



Abstract

The DLP Module 2000 Evaluation Module (EVM) is a low-cost replacement optical engine for use with the DLP LightCrafter Display 2000 EVM (DLPDLCR2000EVM). It uses the same electronic connections as the stock optical engine and can be swapped into the system without any modification to DLPDLCR2000EVM board firmware.

Table of Contents

Abstract	1
1 DLP Module 2000 EVM Overview	2
2 Quick-Start Guide	3
3 What is in the DLP Module 2000 EVM?	4
3.1 Optical Light Engine Overview.....	5
3.2 LED Disclaimers.....	6
4 Additional Documentation	6
5 Additional Disclaimers	6

List of Figures

Figure 1-1. DLP Module 2000 EVM (Standalone).....	2
Figure 1-2. DLP Module 2000 EVM (Installed to DLPDLCR2000EVM, not included with DLPM2000EVM).....	2
Figure 2-1. Disassembled EVM Assembly.....	3
Figure 2-2. DLP Module 2000 EVM Optical Engine and Flex Cable.....	3
Figure 2-3. EVM Splash Screen.....	4
Figure 3-1. DLPM2000EVM Dimensions.....	5

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1 DLP Module 2000 EVM Overview

The DLP Module 2000 EVM (DLPM2000EVM) is a low-cost replacement optical engine for use with the DLP LightCrafter Display 2000 EVM (DLPDLCR2000EVM). It uses the same electronic connections as the stock optical engine and can be swapped into the system without any modification to DLPDLCR2000EVM board firmware. The DLPM2000EVM features a unique design which is not compatible with the stock mechanical mounting components of the original DLP LightCrafter Display 2000 EVM. For the best experience, it is recommended to use the provided mechanical assembly reference design to create a new plate for mounting the EVM.



Figure 1-1. DLP Module 2000 EVM (Standalone)



Figure 1-2. DLP Module 2000 EVM (Installed to DLPDLCR2000EVM, not included with DLPM2000EVM)

2 Quick-Start Guide

This quick-start assumes default conditions as shipped. A DLP LightCrafter Display 2000 EVM is required to use the DLP Module 2000 EVM. To connect the optical engine, follow the guide below:

1. Prepare the necessary mechanical components to install the DLPM2000EVM to the DLP LightCrafter Display 2000 EVM. If using a DLPDLCR2000EVM purchased after March 2020, the included mechanical assembly is compatible with the DLPM2000EVM. Please refer to the [TIDA-01473 TI Reference Design](#) for more information on this assembly and a complete mechanical bill of materials (BOM).

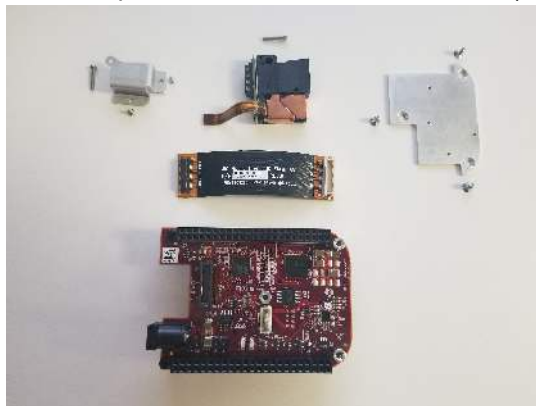


Figure 2-1. Disassembled EVM Assembly

2. Align "pin 1" of the optical engine connector with "pin 1" of the digital micromirror device (DMD) data flex cable (female side). Similarly, align "pin 1" of the DMD data flex cable (male side) to the DLP LightCrafter Display 2000 EVM (at connector J1).

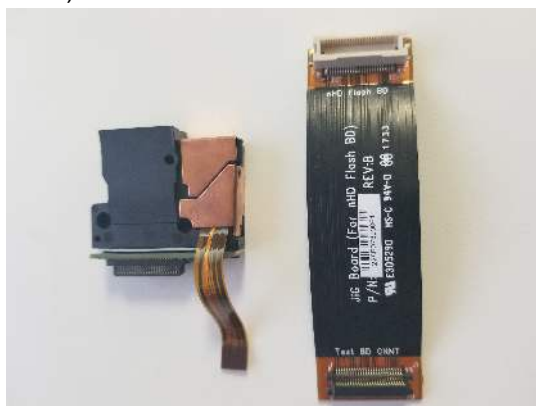


Figure 2-2. DLP Module 2000 EVM Optical Engine and Flex Cable

3. Following the mechanical assembly diagram, fasten the DLPM2000EVM to the DLPDLCR2000EVM. Be sure to install the provided heatsink plate, which is necessary to ensure that the system is able to properly dissipate heat during operation.
4. Power up the DLP LightCrafter Display 2000 EVM by applying an external DC ITE power supply (5-V DC, 3.0 A) to the J2 connector.
 - Use an AC-DC switching power supply which accepts 50-60 Hz 100-240 V AC inputs, and outputs a nominal 5-V DC at maximum 3-A output current. For this purpose we recommend the TE20A0503F01 Desktop Wall Adapter (or equivalent). The DC power supply jack has a 2.5 mm inner diameter and 5.5 mm outer diameter.
 - If the host processor used supports it, the system can be made to receive power through the attached host. Power and ground needs to be supplied via header J3 on the board. Please refer to the user's guide for your respective host processor to determine if enough current can be supplied to drive the DLP LightCrafter Display 2000 EVM. A minimum of 320 mA is recommended for the EVM to run at typical brightness settings.
5. After the DLP LightCrafter Display 2000 EVM is turned on, the projector displays a DLP LightCrafter Display splash screen. See [Figure 2-3](#) for an example:



Figure 2-3. EVM Splash Screen

6. The focus of the image can be adjusted with the focus switch on the optical engine.

From this point, the system must be supplied with a video source (via a host processor such as the BeagleBone Black) and given instructions via the included I²C bus. Instructions on how to do this are provided in the DLP LightCrafter Display 2000 EVM User's Guide.

3 What is in the DLP Module 2000 EVM?

The DLP Module 2000 EVM consists of a single subsystem:

- **Light engine:** Includes the optics, red, green, and blue LEDs, and the 640 × 360 (nHD) DLP2000 DMD. Features a factory-default LED current drive of 320 mA (approximately 20 lumens) out of the box.

Additional subsystems required for use of this EVM include:

- **Mechanical Assembly:** Not included. The mechanical assembly provided with the DLP LightCrafter Display 2000 EVM is compatible with DLP Module 2000 EVM so long as the EVM has been purchased after March 2020. Otherwise, the updated [TIDA-01473 Reference Design](#) and its mechanical assembly should be used with this light engine.
- **Driver board:** Not included. Install DLP Module 2000 EVM as a replacement light engine for the DLP LightCrafter Display 2000 EVM.

3.2 LED Disclaimers

The following disclaimer is provided by OSRAM regarding the LEDs installed in this optical engine:

"The evaluation of eye safety occurs according to the standard IEC 62471:2006 (photo biological safety of lamps and lamp systems). Within the risk grouping system of this IEC standard, the device specified in this data sheet falls into the class "low risk" (exposure time 100 s) for the LCG H9RM and "moderate risk" for the LE BA Q6WM. Under real circumstances (for exposure time, conditions of the eye pupils, observation distance), it is assumed that no endangerment to the eye exists from these devices. As a matter of principle, however, it should be mentioned that intense light sources have a high secondary exposure potential due to their blinding effect. When looking at bright light sources (e.g. headlights), temporary reduction in visual acuity and afterimages can occur, leading to irritation, annoyance, visual impairment, and even accidents, depending on the situation. Subcomponents of this device contain, in addition to other substances, metal filled materials including silver. Metal filled materials can be affected by environments that contain traces of aggressive substances. Therefore, we recommend that customers minimize device exposure to aggressive substances during storage, production, and use. Devices that showed visible discoloration when tested using the described tests above did show no performance deviations within failure limits during the stated test duration. Respective failure limits are described in the IEC60810."

For more information, please consult the relevant documentation from [OSRAM](#).

4 Additional Documentation

The following documents are applicable to the DLP LightCrafter Display 2000 EVM and are available at [www.ti.com](#).


- DLP2000 (0.2 nHD) DMD Data Sheet ([DLPS078](#))
- DLPC2607 DLP PICO Processor 2607 ASIC Data Sheet ([DLPS030](#))
- DLPC2607 Software Programmer's Guide ([DLPU013](#))
- DLP LightCrafter Display 2000 EVM User's Guide ([DLPU049](#))

For assistance, refer to the [DLP and MEMS TI E2E™ community support forums](#).

5 Additional Disclaimers

Before using this EVM, review the [Evaluation Board/Kit/Module \(EVM\) Additional Terms](#) for additional advisories concerning its use.

WARNING



Possible hazardous optical radiation emitted from this EVM. Do not stare at the operating lamp. There are no user serviceable parts inside the EVM optical engine. Never open the optical engine, which can expose a risk group 2 LED which can be harmful to the eye.

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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.
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 - 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/lstds/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。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page

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.

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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.

-
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 - 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.
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 - 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.
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