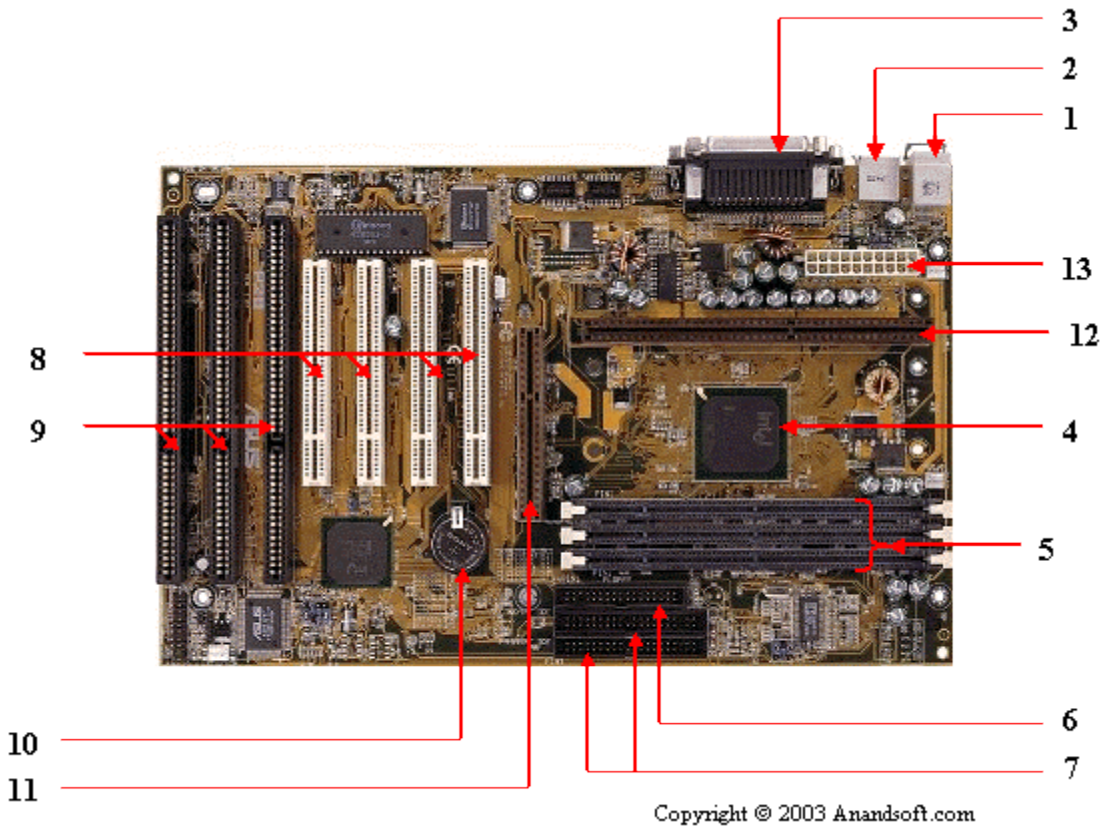
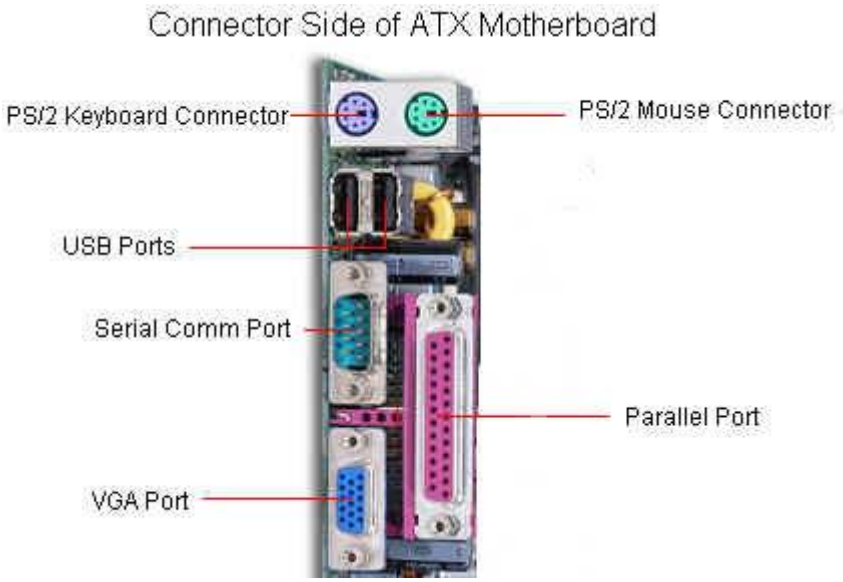
Computer Motherboard and its constituent components:

There are primarily two types of motherboards, AT motherboard, and ATX motherboard. AT motherboards are older, and not commonly used now a days. The AT and ATX motherboards differ in the form factor. Full AT is 12" wide x 13.8" deep, and Baby AT is 8.57" wide x 13.04" deep. Full-ATX is 12" wide x 9.6" deep and Mini-ATX is 11.2" wide x 8.2" deep. Other major differences include power supply connector, and keyboard connector. AT has 5-pin large keyboard connector, where as ATX has 6-pin mini connector. Similarly, AT has single row two connectors +/-5V, and +/-12V, whereas ATX motherboard has double row single connector providing +/-5V, +/-12V, and +3.3V.

A typical ATX PC motherboard with constituent components is given below:

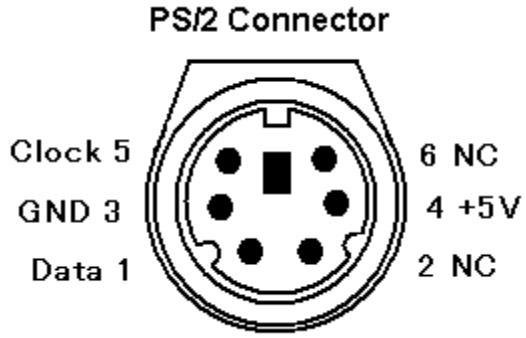




The important constituent components of an ATX Motherboard are given below:

1. **Mouse & keyboard**
2. **USB**
3. **Parallel port**
4. **CPU Chip**
5. **RAM slots**
6. **Floppy controller**
7. **IDE controller**
8. **PCI slot**
9. **ISA slot**
10. **CMOS Battery**
11. **AGP slot**
12. **CPU slot**
13. **Power supply plug in**

1. Mouse & keyboard: Keyboard Connectors are two types basically. All PCs have a Key board port connected directly to the motherboard. The oldest, but still quite common type, is a special DIN, and most PCs until recently retained this style connector. The AT-style keyboard connector is quickly disappearing, being replaced by the smaller mini DIN PS/2-style keyboard connector.



You can use an AT-style keyboard with a PS/2-style socket (or the other way around) by using a converter. Although the AT connector is unique in PCs, the PS/2-style mini-DIN is also used in more modern PCs for the mouse. Fortunately , most PCs that use the mini-DIN for both the keyboard and mouse clearly mark each mini-DIN socket as to its correct use. Some keyboards have a USB connection, but these are fairly rare compared to the PS/2 connection keyboards.

2. USB (Universal serial bus):
USB is the General-purpose connection for PC. You can find USB versions of many different devices, such as mice, keyboards, scanners, cameras, and even printers. a USB connector's distinctive rectangular shape makes it easily recognizable.

USB has a number of features that makes it particularly popular on PCs. First, USB devices are hot swappable. You can insert or remove them without restarting your system.

3. Parallel port: Most printers use a special connector called a parallel port. Parallel port carry data on more than one wire, as opposed to the serial port, which uses only one wire. Parallel ports use a 25-pin female DB connector. Parallel ports are directly supported by the motherboard through a direct connection or through a dangle.

4. CPU Chip : The *central processing unit,* also called the *microprocessor* performs all the calculations that take place inside a pc. CPUs come in Variety of shapes and sizes.
Modern CPUs generate a lot of heat and thus require a cooling fan or heat sink. The cooling device (such as a cooling fan) is removable, although some CPU manufactures sell the CPU with a fan permanently attached.

5. RAM slots: Random-Access Memory (RAM) stores programs and data currently being used by the CPU. RAM is measured in units called bytes. RAM has been packaged in many different ways. The most current package is called a 168-pin DIMM (Dual Inline Memory module).

6. Floppy controller: The floppy drive connects to the computer via a 34-pin *ribbon cable,* which in turn connects to the motherboard. A *floppy controller* is one that is used to control the floppy drive.

7. IDE controller: Industry standards define two common types of hard drives: EIDE and SCSI. Majority of the PCs use EIDE drives. SCSI drives show up in high end PCs such as network servers or graphical workstations. The EIDE drive connects to the hard drive via a 2-inch-wide, 40-pin ribbon cable, which in turn connects to the motherboard. *IDE controller* is responsible for controlling the hard drive.

8. PCI slot: Intel introduced the *Peripheral component interconnect* bus protocol. The PCI bus is used to connect I/O devices (such as NIC or RAID controllers) to the main logic of the computer. PCI bus has replaced the ISA bus.

9. ISA slot: (Industry Standard Architecture) It is the standard architecture of the Expansion bus. Motherboard may contain some slots to connect ISA compatible cards.

10. CMOS Battery: To provide CMOS with the power when the computer is turned off all motherboards comes with a battery. These batteries mount on the motherboard in one of three ways: the obsolete external battery, the most common onboard battery, and built-in battery.

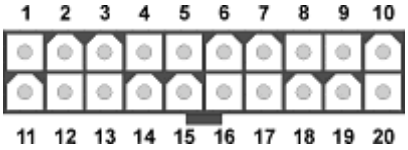
11. AGP slot: If you have a modern motherboard, you will almost certainly notice a single connector that looks like a PCI slot, but is slightly shorter and usually brown. You also probably have a video card inserted into this slot. This is an *Advanced Graphics Port (AGP)* slot

12. CPU slot: To install the CPU, just slide it straight down into the slot. Special notches in the slot make it impossible to install them incorrectly. So remember if it does not go easily, it is probably not correct. Be sure to plug in the CPU fan's power.

13. Power supply plug in:

The Power supply, as its name implies, provides the necessary electrical power to make the pc operate. the power supply takes standard 110-V AC power and converts into +/-12-Volt, +/-5-Volt, and 3.3-Volt DC power.

The power supply connector has 20-pins, and the connector can go in only one direction.



Expansion Slot

Alternatively referred to as a **bus slot** or **expansion port**, an **expansion slot** is an opening located inside a computer on the motherboard or riser board that allows additional boards to be connected to it. For example, if you wanted to install a new video card in the computer you'd purchase a video expansion card and install that card into the compatible expansion slot. Below is a listing of some of the expansion slots commonly found in IBM compatible computers as well as other brands of computers and the devices commonly associated with those slots. Clicking on any of the links below give you additional details about each expansion slot.

Computer expansion slots

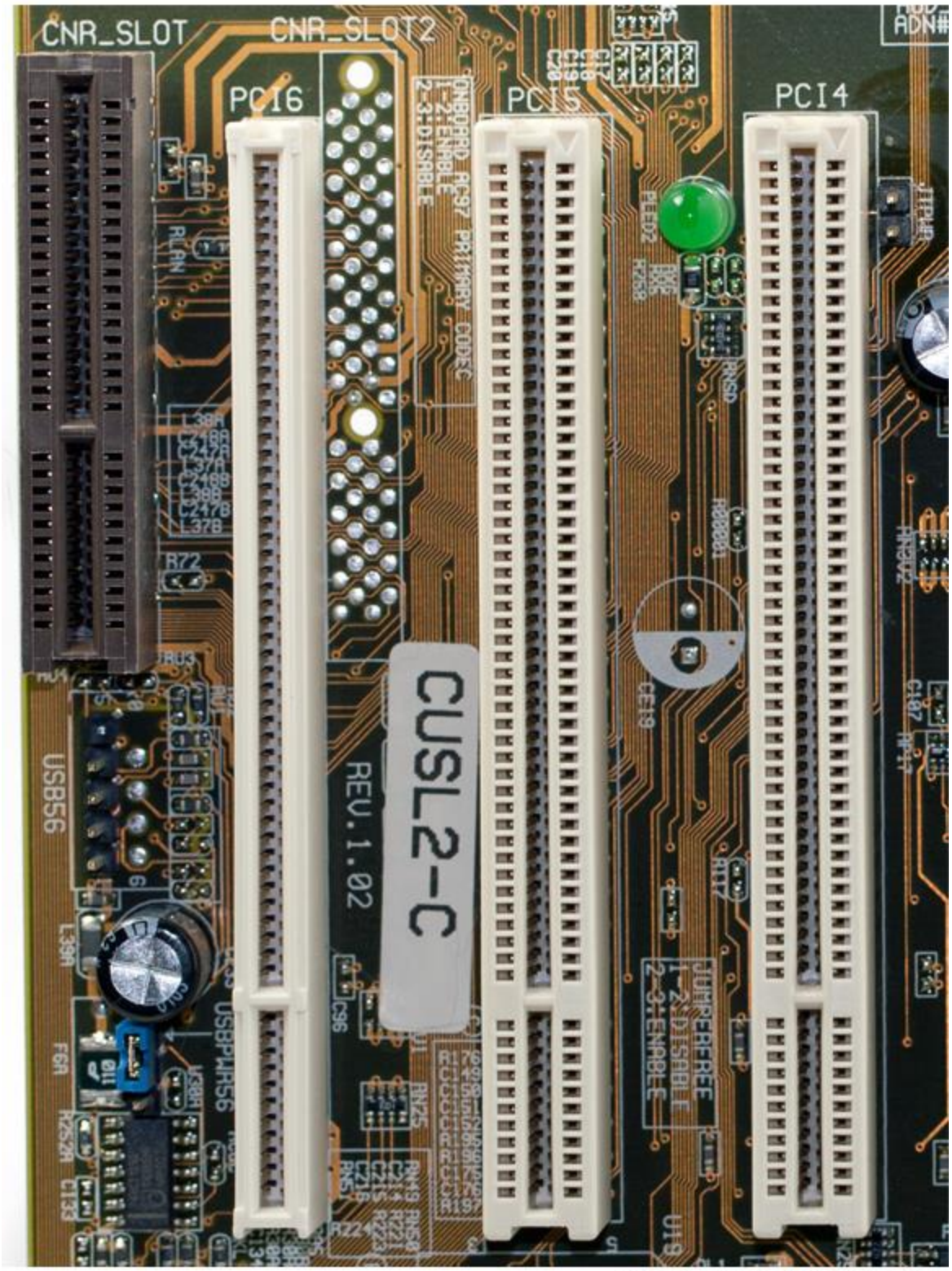
- **AGP** - Video card
- **AMR** - Modem, Sound card
- **CNR** - Modem, Network card, Sound card
- **EISA** - SCSI, Network card, Video card
- **ISA** - Network card, Sound card, Video card
- **PCI** - Network card, SCSI, Sound card, Video card
- **PCIe** - Video card
- **VESA** - Video card

Many of the above expansion card slots are obsolete. You're most likely only going to encounter AGP, PCI, and PCIe when working with computers today. In the picture below, is an example of what expansion slots may look like on a motherboard. In this picture, there are three different types of expansion slots; PCI Express, PCI, and AGP.

PCI

Short for **Peripheral Component Interconnect, PCI** was introduced by Intel in 1992, revised in 1993 to version 2.0, and later revised in 1995 to PCI 2.1 and is as an expansion to the ISA bus. The PCI bus is a 32-bit (133MBps) computer bus that is also available as a 64-bit bus and was the most commonly found and used computer bus in computers during the late 1990's and early 2000's. Unlike, ISA and earlier expansion cards, PCI follows the PnP specification and therefore does not require any type of jumpers or dip switches. Below is an example of what the PCI slots looks like on a motherboard. In the picture, there are three PCI slots, PCI4, PCI5, and PCI6.

CNR and PCI slots



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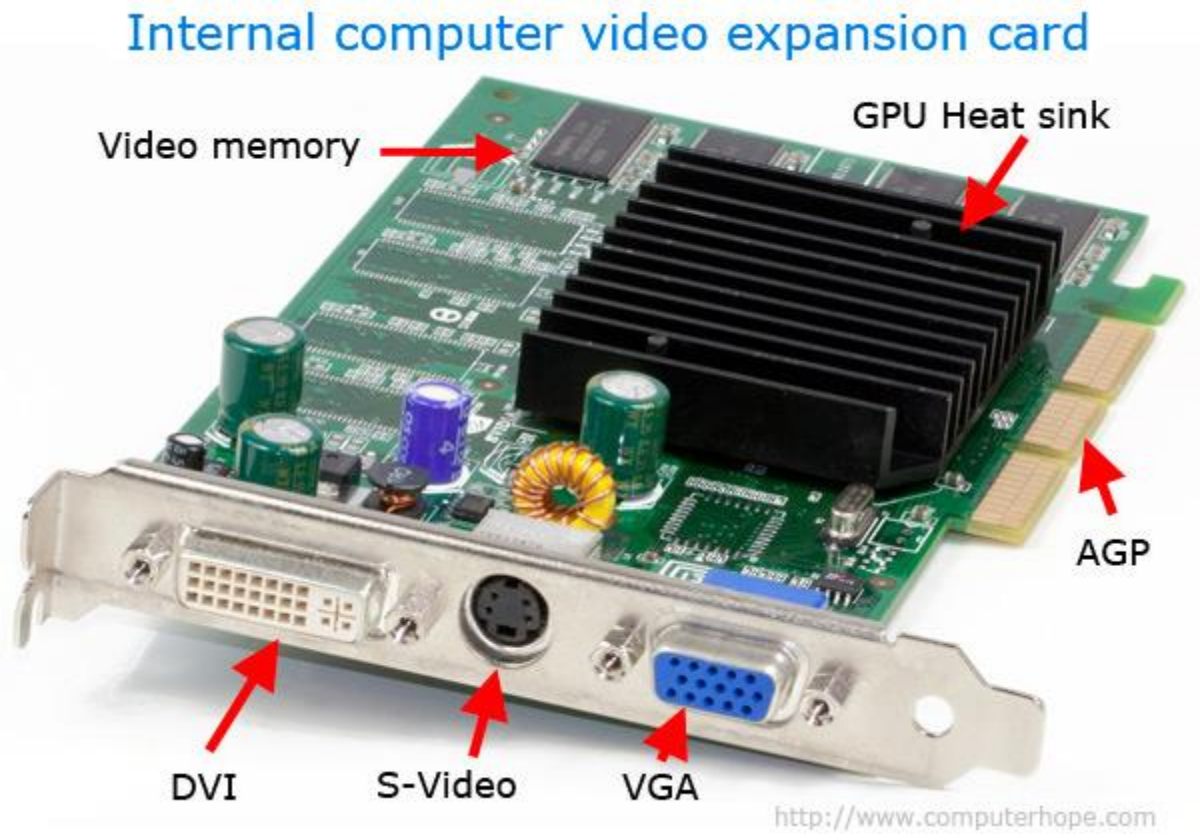
Today's computers and motherboards have replaced PCI with PCI Express (PCIe) slots.

Examples of PCI devices

- Modem
- Network card
- Sound card
- Video card

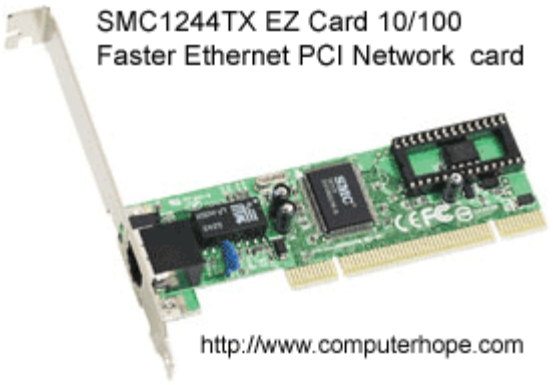
Video card

Alternatively referred to as a **display adapter**, **graphics card**, **video adapter**, **video board**, or a **video controller**, a **video card** is an internal circuit board that allows a display device such as a monitor to display images from the computer.



In the picture above, is an example of a video card with three connections or video ports on the back, the standard VGA connector, S-Video connector, and the DVI connector. In this example, the card connects into the AGP slot on the computer motherboard.

NIC



Short for **Network Interface Card**, a **NIC** is also commonly referred to as an **Ethernet card** and **network adapter** and is an expansion card that enables a computer to connect to a network such as a home network or the Internet using an Ethernet cable with a RJ-45 connector. The picture is an example of a SMC EZ Card 10/100 PCI network card, a network card commonly found in most desktop computers today that do not already have an onboard network on their motherboard.

AGP

Short for **Accelerated Graphics Port**, **AGP** is an advanced port designed for Video cards and 3D accelerators. Designed by Intel and introduced in August of 1997, AGP introduces a dedicated point-to-point channel that allows the graphics controller direct access the system memory. Below is an illustration of what the AGP slot may look like on your motherboard.

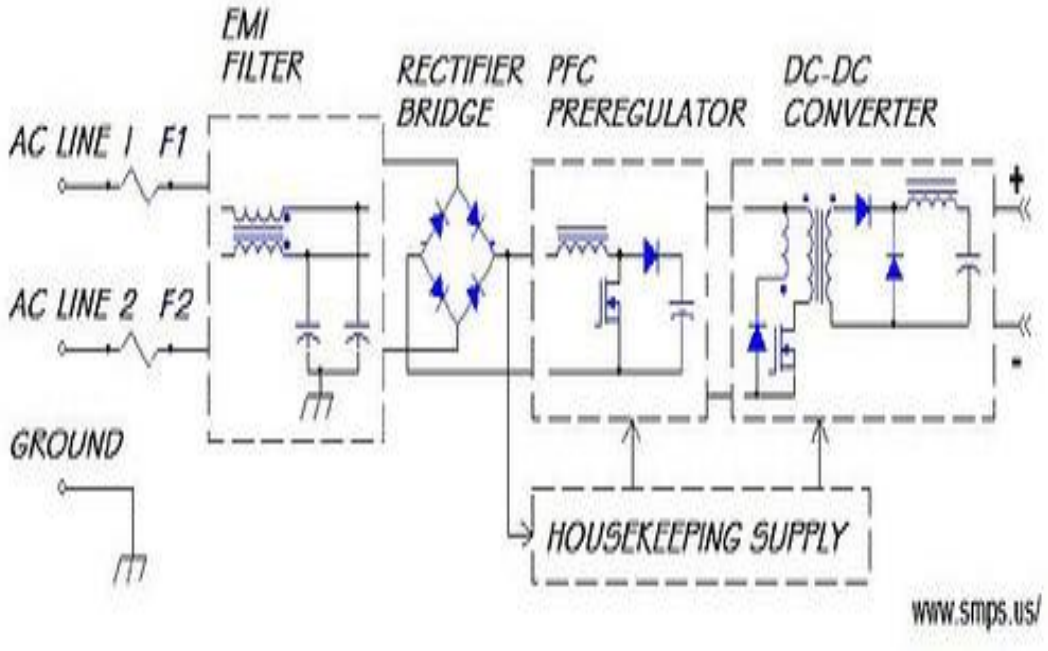
The AGP channel is 32-bits wide and runs at 66 MHz. This translates into a total bandwidth of 266 MBps, which is much greater than the PCI bandwidth of up to 133 MBps. AGP also supports two optional faster modes, with throughput of 533 MBps and 1.07 GBps. It also allows 3-D textures to be stored in main memory rather than video memory.

Each computer with AGP support will either have one AGP slot or on-board AGP video. If you needed more than one video card in the computer, you can have one AGP video card and one PCI video card or use a motherboard that supports SLI.

AGP is available in three different versions, the original AGP version mentioned above, **AGP 2.0** that was introduced in May of 1998, and **AGP 3.0** (**AGP 8x**) that was introduced in

November of 2000. AGP 2.0 added 4x signaling and was capable of operating at 1.5V and AGP 3.0 was capable of double the transfer speeds.

SMPS Block Diagran, Basic Concepts, Theory of operation



Power supply (or power supply unit, PSU) is the device that transfers electric power from a source to a load using electronic circuits.

A typical application of power supplies is to convert utility's AC input power into regulated DC voltage(s) required for electronic equipment. Depending on the mode of operation of power semiconductors PSU can be linear or switching (SMPS).

What is SMPS? SMPS stands for switch mode power supply. In such a device power handling electronic components are continuously switching on and off with high frequency in order to provide the transfer of electric power via energy storage components (inductors and capacitors). By varying duty cycle, frequency or a relative phase of these transitions average value of output voltage or current is controlled . The frequency range of an SMPS is from 20 kHz to several MHz.

Below is the block diagram of a typical off-line switching power supply.

The AC input voltage first passes through fuses and a line filter and is rectified by a full-wave bridge rectifier. The rectified input voltage is next applied to PFC (power factor correction) pre-regulator followed by output DC-DC converter(s).

F1 and F2 shown on the left of the diagram are input fuses. Fuse is a safety device designed to physically open the circuit when the current being drawn through it exceeds its rating for a certain period of time. The fusing time depends on the degree of overload. Due to this time delay fuses will not always protect power supply circuit from a catastrophic failure caused by abnormal conditions. Their main purpose is to protect input line from overheating, prevent tripping of circuit breaker and prevent fire inside the PSU that may be triggered by failed components.

Lowpass EMI filter reduces high frequency currents getting from PSU into the AC line to an acceptable level.

It is necessary to prevent the PSU from causing interference on the mains wiring. There is a number of standards (such as EN55022 for Information technology equipment) that govern the maximum level of EMI caused by PSU.

The filter is followed by the bridge rectifier- the circuit that converts bipolar AC voltage to unipolar pulsating voltage. It uses four diodes in a bridge arrangement to provide the same polarity of output voltage for both polarities of input voltage.