

ABSTRACT

The DLP5532PROJHBQ1EVM Evaluation Module (EVM) is an automotive projector designed to support high brightness transparent window display applications such as advertisement and vehicle-to-vehicle and vehicle-to-pedestrian communication. The DLP5532PROJHBQ1EVM supports proof of concept demos and speeds up the development cycle by providing a high performance projector solution complete with optics, LED light sources, and adjustable throw distance. This EVM includes a complete electronic subsystem designed to control the DLP5532-Q1 chipset. The DLP5532-Q1 chipset consists of the DLP5532-Q1, the DLPC230-Q1, and the TPS99000-Q1. This projector enables high brightness displays with a luminous flux output of 600 lumens and contrast of 600:1 in a compact package. With additional development of the LED driver board - including higher LED current support per channel and a robust thermal design - this projection engine can provide upwards of 1,000 lumens. The projection lens is designed for a throw ratio of 1.8, 100% offset, and an adjustable focus distance from 450 mm to 1000 mm.

The DLP5532PROJHBQ1EVM is not a production design. It is intended for evaluation only.



Figure 1-1. The DLP5532PROJHBQ1EVM



This design incorporates HDMI® technology.

Table of Contents

1 User Guide Overview	3
1.1 What is in the DLP5532PROJHBQ1EVM	3
1.2 Specifications.....	8
2 Quick Start	10
2.1 Kit Assembly Instructions.....	10
2.2 Software Installation.....	13
2.3 Powering-Up EVM.....	13
2.4 Connecting EVM to the DLPC230-Q1 Control Program.....	13
2.5 Steps to Reprogram the Onboard Flash Memory.....	14
3 Optical Engine Requirements and Specifications	15
4 Revision History	15

List of Figures

Figure 1-1. The DLP5532PROJHBQ1EVM	1
Figure 1-1. DLP5532PROJHBQ1EVM Controller PCB.....	3
Figure 1-2. DLP5532PROJHBQ1EVM Illumination Driver PCB (Top).....	5
Figure 1-3. DLP5532PROJHBQ1EVM Illumination Driver PCB (Bottom).....	6
Figure 1-4. EVM Cables.....	7
Figure 2-1. EVM Cable Connections.....	10
Figure 2-2. FTDI to SPI Cable Connection.....	11
Figure 2-3. FTDI to I2C Connection.....	11
Figure 2-4. Fan Connection Cables.....	11
Figure 2-5. Illumination LED Connection Cables.....	12
Figure 2-6. Connecting to the DLPC230-Q1 Using the DLPC230-Q1 Automotive Control Program.....	13
Figure 2-7. DLPC230-Q1 Automotive Control Program Communication Settings.....	14

List of Tables

Table 1-1. Controller PCB Ports.....	4
Table 1-2. Controller LED Indicators.....	4
Table 1-3. Controller PCB Switches.....	4
Table 1-4. Illumination Driver PCB Ports.....	6
Table 1-5. Illumination Driver Header Pins.....	6
Table 1-6. EVM Cables.....	7
Table 1-7. Electrical Specifications.....	8
Table 1-8. EVM Components Which are Not Rated for –40°C to 105°C.....	8
Table 1-9. Typical Timing for Supported Source Resolutions.....	9
Table 3-1. Optical Module Specifications.....	15
Table 3-2. Included LEDs.....	15

Trademarks

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 User Guide Overview

This user's guide presents an overview and general description of the DLP5532PROJHBQ1EVM and provides first steps for getting started using the EVM.

1.1 What is in the DLP5532PROJHBQ1EVM

The DLP5532PROJHBQ1EVM consists of a controller PCB, an illumination driver PCB, cables, and a USB to SPI adapter. The DLP5532PROJHBQ1EVM also includes an optical module designed to combine with the electronic subsystem for evaluation of a fully functioning projector in an automotive setting.

1.1.1 Controller PCB

The controller PCB shown in [Figure 1-1](#) includes the DLP5532-Q1 DMD, the DLPC230-Q1 DMD Controller, and the TPS99000-Q1. The controller PCB supports video inputs from either a micro HDMI or OpenLDI interface and provides the formatting and control to display the video on the DLP5532-Q1 DMD. The EVM can be controlled with either a SPI or an I²C interface. The SPI or I²C interface can also be used to reprogram the serial Flash that is used to store DLPC230-Q1 software and configuration. An optional second SPI port is provided for monitoring the TPS99000-Q1. The EVM has an external photodiode input that is used to control white point and brightness over the dimming range. An optional second photodiode input is also provided. The EVM includes a flex interface to control and monitor the illumination driver PCB. It also provides an optional interface for thermistors on the red, green and blue illuminator PCBs that can be used to monitor the temperatures of the illuminators.

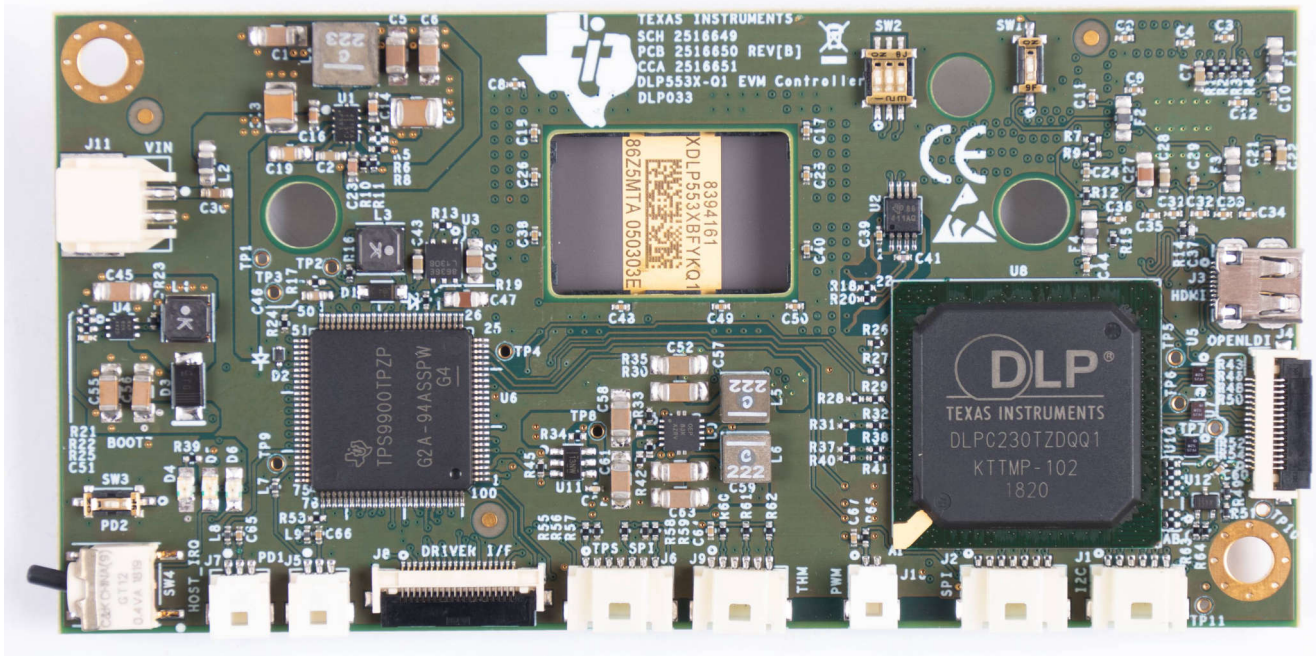


Figure 1-1. DLP5532PROJHBQ1EVM Controller PCB

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

Table 1-1. Controller PCB Ports

Schematic Reference	Function
J1	Host I ² C, PROJ_ON, HOLD_BOOT, HOST_IRQ
J2	Host SPI
J3	Micro HDMI
J4	OpenLDI (Flex connector)
J5	Photodiode 1
J6	TPS99000-Q1 SPI Debug
J7	Photodiode 2
J8	HUD Driver Interface
J9	LED Thermistor
J10	Fan PWM output
J11	Formatter Controller Power

Table 1-2. Controller LED Indicators

Schematic Reference	Function
D4 (Green)	Input power to controller (from illumination driver) Off: No power connected On: Power connected
D5 (Green)	PROJ_ON Off: System Off On: System On
D6 (Red)	HOST_IRQ Off: Interrupt not asserted On: Interrupt asserted

The controller PCB switches are listed in [Table 1-3](#). SW4 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 it comes out of reset. These switches must be set based on the desired configuration options.

Table 1-3. Controller PCB Switches

Schematic Reference / Signal Number	Function
SW1 (1)	Spread Spectrum Enable Off: Disabled On: Enabled
SW2 (1)	Host Port Checksum Select Off: CRC On: Checksum
SW2 (2)	Host Interface Select Off: Host SPI On: Host I ² C
SW2 (3)	Host SPI Mode Off: Mode 0 or 3 On: Mode 1 or 2
SW3	Hold in Boot Off: Do not hold in boot (continue to main application) On: Hold in boot
SW4	PROJ_ON Off: Turn off system On: Turn on system On state is toward the outer edge of the board (Figure 1-1)

1.1.2 Illumination Driver PCB

The illumination driver PCB shown in [Figure 1-2](#) is controlled and monitored by the controller PCB over a flex cable. Power can be input to the illumination driver from a bench top supply. The illumination driver provides reverse bias protection and supplies power to the controller PCB over a separate cable. The illumination driver PCB regulates the input power to 17 V prior to the illumination driver circuitry. The illumination driver has outputs for red, green and blue illuminators. These are typically LEDs, but it is possible other illuminators can be used. Together with the controller PCB, the illuminators are meant to be sequentially pulsed and synchronized with the operation of the DMD micromirrors. See [Electrical Specifications](#) for input and output specifications of the EVM. Depending on operating conditions, some parts and surfaces of the PCB can be hot.

CAUTION



Hot surface. Contact might cause burns. Do not touch!

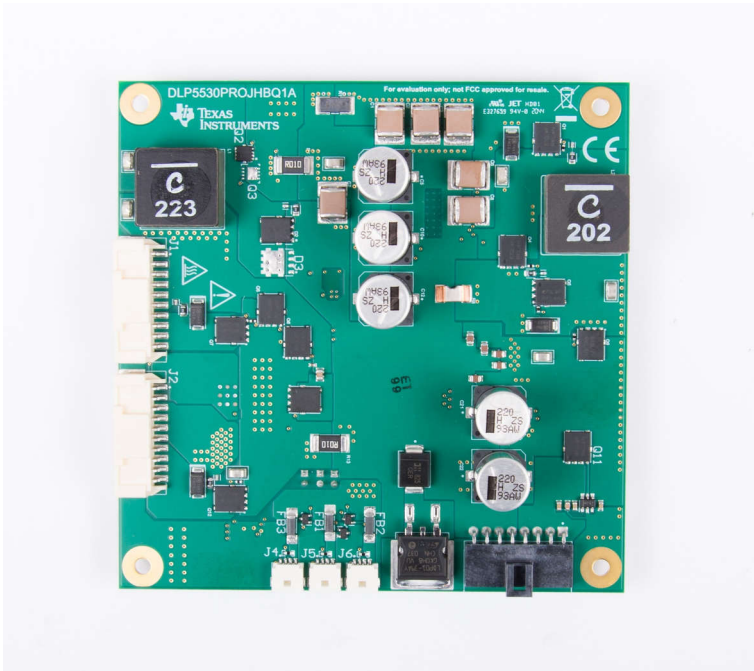


Figure 1-2. DLP5532PROJHBQ1EVM Illumination Driver PCB (Top)

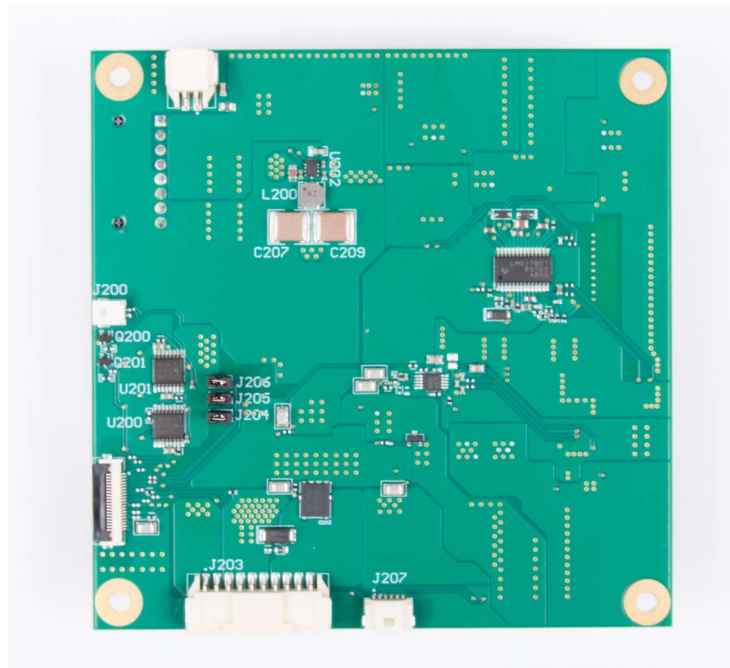


Figure 1-3. DLP5532PROJHBQ1EVM Illumination Driver PCB (Bottom)

The illumination driver PCB contains the ports listed in [Table 1-4](#). Note that all ports with the schematic reference J20# are located on the bottom of the illumination driver PCB board.

Table 1-4. Illumination Driver PCB Ports

Schematic Reference	Function
J1	Red Illumination Output - High current output up to 10 A
J2	Green Illumination Output - High current output up to 10 A
J3	Input Power
J4	Fan 1 Power Output
J5	Fan 2 Power Output
J6	Fan 3 Power Output
J200	Fan PWM from Controller
J201	Controller-Driver Control Interface
J202	Controller Power
J203	Blue Illumination Output - High current output up to 10 A
J207	Thermistors for Red, Green, and Blue LEDs

The illumination driver PCB contains the headers listed in [Table 1-5](#). These headers provide a protective feedback loop between the active cooling fans and the power regulator. In the event that one of the fans is not working or does not receive adequate input power, the feedback loop disables the power regulator and protects the illumination driver circuitry. The headers can be removed to disable the fan feedback loops if fans are not going to be used.

Table 1-5. Illumination Driver Header Pins

Header	PIN1	PIN2
J204	Fan 1 Feedback Signal	EN_UVLO
J205	Fan 2 Feedback Signal	EN_UVLO
J206	Fan 3 Feedback Signal	EN_UVLO

1.1.3 EVM Cables

The DLP5532PROJHBQ1EVM kit contains the cables and FTDI USB to SPI/I2C adapter listed in [Table 1-6](#).

Table 1-6. EVM Cables

Name	Reference	Quantity
Micro HDMI Cable	A	1
Input Power Cable	B	1
Host SPI Cable	C	1
FTDI SPI Host Adapter	D	1
Host I ² C Cable (Includes PROJ_ON, HOLD_BOOT, HOST_IRQ signals)	E	1

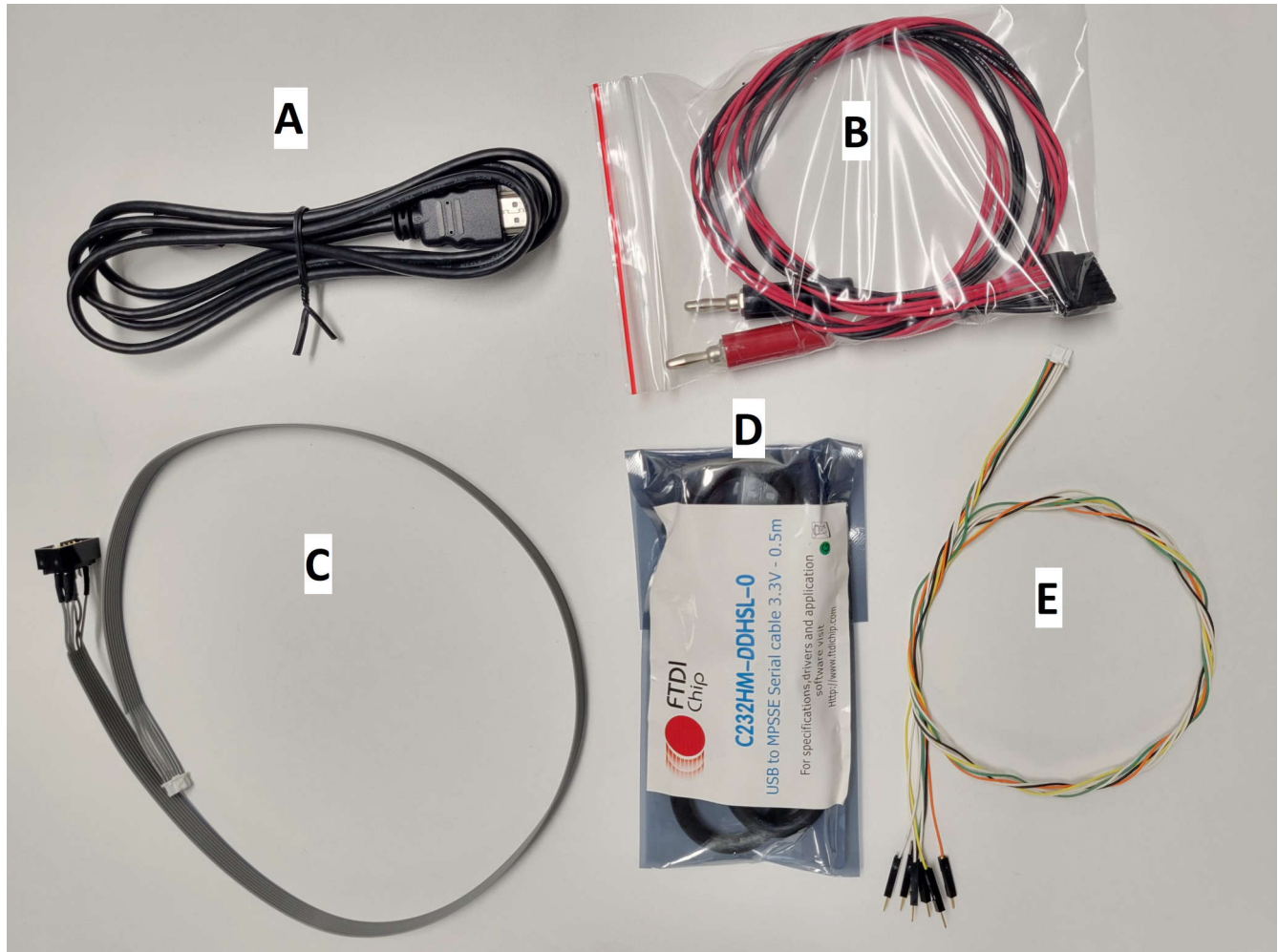


Figure 1-4. EVM Cables

1.2 Specifications

1.2.1 Electrical Specifications

Table 1-7. Electrical Specifications

Parameter	MIN	NOM	MAX	UNIT
Input				
Voltage	8	12	18	V
Power ⁽¹⁾		30	80	W
LED Pre-Regulator Output				
Voltage		17		V
Illumination Driver Output Load				
Voltage (Per LED Color Output)			17	V
Current (Per LED Color Output)			10	A
Temperature				
Operating DMD Temperature ⁽²⁾	-40		105 ⁽³⁾	°C

- (1) Conditions for maximum power: white balanced LED current up to 10 A, LED forward voltage = 12.3 V, display duty cycle = 90/10.
- (2) Care must be taken to ensure that individual components and PCB do not exceed their maximum temperature when driving high-power load.
- (3) Some components are only rated to 85°C. Refer to [Table 1-8](#) for a list of these components.

1.2.2 Component Temperature Ratings

The PCB materials and most of the PCB components are rated to operate between -40°C to 105°C, including the DLP5530-Q1, the DLPC230-Q1, and the TPS99000-Q1.

Some components on board, such as switches, connectors, and indicator LEDs, do not meet this temperature rating. The specifications for EVM components which are not rated between -40°C to 105°C are listed in [Table 1-8](#). Please refer to the EVM bill of materials to review the temperature specifications of all components used in the EVM design.

Table 1-8. EVM Components Which are Not Rated for -40°C to 105°C

Board	Reference	Part Number	Manufacturer	Description	Temperature Minimum (°C)	Temperature Maximum (°C)
Controller	D4, D5	LTST-C171KGKT	Lite-On	LED, GREEN 0805	-55	85
Controller	D6	LTST-C171KRKT	Lite-On	LED, RED 0805	-55	85
Controller	J3	685119248123	Wurth	CONN MICRO HDMI RIGHT ANGLE	-40	85
Controller	SW2	CVS-03TB	Copal Electronics Inc	SWITCH DIP SLIDE 3-POS 1 MM 6 V	-40	85
Controller	SW1,SW3	CVS-01TB	Copal Electronics Inc	SWITCH DIP SLIDE 1-POS 1 MM 6 V	-40	85
Controller	SW4	GT12MSCBE	C&K Comp	SWITCH, SPST, GULL	-30	85
Controller	U5, U7, U10, U503, U504	PCMF2HDMI2SZ	Nexperia	COMMON MODE CHOKE 4LN SMD ESD	-40	85
Controller	U501	TFP401AIPZPRQ1	Texas Instruments	IC PANELBUS DVI RCVR 100-HTQFP	-40	85

The controller and illumination driver PCBs have a UL flame rating of 130°C maximum.

This is not a production design. It is intended for evaluation only.

1.2.3 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 EVM's HDMI interface 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 576 × 288.

- 1152 × 1152
- 1152 × 576
- 576 × 288

The input source timing specified in the EVM's HDMI interface EDID are specified in [Table 1-9](#). TI also recommends these timing parameters for the OpenLDI interface.

Table 1-9. 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)		
1152	1152	80	8	32	40	33	8	22	3	60	87.59
1152	576	80	8	32	40	17	8	6	3	60	43.83
576	288	322	8	154	160	181	8	158	15	59.98	25.26

1.2.4 SPI and I²C Timing

For more information on SPI and I²C specifications, see the [DLPC230-Q1 Automotive DMD Controller for the DLP553x-Q1 Chipset data sheet](#).

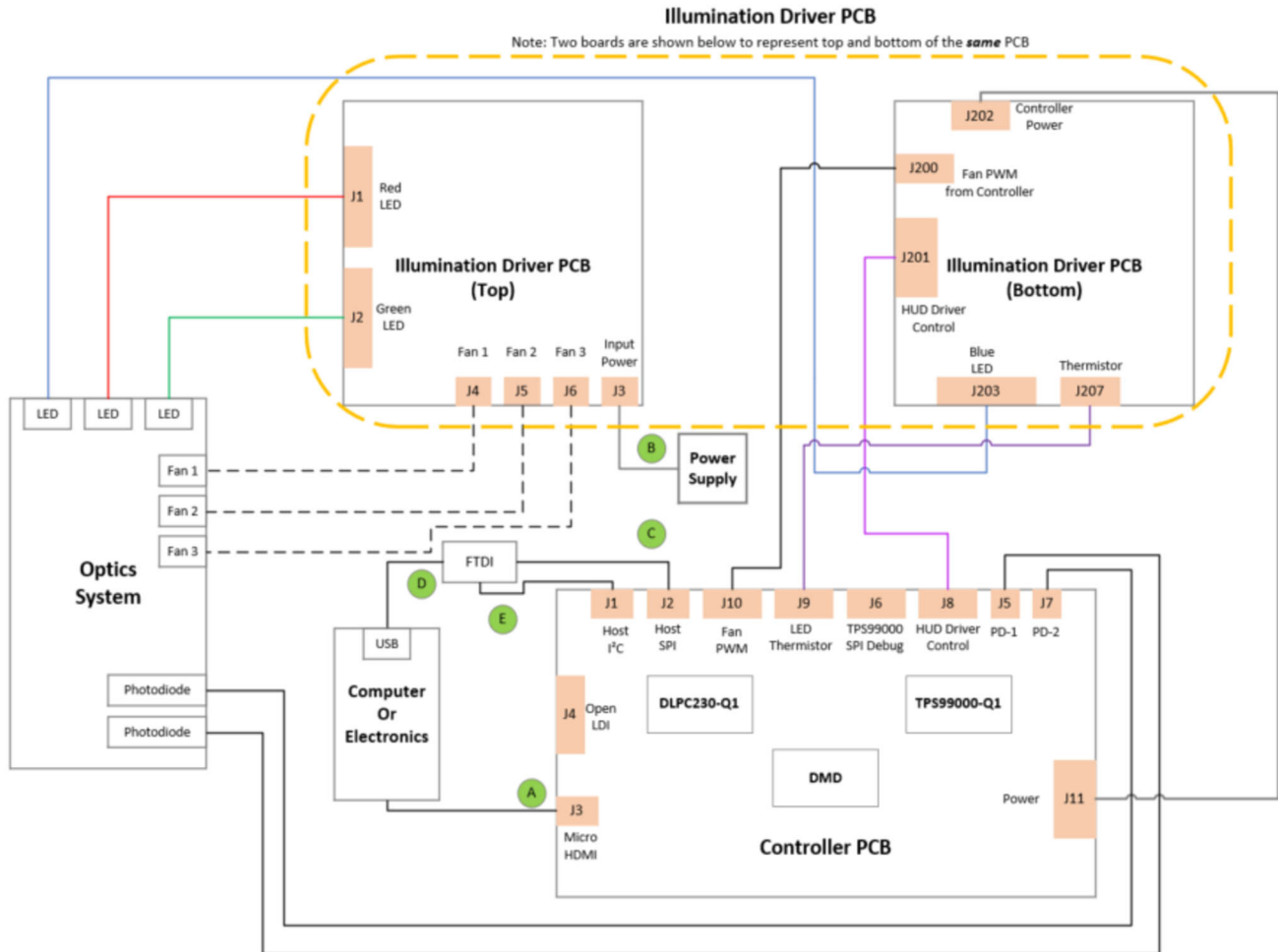
2 Quick Start

Use the following instructions to setup the DLP5532PROJHBQ1EVM and PC for video input and control communication.

2.1 Kit Assembly Instructions

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

1. Connect the host SPI/I2C cable to the controller PCB (J2/J1) and the FTDI adapter. Connect the FTDI adapter's USB cable to PC.
2. Connect the Micro HDMI cable to the controller PCB (J3). Connect the Micro HDMI cable to PC HDMI port.
3. Connect the power input cable to the illumination driver PCB (J3).



A. Reference letters refer to cables listed in [Table 1-6](#).

Figure 2-1. EVM Cable Connections

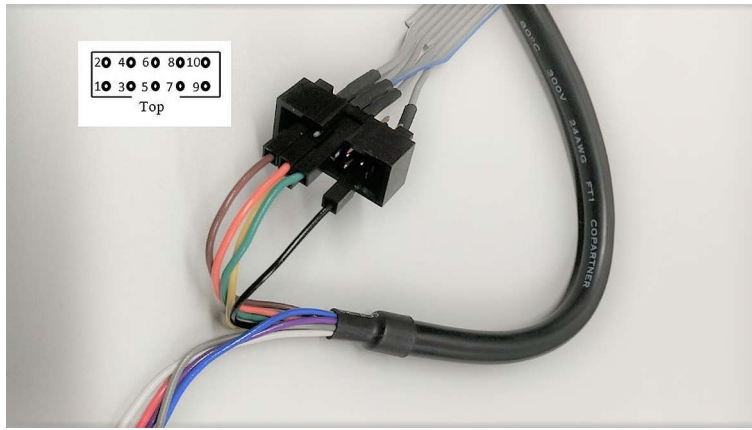


Figure 2-2. FTDI to SPI Cable Connection

For correct orientation of the numbering of leads notice that on the SPI cable there is a notch at the top. Note that there is some unused cables from the FTDI cable and unconnected pins on the SPI cable.

1. Connect brown wire of FTDI cable (Chip Select) to pin 9 of SPI cable.
2. Connect orange wire of FTDI cable (Clock) to pin 7 of SPI cable.
3. Connect green wire of FTDI cable (Serial In) to pin 5 of SPI cable.
4. Connect black wire of FTDI cable (Ground) to pin 2 of SPI cable.
5. Connect yellow wire of FTDI cable (Serial Out) to pin 8 of SPI cable.

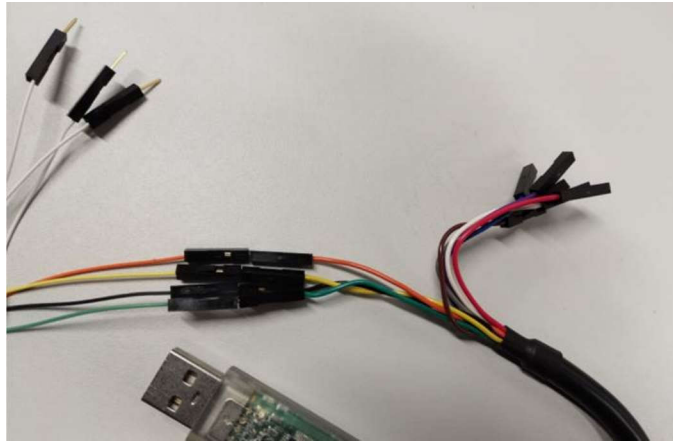


Figure 2-3. FTDI to I2C Connection

It is also possible to communicate with the EVM through I2C. Note that there is some unused cables from the FTDI cable and unused cables from the I2C cable.

1. Connect orange wire of FTDI cable (Clock) to orange wire of I2C cable.
2. Connect yellow wire of FTDI cable (Serial Out) to yellow wire of I2C cable.
3. Connect black wire of FTDI cable (Ground) to black wire of I2C cable.
4. Connect green wire of FTDI cable (Serial In) to green wire of I2C cable.

The following provide visual references for the fan cable connections involving the DLP5532PROJHBQ1EVM projector itself.

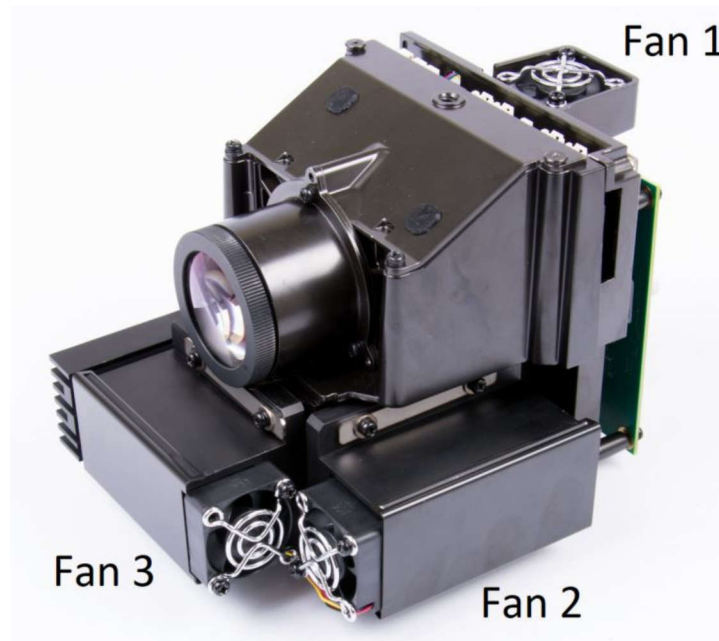
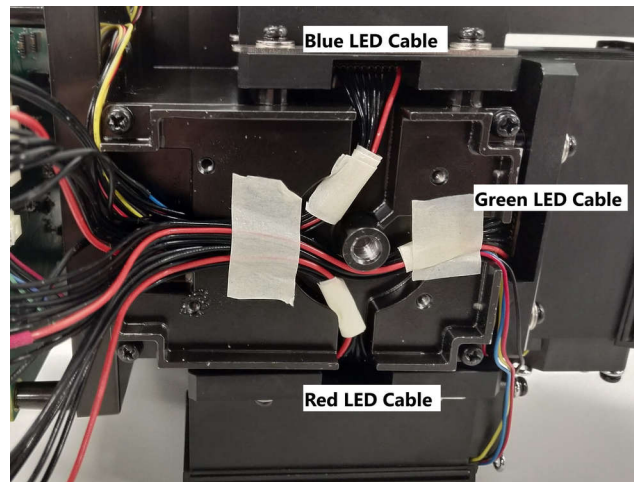


Figure 2-4. Fan Connection Cables

The following provide visual references for the LED cable connections involving the DLP5532PROJHBQ1EVM projector itself.



Note

The cables are already connected and assembled by the manufacturer. Please only disassemble if required. There is a back plate held together by four screws. The LED cables have no locking tabs and can be pulled out with force. To re-insert the LED cables, a tool like a screwdriver can be needed to push down on the connector to ensure a secure connection.

Figure 2-5. Illumination LED Connection Cables

WARNING

Please do not attempt to remove the four screws on the LED heat sinks as this impacts the alignment of the illumination system.

2.2 Software Installation

1. Download and install the [DLPC230-Q1 Control Program Lite](#) from TI.com.
2. Install [Total Phase Cheetah USB Adapter Drivers](#) from the Total Phase website.

2.3 Powering-Up EVM

1. Connect input power cable to a power supply that meets input power specifications defined in [Table 1-7](#). The red wire is the V+ terminal and black wire is the V- terminal.
2. Turn on the supply power. After powered up, a controller PCB LED indicator (D4) illuminates green.
3. Turn the PROJ_ON switch (SW4) ON. The ON position is away from the board, and OFF is toward the board. A controller PCB LED indicator (D5) illuminates green.

2.4 Connecting EVM to the DLPC230-Q1 Control Program

1. Start the DLPC230-Q1 Control Program Lite.
2. On the connection page, set the DLPC230-Q1 Host to SPI and select the Cheetah from the drop-down menu (see [Figure 2-6](#)). Note, the Cheetah must be connected to a computer with USB cable for it to show up in the drop-down menu.

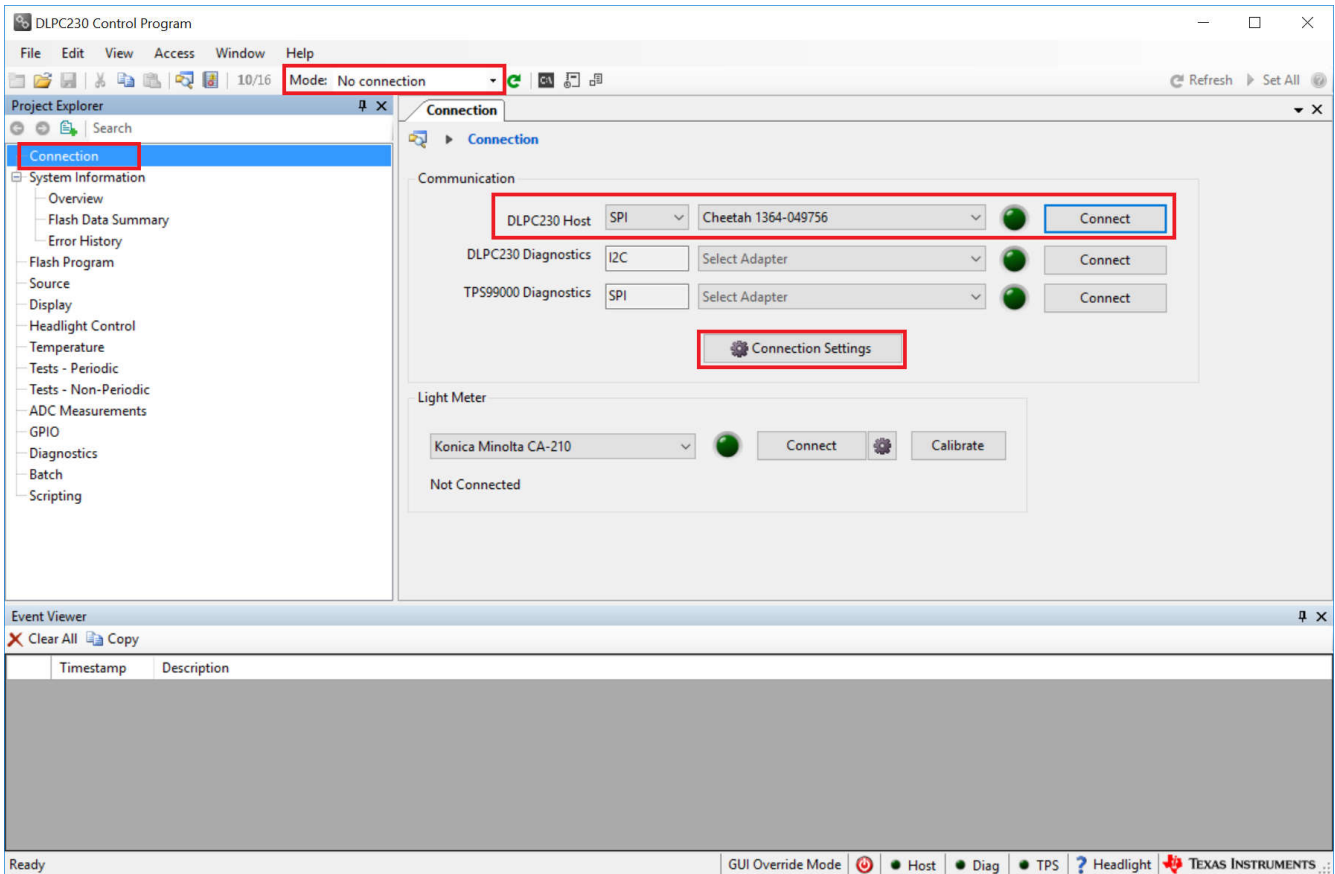


Figure 2-6. Connecting to the DLPC230-Q1 Using the DLPC230-Q1 Automotive Control Program

3. Select *Connection Settings* to confirm the SPI configuration shown in [Figure 2-7](#) matches the controller PCB switch settings described in [Table 1-3](#). Specifically, SPI mode and CRC/Checksum can vary based on switch settings. When configuration is complete, press *OK*.

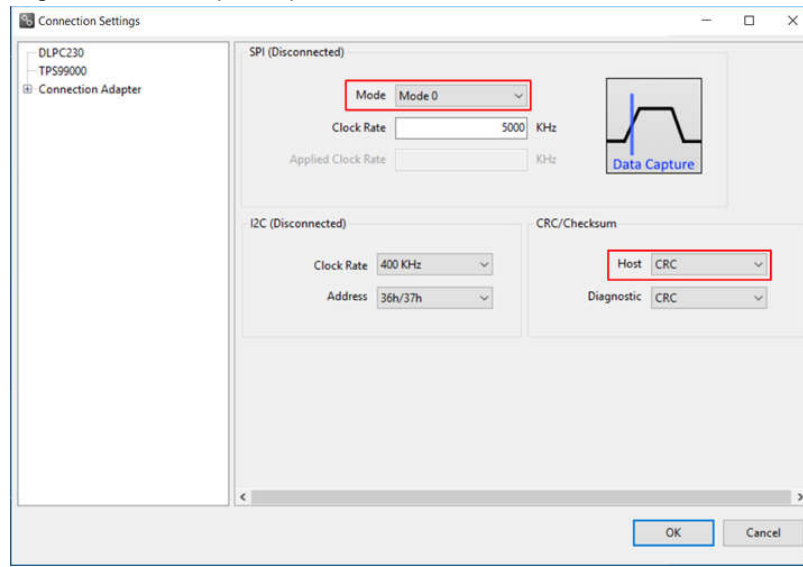


Figure 2-7. DLPC230-Q1 Automotive Control Program Communication Settings

4. Click the *Connect* button. The green circle next to the *Connect* button then lights up to indicate that connection was successful to the Cheetah Adapter.

2.5 Steps to Reprogram the Onboard Flash Memory

The DLP5532PROJHBQ1EVM 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, that is connected to the EVM, navigate to the *Flash Program* tab.
2. Navigate to the *Read Flash* sub tab and select *entire flash* content to be saved to a local storage location. (Note that this step is optional but highly recommended to save the current flash content as a backup.)
3. Navigate back to the *Program Flash* sub tab and using the folder icon, select an Image File (.bin) and open it.
4. Click *Program and Verify Flash Memory*.

Note that if the device is in Display mode, it is automatically be switched to Standby during programming.

3 Optical Engine Requirements and Specifications

The DLP5532PROJHBQ1EVM includes an optical projection system that can be used for transparent window display applications. The optical specifications are listed in [Table 3-1](#).

Table 3-1. Optical Module Specifications


Parameter	MIN	NOM	MAX	UNIT
Luminous flux output		600	1000*	lm
Throw ratio		1.8		
Throw distance	450	750	1000	mm
Image width	250	417	556	mm
f/#		1.8		
MTF	42%		72%	
Optical image offset		100%		
Light uniformity		62%		
FOFO contrast		600:1		

* Note: To achieve 1000 lumens, the LED driver PCB may need to be optimized to support higher currents per color channel, and the thermal robustness of the PCB must be considered as well.

Table 3-2. Included LEDs

Color	Manufacturer	Part Number
Red	Luminus	PTM-50X-RA
Green	Luminus	PTM-50X Converted Green
Blue	Luminus	PTM-50X Blue

CAUTION



Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. Can be harmful to the eye.

4 Revision History

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

Changes from May 30, 2022 to October 31, 2025 (from Revision * (May 2022) 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/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

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