

# DMD Handling Specification

## Application Report



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## DMD Handling Specification

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### 1 PURPOSE

- Define the minimum requirements for DMD Handling.
- Establish precautions to protect the DMD from Electrostatic Discharge (ESD).
- Establish precautions to protect the DMD's glass and electrical contacts.

### 2 SCOPE

- This specification applies to all operations in which DMDs are used.
- Reference EIA-JESD 625A (Requirements for Handling Electrostatic Discharge-Sensitive (ESD) Devices for additional information.

### 3 LIMITS & DEFINITIONS:

#### 3.1 *DLP® Products Electrostatic Discharge Immunity Levels*

All external signals on a DMD are protected from damage by electrostatic discharge, according to JESD22-A114-B Electrostatic Discharge (ESD) Sensitivity Testing Human Body Model (HBM) to the levels indicated in the *Handling Ratings* table of the DMD data sheet.

#### 3.2 *Electrostatic Discharge Definitions*

**Anti-Static Material**—Material that minimizes the generation of static charge when rubbed against itself, or when separated from itself or other similar material.

**Conductive Material**—Material having a surface resistivity of less than  $10 \times 10^5 \Omega$  per square inch

**Electrostatic Discharge (ESD)**—A transfer of electrostatic charge between bodies at different electrostatic potentials caused by direct contact or induced by an electrostatic field.

**ESD Ground**—Use either an earth ground or a third-wire ground.

**Insulative Material**—Material having a surface resistivity equal to or greater than  $10 \times 10^{12} \Omega$  per square inch.

**Ionizer**—Equipment that generates positive and negative ions, either by electrostatic means or by means of a radioactive energy source (such as polonium 210), and distributes a layer of ionized air over a work area to neutralize static charges.

**Static-Dissipative Material**—Material having surface resistivities between  $10 \times 10^5 \Omega$  and  $10 \times 10^{12} \Omega$  per square inch.

#### 3.3 *DMD Handling Definitions*

**DMD Window**—The window is the glass that covers the mirrors in the DMD. This surface of the DMD is referred to as the front of the DMD.

**DMD Pins (Electrical Contact)**—The pins are the electrical connection for the DMD. The electrical connections are on the back of the DMD. Care should be taken not to bend or break the pins.

**DMD Pads and Connector (Electrical Contacts)**—In the case of smaller DMD packages without pins, the pads (for TI internal test use) and connector (for end product use) are the electrical connection for the DMD. These electrical connections are on the back of the DMD.

## 4 ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

- General requirements
  - All equipment, tools, fixtures and handling aids used for processing, handling, or storing of ESD-Sensitive (ESDS) products shall be made from conductive or static-dissipative material. Where conductive or static-dissipative material can not be used, antistatic solution can be used as a means to reduce static charge generation. During application of any antistatic solutions, the guidelines below must be followed:
    - Use approved antistatic solutions only. They must be free of reactive elements (such as chlorine, phosphorus, sodium, and so forth). Antistatic solutions must not contaminate ESDS devices.
    - The solution must be re-applied to insure that the equipment, fixtures, tools, and so forth, generate less than  $\pm 100$  V potential when rubbed vigorously with any insulative material (the frequency of once/day is recommended).
    - Antistatic solutions must not be applied when devices are directly exposed to spray mists.
  - All flooring in the manufacturing area shall be conductive or static-dissipative.
  - All conductive or static-dissipative storage racks, fixtures, and so forth shall be connected to ESD ground through a  $1\text{ M}\Omega \pm 10\%$  resistor.
  - All grounding for work surfaces, racks, equipment, and so forth shall meet all local safety codes and requirements.
  - Any temporary connection used to ground any work surface, rack, equipment, and so forth shall be of a snap or plug-and-socket type.
  - All electrical equipment used at the work station shall be hard grounded (third-wire grounded). Small hand tools such as tweezers may be grounded through the operators.
  - Any electrical equipment located on the work surface shall be hard grounded (third-wire grounded) and shall also be isolated from the work surface.
  - It is strongly recommended that a qualified safety engineer perform a safety review of all new or modified ESD ground connections prior to their initial use.
  - Operators who are handling DMD devices shall wear a [Wrist Strap](#) as described below and a [Heel Strap](#) as described below.
- Ionizers
  - Forced-air, table-mounted ionizers shall be located so that devices are:
    - within a 1.3 meter (4-foot) arc measured by a vertical line from the face of the ionizer and 45 degrees on either side of this line, and
    - at least 0.3 meter (1-foot) away from the ionizer.
  - All ionizing units shall be located in a position to limit charge-buildup in the DMD handling area of the work station to  $\pm 100$  volts.
  - It is recommended that all ionizers be approved by a qualified safety engineer prior to implementation.
  - The following checks on the ionizers (work station ionizers only) shall be performed:
    - On a monthly basis, check for proper operation of the ionizers with the ‘quick check’ procedure (or equivalent) described in Appendix A.
    - On a semi-annual basis, check, as a minimum, for proper ionization output, ionization balance, and electrode cleanliness according to manufacturer’s instructions. Record of the checks shall be maintained.
- Work Stations
  - Wrist straps shall be connected to ESD ground through a  $1\text{ M}\Omega \pm 10\%$  resistor. A workstation monitor which constantly monitors the resistance of the workstation, operator, and wiring connections and alarms when connections are broken or missing is required at all work stations

where ESDS materials are being handled. (Example of Monitor is the 3M Workstation Monitor model 720) Static-dissipative work surfaces, and conductive or static-dissipative floor mats shall be connected to ESD ground through a  $1\text{ M}\Omega \pm 10\%$  resistor.

- An ionizer shall be used at each work station. There shall be no static-generating materials at the work station, and a conductive static-dissipative or antistatic smock shall be worn by the operator. A ceiling ionizer is sufficient for the work station provided that there is no obstruction between it and the work surface where ESD sensitive materials are being handled (such as under a hood).
- Wrist Straps
  - Wrist straps shall be worn when handling DMDs.
  - Wrist straps shall be connected to an ESD monitor.
  - When the wrist strap is connected to the static-dissipative mat, it shall be connected to the same metallic button or the contactor used to ground the mat. This may result in the wrist strap being  $2\text{ M}\Omega \pm 10\%$  above ground, which is acceptable.
  - Wrist strap shall be worn snugly around the wrist to ensure continuous electrical contact with bare skin.
  - Wrist straps shall be checked daily to ensure that proper grounding is maintained.
- Heel Straps or Conductive Shoes or Conductive Slippers
  - Conductive shoes, slippers or heel straps shall be worn when handling DMDs.
  - Heel or toe strap shall solidly contact conductive flooring. The contact ribbon shall make electrical contact with human body.
  - Heel straps or conductive shoes shall be checked daily to ensure that proper grounding is maintained.

## 5 DMD HANDLING PRECAUTIONS:

- The DMD's glass has a higher profile than the DMD's body. Extra caution should be observed when handling the DMD to ensure the glass is not scratched. Never place a DMD face down (glass down) on any surface because scratches in the glass may occur.
- The S2xx and S3xx DMD's are very small and the glass window is entirely exposed. Picking up parts with fingers can easily lead to touching or contaminating the DMD window even when wearing finger cots. It is recommended that plastic tip tweezers, such as TDI International 2AXCPR-SA or TDI International 2AXCFR-SA, or equivalent be used to pick up these DMD's.
- All equipment, tools, and so forth used shall meet the requirements outlined in this document.
- Do not place tape, labels, or marking on the DMD glass or on the back electrical pin contacts of the DMD.
- All manual processing or handling of DMDs shall be performed at static-free work stations.
- Before using a static-free work station, the operator shall:
  - Check that the wrist strap is connected correctly.
  - If work station ionizer is used, check that it is switched on and properly positioned to aim at the devices and operator's hands.
- An antistatic, static-dissipative, or conductive smock must be worn where ionizer is not present. Long-sleeved garments must be completely covered by the smock, except at the neck area.
- DMDs shall be stored and transported between static-free work stations in an enclosed conductive container. Do not transport the DMD device without such a container, even for short distances. The DMD container must keep the device stationary during transport. The container can only be opened at a static-free work station when the container is in contact with a properly grounded static-dissipative surface. The surface must be sturdy and as close to the process as possible.
  - Always hold the DMD containers with two hands away from the body and with a firm grip. Handle the carrier gently.
  - Do not place anything inside the container with the devices except for ESD approved packaging material.
  - Do not allow any object to come in contact with the glass of the DMD device.

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- Do not write on top of a DMD container full of devices.
  - Use clean DMD containers only.
  - Any operation performed with DMDs should be at a static free work station.
  - Clean antistatic or conductive gloves or finger cots must be worn at all times when handling DMD devices. Replace gloves and finger cots when they are dirty or damaged.
  - Extreme caution must be used when handling DMD devices to ensure that the glass area is not touched or scratched. Handle the DMD device by the package edges only.
  - Remove the DMD device from the carrier gently. When putting the DMD into the carrier, use caution. Do not drop the DMDs into the carrier. Ensure that the DMDs are well-seated in the carrier.
  - Touching of pins or contacts must be avoided. Handle the DMD device by the package edges only. Cleaning the window of the DMD device must only be performed per **DLP® DMD Glass Cleaning Procedure - DLPA025**.
  - Clothing other than approved conductive or static-dissipative garments shall not be allowed within 150 mm (12 inches) of any DMD which is not protected in an appropriate conductive container.
  - It is the responsibility of the operator and the area supervisor to ensure that the static- free work area is clear of unnecessary static hazards. All work-related items, including log book, tools, and device containers must be approved for use at the static- free work station.

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## **IONIZER ‘QUICK CHECK’**

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### **A.1 IONIZER ‘QUICK CHECK’**

- A. Equipment / Materials
  - a. Electrostatic voltmeter
  - b. Sticky plastic tape (for example, transparent adhesive tape)
- B. Assure that the ionizer to be checked is turned off and that all other ionizers in the area are either turned off or positioned so that they do not affect the ionizer being checked.
- C. Prepare two (2) pieces of tape as follows:
  - a. Cut two pieces of tape approximately 10 cm (4 inches) in length.
  - b. Fold over each end of one piece of tape (sticky side to sticky side), approximately 1 cm (0.5 inch) to create pull tabs for step d).
  - c. Stick the two pieces of tape together (sticky side of tabbed tape to the non-sticky side of non-tabbed tape).
  - d. Separate the two pieces of tape using a fast, even pull, thereby creating one piece of tape charged to approximately +1000 to +2000 volts and the other charged to approximately –1000 to –2000 volts.
- D. Place the positively charged piece of tape 0.3 – 0.5 meter (1 – 1.5 feet) directly in front of the ionizer to be checked. Turn on the ionizer for 30 – 35 seconds, and then turn it off.
- E. Measure the electrostatic charge on the tape. Acceptable voltage level is  $0 \pm 50$  volts.
- F. Repeat the steps in paragraph 4 through 5, except use the negatively charged piece of tape.

## **Related Documentation**

### 1 Related Documentation

**Table 1. Related Documentation**

Document	TI Literature Number
DLP® DMD Glass Handling Procedure	<a href="#">DLPA025</a>
DLP2010NIR 0.2 WVGA Series Near-Infrared data sheet	<a href="#">DLPS059</a>
DLP3000 0.3 WVGA Series 220 DMD data sheet	<a href="#">DLPS022</a>
DLP4500 0.45 WXGA DMD data sheet	<a href="#">DLPS028</a>
DLP4500NIR 0.45 WXGA Near-Infrared DMD data sheet	<a href="#">DLPS032</a>
DLP5500 0.55 XGA DMD Series 450 DMD data sheet	<a href="#">DLPS013</a>
DLP6500FYE 0.65 1080p DMD data sheet	<a href="#">DLPS053</a>
DLP6500FLQ 0.65 1080p MVSP Type-A DMD data sheet	<a href="#">DLPS040</a>
DLP7000 0.7 XGA Type-A DMD data sheet	<a href="#">DLPS026</a>
DLP7000UV 0.7 XGA UV Type-A DMD data sheet	<a href="#">DLPS061</a>
DLP9000 Family of 0.9 WQXGA Type-A DMD data sheet	<a href="#">DLPS036</a>
DLP9500 0.95 1080p Type-A DMD data sheet	<a href="#">DLPS025</a>
DLP9500UV 0.95 1080p UV Type-A DMD data sheet	<a href="#">DLPS033</a>

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