

Ultrafast LCD panels break 4ms barrier

By Erik Willey

Sr. Product Manager, LCDs
ViewSonic Corp.
E-mail: erik.willey
@viewsonic.com

New design materials and novel manufacturing processes are allowing faster LCDs than ever before. LCDs are up to three times faster than they were a few years ago. However, an LCD is still capable of producing visible smearing with fast moving images. Video is measured in terms of fps and smearing occurs if the LCD panel's response time can't keep up with the number of fps. The minimum response needed for acceptable motion video is in the range of 25ms. This equates to 40fps, which means that the display is capable of refreshing the image up to 40 times each second. The next step from here occurred with a response time of 16ms, equating to a frame rate of 60fps. It was quickly discovered that just achieving a response time equal to the recommended fps was not good enough for some motion-intensive applications such as gaming. It is important to complete all pixel transitions in the shortest time possible within a given frame. This means further improvements in response time will be needed well beyond 12-, 8- and 4ms.

The pixel response time is the time it takes for a pixel to change from one brightness level to another (Figure 1a).

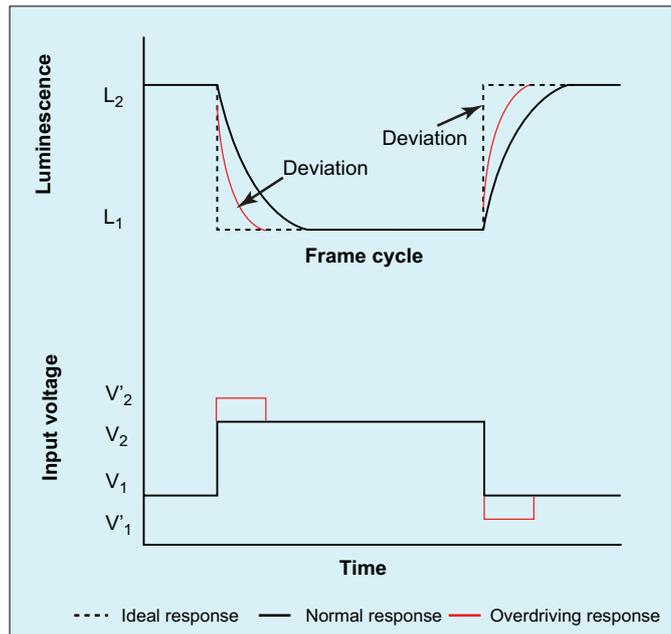


Figure 2: Amplified impulse overdrive scheme uses variable signal modulation to accelerate grayscale transitions for improved motion video.

Response time is one of the few areas remaining where the performance of traditional CRTs still holds an advantage over LCDs. CRTs have nearly instantaneous pixel response times, but LCDs tend to be much slower. The result is that the user might see ghosting or other visual artifacts when there is movement on the screen. A typical LCD monitor has a response time of 25ms or faster, which is still slow compared to a CRT. For the first time, we are now able to produce LCD panels with response times as fast as 4ms, thanks to improved technology and

manufacturing techniques.

ViewSonic has introduced two new ClearMotiv 4ms technologies. The first of these is dynamic structure technology, which targets the raw materials and structure of the LCD panel to achieve the fastest possible response times. The dynamic structure technology uses innovative lower-viscosity liquid crystal (LC) material and reduced cell-gap thickness to accelerate video response to frame rates of up to 250fps.

Enhanced LC material and reduced cell gap result in a relative response-time improvement that is reflected across the entire grayscale range, not just the black/white transitions. This is an important point, since real-world video content contains a combination of grayscale images and it generally takes longer to transfer to

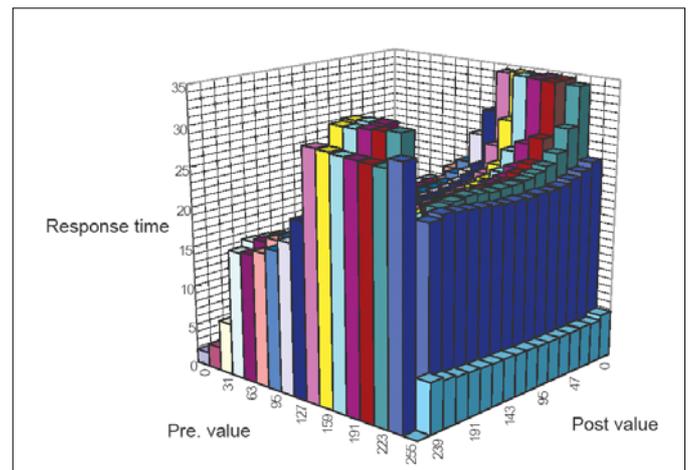


Figure 3: Traditional 8ms fast response LCD panel.

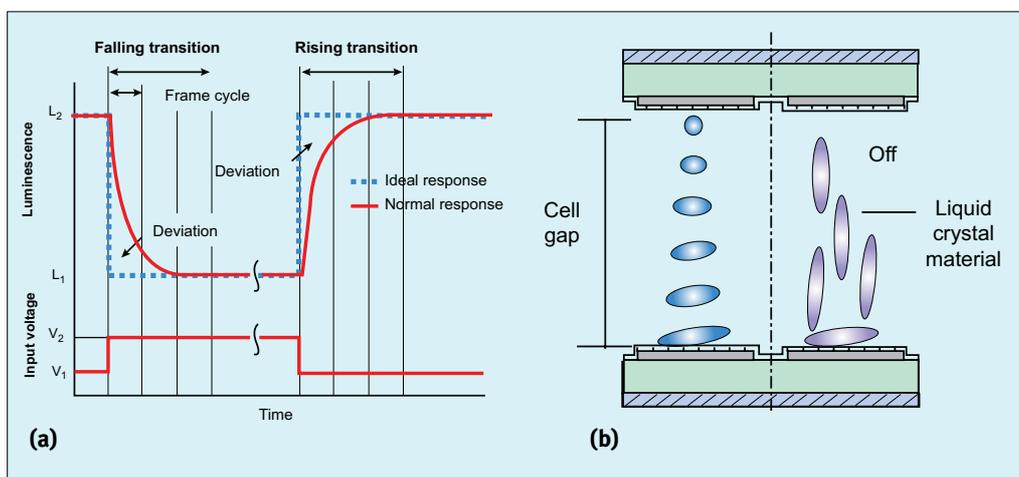


Figure 1: (a) Pixel response time is the time it takes for a pixel to change from one brightness level to another; (b) LCD panels with response times as fast as 4ms are possible with improved manufacturing techniques.

an intermediate level of intensity than it does to turn completely black or completely white. This is the reason why the ClearMotiv 4ms has compatibility for frame rates of up to 250fps for true digital broadcast-quality video, in time for both black/white and grayscale transitions.

The second ClearMotiv 4ms innovation is amplified impulse technology, which supercharges the relative improvements in grayscale transitions brought by dynamic structure technology. This overdrive technique works by applying a "full-white" drive signal for a brief duration to give the pixels

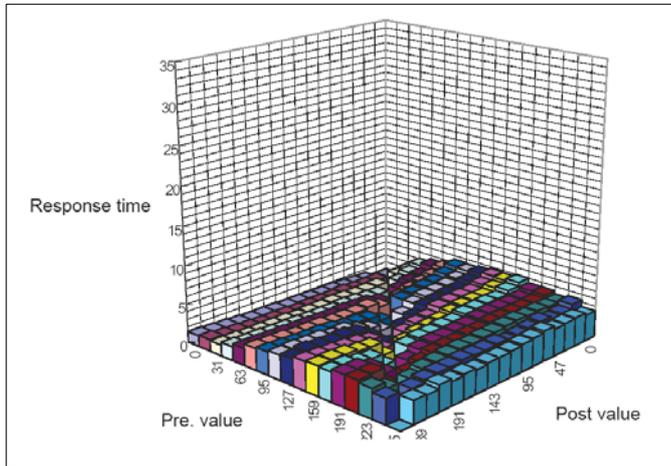


Figure 4: ClearMotiv 4ms fast response panel.

a “jump-start.” Amplified impulse technology allows gray-to-gray transitions to be completed up to eight times faster than typical “fast-response” LCDs. With no trade-offs other than manufacturing cost, amplified impulse technology provides for improvement in gray-to-gray response time and motion-video performance.

Figure 2 shows how amplified impulse uses variable signal modulation to accelerate

grayscale transitions for improved motion video and gaming. The dotted lines represent an idealized response, the black lines represent the response from a traditional LCD and the red lines represent the expected improvement from amplified impulse technology.

It is important to note that not all LCD panels can qualify as ClearMotiv 4ms.

Opportunities for improving the response time, including



Figure 5: An ultrafast response time is one important consideration when making your LCD purchase decision.

grayscale performance, should be actively pursued due to the increased importance of video content in many applications.

An ultrafast response time is one important consideration when making an LCD purchase decision. This is a key factor in determining how good a display will look when combined with moving images. Imagine play-

ing a fast action game and seeing blurring and trails with each quick movement. The same effect holds true while watching any type of motion video. Even if these applications do not seem critical, customers will still want to consider the future usage and upgrade potential of the display over the next several years. □