



## ABSTRACT

This user's guide presents an overview of the DLP® LightCrafter™ Display 471TP evaluation module (EVM) and a general description of the main features and functions. The document explains the first steps to getting started and shows a detailed description of onboard LEDs, connectors, and overall EVM assembly. The document provides the user a start with their first DLP LightCrafter Display 471TP evaluation module.

In addition to this document, additional reference documents are provided in [Section 2](#).

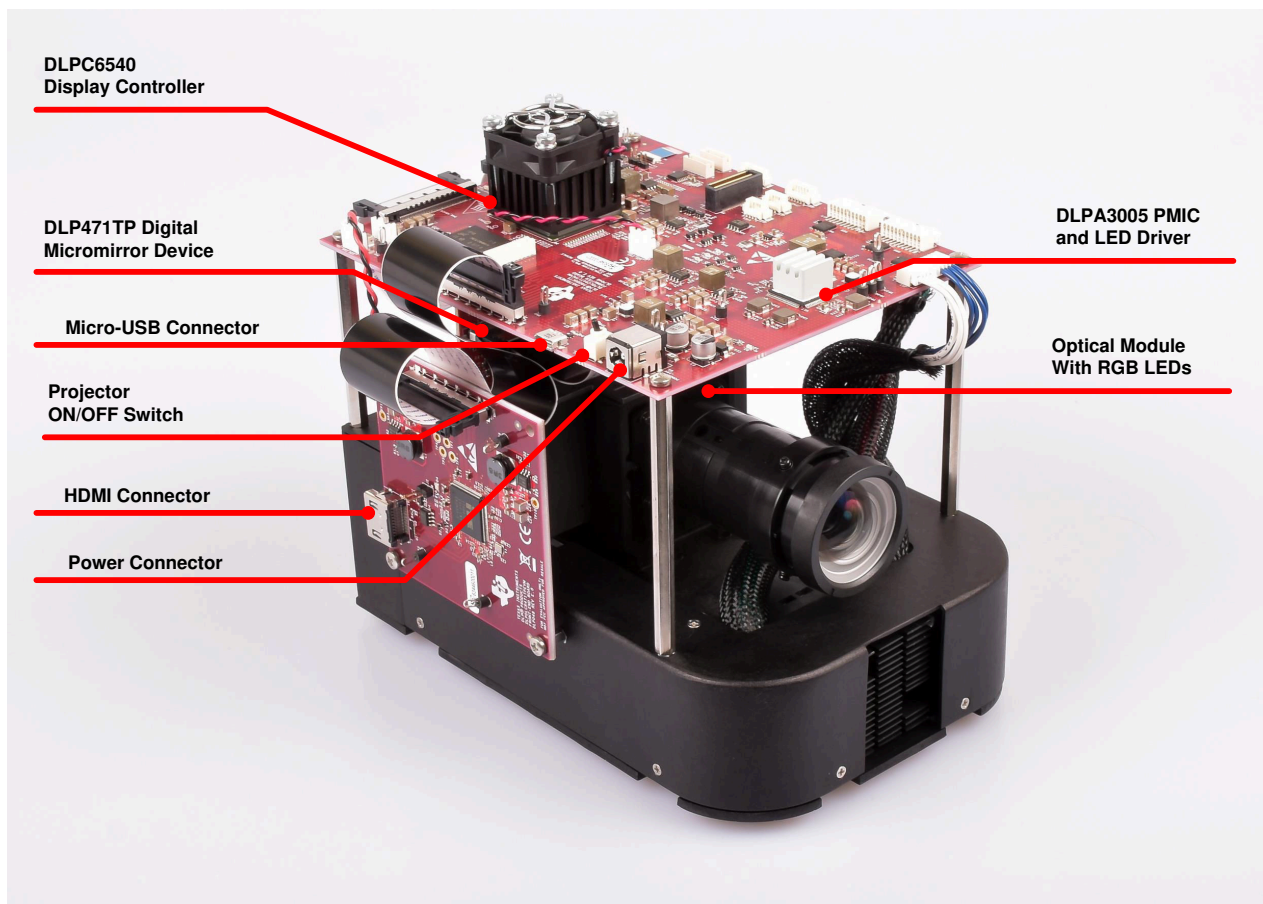


Figure 1-1. DLP LightCrafter Display Complete EVM



This design incorporates HDMI® technology.

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## Trademarks

LightCrafter™ and E2E™ are trademarks of Texas Instruments.

DLP® is a registered trademark of Texas Instruments.

All trademarks are the property of their respective owners.

The terms HDMI, HDMI High-Definition Multimedia Interface, HDMI trade dress, and the HDMI Logos are trademarks or registered trademarks of HDMI Licensing Administrator Inc.

## 1 Safety Instructions

### CAUTION



Hot surface. To minimize risk of burns, do not touch.

### WARNING



Possible hazardous optical radiation emitted from this product. Do not stare at the operating LEDs. May be harmful to the eye.

### WARNING



Observe handling precautions. Electrostatic sensitive devices.

### WARNING

Always ensure all fans are running during operation to help avoid overheating and ensure reliable operation.

## 2 Applicable Documents

The following documents are applicable to the DLP LightCrafter Display 471TP EVM and are available at [TI.com](http://TI.com).

1. Texas Instruments, [DLP471TP .47 4K UHD DMD](#) data sheet.
2. Texas Instruments, [DLPA3005 PMIC and High-Current LED Driver IC](#) data sheet.
3. Texas Instruments, [DLPC6540 High Resolution Display Controller](#) data sheet.
4. Texas Instruments, [DLPC6540 Software Programmer's Guide](#).
5. Texas Instruments, [DLP®LightCrafter™ Display and Light Control EVM GUI Tool](#) user's guide.

If you need additional assistance, refer to the [DLP Products and MEMS TI E2E™](#) community support forums.

### 3 DLP LightCrafter Display 471TP EVM Components

The DLP LightCrafter Display module consists of three subsystems:

- Light engine – Includes the optics, red, green, and blue LEDs, DMD interface board, and a DLP471TP 4K UHD DMD capable of over 500 lumens out-of-the-box.
- Formatter Board – Includes the DLP chipset comprised of a DLPC6540 controller and DLPA3005 PMIC/LED driver, USB, and power connector.
- Front-End Board – Includes the HDMI receiver and external HDMI connector.

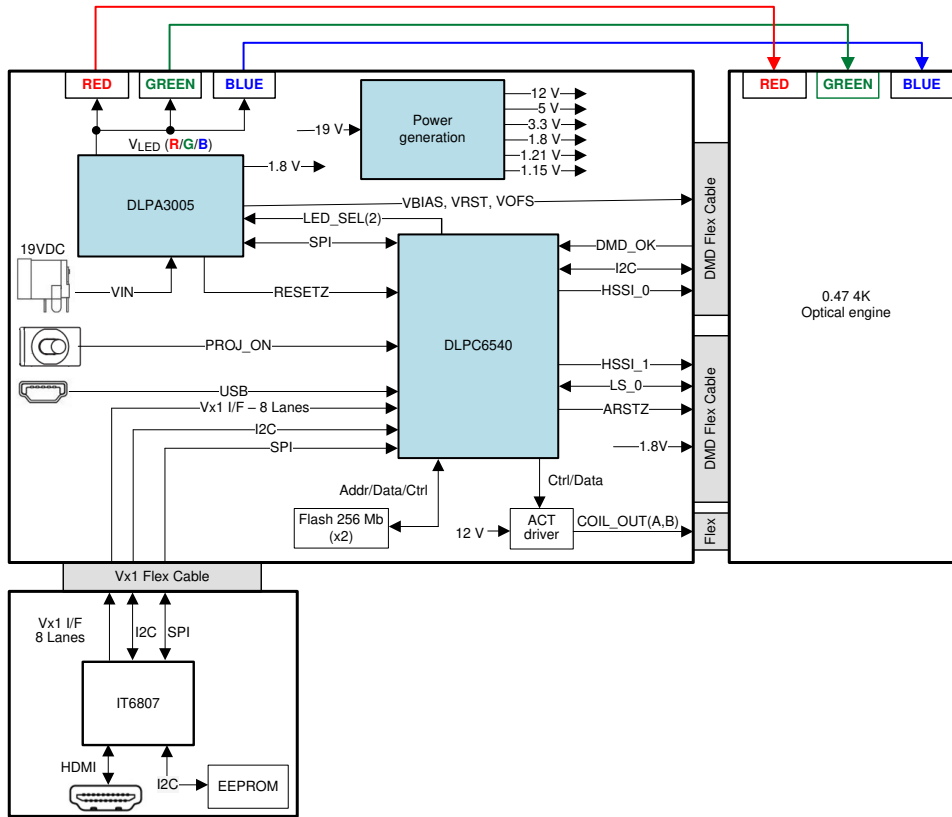


Figure 3-1. DLP LightCrafter Display EVM Block Diagram

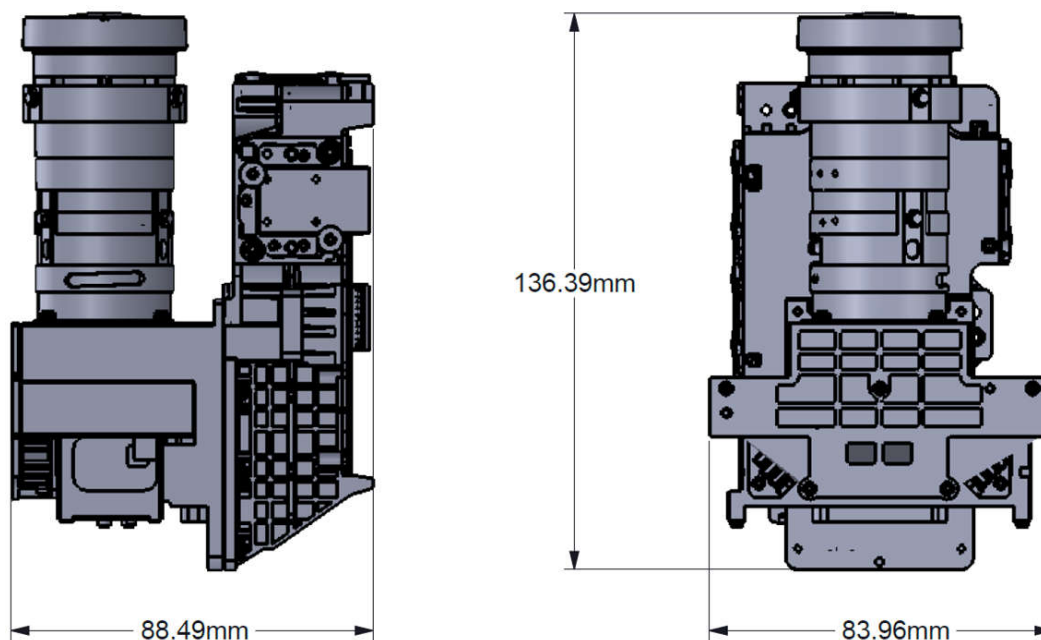
## 4 Light Engine

Anhua developed the optical engine in the EVM and is production ready. The light engine consists of the following components:

- DLP471TP (0.47-inch 4K UHD DMD).
- Osram red (LE A P1MQ), green (LE CG P1AQ), and blue (LE B P1MQ) LEDs.
- This light engine interfaces with the EVM using DMD pin mapping **Option 1**. For additional DMD interface information, refer to the [DLPC6540 High Resolution Controller](#) data sheet.

**Table 4-1. Optical Engine Specifications**

Parameter	MIN	TYP	MAX	UNIT
Brightness at 4-A RGB LED Current		500		lm
RGB LED Current		4		A
Brightness Uniformity	85%			
Throw Ratio		1.2		
Offset		100%		
Focusable Diagonal Image Size	60		120	inch



**Figure 4-1. Optical Engine Dimensions**

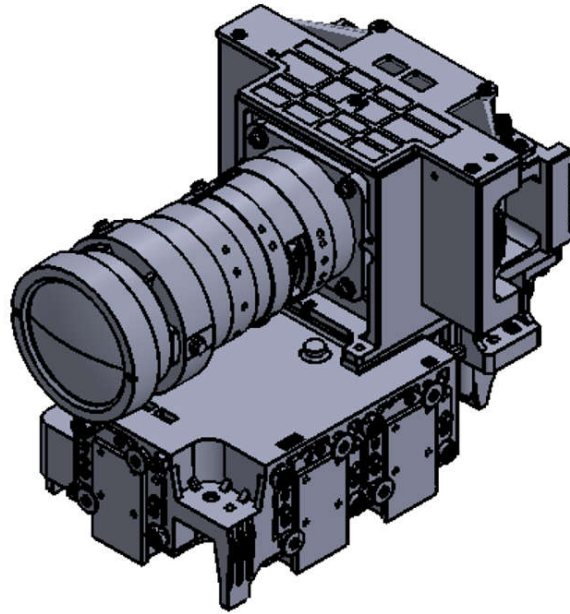


Figure 4-2. Optical Engine View

## 5 Quick-Start Procedure

This quick-start procedure considers default conditions as shipped.

1. Power up the DLP LightCrafter Display 471TP EVM by applying an external DC power supply (19-V DC, 4.74A) to the J1 connector.

### External Power Supply Requirements:

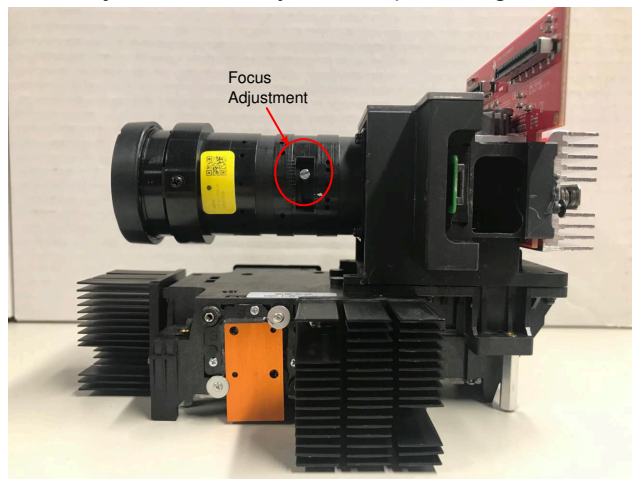
- Nominal Output Voltage: 19 VDC
- Minimum Output Current: 2.5 A
- Maximum Output Current: 4.74 A
- Efficiency Level: VI
- Connector Barrell Size: 2.5 x 5.5 x 8.25 [ID x OD x L(min)] mm
- Connector Polarity: Center +

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### Note

- TI recommends using an external power supply that complies with applicable regional safety standards such as UL, CSA, VDE, CCC, and PSE.
  - The P19VIN (D3), PWRGOOD (D5) and POSENSE (D8) LEDs on the Formatter board will turn on to indicate that input and standby powers are applied.
- 

1. Move SW1 switch to the ON position to turn on the DLP LightCrafter Display 471TP EVM. When the DLP LightCrafter Display 471TP EVM is turned on, the POSENSE (D8) LED will turn off and PROJ\_ON LED (D7) will turn on. The HEARTBEAT LED (D8) will start blinking.
2. After the DLP LightCrafter Display 471TP EVM is turned on, the projector will default to displaying a DLP LightCrafter Display splash image.
3. The focus of the image can be adjusted manually on the optical engine.



**Figure 5-1. Optical Engine with Focus Adjustment**

4. Connect the USB to the DLP LightCrafter Display 471TP EVM and open the latest GUI on your computer. If needed, connect an HDMI source to the EVM and communicate to the EVM via the GUI software.
5. When turning off the projector, turn off the SW1 switch prior to removing the power cable.

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### Note

To avoid potential damage to the DMD, it is recommended to turn off the projector with the SW1 switch before disconnecting the power.

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There are eight indicator LEDs on the DLP LightCrafter Display 471TP EVM (Formatter and Front-End boards), and they are defined in [Table 5-1](#).

**Table 5-1. Status LEDs on the DLP LightCrafter Display 471TP EVM**

Board	LED Reference	Signal Indication	Description
Formatter	D1	LOCKN	Vx1 Interface locked.
Formatter	D3	VIN	Input 19 V power.
Formatter	D4	HEARTBEAT	BLINKING after SW1 Switched ON and ASIC is running.
Formatter	D5	PWRGOOD	ON when 19 V is applied and PMIC is up.
Formatter	D6	FAULT	Indicates ASIC SW fault has occurred.
Formatter	D7	PROJ_ON	ON when SW1 switched ON.
Formatter	D8	POSENSE	ON (Red) when 19 V power applied but PROJ_ON is still OFF.
Front-End	D4	SCDT_DR5	HDMI Input stable.

## 6 Circuit Description

### 6.1 Connectors and Switches on Formatter Board

- J1** Connector for 19-V external power supply interface.
- J2** Connector for USB cable.
- J3** Connector for Vx1 flex cable from Front-End Board.
- J4** 12-V power connector (used for EVM cooling fan).
- J5** 12-V power connector (spare).
- J6** Connector for ASIC testpoints.
- J7** DMD Interface flex cable connector (HSSI0 Bus).
- J8** 12-V power connector (used for ASIC cooling fan).
- J9** Header for BOOT\_HOLD jumper
- J10** DMD Interface flex cable connector (HSSI1 Bus).
- J11** Connector for Blue LED cable.
- J12** Connector for IIC1 interface cable (spare).
- J13** Connector for Actuator Current Driver interface (not installed by default).
- J14** Header for Actuator Coil\_A testpoint.
- J15** Header for Actuator Coil\_B testpoint.
- J16** Connector for IIC0 interface cable (spare).
- J17** Connector for actuator flex cable.
- J18** Connector for Green LED cable.
- J19** Connector for Red LED cable.
- J20** Connector for ASIC JTAG cable.
- J21** Connector for WPC interface cable (spare).
- J22** Connector for SPI1 interface cable (spare).
- J23** Connector for UART0 interface cable (spare)
- SW1** Projector ON/OFF Switch.

### 6.2 Connectors on Front-End Board

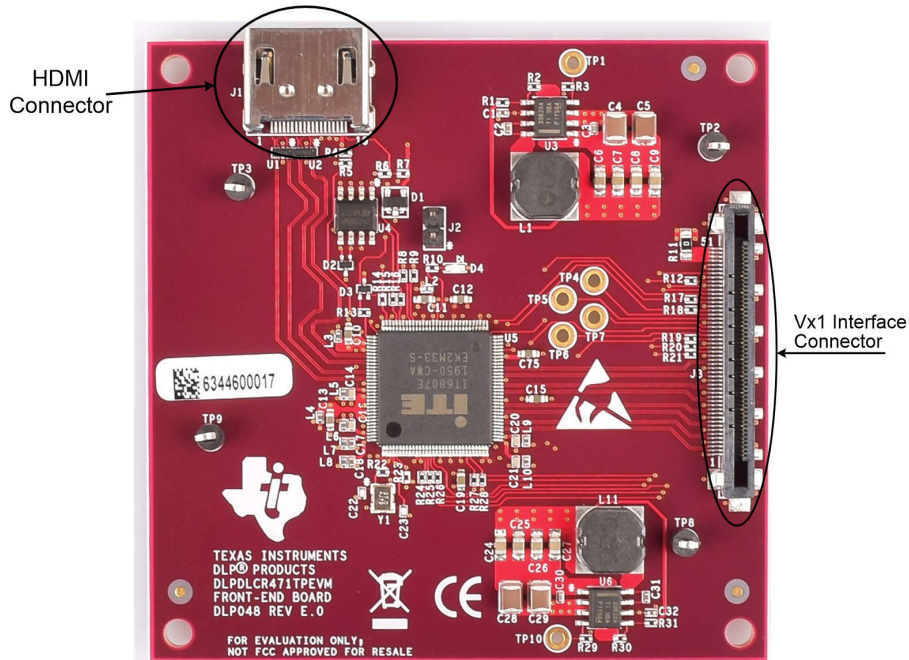
- J1** HDMI input connector.
- J2** Header for EDID EEPROM programming jumper.
- J3** Connector for Vx1 flex cable to Formatter Board.

## 7 EVM Setup

The DLP LightCrafter Display 471TP EVM is composed of three parts:

- Front-End board
- Formatter Board
- Optical Engine with LED connections and Flex cables

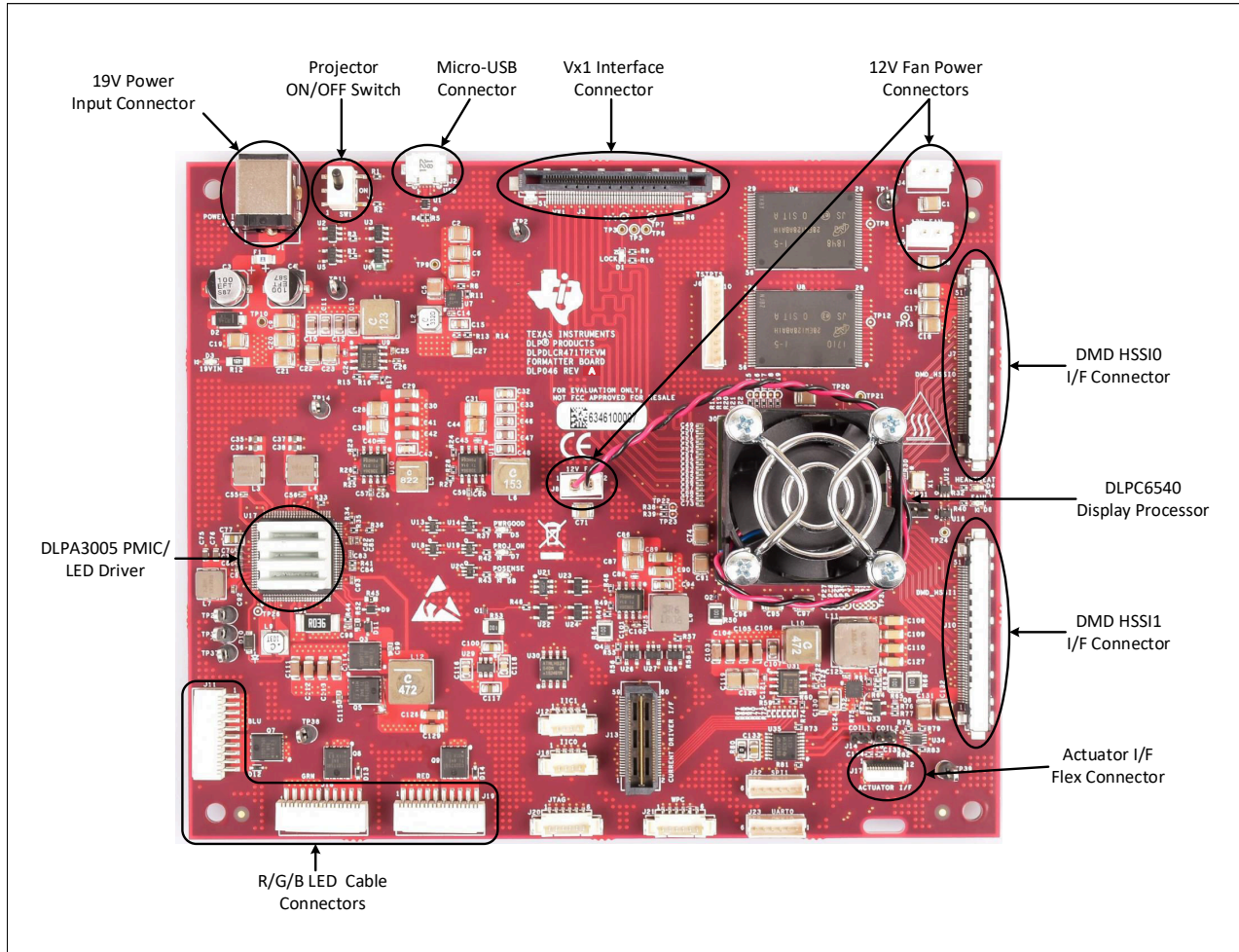
The Front-End board contains the connector for the HDMI input and a flex cable connector for interfacing to Formatter board. [Figure 7-1](#) shows the main connectors on the Front-End board.



**Figure 7-1. DLP LightCrafter Display Front-End Board**

The Formatter board contains connector for the external power supply, a USB connector to communicate to the DLP LightCrafter Display software, the RGB LED connectors, the DMD flex cable connectors, the Front-End Board interface flex connector, and 12 V fan power connectors. The Formatter board also contains a switch to turn on the projector after external power is supplied. The connectors for each LED are labeled on the board as well as on the light engine.

Always ensure a good connection of the flex cables, power cables and LED cables to the Formatter Board before turning the EVM on.



**Figure 7-2. DLP LightCrafter Display Formatter Board**

## 8 Notifications

In Compliance with Article 33 provision of the EU REACH regulation, we are notifying you that this EVM includes component(s) containing at least one Substance of Very High Concern (SVHC) above 0.1%. These uses from Texas Instruments do not exceed 1 ton per year. The SVHC's are:

**Table 8-1. REACH Compliance SVHC Substances**

Component Manufacturer	Component Type	Component Part Number	SVHC Substance	SVHC CAS
ITE Tech Inc.	HDMI Receiver	IT6807E/DW	4,4'-isopropylidene diphenol; Bisphenol A: BPA	80-05-7
Bourns	TVS Diode	SMAJ22A	Lead	7439-92-1
Anhua	Optical Engine	T-F16D	Diboron Trioxide	1303-86-2

## 9 Revision History

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

### Changes from March 31, 2021 to October 31, 2025 (from Revision \* (March 2021) to Revision A (October 2025))

	Page
• Added HDMI trademark information.....	3

## STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
  - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
  - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
  - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
  - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
  - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

### **WARNING**

**Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.**

**User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI's recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI's instructions for electrical ratings of interface circuits such as input, output and electrical loads.**

**NOTE:**

**EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGRADATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.**

### 3 Regulatory Notices:

#### 3.1 United States

##### 3.1.1 Notice applicable to EVMs not FCC-Approved:

**FCC NOTICE:** This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

##### 3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

#### **CAUTION**

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

#### **FCC Interference Statement for Class A EVM devices**

*NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*

#### **FCC Interference Statement for Class B EVM devices**

*NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:*

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

#### 3.2 Canada

##### 3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

#### **Concerning EVMs Including Radio Transmitters:**

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

#### **Concernant les EVMs avec appareils radio:**

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

#### **Concerning EVMs Including Detachable Antennas:**

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

### Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

#### 3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see [http://www.tij.co.jp/llds/ti\\_ja/general/eStore/notice\\_01.page](http://www.tij.co.jp/llds/ti_ja/general/eStore/notice_01.page) 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

<https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html>

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。技術適合証明を受けていないものご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

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3.3.3 *Notice for EVMs for Power Line Communication:* Please see [http://www.tij.co.jp/llds/ti\\_ja/general/eStore/notice\\_02.page](http://www.tij.co.jp/llds/ti_ja/general/eStore/notice_02.page)

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#### 3.4 European Union

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.



- 
4. *EVM Use Restrictions and Warnings:*
    - 4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.
    - 4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.
    - 4.3 *Safety-Related Warnings and Restrictions:*
      - 4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.
      - 4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.
    - 4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.
  5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.
  6. *Disclaimers:*
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