



DEPARTMENT OF ELECTRONIC & TELECOMMUNICATION ENGINEERING  
UNIVERSITY OF MORATUWA

EN2031 - Fundamentals of Computer Organization and Design

MOTHERBOARD DISSECTION REPORT

HP E93839

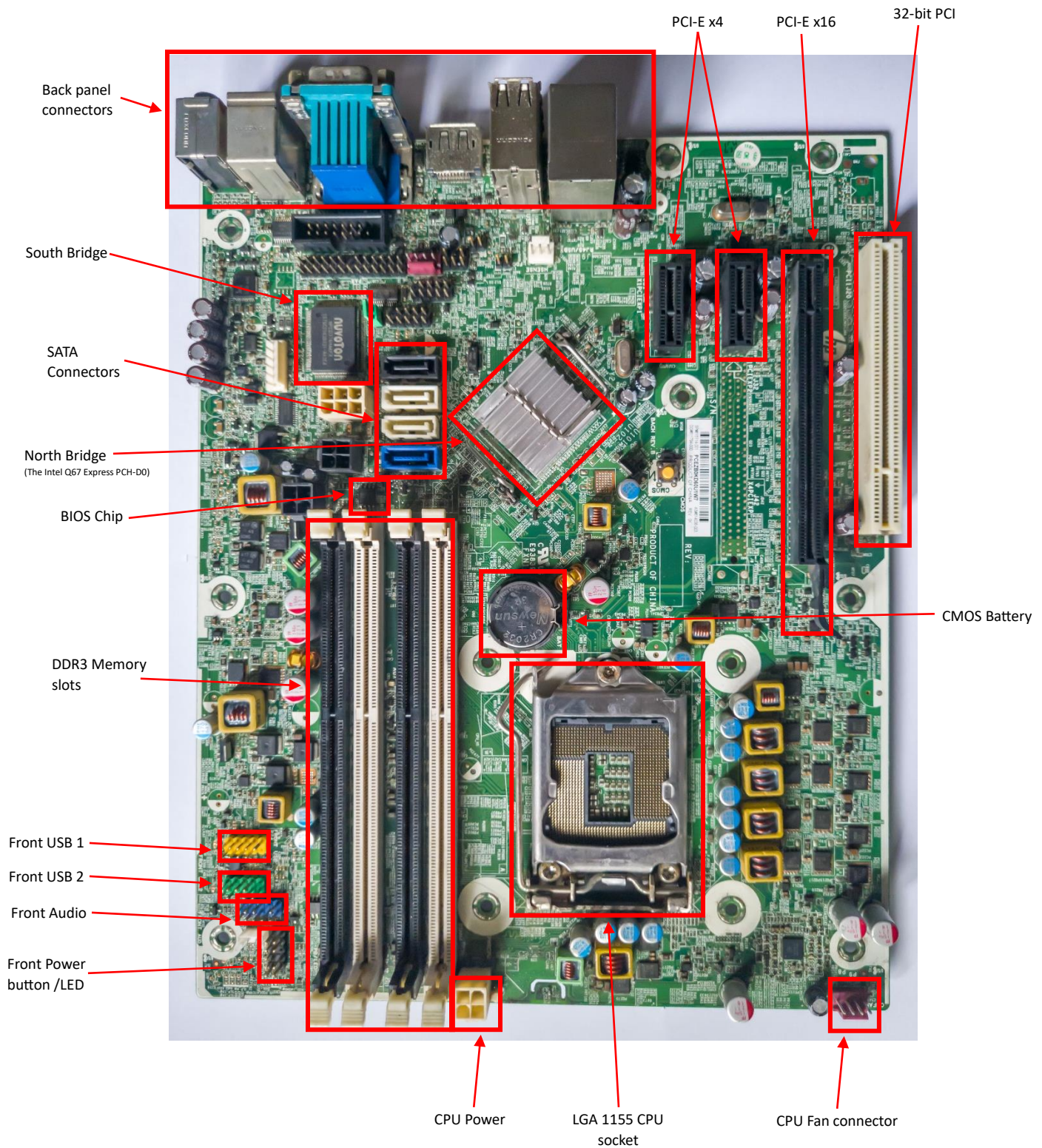


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## 1. Main components of HP E93839 Motherboard





## 1.1 Central Processing Unit

This motherboard is compatible with a range of Intel processors including Celeron, Pentium, Core i3, Core i5, and Core i7. These processors can run software designed for earlier x86 microprocessors and come with streaming SIMD extensions (SSE, SSE2, and SSE3) that enhance performance in tasks like 3D graphics and speech processing. Intel processors featuring vPro Technology offer hardware-based features that enable remote management and security by corporate IT teams.

The motherboard features a ZIF (zero-insertion-force) H2 socket, specifically the LGA1155 socket type, which is designed for installing CPUs with the LGA1155 package. The primary processors that can be used with this setup are Intel's offerings.

- Intel core i3 – 2xxx/3xxx
- Intel core i5 – 2xxx/3xxx
- Intel core i7 – 2xxx/3xxx



LGA 1155 socket enables an electrical connection of the CPU to the motherboard while guaranteeing physical security and protection. The socket form factor comprises a land grid array (LGA) of 1155 pins to connect the CPU.

## 1.2 Chipset



The Intel Q67 Express PCH-D0 is a flexible hub that plays a crucial role in computer systems' flawless operation. Functioning as a central unit, it regulates data flows through PCI and PCIe bus controllers, interacts with Low Pin Count and SMBus systems, and facilitates SATA storage connections. Alongside this, it performs HD audio tasks, maintains precise timekeeping with RTC/CMOS features, and effectively manages peripheral device activities with IRQ control. Furthermore, it enables communication with serial devices via the Serial Peripheral Device interface and optimizes power efficiency with clever power management logic.

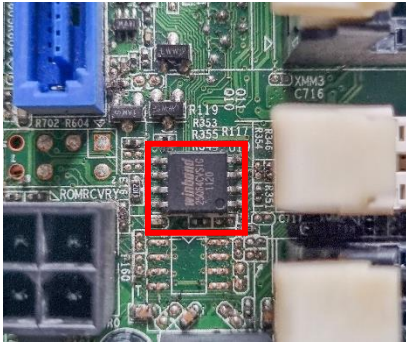
The chip's capabilities extend to communication as well, with USB 1.1/2.0 controllers enabling an amazing 14 USB ports for seamless peripheral integration. Its integration of a Gigabit Ethernet controller further bolsters networking speeds for fast data transfer. Overall, the Q67 Express PCH-D0 is a crucial component, increasing system performance, manageability, connection, and energy efficiency. Its integration of important interfaces and controllers accelerates system design and functionality, making it a cornerstone for comprehensive computing systems.

## 1.3 Memory

These computers utilize a dual-channel DDR3 memory setup. All variations are compatible with DDR3 1333-MHz (PC3-10600) and 1066-MHz (PC3-8500) memory modules. For the CMT, MT, and SFF form factors, there are four UDIMM (unbuffered dual in-line memory module) sockets available, allowing a maximum memory capacity of 16



gigabytes. On the other hand, the USDT form factor is equipped with two SODIMM (small outline dual in-line memory module) slots and can support a maximum of eight gigabytes of memory. BIOS Chip (ROM)



The BIOS chip on the HP E93839 motherboard, known as the Winbond W25Q80BV, is an 8MB (1M x 8) serial flash memory chip responsible for storing the BIOS firmware. This firmware provides important instructions that enable the computer to start up and initialize its hardware components. The Winbond W25Q80BV chip is generally regarded for its stability and longevity, usually found in many motherboards. While uncommon, if the chip fails, it can be changed to restore proper functionality. To locate the BIOS chip, look for a little rectangular chip labeled "BIOS" or "UEFI," with the exact IC number "Winbond W25Q80BV" printed on it. This chip's job is important in providing a smooth and stable system boot procedure.

#### 1.4 CMOS

CMOS (Complementary Metal Oxide Semiconductor) is a memory chip where BIOS setup; and system settings such as date and time are stored. Usually, its capacity is about 256 bytes. It has a CR2032 lithium battery dedicated to powering the CMOS.



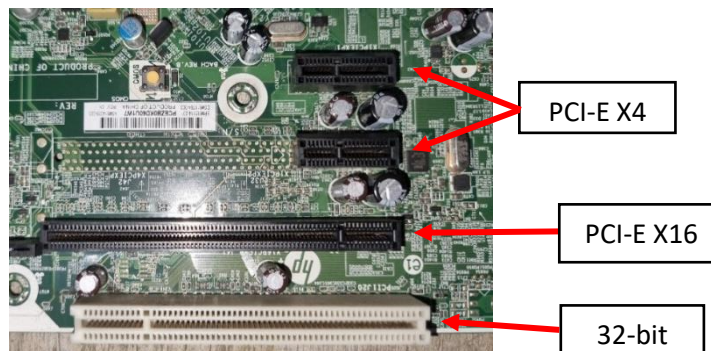
#### 1.6 Input Output Components

The motherboard contains the IO ports listed below:

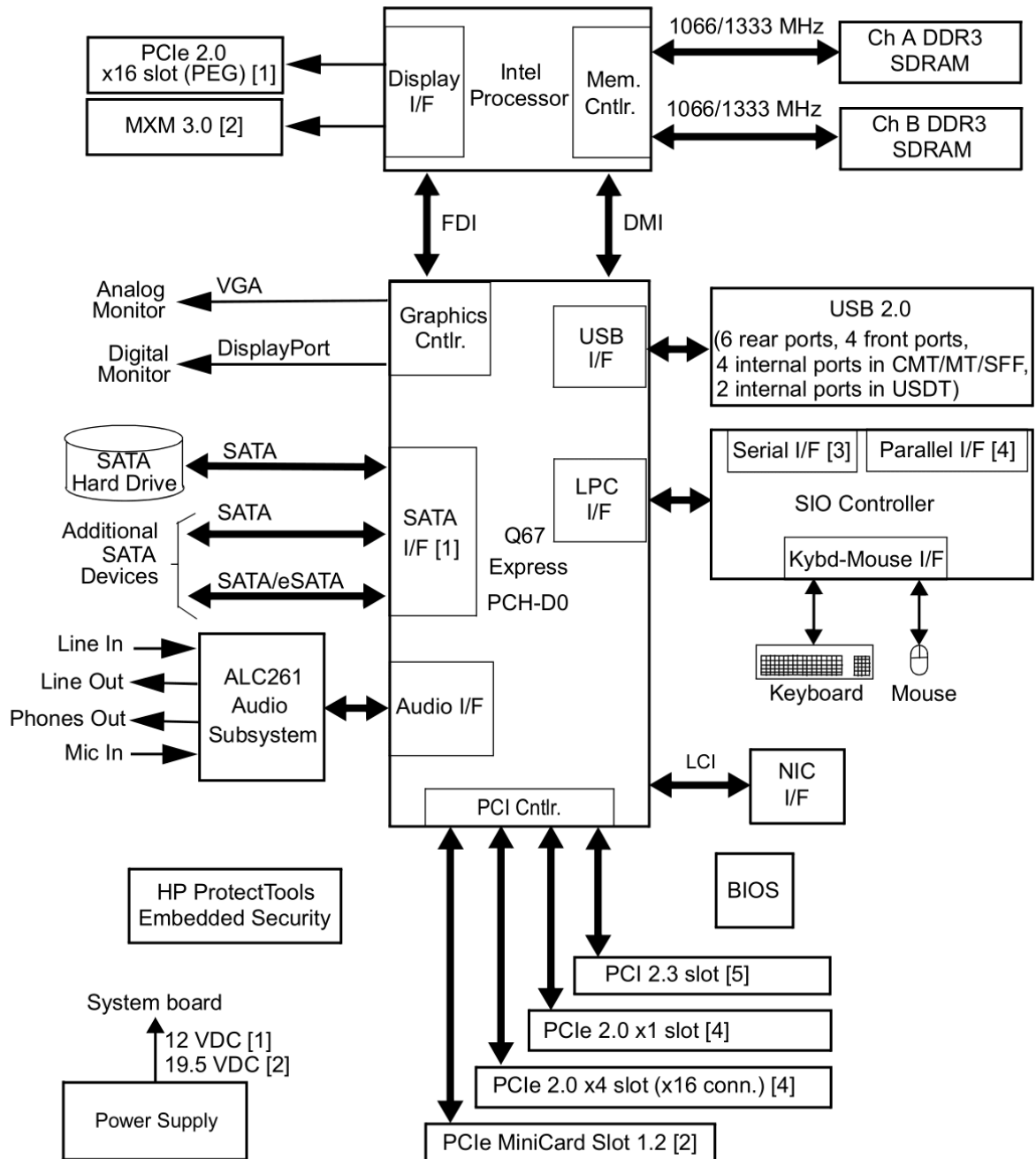
- USB Ports: There are 6 USB ports in the motherboard.
- VGA Port: To connect an analog monitor.
- LAN (RJ-45 jack) Port: This port connects the computer to the wired LAN.
- Display Port: To attach a digital monitor.
- PS/2 Ports: There are 2 ports to connect the mouse and the keyboard.
- Serial (RS232) Port: To communicate the computer and external devices.
- Audio jacks: 2 audio ports to connect audio devices.

#### 1.7 Peripheral Component Interconnect (PCI and PCIe) Slots

The motherboard features ten accessible USB ports: four on the front and six on the back. It allows for simultaneous VGA and DisplayPort dual-monitor setup. A PCIe x16 connector supports graphics cards, and a PCIe x16 slot operates at x4 or x16 for additional cards. Installing a card involves shutdown, cover removal, card installation, and power-up. The integrated graphics controller can be disabled for alternate multi-monitor operation. PCI 2.3 and PCI Express (PCIe) buses are utilized, ensuring compatibility and efficient data transfer. Software/driver compatibility is maintained between PCIe and legacy PCI systems during initialization.

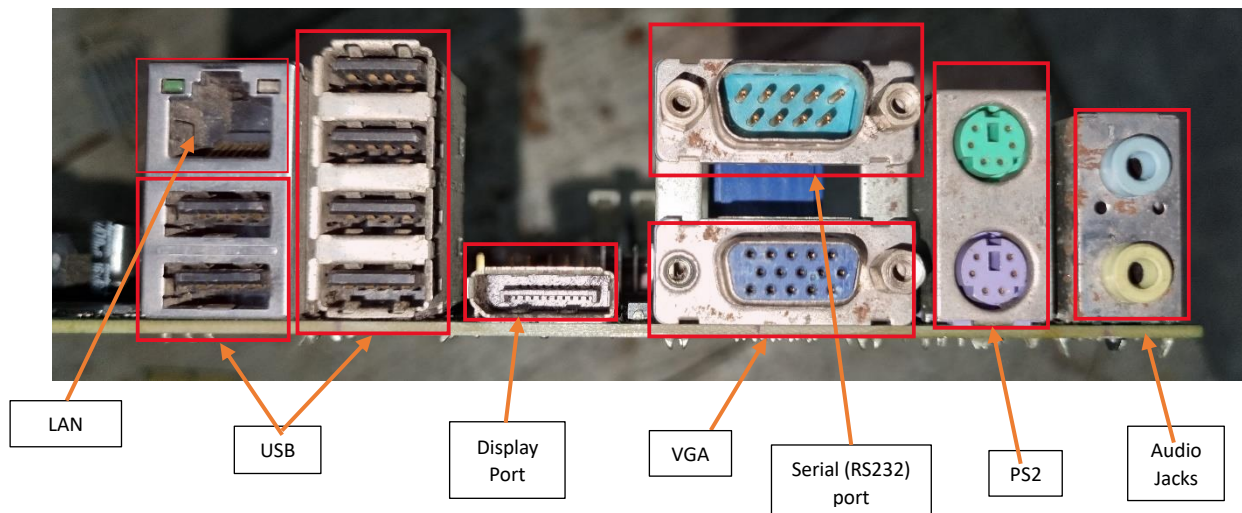


## 2. Functional Block Diagram



### 3. Classification of IO Components

Input/Output components, commonly known as IO ports, are crucial for the proper functioning of a computer. These components are typically integrated into the motherboard and serve essential purposes. This report will discuss the various types of IO components and provide an overview of their functionalities.



#### 3.1 USB Ports:

- This motherboard provides 6 rear panel USB ports. These systems include an internal header connection for USB option modules.
- These USB 2.0 controllers provide a maximum transfer rate of 480 Mb/s.
- The recommended USB cable length between the host and the USB device is less than 16 feet for full-channel (12 MB/s) operation.

#### 3.2 LAN (RJ-45 jack) Port:

- This connector includes the two status LEDs as part of the connector assembly.
- This port connects the computer to a Local Area Network via a wired connection of Cat5/5e/6/6a cables.
- The connector supports a 10/100/1000 Mbps network which we can indicate the currently occupied network by the LEDs.

#### 3.3 PS/2 Ports:

- This motherboard has separate PS/2 connectors for the keyboard and pointing device. Both connectors are identical both physically and electrically.
- Each port has 6 pins. There are 4 pins, which are dedicated to data transfer, power supply, grounding, and clock synchronization, and 2 pins are not connected.

#### 3.4 VGA Port:

- The motherboard includes a legacy VGA connector for attaching an analog video monitor.
- This port can be used to connect a monitor/display externally to the computer. It is known as a D-sub connector. There are 15 pins which are in 3 row.

#### 3.5 Display Port:

- The motherboard has a DisplayPort connector for attaching a digital monitor.
- This interface also supports the use of an optional adapter/dongle for converting the DisplayPort output to a DVI, HDMI, or analog VGA output.



### 3.6 Audio Jacks:

- We can connect speakers and other audio devices by using these audio devices.
- There are two audio output jacks. One is a headphone out jack, while the other is a line out jack.
- The Headphone Out jack can provide audio for one application while the Line Out jack can provide external speaker audio from another application.

### 3.7 Serial (RS232) Port:

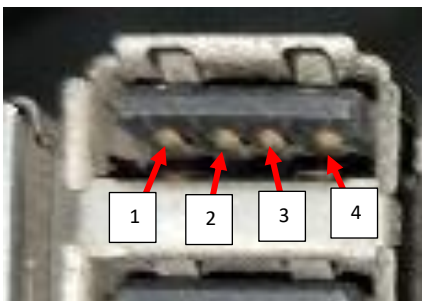
- This RS-232-C-type serial interface is used to transmit and receive asynchronous serial data with external devices.
- The serial interface uses a DB-9 connectors which has 9 pins.
- The serial interface function is provided by the super I/O controller component that includes two NS16C550-compatible UARTs.

## 4. Connectivity Options with Key Specifications

### 4.1 USB Connector

The motherboard provides ten USB ports for connecting devices. Four are situated at the front and six at the back. Different form factors include additional internal USB ports. Some models have two internal USB ports, while others have four. All ports support USB 1.1 and 2.0. USB ports can be disabled individually or in groups through BIOS Setup to enhance security against physical attacks.

The Universal Serial Bus (USB) interface enables both asynchronous and isochronous data transfers with compatible peripherals. This interface ensures high-speed data transmission, capable of achieving a maximum rate of 480 Mb/s. USB also supports hot plugging, making it possible to reconfigure systems without the need for a restart. The systems provide a total of ten USB ports for external access – four at the front and six at the back. The USB 2.0 controller efficiently manages a maximum transfer rate of 480 Mb/s. To ensure optimal operation, it's recommended to maintain a cable length of up to sixteen feet between the host and the USB device.



USB Connector Pinout					
Pin	Signal	Description	Pin	Signal	Description
1	Vcc	+5 VDC	3	USB+	Data (plus)
2	USB-	Data (minus)	4	GND	Ground



## 4.2 Ethernet

The RJ-45 connector serves as the interface for the NIC. This connector incorporates the two status LEDs within its assembly.



Speed LED    Activity LED

Pin	10Base T	100Base-TX	1000Base-T
1	TX+	TX_D1+	BI_DA+
2	TX-	TX_D1-	BI_DA-
3	RX+	RX_D2+	BI_DB+
4	Nc	BI_D3+	BI_DC+
5	Nc	BI_D3-	BI_DC-
6	RX-	RX_D2-	BI_DB-
7	nc	BI_D4+	BI_DD+
8	nc	BI_D4-	BI_DD-

## 4.3 PCI

PCIe slots on the motherboard serve as expansion points for additional components. These slots include a 2.0 x16 slot for graphics cards, a 2.0 x4 slot that can also accommodate x16 cards and a 2.0 x1 slot. Furthermore, there's a 1.2 Mini Card slot. All these slots are designed to support low-profile components. In terms of full-height slots, there are three PCIe slots: one 2.0 x16 slot and two 2.0 x1 slots. These slots can house various add-on cards, enhancing the computer's capabilities. For example, PCIe (Peripheral Component Interconnect Express) offers high-speed serial communication, while PCI (Peripheral Components Interconnect) functions in parallel.

## 4.4 SATA (Serial Advanced Technology Attachment)

The system offers up to four speedy SATA interfaces, reaching 6.0 Gb/s (for some ports) and 3.0 Gb/s for others. RAID protection is included, and external SATA (eSATA) devices are supported. The PCH DO component eases migration to dual-drive RAID setups. Intel Matrix RAID ensures strong storage performance and data security.



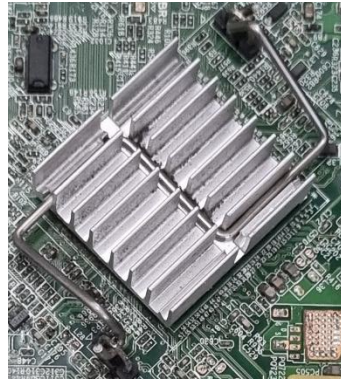
# 5. Cooling system

When contemplating computer cooling, the motherboard's cooling system plays a vital role. Contemporary computers offer diverse cooling methods, including liquid cooling, fans, heat sinks, vapor cooling, and heat pipes. The HP E93839 motherboard employs fans and heat sinks for effective cooling.

## 5.1 Heat sinks

There exist two categories of heat sinks:

1. Passive heat sinks - This form of cooling operates without fans, hence a heat sink lacking a fan is known as passive.
2. Active heat sinks - A heat sink connected with a cooling fan is termed as active.

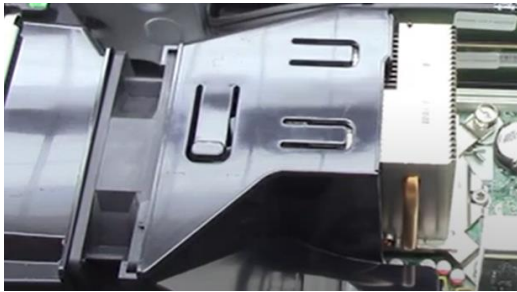


A heat sink is essential for enhancing environmental conditions like temperature and airflow around devices. This indirectly curbs power loss, extends component lifespan, and averts overheating-induced hardware failures. Employing an aluminum heat sink, like in these systems, notably diminishes such risks, boosting motherboard durability and security. Moreover, the LGA1155 ZIF (H2) mounting socket in these systems mandates a processor-integrated heatsink/fan assembly for optimal cooling. It's vital

to replace it with a matching assembly to ensure efficient heat transfer from the processor, safeguarding its performance and longevity. Thermal paste ensures effective heat conduction between the chipset and heatsink.

## 5.2 Fan

All systems have adjustable fans attached to the processor heatsink assembly. They also offer an extra chassis fan. Fans are regulated using temperature sensing on the system board and/or power supply. Despite electrical distinctions between form factors and models, overall operation remains consistent. Cooling situations include:



1. Normal—Low fan speed.
2. Hot processor— ASIC directs Speed Control logic to increase the speed of the fan.
3. Hot power supply— The power supply increases the speed of the fan.
4. Sleep state—Fan turned off.

## 6. References

- Technical Reference Guide HP Compaq 8200 Elite Series  
<https://www.levnapc.cz/ProductsFiles/HP-8200-Elite-manual-en.pdf>
- Basics of Computers Tutorial by Tutorials points  
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