Application Brief

8.3 Million Reasons to Choose TI DLP™ True 4K Ultra-High Definition (UHD) Projection

The evolution of 4K UHD projection technology has sparked significant advancements in home theater and professional display systems, with distinct approaches to achieving ultra-high-definition visuals. This application brief compares True 4K UHD projection using Texas Instruments' (TI) DLP™ technology, which delivers 8.3 million pixels, against alternative technologies, such as 3LCD Pro-UHD 4K UHD and emerging Liquid Crystal on Silicon (LCoS) systems. LCoS systems often rely on pixel-shifting or enhanced processing to approximate 4K UHD resolution without providing a full 8.3 million pixels.

4K UHD UHD as Defined by the Consumer Technology Association

The Consumer Technology Association (CTA) defines a 4K UHD Ultra HD TV based on specific minimum performance attributes, including:

- Display resolution of at least 3840x2160 pixels (over 8 million active pixels)
- Individually addressable pixels
- Native resolution aspect ratio of 16:9 or wider

DLP 4K UHD Chipsets Deliver 8.3 Million Pixels

DLP projectors achieve True 4K UHD with 3840x2160 resolution by using TI's XPR pixel shift technology.

The DLP chip splits the 4K UHD input frames into four 1080p sub-images and displays them serially. The actuator module, in tandem, steers each of the sub-images to unique positions on the screen, effectively creating 8.3 million pixels for True 4K UHD at 60Hz.

DLP technology design makes sure of excellent alignment of red, green and blue colors, avoiding convergence issues common in 3LCD systems. This precision maintains the integrity of the 8.3 million pixels, delivering sharp, crisp images as required by True 4K UHD.

3LCD 4K UHD Pro-UHD and Limited 4.2 Million Pixels

3LCD systems using PRO-UHD 4K UHD or 4K UHD enhancement typically use a native resolution lower than 3840 x 2160 and employs pixel-shifting to display approximately 4.1 million pixels. For example, a 1080p chip with two-phase pixel shifting doubles the pixel count but only reaches half of the 8.3 million pixels required for True 4K UHD. In this case, PRO-UHD 4K UHD only has 50% of the resolution compared to True 4K UHD UHD.

PRO-UHD® is a term used to describe the resolution produced by Epson's e-shifting technology in their projectors. This technology allows the projectors to display content with a resolution that is marketed as *PRO-UHD*, which is different from True 4K UHD. PRO-UHD is not an industry specification.

3LCD systems have introduced precision shift glass plate technology that offers 8.3 million pixels on a limited number of projectors

LCoS Limited Pixel Count

Many high-end native 4K UHD home theater projectors utilize LCoS chips. However, an LCoS enhanced processing technology is being evaluated that can enable LCoS chips to mimic 4K UHD resolution at a much lower price point. This turbo functionality can market a 4K UHD user experience, but fails to meet the 8.3 million pixel count to be considered True 4K UHD.

References

- Texas Instruments, Seeing More with 4K UHD UHD , technical article
- Texas Instruments, TI DLP Products illuminating the way to next-generation 4K UHD UHD applications, marketing white paper
- Texas Instruments, TI DLP Optical Design Guidelines
- Texas Instruments, The DLP technology difference

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