Series 4xx DMD Glass Cleaning Procedure

Application Report

Literature Number: DLPA025
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1 PURPOSE

Provide correct and consistent methods for cleaning the glass of the DMD in such a way that the anti-reflective coatings on the glass surface are not damaged.

2 SCOPE

To remove contaminants such as smudges, fingerprint oils, or foreign materials from the DMD glass.

3 MATERIALS

- Antistatic or conductive finger cots or gloves
- 3x magnification lens
- Microfiber optical cleaning cloth, examples include “Mikros” from Crystal Optical, 11620 Trask Avenue, Garden Grove, CA, 92843, 1-800-766-8228, or “Anticon-100” from Controlled Environment Products Inc. 3605 N.E. Kimball Dr, Kansas City, MO. 64161, phone 1-800-243-7404, or equivalent.
- Texas Instruments recommends using the 4-inch square microfiber cloths available from manufacturers. These can be discarded after each wipe.
- Optical cleaning pad saturated with de-ionized (DI) water and isopropyl alcohol (IPA).
- Acetone
- High-quality cotton swabs
- High-intensity light source
- De-ionized water
- Forced ionized air (regulated to 35 ±5 lbs and extremely clean.)

4 PROCEDURE

4.1 General Instructions

- For each cleaning method listed below, always use a new section of the microfiber optical cleaning cloth, optical cleaning pad, or cotton swab when cleaning the DMD glass. Using the same section of the Cloth (or Swab) has the potential of dragging particles and or adding contaminants to the glass surface which may scratch the glass.

  Scratches are permanent and can cause projected image artifacts. Using proper procedures will help prevent scratches.
- ESD handling precautions outlined in Series 4xx DMD Handling Specifications (TI Literature number DLPA019) must be observed when cleaning the DMD glass.
- The DMD should be placed glass-up on an ESD dissipating work surface and held firmly. After each cleaning attempt, inspect the glass and repeat if necessary.
- All cleaning of DMDs shall be performed with the appropriate cleaning method only. Exception to these methods must be approved in writing by Texas Instruments production or customer engineering.
- In all cases, the least aggressive cleaning method shall always be tried first. If the least aggressive cleaning method does not remove the contaminant, then proceed to the next level of cleaning method.
- The contaminant on the DMD glass will determine what cleaning method is to be used. Contaminants such as dust or light oils can be cleaned off easily with a microfiber cleaning cloth or an optical cleaning pad. More difficult contaminants such as heavy finger oils may require an acetone cleaning. Contaminants that are water based may require an initial cleaning with DI water, then dried completely, and then followed by an acetone cleaning.

4.2 Specific Instructions

4.2.1 Light Cleaning – Less Aggressive Cleaning Method

The least aggressive cleaning method is to use Forced Ionized Air. The Ionized Air used must be extremely clean. This will require in-line filters on the air hose.

1. Gently blow off the glass surface of the DMD. If this does not remove the contaminant from the glass then proceed to the next cleaning level described in step 2.
2. With the microfiber optical cleaning cloth the recommended method is to start in the center of the DMD glass window, wipe lightly toward the outer edge with one continuous stroke. Rotate the DMD 180 degrees and obtain a clean area of the microfiber cleaning cloth. Again, start in the center of the DMD and wipe toward the outer edge with one stroke. Inspect the glass and repeat if necessary.
3. If contaminants remain on the glass after cleaning, proceed to next level of cleaning described in Section 4.2.2.

4.2.2 Wet Cleaning -- Intermediate Cleaning Method

A more aggressive cleaning method is a wet wash. This method uses liquids such isopropyl alcohol with DI water. The isopropyl alcohol with DI water comes prepackaged as optical cleaning pads. These optical cleaning pads are optical quality cleaning clothes that are saturated with Isopropyl alcohol and DI water.

1. The DMD shall be placed glass up on an ESD dissipating work surface and held firmly.
2. With the optical cleaning pad the recommended method is to start in the center of the DMD glass window, wipe toward the outer edge with one continuous stroke. Rotate the DMD 180 degrees and obtain a clean area of the optical cleaning pad. Again, start in the center of the DMD and wipe toward the outer edge with one stroke. Inspect the glass and repeat if necessary.
3. If contaminants remain on the glass after cleaning, proceed to next level of cleaning method described in Section 4.2.3

4.2.3 Aggressive Cleaning -- Acetone Cleaning Method

NOTE: Care should be taken to ensure that Acetone does not touch the DMD's symbolization. Acetone will remove the symbolization ink.

A more aggressive cleaning method is an acetone cleaning. For acetone specific applications where extremely stringent cleaning is required the following steps are suggested as guidelines.

Acetone cleaning will require a high quality optical cloth such as a microfiber optical cleaning cloth to apply the liquid to the glass surface. High-quality cotton swabs may be substituted. Care must also be taken to ensure the acetone is clean and is in a dispenser that will not pick up moisture from the air. If acetone is in an open air container then it must be discarded after one week because it will pick-up moisture from the air.

1. The recommended method is always to start in the middle of the glass and wipe towards the outer edge of the DMD. Rotate the assembly 180 degrees and again start in the center of the DMD glass and wipe towards the outer edge of the device. On each wipe use an un-used area of the cloth for the wiping action.
2. Inspect the DMD to ensure that it is clean. Repeat if necessary.

4.2.4 Special Cleaning --- Water based Contaminants

NOTE: DI water and acetone must not be mixed or allowed to combine on the glass surface. The combination of DI water and acetone will form a white haze on the glass surface. Care must be taken to ensure that the glass surface is dry and free of DI water before any acetone is applied.

For water based contaminants on the DMD glass the following steps are recommended as guidelines.

1. Fold a microfiber cleaning cloth (i.e., Anticon-100) twice to have two layers. Dampen the cloth with DI water.
2. Wipe the DI water pump to clean the lid, discard the cloth. The pump should be cleaned periodically during the day.
3. Obtain a new cloth, fold twice and dampen with DI water. Wipe the gold portion of the DMD without letting the cloth touch the glass. This action removes potentially damaging abrasives. Discard the cloth.
4. Obtain a new cloth, fold twice and dampen with DI water. Slowly wipe the glass surface starting at the center and wiping to the outside.
5. Fold the cloth over to expose a clean section of the cloth or obtain a new DI water dampened cloth. Rotate the DMD 180 degrees and again start in the center of the DMD glass and wipe towards the outer edge of the device.
6. Obtain a new dry cloth, fold twice (**do not dampen**) and wipe the surface of the DMD from one end to the other, starting with the edge of the glass. The purpose of this cloth is to dry the glass surface and ensure there is no DI water remaining on the glass surface. Discard the cloth.
7. Obtain a new cloth, fold twice and dampen with acetone. Wipe the gold portion of the DMD without letting the cloth touch the glass. This action removes potentially damaging abrasives. Discard the cloth.
8. Obtain a new cloth, fold twice and dampen with acetone. Slowly wipe the glass surface from the center out, at a rate such that the acetone evaporates within 1/8 inch of the wipe.
9. Fold the cloth over to expose a clean section of the cloth or obtain a new dampened cloth. Rotate the DMD 180 degrees and again start in the center of the DMD glass and wipe towards the outer edge of the device.
10. Obtain a new cloth, fold twice (do not dampen with acetone) and wipe the surface of the DMD from one end to the other, starting with the edge of the glass. Discard the cloth
11. Inspect the DMD's glass and repeat steps 1 through 10, if necessary.

4.2.5 Follow-up all wet cleanings with a dry microfiber cleaning cloth (per Section 4.2.1) to ensure no residue is left on the DMD glass.

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