ASSIGNMENT

Main Motherboard Components

1.CPU (Central Processing Unit) chip

2.RAM (Random Access Memory) slots

3.Southbridge/northbridge

4.BIOS (Basic Input/Output System)

5.I/O port

6.USB (Universal Serial Bus)

7.CPU slot

8.PCI (Peripheral Component Interconnect) slot

9.AGP (Accelerated Graphics Port) slot

10.ISA (Industry Standard Architecture) slot

11.Parallel port

12.FDC (Floppy-Disk Controller)

13.IDE (Integrated Drive Electronics) controller

14.CMOS (Complementary Metal-oxide-semiconductor) battery

15.Power supply connector

16.Mouse and keyboard ports

17.DIP (Dual In-line Package) switch

18.Jumper

19.Heat sink/heatsink (cooling system)

20.Clock generator

1. CPU (Central Processing Unit) chip

CPU is the electronic circuitry in a computer that executes instructions that make up a program. It is also known as a central processor or the main processor. The CPU executes the basic logic, arithmetic, controlling as well as input/output (I/O) operations specified by the instructions in the desktop programs.

2. RAM (Random Access Memory) slots

RAM is a kind of computer memory that can be read and written. It is mainly used to save data and machine code. A RAM device permits data to be read or written in nearly the same amount of time no matter where the data's physical location is in the memory. Compared to the direct-access storage devices like hard drives, CD/DVD and magnetic tapes, RAM media is much faster for data reading and writing.

3. Southbridge/northbridge

They are the two chips in the core logic chipset on the motherboard. Typically, the southbridge implements the slower capabilities of the motherboard in a northbridge/southbridge chipset computer architecture.

The northbridge, also known as host bridge or Memory Controller Hub, is connected directly to the CPU via the front-side bus (FSB). It is responsible for tasks requiring the highest performance. Together with the southbridge, they manage communications between the CPU and other motherboard components.

4. BIOS (Basic Input/Output System)

BIOS, also called system BIOS, PC BIOS or ROM BIOS, is firmware that is used to perform hardware initialization during the booting process; and to provide runtime services for operating system and programs. The BIOS firmware is the first software to run when powered on; it is re-installed on a PC's system board.

5. I/O port

Input/output ports are the connections between the CPU and peripheral devices on a motherboard. There are two complementary methods to perform input and output processes: memory-mapped I/O (MMIO) and port-mapped I/O (PMIO). Alternatively, you can use dedicated I/O processors, called channels on mainframe computers, which execute their own instructions.

6. USB (Universal Serial Bus)

USB is an industry standard that creates specifications for connectors, cables and protocols for connection; power supply (interfacing) and communication among computers, computer peripherals as well as other desktops. There are a great many USB hardware including several different connectors, of which USB-C is the latest kind.

7. CPU slot

A CPU slot, also called a CPU socket or Processor socket, contains one or more mechanical components that provide mechanical and electrical connections between the PCB and a microprocessor (CPU). Therefore, you can install a CPU on a motherboard without soldering.

8. PCI (Peripheral Component Interconnect) slot

Peripheral Component Interconnect is a local computer bus for connecting hardware to a computer. It supports all the functions of a processor bus. PCI is usually been called Conventional PCI to distinguish it from its successor PCI Express (PCIe, PCI-e or PCI-E).

PCI Express is a high-speed serial computer expansion bus standard designed to replace the older PCI, PCI-X and AGP bus standard. It is a general-use motherboard interface for the graphics card, SSDs, hard drives, Wi-Fi as well as Ethernet hardware connections.

9. AGP (Accelerated Graphics Port) slot

AGP was designed as a high-speed point-to-point channel for connecting a video card (graphics card) to a computer system. Primarily, it was used to assist in the acceleration of 3D computer graphics. AGP is originally designed to be a descendant of the PCI series of connections for video cards. Yet, it was replaced by the PCIe slots.

10. ISA (Industry Standard Architecture) slot

ISA is the 16-bit internal bus of IMB PC/AT and similar computers that are based on Intel 80286 and its immediate successors during the 1980s. It was backward compatible with the 8-bit bus of the 8088-based IBM PC largely.

There once was an attempt to extend ISA into a 32-bit bus, called Extended Industry Standard Architecture (EISA). The attempt wasn't very successful and the EISA was largely replaced by the later VESA Local Bus and the PCI bus.

11. Parallel port

A parallel port is a kind of interface for attaching peripherals on desktops. The name of this kind of port is derived from the way the data is sent. That is, the parallel ports send multiple bits of data at the same time. Serial interfaces, on the contrary, send bits one data at once. To achieve parallel data transfer, there are multiple data lines in the parallel port cables. The parallel port cable is larger than the cable of a contemporary serial port, which only has one data line within.

12. FDC (Floppy-Disk Controller)

FDC is a special-purpose chip and associated disk controller circuitry. It controls and directs reading from and writing to a computer's floppy disk drive (FDD).

13. IDE (Integrated Drive Electronics) controller

The devices used for connecting IDE, Ethernet, FireWire, USB and other systems can be called host adapter. So, the IDE controller refers to the host adapter. A host adapter, also called a host controller or a host bus adapter (HBA), connects a computer (acting as the host system) to other network and storage devices.

14. CMOS (Complementary Metal-oxide-semiconductor) battery

CMOS battery, also called memory battery, clock battery or real-time clock (RTC), is generally a CR2032 lithium coin cell. The lifespan of the CMOS battery is estimated to be three years when the power supply unit (PSU) is unplugged or switch off.

15. Power supply connector

A power supply provides the necessary electrical power to let the computer to work. It takes standard 110-Volt AC (Alternative Current) power to DC (Direct Current) power of 12 Volt, 5 Volt, 3.3 Volt, etc.

16. Mouse and keyboard ports

All computers have a keyboard port connected directly to the motherboard. There are two types of connectors. The oldest one is a special DIN (Deutsches Institut für Normung) connector while the newest one is the mini DIN PS/2-style connector. Many PCs use the PS/2-style connectors for both keyboard and mouse; and the connectors are marked clearly for different usage.

17. DIP (Dual In-line Package) switch

A DIP switch is a manual electric switch packaged with others in a standard dual in-line package. The term may refer to an individual switch or the whole unit. The DIP switch is designed to be used on a printed circuit board (motherboard) together with other electronic motherboard components. It is usually used to customize the behavior of an electronic device for specific situations.

18. Jumper

A jumper is a short length of conductor that is used to close, open or bypass part of an electronic circuit. Typically, jumpers are used to set up or configure printed circuit boards like the motherboard.

19. Heat sink/heatsink (cooling system)

A heat sink is a passive heat exchanger that transfers the heat generated by parts of motherboard into a fluid medium like liquid or air. The fluid medium will dissipate away from the device. Thus, the temperature of the device is kept within a tolerable range. On the motherboard, the heatsink is usually used to cool CPU, GPU (graphics processing unit), chipsets and RAM modules.

20. Clock generator

A clock generator is an electronic oscillator (circuit) that produces a clock signal for usage in synchronizing a circuit's operation. The clock signal ranges between high and low frequencies, thus creating a metronome for the coordination of actions.

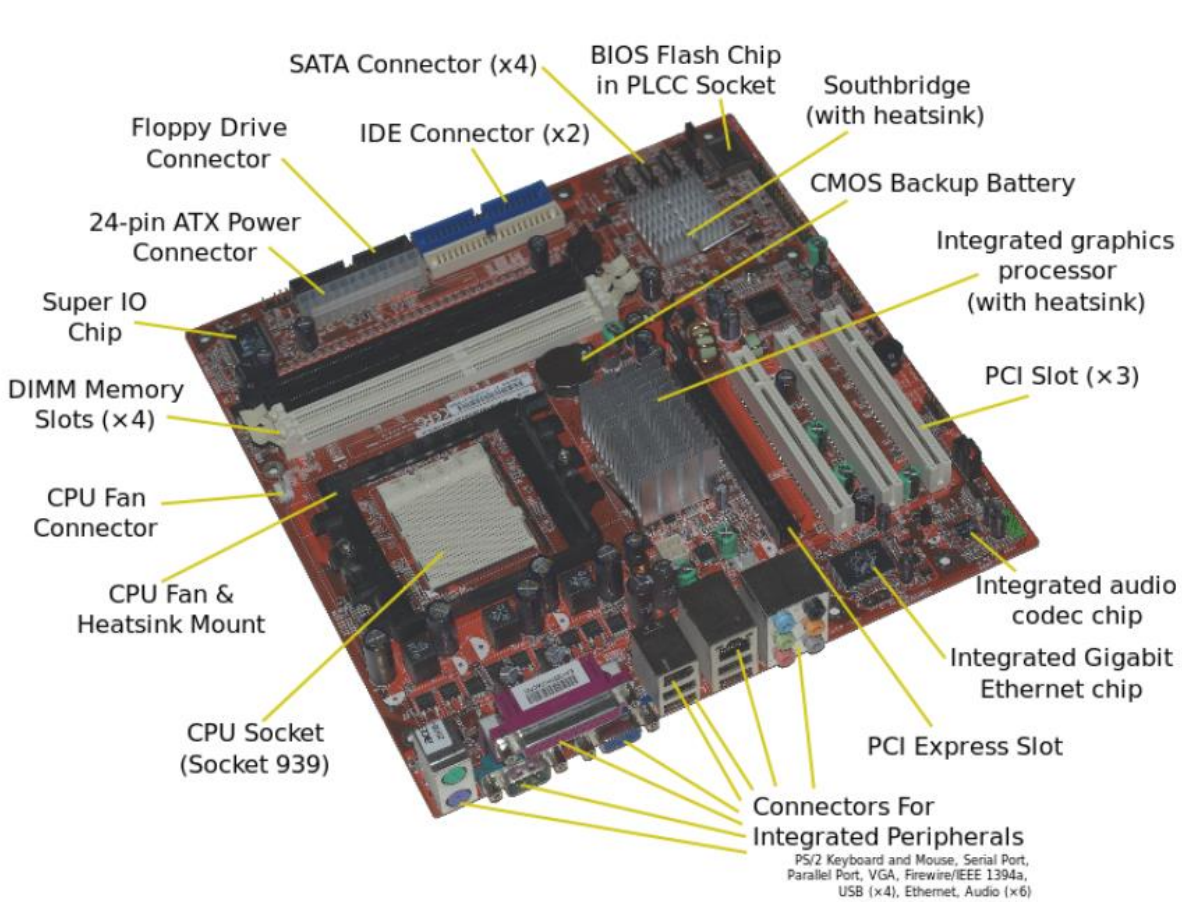


Figure 1: Motherboard Diagram with all components labeled

Ram module

RAM is used for programs and data as well as by the operating system for disk caching (using RAM to hold recently accessed information). Thus, installing more RAM improves transfers between the CPU and both RAM and hard drives.

RAM Types

SRAM

Static random-access memory (SRAM) is RAM that does not need to be periodically refreshed. Memory refreshing is common to other types of RAM and is basically the act of reading information from a specific area of memory and immediately rewriting that information back to the same area without modifying it. Due to SRAM's architecture, it does not require this refresh.

SDRAM

Synchronous DRAM (SDRAM) was the first type of memory to run in sync with the processor bus (the connection between the processor, or CPU, and other components on the motherboard). Most 168-pin DIMM modules use SDRAM memory.

DDR SDRAM

The second generation of systems running synchronous DRAM use double data rate SDRAM (DDR SDRAM). DDR SDRAM performs two transfers per clock cycle (instead of one, as with regular SDRAM) and features a two-bit prefetch buffer. 184-pin DIMM memory modules use DDR SDRAM chips.

DDR2 SDRAM

Double data rate 2 SDRAM (DDR2 SDRAM) is the successor to DDR SDRAM. DDR2 SDRAM runs its external data bus at twice the speed of DDR SDRAM and features a four-bit prefetch buffer, enabling faster performance. However, DDR2 SDRAM memory has greater latency than DDR SDRAM memory.

DDR3 SDRAM

Double data rate 3 SDRAM (DDR3 SDRAM) Compared to DDR2, DDR3 runs at lower voltages, has twice the internal banks, and most versions run at faster speeds than DDR2. DDR3 also has an eight-bit prefetch bus.

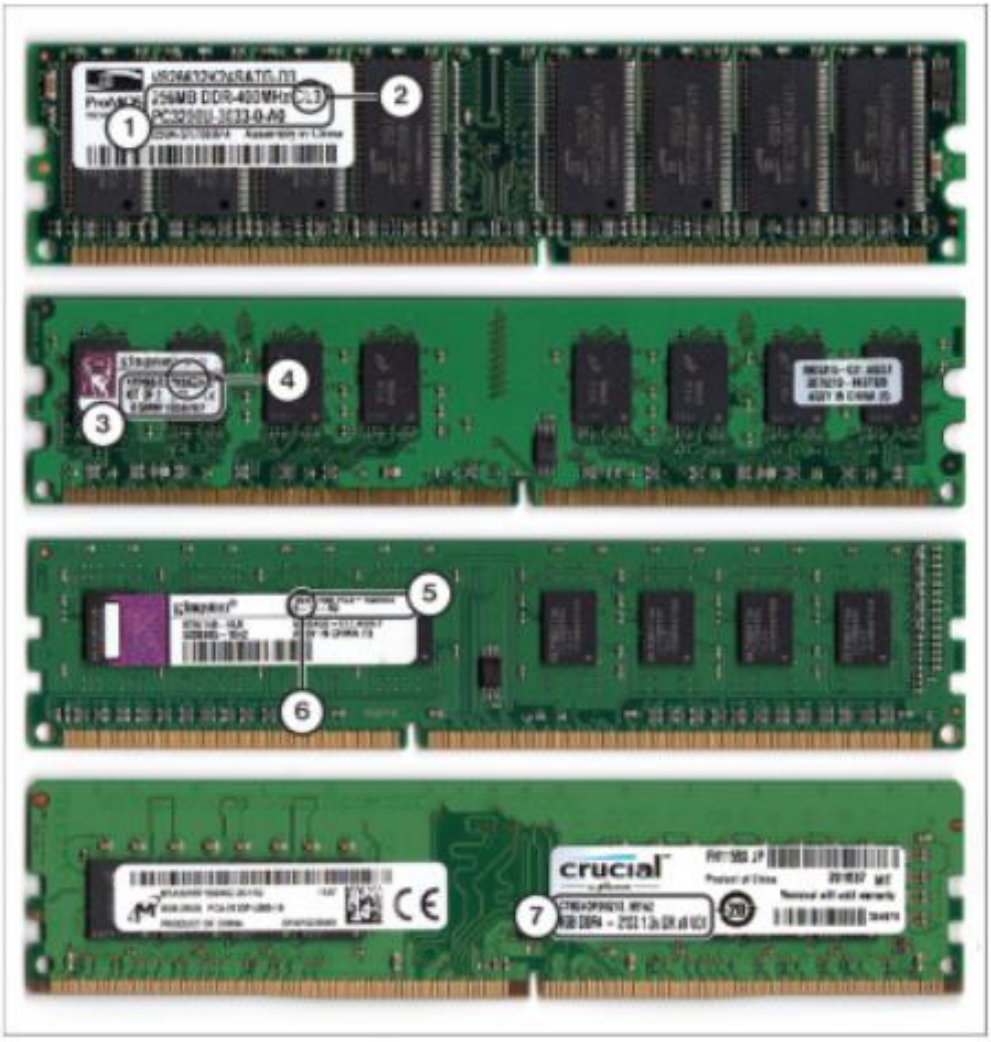


Figure 4-1 *From top to bottom, DDR, DDR2, DDR3, and DDR4 DIMM desktop memory modules.*

Daughter Cards

A daughterboard (or daughter board , daughter card , or daughtercard) is a circuit board that plugs into and extends the circuitry of another circuit board. often have plugs, sockets, pins or other attachments for other boards. Daughterboards often have only internal connections within a computer or other electronic devices, and usually access the motherboard directly rather than through a computer bus.

Examples of daughterboard-style expansion cards include:

.) Raspberry Pi "HAT add-on board"

.) Bluetooth daughterboard

Raspberry PI 4B single-board computer with "TV Hat" card (for DVB-T/T2 television reception) attached.

Bus Slots

Alternatively known as a bus slot or expansion port, an expansion slot is a connection or port inside a computer on the motherboard or riser card. It provides an installation point for a hardware expansion card to be connected.

Examples

AGP - Video card.

AMR - Modem, sound card.

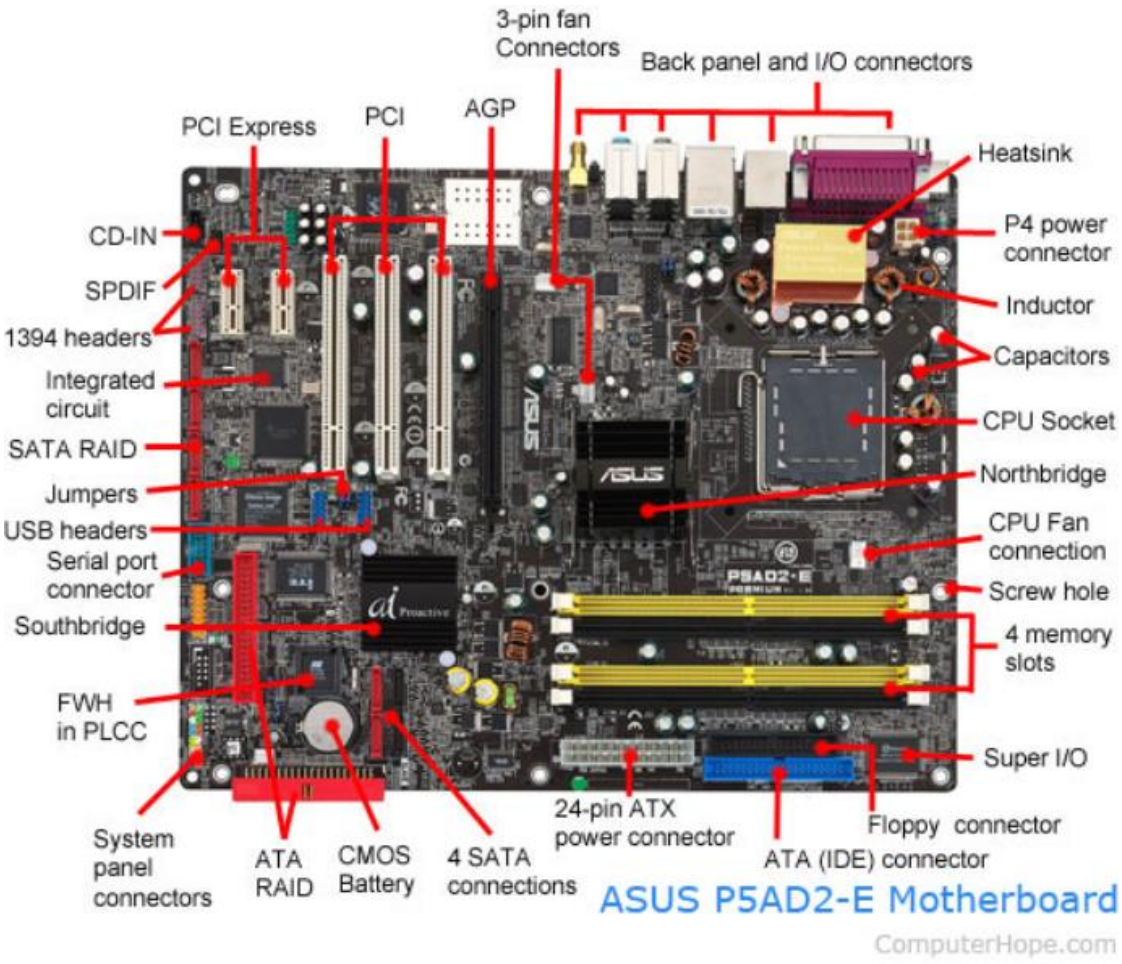
CNR - Modem, network card, sound card.

ISA - Network card, sound card, video card.

PCI - Network card, SCSI, sound card, video card.

PCI Express - Video card, modem, sound card, network card.

VESA - Video card.



SMPS

an SMPS transfers power from a DC or AC source (often mains power, see AC adapter) to DC loads, such as a personal computer, while converting voltage and current characteristics. Unlike a linear power supply, the pass transistor of a switching-mode supply continually switches between low-dissipation, full-on and full-off states, and spends very little time in the high dissipation transitions, which minimizes wasted energy.

Interior view of an ATX SMPS: below

Internal storage devices

Storage devices are the computer hardware used to remember/store data.

There are many types of storage devices, each with their own benefits and drawbacks.

Hard Disk Drive (HDD)

Hard disk drives are non-volatile magnetic storage devices capable of remembering vast amounts of data.An electromagnet in the read/write head charges the disk's surface with either a positive or negative charge, this is how binary 1 or 0 is represented.The read/write head is then capable of detecting the magnetic charges left on the disk's surface, this is how data is read.

Solid State Drive (SSD)

Solid state drives are non-volatile storage devices capable of holding large amounts of data.They use NAND flash memories (millions of transistors wired in a series on a circuit board), giving them the advantage of having no mechanical moving parts and therefore immediate access to the data.

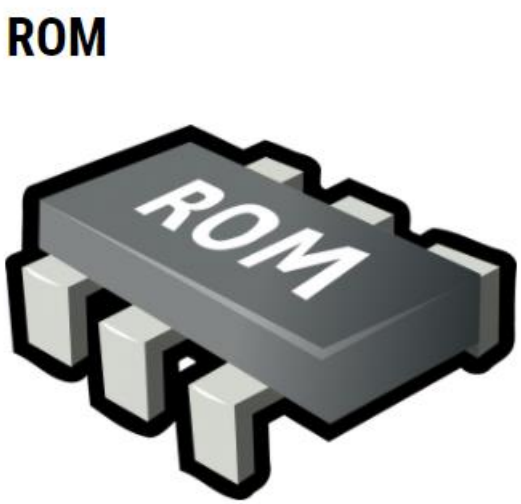
Random Access Memory (RAM)

RAM is a computer's primary memory. It is a very fast solid state storage medium that is directly accessible by the CPU.Any open programs or files on a computer are temporarily stored in RAM whilst being used.Being volatile, any data stored in RAM will be lost when power is removed. This makes RAM totally unsuitable for the long term permanent storage of data – that is the role of a HDD or SSD instead.

ROM

ROM is a non-volatile memory chip whose contents cannot be altered.

It is often used to store the start up routines in a computer (e.g. the BIOS).



Interfacing ports.

A Computer Port is an interface or a point of connection between the computer and its peripheral devices. Some of the common peripherals are mouse, keyboard, monitor or display unit, printer, speaker, flash drive etc.

In Computers, communication ports can be divided into two types based on the type or protocol used for communication. They are Serial Ports and Parallel Ports.

A serial port is an interface through which peripherals can be connected using a serial protocol which involves the transmission of data one bit at a time over a single communication line. The most common type of serial port is a D-Subminiature or a D-sub connector that carry RS-232 signals.

A parallel port, on the other hand, is an interface through which the communication between a computer and its peripheral device is in a parallel manner i.e. data is transferred in or out in parallel using more than one communication line or wire. Printer port is an example of parallel port.

PS/2

PS/2 connector is developed by IBM for connecting mouse and keyboard. It was introduced with IBM's Personal Systems/2 series of computers and hence the name PS/2 connector. PS/2 connectors are color coded as purple for keyboard and green for mouse.

Serial Port

Even though the communication in PS/2 and USB is serial, technically, the term Serial Port is used to refer the interface that is compliant to RS-232 standard. There are two types of serial ports that are commonly found on a computer: DB-25 and DE-9.

DB-25

DB-25 is a variant of D-sub connector and is the original port for RS-232 serial communication. They were developed as the main port for serial connections using RS-232 protocol but most of the applications did not require all the pins.

Hence, DE-9 was developed for RS-232 based serial communication while DB-25 was rarely used as a serial port and often used as a parallel printer port as a replacement of the Centronics Parallel 36 pin connector.

DE-9 or RS-232 or COM Port

DE-9 is the main port for RS-232 serial communication. It is a D-sub connector with E shell and is often miscalled as DB-9. A DE-9 port is also called as a COM port and allows full duplex serial communication between the computer and it's peripheral.Some of the applications of DE-9 port are serial interface with mouse, keyboard, modem, uninterruptible power supplies (UPS) and other external RS-232 compatible devices.

Parallel Port or Centronics 36 Pin Port

Parallel port is an interface between computer and peripheral devices like printers with parallel communication. The Centronics port is a 36 pin port that was developed as an interface for printers and scanners and hence a parallel port is also called as a Centronics port.

Audio Ports

Audio ports are used to connect speakers or other audio output devices with the computer. The audio signals can be either analogue or digital and depending on that the port and its corresponding connector differ.

S/PDIF / TOSLINK

The Sony/Phillips Digital Interface Format (S/PDIF) is an audio interconnect used in home media. It supports digital audio and can be transmitted using a coaxial RCA Audio cable or an optical fiber TOSLINK connector.

Most computers home entertainment systems are equipped with S/PDIF over TOSLINK. TOSLINK (Toshiba Link) is most frequently used digital audio port that can support 7.1 channel surround sound with just one cable. In the following image, the port on the right is an S/PDIF port.

Video Ports

VGA Port

VGA port is found in many computers, projectors, video cards and High Definition TVs. It is a D-sub connector consisting of 15 pins in 3 rows. The connector is called as DE-15.

Digital Video Interface (DVI)

DVI is a high speed digital interface between a display controller like a computer and a display device like a monitor. It was developed with an aim of transmitting lossless digital video signals and replace the analogue VGA technology.

Display Port

Display Port is a digital display interface with optional multiple channel audio and other forms of data. Display Port is developed with an aim of replacing VGA and DVI ports as the main interface between a computer and monitor.

RCA Connector

RCA Connector can carry composite video and stereo audio signals over three cables. Composite video transmits analogue video signals and the connector is as yellow colored RCA connector.

The video signals are transmitted over a single channel along with the line and frame synchronization pulses at a maximum resolution of 576i (standard resolution).

Component Video

Component Video is an interface where the video signals are split into more than two channels and the quality of the video signal is better that Composite video.

Like composite video, component video transmits only video signals and two separate connectors must be used for stereo audio. Component video port can transmit both analogue and digital video signals.

HDMI

HDMI is an abbreviation of High Definition Media Interface. HDMI is a digital interface to connect High Definition and Ultra High Definition devices like Computer monitors, HDTVs, Blu-Ray players, gaming consoles, High Definition Cameras etc.

USB

Universal Serial Bus (USB) replaced serial ports, parallel ports, PS/2 connectors, game ports and power chargers for portable devices.

USB port can be used to transfer data, act as an interface for peripherals and even act as power supply for devices connected to it. There are three kinds of USB ports: Type A, Type B or mini USB and Micro USB.

USB Type A

USB Type-A port is a 4 pin connector. There are different versions of Type – A USB ports: USB 1.1, USB 2.0 and USB 3.0. USB 3.0 is the common standard and supports a data rate of 400MBps.

USB 3.1 is also released and supports a data rate up to 10Gbps. Usually, but not all the times, the USB 2.0 is Black color coded and USB 3.0 is Blue. The following image shows USB 2.0 and USB 3.0 ports.

USB Type C

USB Type – C is the latest specification of the USB and is a reversible connector. USB Type – C is supposed to replace Types A and B and is considered future proof.

RJ-45

Ethernet is a networking technology that is used to connect your computer to Internet and communicate with other computers or networking devices.

The interface that is used for computer networking and telecommunications is known as Registered Jack (RJ) and RJ – 45 port in particular is used for Ethernet over cable. RJ-45 connector is an 8 pin – 8 contact (8P – 8C) type modular connector.

RJ-11

RJ-11 is another type of Registered Jack that is used as an interface for telephone, modem or ADSL connections. Even though computers are almost never equipped with an RJ-11 port, they are the main interface in all telecommunication networks.

e-SATA

e-SATA is an external Serial AT Attachment connector that is used as an interface for connecting external mass storage devices. Modern e-SATA connector are called e-SATAp and stands for Power e-SATA ports.

Ports


Optical Audio "Toslink"
USB A 1.0/1.1/2.0
Firewire 4 pin iLink
Firewire 400 1394a
Firewire 800/3200 1394b/c
Ethernet 8P8C common:RJ-45
Modem RJ-11
Apple Desktop Bus - ADB
Mac Serial
PS/2
Future
USB A 3.0
DE-9F
DB-25 Serial/Com Port
DE-9 Serial RS232
e-SATA
Centronics Parallel 36pin
Centronics SCSI 50pin
AT Keyboard
50 pin SCSI 2
Surround sound
stereo/ Headphones
Line In
Mic
Digital Audio RCA plug style
AAUI
Composite Audio/Video
S-Video
Component Video
F-Connector RF/COAX
Parallel Port/SCSI 1/DB-25F
Mac Video/MIDI /gameport/AUI/DA-15
Mini DisplayPort
Mini-DVI
Mini-VGA
Apple Hi-Density Video HDI-45
Apple Display Connector - ADC
LFH60 (dual DVI-D)
DMS59 (dual DVI-D)
HDMI
Micro-DVI
DisplayPort
DVI Video
DE-15/HD-15 VGA/SVGA