Display Technologies
and Information
Passive-Matrix Displays

In a passive-matrix LCD, such as you would find on older and less expensive notebook computers, each cell is controlled by the electrical charges of two transistors, which are determined by the cell’s row and column positions on the display. The number of transistors along the screen’s horizontal and vertical edges determines the resolution of the screen. For example, a screen with a 1024×768 resolution has 1,024 transistors on its horizontal edge and 768 on the vertical. As the cell reacts to the pulsing charge from its two transistors, it twists the light wave, with stronger charges twisting the light wave more. Supertwist refers to the orientation of the liquid crystals, comparing on mode to off mode—the greater the twist, the higher the contrast.

Charges in passive-matrix LCDs are pulsed; therefore, the displays lack the brilliance of active-matrix, which provides a constant charge to each cell. To increase the brilliance, virtually all vendors have turned to a technique called double-scan LCD, which splits passive-matrix screens into a top half and bottom half, reducing the time between each pulse. In addition to increasing the brightness, dual-scan designs also increase the response time and therefore the perceptible speed of the display, making this type more usable for full-motion video or other applications in which the displayed information changes rapidly.

Comparing Active-Matrix and Passive-Matrix Displays

In an active-matrix LCD, such as those used on most current notebook computer displays and all desktop LCD panels, each cell has its own dedicated transistor behind the panel to charge it and twist the light wave. Thus, a 1024×768 active-matrix display (the most common resolution for 15” LCD panels and notebook computer displays) has 786,432 transistors. This provides a brighter image than passive-matrix displays because the cell can maintain a constant, rather than a momentary, charge. However, active-matrix technology uses more energy than passive-matrix, leading to shorter battery life on portable systems. With a dedicated transistor for every cell, active-matrix displays are more difficult and expensive to produce, but in return they offer a faster display that can be used in outdoor as well as indoor conditions and at wider viewing angles than dual-scan displays.

Note

Because an LCD display requires a specified number of transistors to support each cell, there are no multiple frequency displays of this type. All the pixels on an LCD screen are of a fixed size, although CRT pixels are variable. Thus, LCD displays are designed to be operated at a specific resolution; however, most recent notebook and desktop display panels offer onboard scaling. Before purchasing this type of display, be sure your video adapter supports the same resolution as the screen and that the resolution is sufficient for your needs throughout the life of the monitor.

In both active- and passive-matrix LCDs, the second polarizing filter controls how much light passes through each cell. Cells twist the wavelength of light to closely match the filter’s allowable wavelength. The more light that passes through the filter at each cell, the brighter the pixel.

Monochrome LCDs used in handheld organizers and industrial LCD panels achieve grayscales (up to 64) by varying the brightness of a cell or dithering cells in an on-and-off pattern. Color LCDs, on the other hand, dither the three-color cells and control their brilliance to achieve different colors on the screen. Double-scan passive-matrix LCDs (also known as DSTN) have been used in some lower-cost notebook models in recent years because they approach the quality of active-matrix displays but do not cost much more to produce than other passive-matrix displays. Although DSTN panels offer better on-axis (straight-ahead) viewing quality than straight passive-matrix panels, their off-axis (viewing at an angle) performance is still poor when compared to active-matrix (TFT) panels. Most low-cost notebook computer lines that formerly used DSTN or other passive-matrix designs have now switched to TFT active-matrix displays.
Note
An alternative to LCD screens is gas-plasma technology, typically known for its black and orange screens in some of the older Toshiba notebook computers. Some companies are incorporating full-color gas-plasma technology for desktop screens and color high-definition television (HDTV) flat-panel screens, such as the Philips Flat TV. At this point, full-color gas-plasma technology is not cost-effective for computer displays.

Historically, the big problem with active-matrix LCDs has been that the manufacturing yields are lower than for passive-matrix LCDs, forcing higher prices. This means many of the panels produced have more than a certain maximum number of failed transistors. The resulting low yields limit the production capacity and incur somewhat higher prices. Recent improvements in technology and more factories producing LCD panels have helped prices for both notebook computers and desktop LCD panels drop significantly. As a result, prices have dropped below $400 for some of the newest 15” desktop LCD display panels and for the use of active-matrix LCDs in almost all notebook computers now on the market.

In the past, several hot miniature CRTs were needed to light an LCD screen, but portable computer manufacturers now use a single tube the size of a cigarette. Fiber-optic technology evenly spreads light emitted from the tube across an entire display.

Thanks to supertwist and triple-supertwist LCDs, today’s displays enable you to see the screen clearly from more angles with better contrast and lighting. To improve readability, especially in dim light, virtually all laptops include backlighting or edgelighting (also called sidelighting). Backlit screens provide light from a panel behind the LCD, whereas edgelit screens get their light from small fluorescent tubes mounted along the sides of the screen. Some older laptops excluded such lighting systems to lengthen battery life. Power-management features incorporated into notebook computers enable you to run the backlight at a reduced power setting that dims the display but allows for longer battery life.

VESA Video Interface Port
The most recent attempt at a standard interface between video cards and other video devices is the VESA Video Interface Port (VESA VIP), originally introduced in 1997. Version 2, the latest version of this standard, was introduced in October 1998.

The VESA VIP provides a dedicated connection designed to allow video cards to connect with one or more third-party hardware devices, such as MPEG-2 or HDTV decoders, video digitizers, video encoders, and so on. A dedicated connection prevents competition with other data movement on the PCI bus.

VIP is more widely supported than previous standards, but it exists in two versions (1.1 and 2.0) and is implemented in various ways by card vendors. For example, some versions of certain ATI video cards—such as the Xpert 99, Xpert 128, and Rage Magnum—use a 40-pin proprietary connector called the AMC connector, which also works as a 26-pin VIP connector. To avoid VESA VIP-compatibility problems, check the compatibility list for both the video card and the device you want to connect. You might need to purchase an adapter cable to connect the device to your card. ATI stopped adding the AMC connector to its products in 1999, and most other video card makers have also discontinued support for the VESA VIP port due to lack of demand.