How a Computer Graphics Card Functions

People across the globe are constantly becoming more dependent on technology and computers. There are countless physical components that are inside of a computer to make it function. A graphics card, or video card, is most simply described as the component that is responsible for displaying an image on a monitor that the user sees. In relation to computer video computing, an image a display is a combination of hundreds or thousands of individual pixels. It is the graphics card of a computer to tell the monitor exactly what color, and for how long, to activate each pixel. Without a graphics card to perform necessary display calculations for a computer, the workload would be too much for a computer to handle.

Physical Components of a Graphics Card

To better understand how a graphics card physically functions, it is beneficial have an understanding of the hardware that makes-up a video card. A graphics card only has a handful of individually critical pieces, although there is hundreds of subcomponents that make-up a video card. Below is an image of a simple graphics card[1]:

The key physical components of a graphics card (as seen above) are explained in greater detail below:

- The heatsink and cooling fan are essential to every physical computing control device to ensure that it does not physically overheat. Computer pieces generate a lot of heat while performing calculations and operations, so it is essential that they do not overheat.

The motherboard connection terminal is made of gold to conduct electrical signals. It is the actual connection between the motherboard, which is the primary piece of the computer that all other pieces attach to, and the graphics card. In this specific image, the graphics card also gets its power source through this connection, however, in some even more powerful cards; the graphics card has an independent power connection port.

The video RAM, commonly known as VRAM is the same thing as volatile computer RAM, except it is attached to the video card and can only be used by the video card for graphic related memory holding. It is the physical memory that stores the images while the card is processing and generating the pictures.

The capacitors and wires are essential to assist timing and powering of the actions of the card. They serve as a physical means of connection for power and resistance of a video card.

The monitor cable connection ports physically attach the video card on the computer to the display. A desktop computer is comprised of a computer unit, an external mouse and keyboard, and a monitor. These ports on the video card are known as the outputs. They are the physical passageway from the card, through the cord, to the screen. The card transmits the image signal through these cords so the user can see the images on the display.

**Graphics Card to Display Output Connections**

There are three common methods to connect video cards to computer peripherals, known as a display or a monitor. The three primary methods are HDMI, DVI, and VGA.

High-Definition Multimedia Interface (HDMI) is the most recent of the three connection methods, and it is rapidly becoming the most common too. HDMI has the unique ability to transfer both high definition audio and video through the same one cord, whereas DVI and VGA can only transmit video signals. HDMI cords are becoming ever more common on all types of video cards: from computer video cards to the displays on televisions and video game consoles.

Digital Visual Interface (DVI) is a digital based standard design for displays such as high definition monitors, flat panels LCD and plasma screens, and video projectors. DVI was one of the earlier forms of high definition video output and it is still commonly used today. DVI, like every form of video connection methods, has a unique pin set on both the male and female adapters of the video card and the connection cable.

Output connection images from [http://en.wikipedia.org/wiki/Video_card](http://en.wikipedia.org/wiki/Video_card)
Video Graphics Array (VGA) is one of the oldest standard analog based video displays which was adopted in the late 1980s. It is the least refined of all three connection methods and VGA was known to have problems with image distortion and sampling errors when evaluating pixels. VGA connection also becomes continually more blurry as the display size increases, which is why most modern displays use either HDMI or DVI connection methods.

The Role of a Graphics Card in an Image Display

A graphics card works in constant conjunction with the central processing unit (CPU) and the RAM of a computer. The CPU is essentially the central command of a computer and RAM is a form of volatile memory. The graphics card creates an image out of binary data received from the CPU and produces a 3-D image displayed on the monitor. The graphics card accomplishes this task by simultaneously utilizing four main components of a computer:

- A motherboard connection to serve as a physical data transfer connection
- A CPU processor to perform the calculations to physically decide what to do with each individual pixel
- Memory to temporarily store pictures and movements of each pixel
- A physical display, or monitor, so the user can actually see the result

To create a 3-D image, a graphics card first creates a virtual outline of an object out of only straight lines. Then it rasterizes, the process of converting a vector image into a bitmap image, or simply put, fills in the remaining in-between pixels. After the image has become a virtually solid object, the graphics card then adds lighting, texture, and color to the object. Rasterization is a common technique when creating 3-D objects for video games and computer aided design modeling because it is the only way to provide speed and efficiency while delivering the image. The graphics card performs all of the necessary calculations to process the images so the computer can handle the virtual load of delivering moving pictures and images on a screen.

Graphics Card Graphics Processing Unit

Just like a central processing unit (CPU) of a computer a graphics card has an equivalent graphics processing unit (GPU). It is essentially the brain of a graphics card, just like the CPU, or chip, is to the computer as a whole. A GPU is a specialized electronic circuit “designed to rapidly manipulate and alter memory to accelerate the building of images in a frame buffer intended for output to a display”. Modern GPUs are very efficient at manipulating computer graphics which is enabled by their highly parallel structure to the CPU’s algorithms. A computer has countless key components that all need to dovetail to produce a near flawless machine that people use every single day, with limitless possibilities.