

Technical Article

Big-screen gaming anywhere: making portable 4K UHD, 240Hz gaming projectors a reality



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A next-generation gaming monitor may not look much like a traditional monitor at all.

Projected gaming displays can offer the performance of a gaming monitor with the flexibility of a display that can easily be moved and create different screen sizes. Similar to how 100- to 150-inch laser TVs, as discussed in the white paper, [“TI DLP® Technology for Laser TV Displays,”](#) have become a popular alternative to bulky, heavy TVs over 80 inches, an ultra-short-throw projected gaming display could soon become an attractive alternative to gaming monitors for gamers looking for larger screen sizes and the ability to create a display anywhere.

To make these projectors a reality, designers need to meet high-performance requirements for modern gaming, including enabling higher frame rates, lower display latency and variable refresh rates. While some of these challenges are similar for high-resolution projectors for media, gaming is unique in that gamers directly interact with the content being projected. Any loss in responsiveness or latency can diminish the user experience – especially for competitive gamers.

While meeting the high-performance requirements of modern gamers, these displays also need to be capable of supporting future generations of video-game consoles and gaming PCs. Current projection display solutions can achieve some of these specifications; however, there are trade-offs in terms of higher cost and a larger, less portable system.

In this article, I'll discuss the importance of high frame rates, low display latency and variable refresh rates for next-generation projected gaming displays, along with current challenges to meeting the requirements for this type of display.

High frame rates

Faster frame rates deliver smoother gaming experiences with reduced motion blur and lower latency. This provides a more immersive, responsive gaming experience.

Figure 1 compares motion blur across different display frame rates.



Figure 1. Comparison of motion blur across display frame rates, from 60Hz to 240Hz

High frame rate displays of 120Hz and higher are common in the gaming monitor market. However, in the TV and projector market, only premium, more expensive TVs and projectors that use higher-cost chipsets and display components support frame rates above 60Hz. Newer generations of [DLP® display technology chipsets](#), which include the [DLPC8445](#) controller, support frame rates up to 240Hz.

Low display latency

Display latency – the amount of time it takes for the display to update after receiving a new frame – is extremely important in high-performance gaming. Whether someone is playing a racing game and needs to brake at exactly the right time, or playing an action game with a precise jumping sequence, gamers want their display to react as fast as possible relative to the controller's input. Display latency is typically measured with a photodetector connected to a computer and placed on the screen to detect changes in the display's light output, with latency less than 20ms considered acceptable for gaming – assuming minimal system latency from user input to the display.

While a higher refresh rate can enable lower latency, the time it takes for a pixel to be updated on the display also depends on the entire data-processing pipeline, including the features and functionality of the display controller. Image processing upstream of the display controller can also impact display latency.

For example, to date all previous DLP display controllers have used a double-frame buffer architecture, which adds a one-frame delay. The DLPC8445 DLP display controller uses a new frame buffer architecture that enables significantly reduced display latency. When combined with the fast switching speed of the digital micromirror device (DMD), the DLPC8445 can enable display latency less than 1ms when measured at the corner of the image from which new frame data enters.

Variable refresh rate support

Gaming PCs and current-generation gaming consoles support variable refresh rates, which allows the frame rate of games to vary as you play them. For example, the frame rate could run at 120Hz for most of the game, but might drop to a lower rate as the action gets busier and puts greater demand on the graphics processing unit.

If a variable refresh rate source is connected to a traditional fixed refresh rate display, gamers will see image artifacts such as stuttering and tearing, as frames are delayed and displayed out of sync with the fixed refresh rate of the display. This would cause display latency to vary from frame to frame.

A display with variable refresh rate support will show new frames without delay as they arrive from the source, regardless of whether the source is dynamically changing its frame rate. The result is a smoother gaming experience with higher image quality and lower latency.

Variable refresh rate is a feature that has grown in popularity in gaming monitors and TVs over the last decade. The DLPC8445 DLP display controller is the first DLP display controller to support variable refresh rates. Combined with the speed of the DMDs, it can react to changes in frame rates in less than 1ms.

Conclusion

The smaller printed circuit board size and lower power enabled by the DLPC8445 controller will enable a class of mobile 4K ultra-high-definition projectors that are able to not only easily move around a home but also small enough to fit in a backpack.

With new, higher-performance projected gaming displays within reach, designers can also think even bigger – or in this case, smaller. Someday soon, ultra-short-throw optics and improvements in red-green-blue laser illumination can enable laser gaming monitors small enough to sit on a desktop and create an immersive gaming display.

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