sinks are widely used to remove the heat generated in the CPU (Central Processing Unit) and the GPU (Graphic Processing Unit). These heat sinks are usually connected on the top of the components mentioned above. This motherboard has three heat sinks installed on top of the CPU, North Bridge and South Bridge.

Fans are connected to the pointers where heat is generated in the motherboard and the fan speed is controlled according to thermal conditions. This motherboard comes with a fan mounted on top of the heatsink installed on top of the CPU.

8 Contribution

Index Number	Name	Covered Area
200476P	Pramuditha A.A.H.	Connectivity options, Abstract
200650U	Thilakarathne D.L.J.	Layout, Cooling options, Main components
200733D	Wijetunga W.L.N.K.	Introduction, Functional block diagram, Photographs

Table 2

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