

Technical Article

Seeing More with 4K UHD



Veronica Marques

True 4K ultra high definition (UHD) technology reveals stunning detail in a variety of applications. But what is "true" 4K UHD? The Consumer Technology Association (CTA) defines 4K UHD as a screen display of over 8 million pixels. The resolution of 4K UHD is 3840×2160 , or 8.3 million pixels. That's four times the number of pixels in a 1080p display, which has a resolution of 1920×1080 , or 2 million pixels.

But not all 4K projection technologies actually deliver the over 8 million pixels of 4K UHD specified in the CTA "[Television Technology Consumer Definitions](#)." One way to verify true UHD is to confirm that the UHD acronym appears in the specification of the technology you plan to use.

Why 4K UHD?

4K UHD content can enhance displays in a variety of applications. In workplace settings, seeing the detail in a spreadsheet projected during a meeting is important. In schools, every child in the classroom should be able to read the instructional material. Pro audiovisual (AV) applications such as museums and theme parks benefit from large screens with sharp, immersive detail. Applications such as warping and mapping in large venues require vast amounts of detail to paint perspective 3D facades on buildings, as seen in [Figure 1](#).



Figure 1. Warp and Map Example on a Large Building

The applications for 4K UHD projection display technology extend to areas such as digital signage, laser TVs and mobile smart TVs. Digital signage enables businesses or organizations to convey real-time information in a public setting, such as in a restaurant or on a billboard.

A laser TV is a 4K UHD ultra-short throw-projection display that displays on-demand video content in ambient light conditions such as living rooms, as shown in [Figure 2](#). Consumers can place the product on the floor or on a shelf and project a 100-inch or larger display, either onto a special ambient-light projection screen or just a wall. Laser TVs with DLP® technology imagers can help maximize the immersive detail within the content of a 4K UHD display.



Figure 2. A Laser TV Can Change the Home Viewing Experience

Display Technologies for 4K UHD

With so many pixels on a display, it can be challenging to choose a display technology that fully showcases the detail, depth and immersive realism of 4K UHD. There are three critical elements of DLP technology that help make a great 4K UHD projection display:

- **Digital technology.** As the resolution of a display increases, the projected pixel size decreases, making it increasingly difficult to maintain precise control over the pixels. Older analog display technologies are less precise. Projection displays that use digital technology, such as DLP technology, can enable greater precision in displays and thus reveal the detail contained in 4K imagery.
- **Switching speeds.** The faster a pixel can switch on and off, the more image detail it can convey. DLP technology has switching speeds that can be measured in microseconds, while some other technologies can be as much as 1,000 times slower. Speed can display millions of beautiful colors; reduce motion blur; and reveal crisp, sharp detail in an image. True 4K content contains incredible detail, and display speed can help enhance it.
- **Accurate pixel convergence.** Accurate pixel convergence is a technology that allows the same pixel to display all colors. It eliminates mechanical alignment errors between different colors which makes displayed images crisper, sharper and more precise. Accurate pixel convergence is usually implemented where one display device manages all colors in a projector. Alternative display technologies may use different display devices for each of the three primary colors: red, green and blue. The 4K pixels are so small that it is very hard to make the colors perfectly overlap if each color routes through a different display device resulting in blurrier images.

Pushing the Boundaries of 4K UHD

TI's [DLP472TP](#), [DLP472TE](#), [DLP650TE](#), [DLP780TE](#) and [DLP781TE](#) devices display four pixels on the screen per micromirror. The wide range of lumen capabilities – as high as 13,000 lumens – enables designers to develop systems that leverage the devices' high brightness capabilities and small form factors. These 4K UHD chipsets are powered by [DLPC8445](#), [DLPC4420](#) or [DLPC7540](#) controllers, which include features to help ensure easy setup for [screenless TVs](#) and pro AV projectors. An example of using warping to set up a laser TV can be seen in the image below.

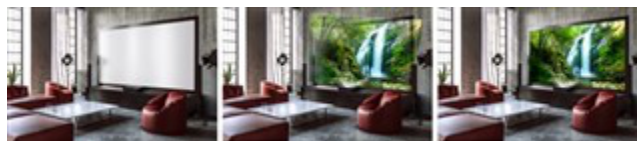


Figure 3. A Warping Engine Enabling Easy Setup with Automatic Screen-fit Adjustment

Conclusion

As 4K technology becomes the standard in homes and businesses, it's important to be ready as more content transitions to 4K. DLP technology for true 4K UHD delivers clear, crisp and precise images with advanced image-processing algorithms. True 4K UHD can help bring 4K content to life and make it easier to for consumers to see, read and be entertained.

Additional Resources

- Check out these white papers: "[TI DLP Technology for Laser TV Displays.](#)" and "[TI DLP Products Illuminating the Way to Next-Generation 4K UHD Applications.](#)"
- Download the product overview, "[TI DLP 4K Ultra High Definition \(UHD\) Display Chipset.](#)"
- Download the application note, "[How to solve screenless TV design challenges](#)" and "[DLP® Technology for Mobile Smart TV](#)".
- Search for [DLP 4K UHD standard chipsets](#).

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#) or other applicable terms available either on [ti.com](https://www.ti.com) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2024, Texas Instruments Incorporated