Application Report
DLPA031C–May 2012–Revised March 2014

Wavelength Transmittance Considerations for DLP® DMD Window

ABSTRACT

The use of DLP technology in non-projection applications such as 3D scanning, optical networking, spectroscopy, vascular imaging, and others has gained significance. Various optical factors must be taken into consideration to facilitate these applications.

The digital micromirror device (DMD) efficiency observed in a specific application depends on application-specific design variables such as illumination wavelength, illumination angle, projection aperture size, overfill of the DMD micromirror array, and so on. Overall optical efficiency of each DMD can generally be estimated as a product of window transmission (2 passes), diffraction efficiency, micromirror surface reflectivity, and array fill factor. The first three factors depend on wavelength of the illumination source. This application report provides information specifically on transmittance of DMD windows in different regions of the electromagnetic spectrum.

1 Introduction

DLP technology uses two types of materials for DMD windows. The window material for all DMDs except Type-A is Corning Eagle XG, whereas Type-A DMDs use Corning 7056. Both window types have an anti-reflective (AR) thin film coating on both the top and the bottom of the window glass material. AR coatings reduce reflections and increase transmission efficiency.

The DMD windows are designed for three different transmission regions.

- Ultraviolet (UV) light: 320 to 400 nm
- Visible light: 400 to 700 nm
- Near infrared (NIR) light: 700 to 2500 nm

The coating used depends on the application. UV windows have special AR coatings designed to be more transmissive for ultraviolet wavelength, visible coatings for visible DMDs, and NIR coatings for NIR DMDs.

The measured data provided in the following sections reflects a typical single-pass transmittance through both top and bottom AR coated window surfaces with random polarization. The angle of incidence (AOI) of 0° is measured perpendicular to the window surface, unless mentioned otherwise. With an increase in the number of window passes, the efficiency would decline.

NOTE: The curves shown are typical performance and not minimum specified limits or ensured values.

2 Corning 7056 Window Transmission Curves

The window transmission response curves in this section apply to Type-A DMDs in their specified illumination wavelength regions. Figure 1 shows the UV window transmittance measured perpendicular to the window surface and visible window transmittance at AOI of 0° and 30°. Figure 2 and Figure 3 are the zoomed-in views of the typical visible and UV AR coated window transmittances in their maximum transmission regions.

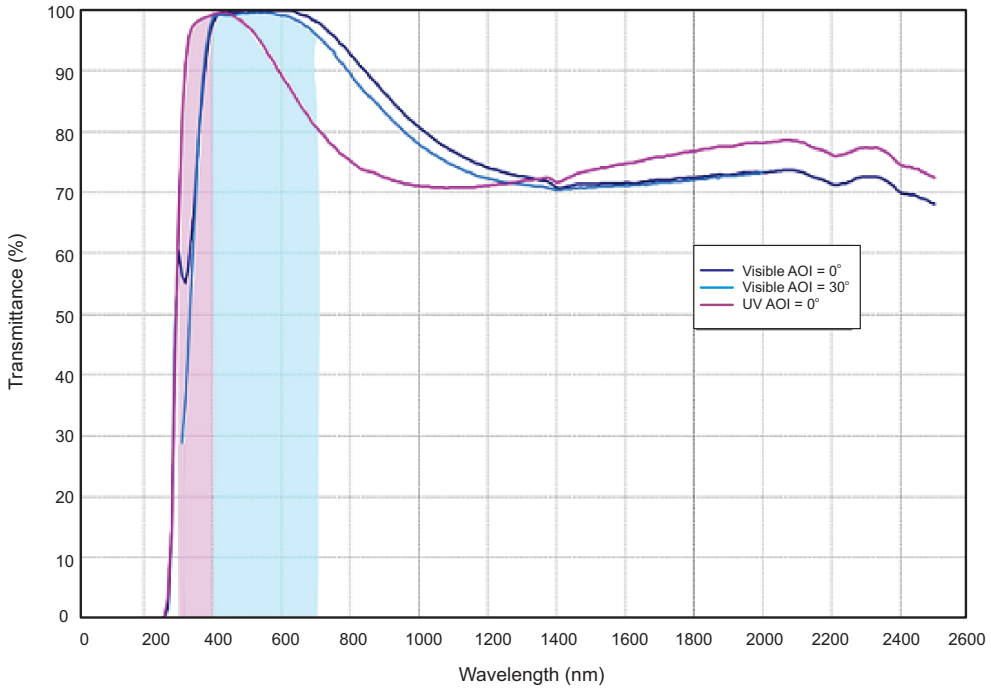

Figure 1. Corning 7056 Visible and UV Window Transmittance Response Curves

The visible window is optimized for 420 to 700 nm wavelengths. The UV window is optimized for 355 to 400 nm wavelengths.

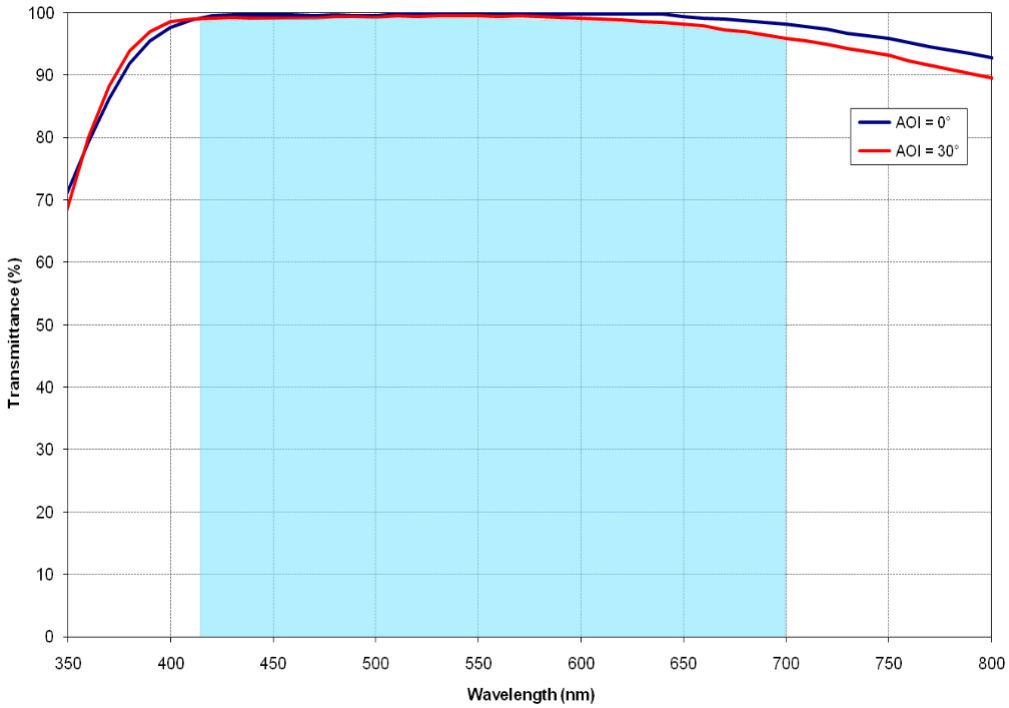

Figure 2. Corning 7056 Visible Window Transmittance (Maximum Transmission Region)

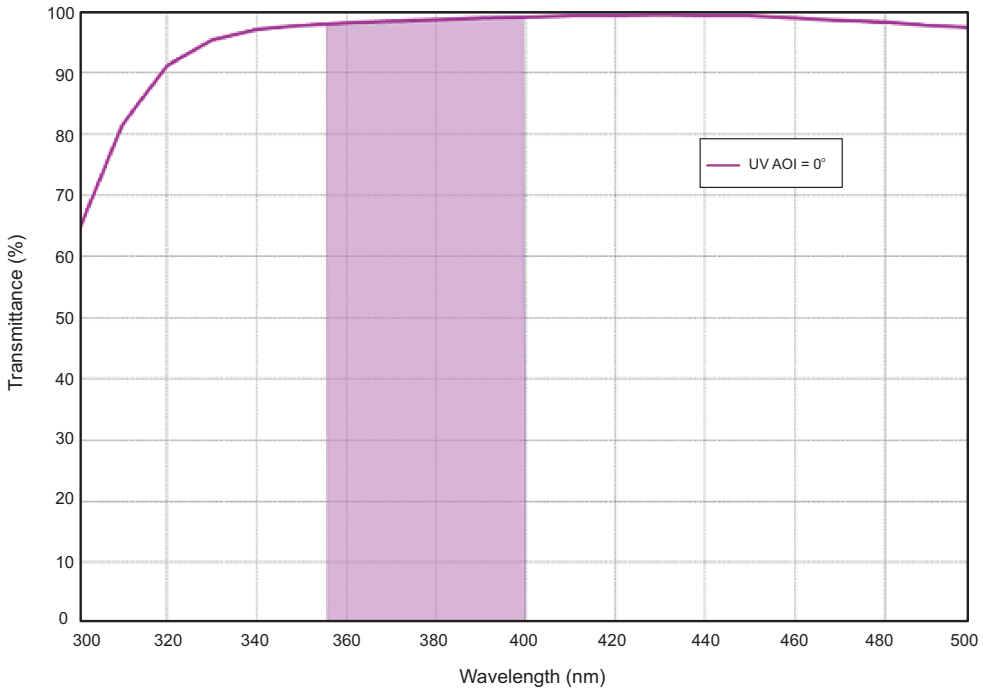

Figure 3. UV Window AR Coating Transmittance (Maximum Transmission Region)

3 Corning Eagle XG Window Transmission Response Curves

The AR coated Corning Eagle XG window transmittance is shown in Figure 4 for different transmission regions.

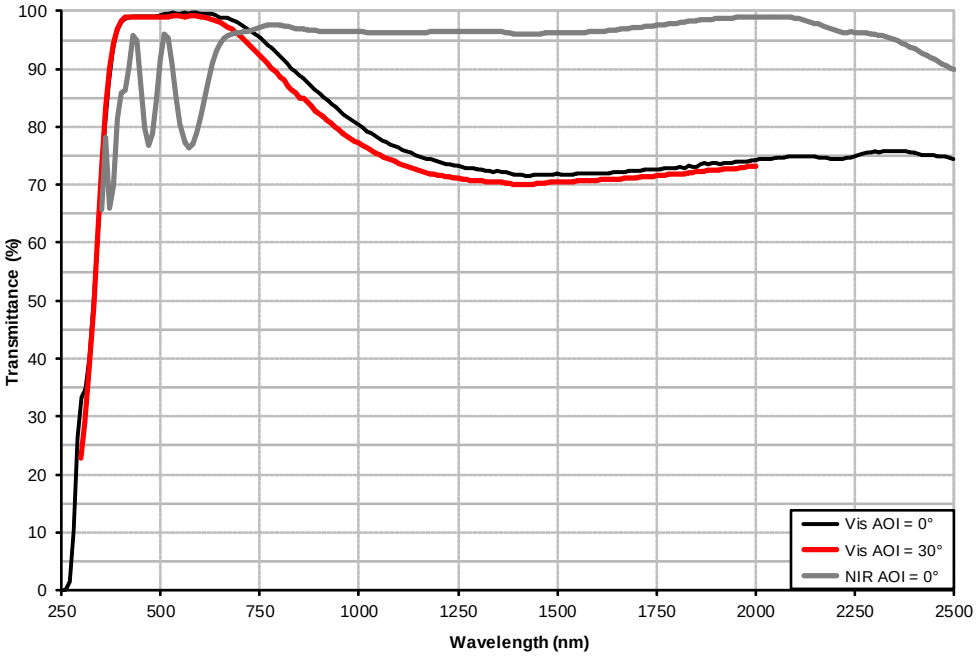

Figure 4. Corning Eagle XG Window AR Coating Options

The visible Corning Eagle XG window transmission data in Figure 5 applies to the DLP5500, DLP1700, DLP3000, and DLP4500 DMDs . The typical transmittance observed in these DMDs in broadband visible region is approximately 97% (single-pass through two surface transitions).

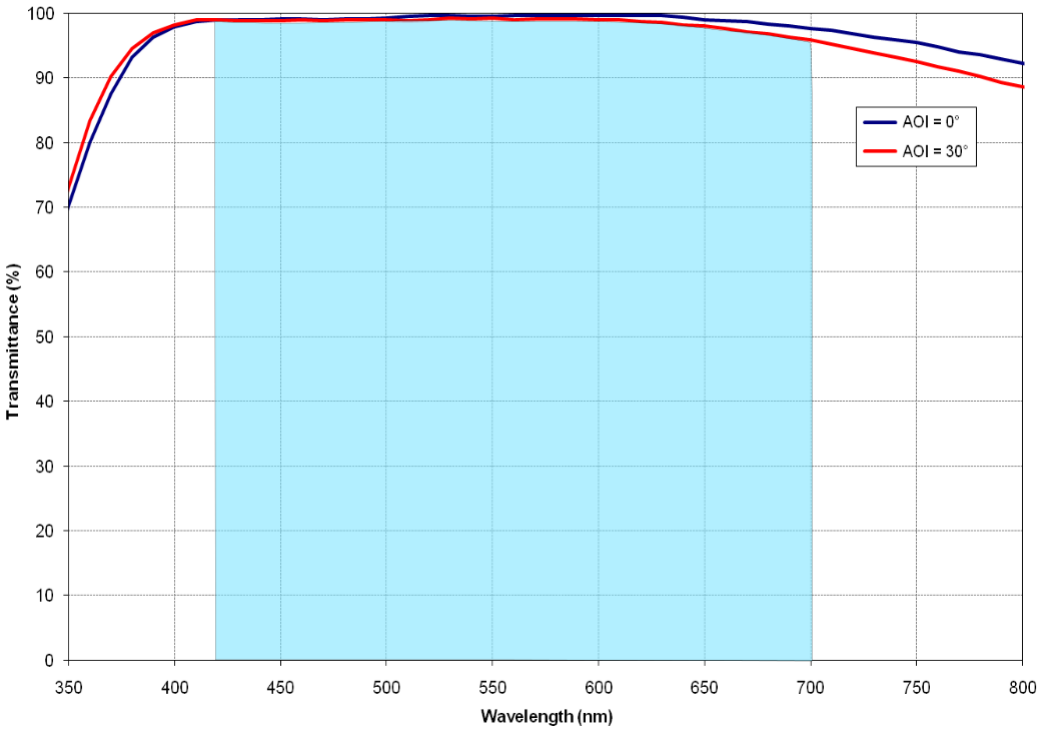

Figure 5. Corning Eagle XG Visible AR Coating Transmittance

The NIR Corning Eagle XG window transmission data in Figure 6 applies to the DLP4500NIR DMD. The typical transmittance observed in the NIR DMDs in the broadband NIR region is approximately 96% for most of the region (single-pass through two surface transitions), with a dip toward 90% as it nears 2500 nm.

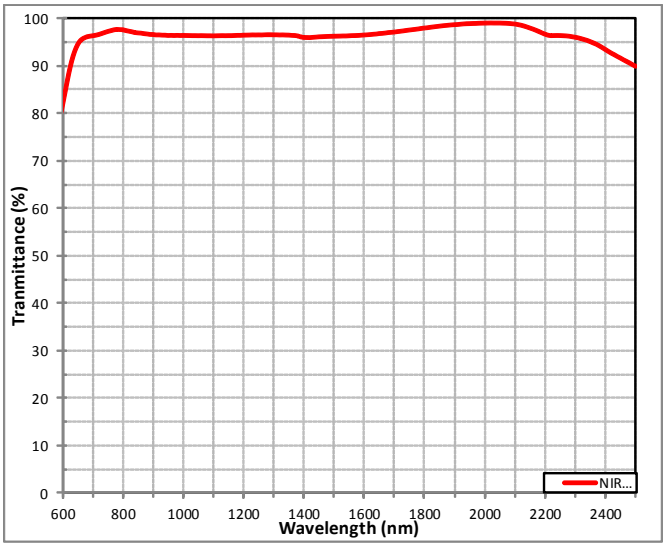

Figure 6. Corning Eagle XG NIR AR Coating Transmittance

Revision History

Changes from B Revision (November 2012) to C Revision	Page
• Updated Figure 4	3
• Added Figure 6	4

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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