

# EVM User's Guide: DLP4620SPGUQ1EVM

## DLP4620SPGUQ1EVM Evaluation Module



### Description

The Texas Instruments (TI) DLP4620SPGUQ1EVM evaluation module (EVM) is a complete electronic and optical system designed to control and interface with the DLP4620S-Q1 chipset. The DLP4620S-Q1 chipset consists of the DLP4620S-Q1 DMD, DLPC23xS-Q1 DMD controller, TPS99000S-Q1 PMIC, projection optics, three Osram Q8 LEDs in red, green, and blue, and a photodiode. The EVM can be used to develop an automotive-grade projector or picture generation unit (PGU) for applications such as augmented reality head-up display (AR HUD). This projector offers high brightness of over 100 lumens. With a typical contrast of 1800:1, this projector also boasts a high contrast ratio in a compact package. The EVM is made of robust metal housing and optical elements, but these can potentially be traded for more cost-effective plastic options in a production design.

### Get Started

1. Order the [DLP4620SPGUQ1EVM](#).
2. Download and install the following:
  - a. DLPC23x Automotive Control Program GUI
  - b. See the latest documentation for DLP4620S-Q1, DLPC23xS-Q1, and TPS99000S-Q1 for further details

3. See the [Section 2.1](#) and [Section 3.1](#) sections for how to get the system running.
  - a. For further training, visit Texas Instruments Resource Explorer (TIREX) in the [DLP4620SPGUQ1EVM](#) product page

### Features

- Optical EVM module with projection optics for DLP4620S-Q1 DMD with the DLPC231S-Q1 DMD controller
- 600MHz SubLVDS DMD interface for low power and emission
- DMDs have a 0.46in diagonal micromirror array
  - 7.6 $\mu$ m micromirror pitch
  - $\pm 12^\circ$  micromirror tilt angle
  - Bottom illumination enables high efficiency and smaller engine size
- Video input interface
  - Single openLDI (FPD-Link I) port up to 110MHz
  - 24-bit RGB parallel interface up to 110MHz
  - Video resolutions up to 1358  $\times$  566 at 60Hz
- Configurable SPI (10MHz)

### Applications

- Augmented reality head-up display (AR HUD)
- Transparent window display



DLP4620SPGUQ1EVM

# 1 Evaluation Module Overview

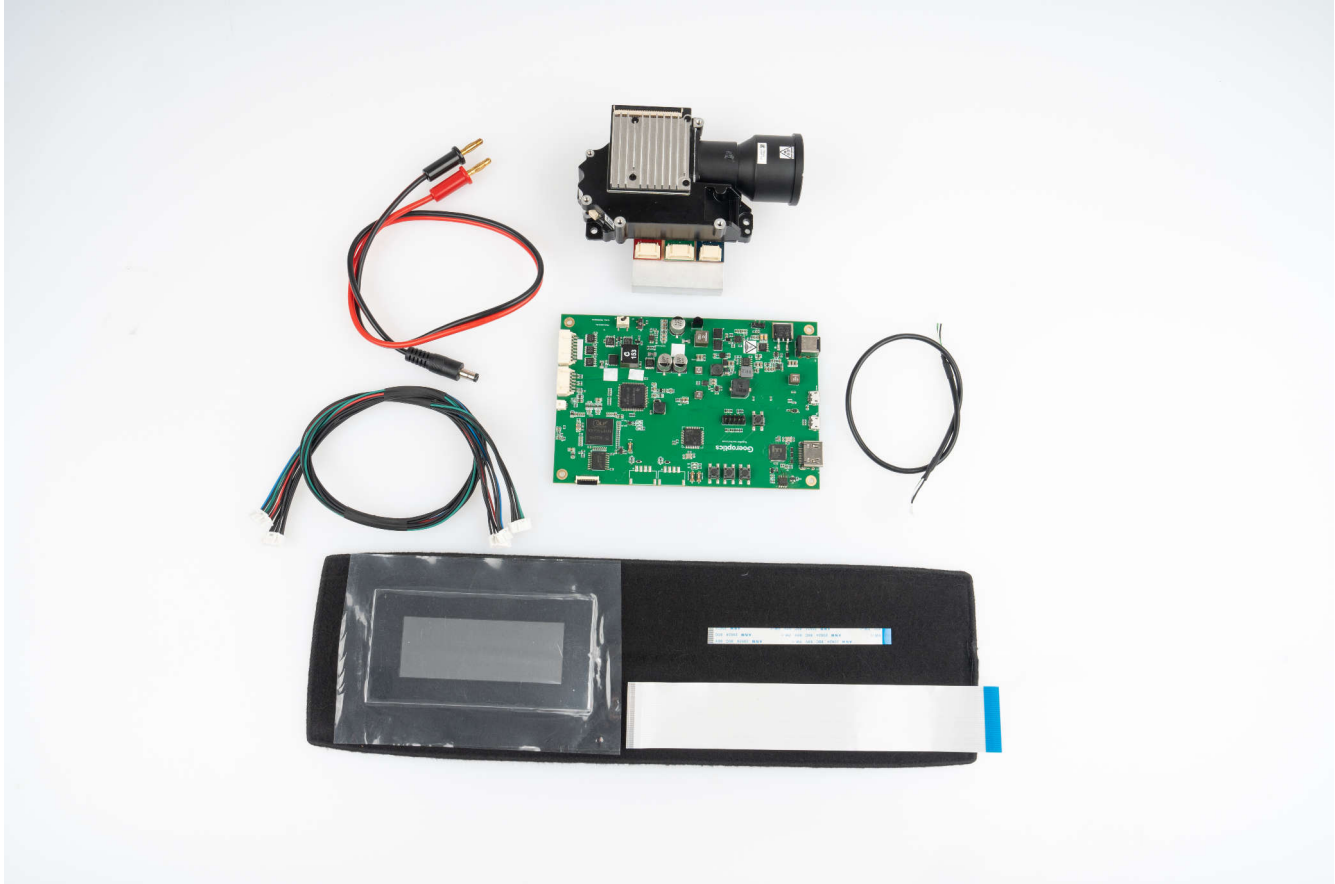
## 1.1 Introduction

This user's guide presents an overview and general description of the DLP4620SPGUQ1EVM, providing the first steps for getting started with this optical evaluation module. Throughout this document, the terms demonstration kit, evaluation board, evaluation module, and EVM are synonymous with the DLP4620SPGUQ1EVM.

The DLP4620SPGUQ1EVM is not a production design and is intended for evaluation only.

## 1.2 Kit Contents

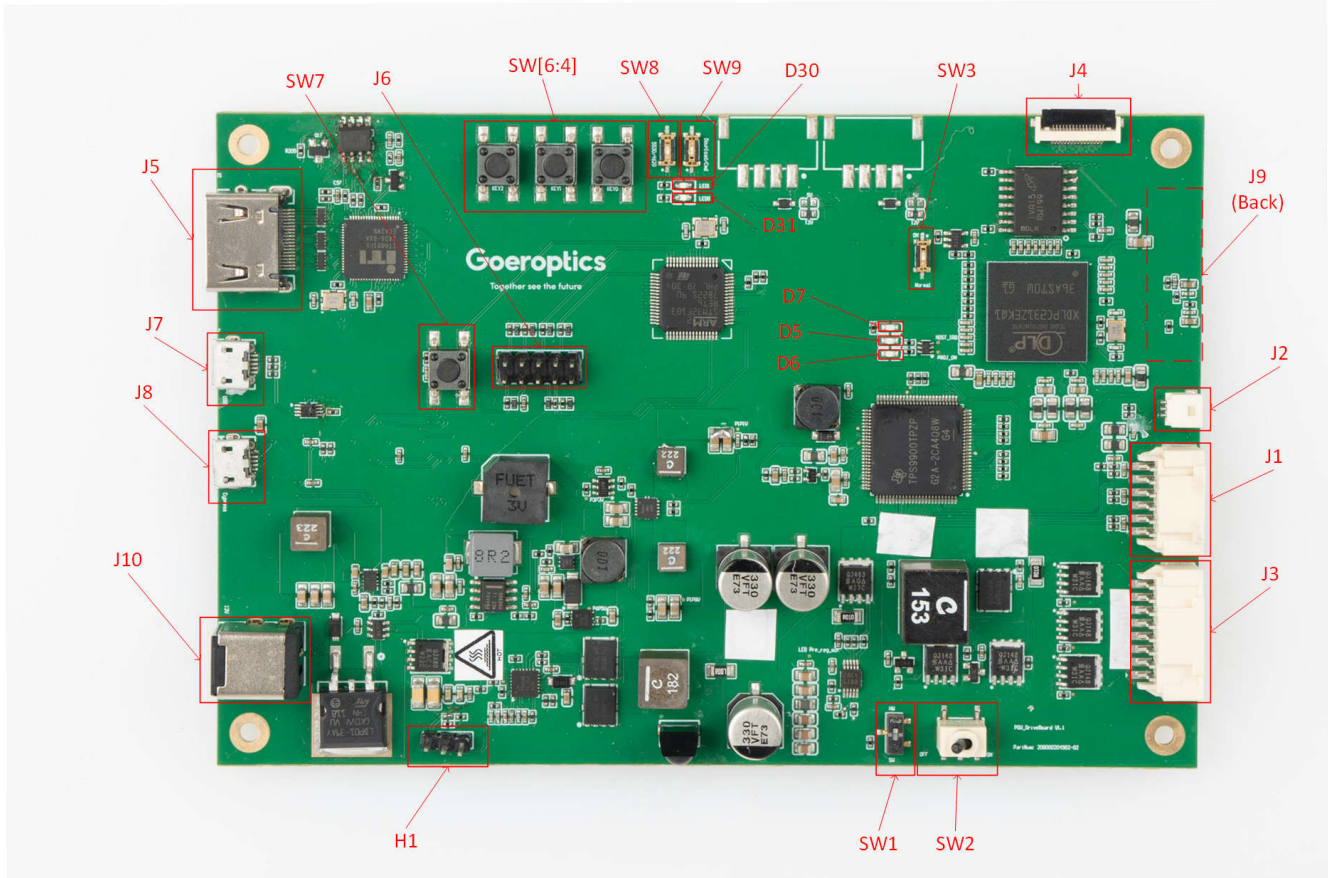
The DLP4620SPGUQ1EVM consists of a controller or illumination PCB and cables. The kit also includes an optical module designed to combine the electronic subsystem for evaluation of a fully functioning projector in an automotive setting.



**Figure 1-1. DLP4620SPGUQ1EVM Kit**

### 1.2.1 Driver Board

The controller or illumination board shown in [Figure 1-2](#) includes the DLP4620S-Q1 DMD, the DLPC231S-Q1 DMD Controller, and the TPS99000S-Q1. For the rest of the document, this board is interchangeably called the *driver board* and *controller PCB*. The driver board supports video inputs from either an HDMI™ or OpenLDI interface and provides the formatting and control to display the video on the DLP4620S-Q1 DMD. The EVM can be controlled with a USB-to-SPI port, which can also be used to reprogram the serial Flash that is used to store DLPC231S-Q1 software and configuration. The EVM has an external photodiode input that is used to control white point and brightness over a wide dimming range. A flex cable connects to the optical or light engine in this kit. This allows the driver board to communicate with the DMD found inside the optical or light engine. The driver board provides an interface for thermistors on the red, green and blue illuminator PCBs that can be used to monitor the temperatures of the illuminators.



**Figure 1-2. DLP4620SPGUQ1EVM Driver Board**

The controller PCB contains the ports listed in [Table 1-1](#). Indicator LEDs are listed in [Table 1-2](#). Switches are defined in [Table 1-3](#).

**Table 1-1. Controller PCB Ports**

Schematic Reference	Function
J1	LED common anode (6-pin) - high current output up to 6A, locking and keyed connector
J2	Photodiode (3-pin)
J3	RGB LEDs and Thermistors (8-pin)
J4	OpenLDI (Flex connector)
J5	HDMI
J6	Header (6-pin): Texas Instruments internal use
J7	USB: Texas Instruments internal use
J8	USB-to-SPI (micro USB-B connector)
J9	DMD (Flex connector)
J10	12V Power input

**Table 1-2. Controller LED Indicators**

Schematic Reference	Function
D5 (Red)	HOST_IRQ Off: Interrupt not asserted On: Interrupt asserted
D6 (Green)	PROJ_ON – Indicates PGU power has been turned ON
D7 (Green)	3.3V Power Good - input power to the driver board Off: No power connected On: Power connected
D30 (Green)	LED0 System heartbeat
D31 (Blue)	LED1 MCU Power Good

The controller PCB switches are listed in [Table 1-3](#). SW2 is a toggle switch for PROJ\_ON which is used to turn on and off the electronics. Note that parts of the board are still powered when PROJ\_ON is in the off position. SW1, SW2 and SW3 are dip switches that control the states of configuration signals the DLPC230-Q1 reads when the device comes out of reset. These switches must be set based on the desired configuration options.

**Table 1-3. Controller PCB Switches**

Schematic Reference or Signal Number	Function
SW1	HW/SW PROJ_ON Toggle Selection Switch HW Mode: Toggle PROJ_ON using physical toggle switch (SW2) SW Mode: Toggle PROJ_ON using software commands
SW2	PGU Power (Toggle) - Turns on system when SW1 is set to HW control mode
SW3	HOLD_BOOTZ (DIP Switch) ON: Low state - holds software in bootloader Normal: High state - normal operation
SW4	Key0: Texas Instruments internal use
SW5	Key1: Texas Instruments internal use
SW6	Key2: Texas Instruments internal use
SW7	MCU Reset (momentary switch)
SW8	DMD Select: Set to DLP4620 -- Texas Instruments internal use
SW9	SPI download or command: Set to OFF position - Texas Instruments internal use

### 1.2.1.1 Driver Board - Illumination Driver

The illumination driver is controlled and monitored by the driver board. Power can be input to the driver board from a benchtop supply. The illumination driver regulates the input power to 6.5V or 8V prior to the illumination driver circuitry. The illumination driver has outputs for red, green and blue illuminators. These are typically LEDs, but other illuminators can be used. See [Section 1.3.1](#) for input and output specifications of the EVM. Depending on operating conditions, some parts and surfaces of the PCB can be hot. TI does not recommend to operate the EVM at or near the maximum brightness setting for extended periods of time without proper cooling.

**WARNING**



Hot surface. Contact can cause burns. Do not touch! To mitigate the risk of bodily harm, make sure proper cooling is enabled.

**WARNING**



High-powered LEDs. Always consider and implement the use of effective light filtering and darkening protective eyewear. Be fully aware of surrounding laboratory-type setups when viewing intense light sources that can be required to minimize or eliminate such risks to avoid accidents related to temporary blindness.

The illumination driver contains the ports listed in [Table 1-1](#).

H1 selects the illumination drive voltage. Place a jumper across pins 1 and 2 for 6.5V drive. Place a jumper across pins 2 and 3 for 8V drive. Do not hot-swap this jumper; remove or replace the jumper only with power disconnected from the board.

### 1.2.2 EVM Cables

The DLP4620SPGUQ1EVM kit contains the cables listed in [Table 1-4](#) and shown in [Figure 1-3](#).

**Table 1-4. EVM Cables**

NAME	REFERENCE	QUANTITY
Input power cable	A	1
LED and thermistor cables (RGB)	B	1
Photodiode cable	C	1
Formatter controller to driver control flex	D	1
OpenLDI cable	E	1



**Figure 1-3. DLP4620SPGUQ1EVM Kitting List - Cable Designators**

## 1.3 Specifications

### 1.3.1 Electrical Specifications

**Table 1-5. Electrical Specifications**

PARAMETER	MIN	NOM	MAX	UNIT
<b>Input</b>				
Voltage	8	12	18	V
Power <sup>(1)</sup>		12	40	W
<b>LED Pre-Regulator Output</b>				
Voltage		6.5 or 8 <sup>(2)</sup>		V
<b>Illumination driver output load</b>				
Voltage (per LED color output)			7.5	V
Current (per LED color output)			6	A

(1) Conditions for nominal power: white balanced LED current up to 6A, LED forward voltage = 3.5V, display duty cycle = 90/10.

(2) Pre-regulator output voltage is set by the jumper position of header H1. Place A jumper across pins 1 and 2 for 6.5V operation.

### 1.3.2 Component Temperature Ratings

The PCB materials and most of the PCB components are rated to operate between  $-40^{\circ}\text{C}$  to  $105^{\circ}\text{C}$ , including the DLP4620S-Q1, the DLPC231S-Q1, and the TPS99000S-Q1.

Some components on board, such as switches, connectors, and indicator LEDs, do not meet this temperature rating.

The DLP4620SPGUQ1EVM is not a production design and is intended for evaluation only.

### 1.3.3 Input Video Specifications

The following input video resolutions are supported on the HDMI and OpenLDI interfaces. These input video resolutions are programmed in the Extended Display Identification Data (EDID) EEPROM for the HDMI interface of the EVM, allowing a connected computer to read the supported resolutions and timing. Note that some computers are not able to output all of these resolutions, in particular  $480 \times 240$ . For more timing resolutions supported by the DLPC23xS-Q1 chipset, see the [DLPC23xS-Q1 Automotive Digital Micromirror Device Controller datasheet](#).

The input source timing specified in the HDMI interface EDID of the EVM are specified in [Table 1-6](#). These timing parameters are also recommended for the OpenLDI interface.

**Table 1-6. Typical Timing for Supported Source Resolutions**

Horizontal Resolution	Vertical Resolution	Horizontal Blanking				Vertical Blanking				Vertical Rate (Hz)	Pixel Clock (MHz)
		Total	Sync (Pixel Clocks)	Back Porch (Pixel Clocks)	Front Porch (Pixel Clocks)	Total	Sync (Lines)	Back Porch (Lines)	Front Porch (Lines)		
1358	566	160	32	80	48	19	10	6	3	60.02	53.29
1220	610	160	32	80	48	19	10	6	3	60	52.08
960	960	160	32	80	48	28	10	15	3	60	66.39
960	480	240	96	120	24	20	10	7	3	60	36
480	240	320	32	240	48	200	10	187	3	60	21.12

### 1.3.4 SPI and I<sup>2</sup>C Timing

For more information on SPI and I<sup>2</sup>C specifications, see the [DLPC23xS-Q1 Automotive Digital Micromirror Device Controller data sheet](#).

## 1.4 Device Information

The DLP4620SPGUQ1EVM uses the DLP4620S-Q1 DMD, which is controlled by the DLPC231S-Q1 DMD controller. When the DMD and controller are paired with an appropriate LED driver unit and projection optics, the PGU can be controlled by the user through the USB port.

The SPI allows the user to send commands to the DLPC231S-Q1 controller to change display and calibration data that is outputted onto the DLP4620S-Q1 DMD. The projection and illumination optics that are included with the device then illuminates light onto the DMD to be redirected to the user's diffuser screen for display.

[Figure 2-1](#) outlines the major hardware components of the DLP4620SPGUQ1EVM's system hardware.

## 2 Hardware

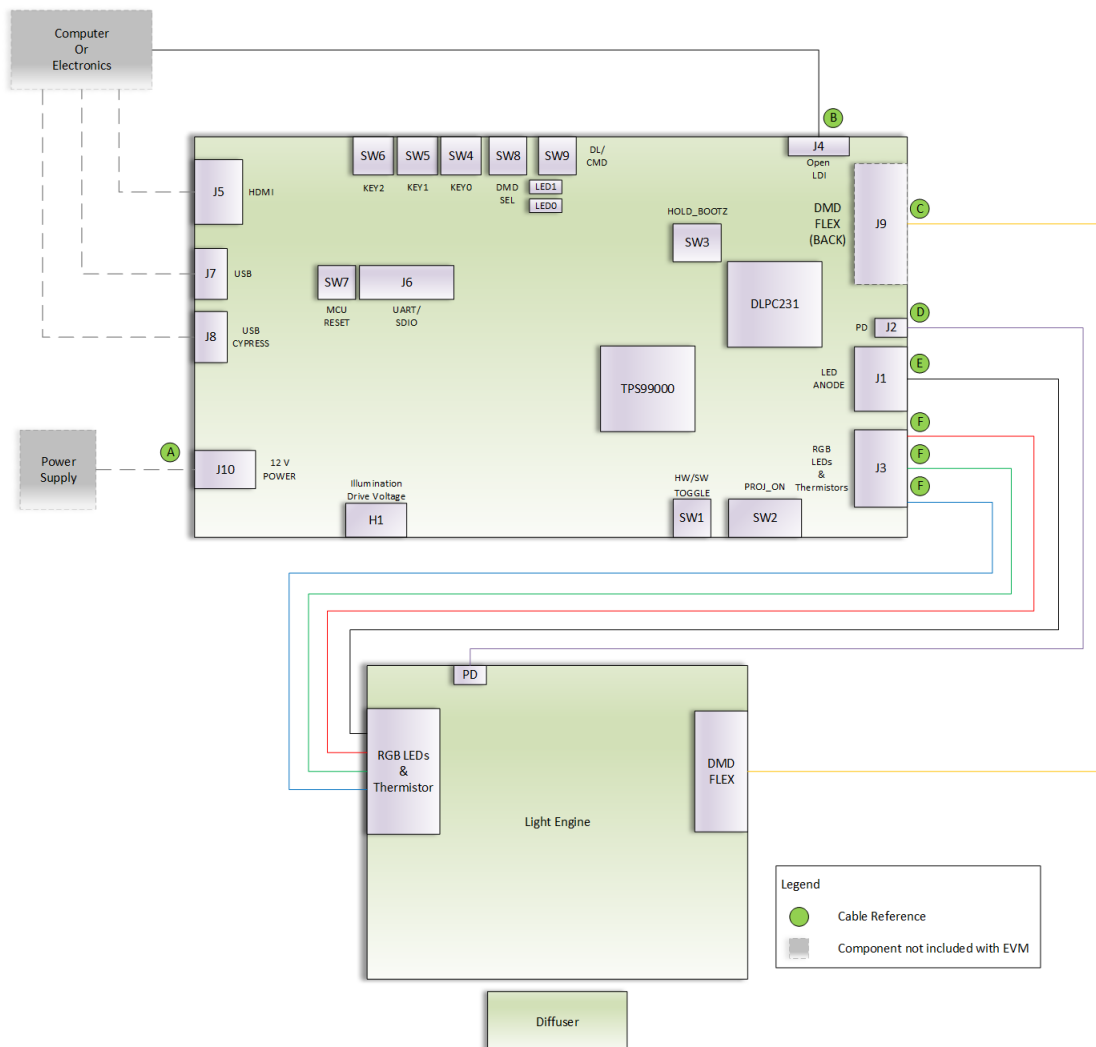
### 2.1 Quick Start

Use the following instructions to set up the DLP4620SPGUQ1EVM and host.

#### 2.1.1 Kit Assembly Instructions

A diagram of all connections is shown in [Figure 2-1](#).

1. Connect the DMD flex cable (J9) to the optical or light engine.
2. Connect the micro-USB to the controller PCB (J8) and the host computer.
3. Connect the RGB illumination wire harness to the driver board (J1 & J3) and the optics engine. The optics engine colors correspond with the LED wire harness's colors.
4. Connect the photodiode cable to the controller PCB (J2) to a photodiode located in the illumination path of the optics engine.
5. Connect the HDMI cable to the controller PCB (J5). Connect the HDMI cable to PC HDMI port.
6. Connect the power input cable to the driver board (J10).



**Figure 2-1. DLP4620SPGUQ1EVM Block Diagram**



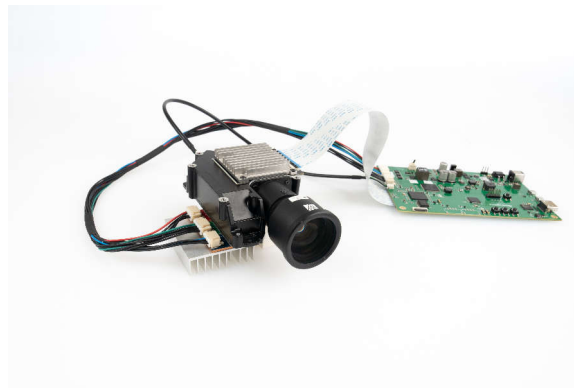
**Figure 2-2. Kitting List Reference**

### 2.1.2 Powering-Up EVM

1. Turn the HW/SW DIP (SW1) switch to the HW position to enable manual control of the PROJ\_ON switch.
2. Connect input power cable to a power supply that meets input power specifications defined in [Table 1-5](#). The red wire is the V+ terminal and black wire is the V- terminal.
3. Turn on the supply power. Once powered up, a controller PCB LED indicator (D7) illuminates green. In addition to this LED, the MCU powergood LED (D31) and heartbeat LED (D30) illuminates blue and green, respectively. The heartbeat LED blinks on and off.
4. Turn the PROJ\_ON switch (SW2) ON. The ON position is away from the board, and OFF is toward the board. The silkscreen indicates these positions. A controller PCB LED indicator (D6) illuminates green.

## 2.2 Optical Engine Specification

The DLP4620SPGUQ1EVM includes an optical projection system that can be used for head-up display (HUD) applications. The optical specifications are listed in [Table 2-1](#).



**Figure 2-3. DLP4620SPGUQ1EVM Optical Module**

**Table 2-1. Optical Module Specifications**

PARAMETER	MIN	NOM	MAX	UNIT
Luminous flux output	120 lm			lm
Throw ratio		1.68		
Throw distance		127		mm
Image width		98.8		mm
f/#		2.4		
MTF		35%		
Optical image offset		100%		
Light uniformity	90%			
FOFO contrast		1800:1		

**Table 2-2. Included LEDs**

Color	Manufacturer	Part Number
Red	Osram	Q8WP LE A
Green	Osram	Q8WP LE CG
Blue	Osram	Q8WP LE B

**WARNING**



High-powered LEDs. Always consider and implement the use of effective light filtering and darkening protective eyewear. Be fully aware of surrounding laboratory-type setups when viewing intense light sources that can be required to minimize or eliminate such risks to avoid accidents related to temporary blindness.

## 3 Software

### 3.1 Software Installation

1. Download and install [DLPC230 Control Program Lite](#)
2. Download and install the [Cypress USB Drivers](#) shown in [Figure 3-1](#)

## Design Support

Q
Clear All

Application


No options available
▾

Type

Please select
▾

All (18)
Boards & Designs (1)
PCB Design Data (3)
Development Tools (6)
Embedded Software (8)


Boards & Designs



Boards & Designs

**CYUSBS236**

Status: active and preferred




Infineon

> Read More

Buy Online

PCB Design Data




pdf

**CY8CKIT-149 Schematic**

01\_00 | 2021-01-09 | 1.3 MB

Download

Share
> EN




pdf

**CY8CKIT-146 Schematic**

01\_00 | 2020-06-25 | 742 KB

Download

Share
> EN



zip


**CY8CKIT-146 Design Files**

01\_00 | 2020-06-25 | 2.1 MB

Download


Share
> EN

Development Tools




Development Tools

**DOWNLOAD - CypressDriverInstaller\_1.exe**




Infineon

> Read More




Development Tools

**DOWNLOAD - USBSerialSDKSetup.exe**



Infineon

> Read More



zip

**Serial port test tool 1.0.0.3**

01\_00 | 2016-06-03 | 3.6 MB

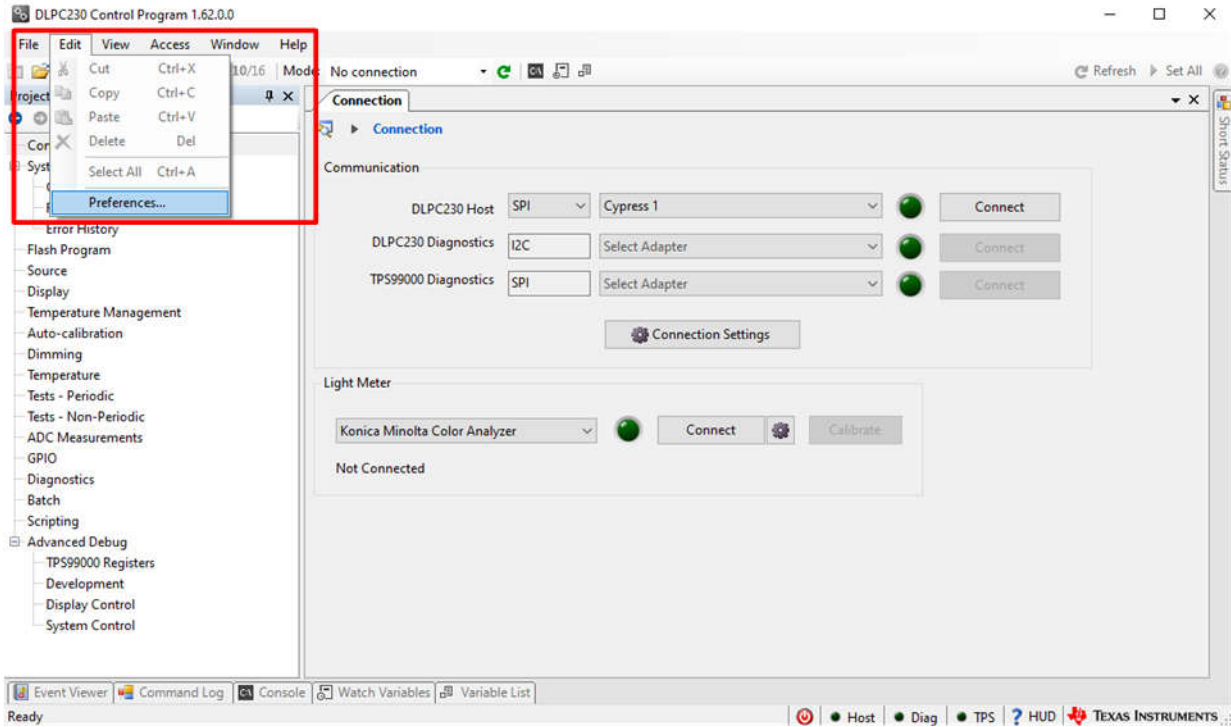
Download

Share
> EN

**Figure 3-1. Cypress USB Driver**

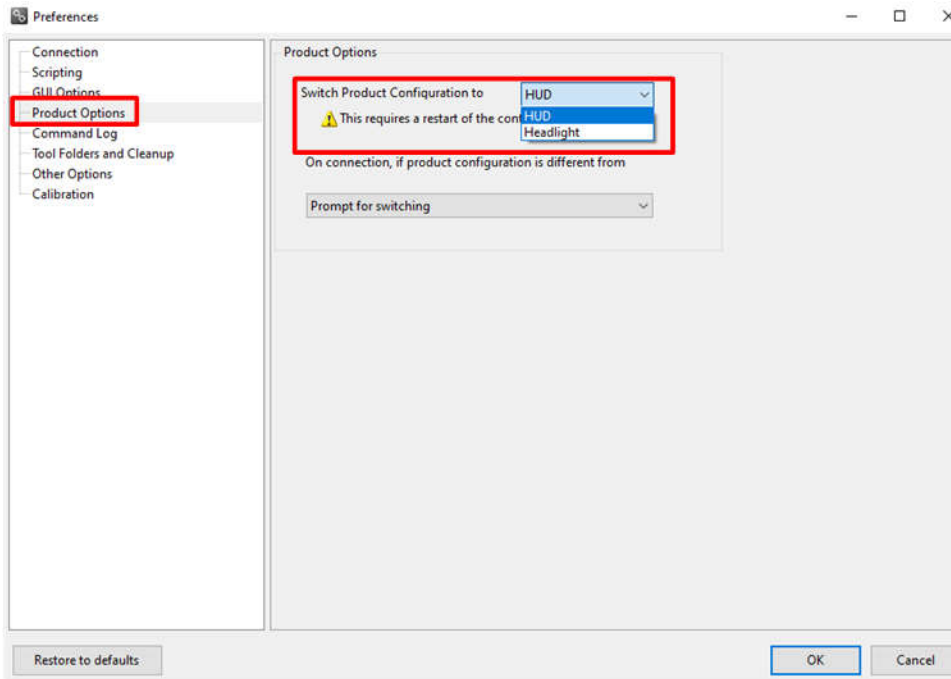
### 3.2 Changing Product Option to HUD Mode

1. Start the DLPC230-Q1 Control Program Lite.
2. In the File menu on the top left of the graphical user interface (GUI), select *Preferences...*



**Figure 3-2. Changing to HUD Product Option - File Menu**

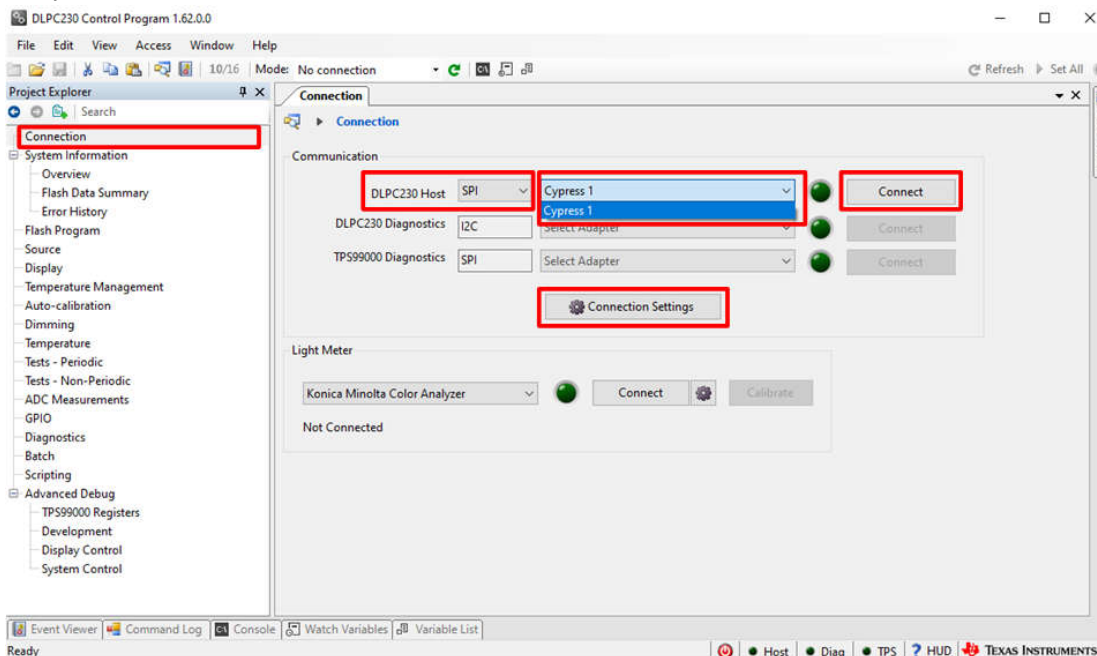
3. A new *Preferences* window opens up. Select *Product Options* and then use the drop-down box shown in [Figure 3-2](#) to select the HUD product option for the PGU.



**Figure 3-3. Selecting Product Option**

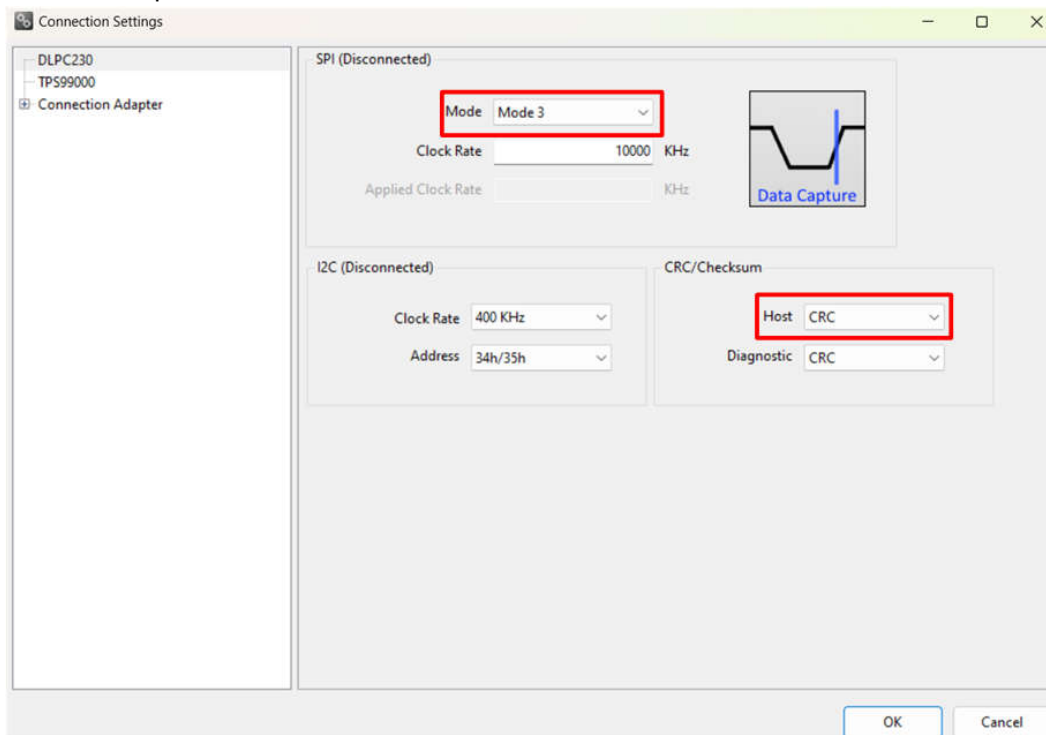
### 3.3 Connecting EVM to the DLPC230-Q1 Control Program

1. On the connection page set the DLPC230-Q1 Host to SPI and select *Cypress* from the drop-down menu (see [Figure 3-4](#)). Note, the Cypress must be connected to computer with a micro-USB cable for to show up in the drop-down menu.



**Figure 3-4. Connecting to the DLPC231-Q1 Using the DLPC230-Q1 Automotive Control Program**

2. Select *Connection Settings* to confirm the SPI configuration shown in [Figure 3-5](#). Press OK once configuration is complete.



**Figure 3-5. DLPC230-Q1 Automotive Control Program Communication Settings**

3. Click the *Connect* button. The green circle next to the *Connect* button then lights up to indicate that connection was successful to the DLP4620SPGUQ1EVM.

### 3.4 Steps to Reprogram the Onboard Flash Memory

The DLP4620SQ1PGUEVM comes with onboard serial Flash that is pre-programmed with software and basic configuration. The software and configuration can be updated by reprogramming the serial Flash with the DLPC230-Q1 Automotive Control Program. Steps to re-program the serial Flash are listed below.

1. Using the DLPC230-Q1 Automotive Control Program, which is connected to the EVM, navigate to the *Flash Program* tab.
2. Using the folder icon, select an Image File (.bin) and open.
3. Click *Program and Verify Flash Memory*.

---

#### Note

Note that if the device is in Display mode, then the device automatically switches to Standby during programming.

---

## 4 Hardware Design Files

### 4.1 Schematics

Please reach out to Texas Instruments' [DLP® E2E](#) forums for schematics or ask an applications or systems engineer. List DLP4620SPGUQ1EVM as the product.

### 4.2 PCB Layouts

Please reach out to Texas Instruments' [DLP® E2E](#) forums for layout files or ask an applications or systems engineer. List DLP4620SPGUQ1EVM as the product.

Examples for Texas Instruments' electronics-only EVM for a 0.46" DMD design can also be found on the [DLP4620SQ1EVM tools folder](#).

---

#### Note

Note that the PGU design is similar, but not identical to the DLP4620SQ1EVM, which is an electronics-only kit.

---

### 4.3 Bill of Materials (BOM)

Please reach out to Texas Instruments' [DLP® E2E](#) forums for the BOM or ask an applications or systems engineer. List DLP4620SPGUQ1EVM as the product.

## 5 Compliance Information

### 5.1 REACH Compliance

In compliance with the Article 33 provision of the EU REACH regulation, TI is notifying users that this EVM includes components 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 5-1. Optical Engine SVHC Components**

Component Manufacturer	Component Type	Component Part Number	SVHC Substance	SVHC CAS
C&K	Toggle Switch	GT11MSCBETR	Lead	7439-92-1

## 6 Additional Information

### 6.1 Trademarks

HDMI™ is a trademark of HDMI Licensing LLC.  
All trademarks are the property of their respective owners.

## 7 Revision History

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

Changes from Revision * (April 2025) to Revision A (October 2025)	Page
• Updated Lumen Output and Screen Width to Gen2 Spec.....	10

---

## 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/lstds/ti\\_ja/general/eStore/notice\\_01.page](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。

<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。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。日本テキサス・インスツルメンツ株式会社  
東京都新宿区西新宿 6 丁目 2 4 番 1 号  
西新宿三井ビル

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

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。 <https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html>

#### 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:*
    - 6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.
    - 6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.
  7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.
-

8. *Limitations on Damages and Liability:*

8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2023, Texas Instruments Incorporated

## IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to [TI's Terms of Sale](#), [TI's General Quality Guidelines](#), or other applicable terms available either on [ti.com](#) or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2025, Texas Instruments Incorporated

Last updated 10/2025