EVM User's Guide: DLP4620SQ1EVM DLP4621Q1EVM

DLP4620SQ1EVM and DLP4621Q1EVM Evaluation Module

Description

The DLP4620SQ1EVM Evaluation Module (EVM) is a complete electronic subsystem designed to control the DLP4620S-Q1, DLPC231S-Q1, and TPS99000S-Q1 devices, which support RGB display applications such as augmented reality head-up displays.

The DLP4621Q1EVM EVM is designed to control the DLP4621-Q1, DLPC231-Q1, and TPS99001-Q1, which support monochrome applications such as high-resolution headlights.

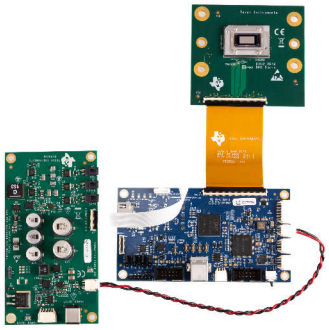
There are no optical elements provided with this EVM, except for the DMD. Expect that this EVM is procured to mount to a custom-designed picture generation unit (PGU) or projector.

Features

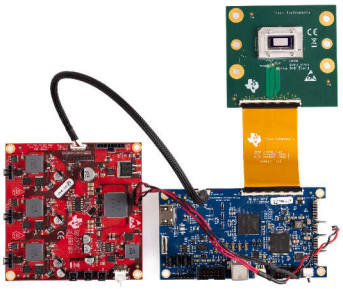
- DLP4620S-Q1 DMD board with RGB display LED driver and DLPC231S-Q1 DMD controller for DLP4620SQ1EVM kit
- DLP4621-Q1 DMD board with Headlight LED driver and DLPC231-Q1 DMD controller for DLP4621Q1EVM kit
- 600MHz SubLVDS DMD interface for low power and emission
- DMDs have 0.46-inch diagonal micromirror array
  - 7.6µm micromirror pitch
  - ±12° micromirror tilt angle
  - Bottom illumination enables high efficiency and smaller engine size
  - 10kHz DMD refresh rates over temperature extremes
  - Compatible with LED or laser illumination
- Video input interface on controller board
  - Single OpenLDI (FPD-Link I) port up to 110MHz
  - 24-bit RGB parallel interface up to 110MHz
- Configurable host interface
  - I2C (400kHz)
  - SPI (10MHz)

Applications

- Augmented reality head-up display (AR HUD)
- Transparent window display
- Adaptive driving beams, glare-free beam steering, reflective traffic sign and pedestrian dimming, symbol projection



DLP4620SQ1EVM



DLP4621Q1EVM

1 Evaluation Module Overview

1.1 Introduction

This user's guide presents an overview and general description of the DLP4620S-Q1 and DLP4621-Q1 EVMs and provides first steps for getting started using the EVMs.

1.2 Kit Contents

The DLP4620SQ1EVM consists of a DLPC231S-Q1 DMD controller board, a DLP4620S-Q1 DMD board, an LED driver board, and cables.

Similarly, the DLP4621Q1EVM consists of the DLPC231-Q1 DMD controller board, a DLP4621-Q1 DMD board , an LED driver board, and cables.

1.3 Specifications

1.3.1 Electrical Specifications

Table 1-1. Electrical Specifications - DLP4620SQ1EVM

PARAMETER	MIN	NOM	MAX	UNIT
Input				
Voltage	8	12	18	V
Power(1)		12	40	W
LED Pre-Regulator Output				
Voltage		6.5 or 8(2)		V
LED Driver Output Load				
Voltage (Per LED Color Output)			7.5	V
Current (Per LED Color Output)			6	A
Temperature				
Operating DMD Temperature(3)	–40		105(4)	°C

(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 H2. See Table 2-5.
(3) Care must be taken to make sure that individual components and PCB do not exceed the maximum temperature when driving high-power load.
(4) Some components are only rated to 85℃. Refer to Table 1-4 for a list of these components.

Table 1-2. Electrical Specifications - DLP4621Q1EVM

Parameter	Min	Nom	Max	UNIT
Input				
Voltage	8	12	18	V
Power			96	W
LED Pre-Regulator Output				
Voltage	3		12	V
LED Driver Output Load				
Voltage(Per LED Output)			12	V
Current(Per LED Output)			6 (1)	A
Temperature				
Operating DMD Temperature(2)	-40		105(3)	

(1) 8A may be used, but care must be taken to ensure that individual components and the PCB do not exceed their maximum temperature
(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 85C. Refer to for a list of these components.

1.3.2 Component Temperature Ratings - DLP4620SQ1EVM

The PCB materials and most of the PCB components are rated to operate between –40°C to 105°C, including the DLP4620S-Q1, the DLPC231-Q1 or DLPC231S-Q1, and the TPS99000S-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 1-3. Please refer to the EVM bill of materials to review the temperature specifications of all components used in the EVM design.

Table 1-3. 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	LTST-C171KRKT	Lite-On	LED, GREEN 0805	–55	85
Controller	J4	2086588131	Molex	CONN MICRO HDMI™ RIGHT ANGLE	-20	85
Controller	J9	1734346-1	TE Connectivity	CONN USB TYPE B RIGHT ANGLE	0	50
Controller	SW1, SW2, SW3, SW4	CVS-01TB	Copal Electronics Inc	SWITCH DIP SLIDE 1-POS 1 mm 6V	–40	85
Controller	SW6	GT12MSABETR	ITT C&K	SWITCH TOGGLE SPST RIGHT ANGLE	-30	85
Controller	U12	SN74AVC4T774PWR	Texas Instruments	DUAL SUPPLY TRANSCEIVER	-40	85
Controller	U501	TFP401AIPZPRQ1	Texas Instruments	IC PANELBUS DVI RCVR 100-HTQFP	–40	85
Controller	U503	AT34C02D-MAHM-T	Microchip	EEPROM MEMORY 2 Kb	-40	85
Controller	U505, U506, U507, U509, U511	PCMF2HDMI2SZ	Nexperia	COMMON MODE CHOKE 4LN SMD ESD	–40	85
LED Driver	J2	PJ-082BH	CUI Inc	CONN PWR JACK 2.5X5.5mm SOLDER	–25	85

The DLP4620SQ1EVM is not a production design and is intended for evaluation only.

1.3.3 Component Temperature Ratings - DLP4621Q1EVM

The PCB materials and most of the PCB components are rated to operate between –40°C to 105°C, including the DLP4621-Q1, the DLPC231-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 1-4. Please refer to the EVM bill of materials to review the temperature specifications of all components used in the EVM design.

Table 1-4. 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	LTST-C171KRKT	Lite-On	LED, GREEN 0805	–55	85
Controller	J4	2086588131	Molex	CONN MICRO HDMI RIGHT ANGLE	-20	85
Controller	J9	1734346-1	TE Connectivity	CONN USB TYPE B RIGHT ANGLE	0	50
Controller	SW1, SW2, SW3, SW4	CVS-01TB	Copal Electronics Inc	SWITCH DIP SLIDE 1-POS 1 mm 6V	–40	85
Controller	SW6	GT12MSABETR	ITT C&K	SWITCH TOGGLE, SPST RIGHT ANGLE	-30	85
Controller	U12	SN74AVC4T774PWR	Texas Instruments	DUAL SUPPLY TRANSCEIVER	-40	85

Table 1-4. EVM Components Which are Not Rated for –40°C to 105°C (continued)

Board	Reference	Part Number	Manufacturer	Description	Temperature Minimum (°C)	Temperature Maximum (°C)
Controller	U501	TFP401AIPZPRQ1	Texas Instruments	IC PANELBUS DVI RCVR 100-HTQFP	–40	85
Controller	U503	AT34C02D-MAHM-T	Microchip	EEPROM MEMORY 2 Kb	-40	85
Controller	U505, U506, U507, U509, U511	PCMF2HDMI2SZ	Nexperia	COMMON MODE CHOKE 4LN SMD ESD	–40	85
LED Driver	SW1	G3T12AH-R	NKK Switches	SWITCH TOGGLE, SPDT, 28V, 100mA	–25	85

The DLP4621Q1EVM is not a production design and is intended for evaluation only.

1.3.4 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.

Table 1-5. Supported Resolutions

Feature	0.46" Non-Diamond Down Sampling (non-DDS) Mode - HL	0.46" Non-Diamond Down Sampling (non-DDS) Mode - HUD	0.46" Diamond Down Sampling (DDS) Mode - HUD
EVM Part Number	DLP4621Q1EVM	DLP4620SQ1EVM	DLP4620SQ1EVM
Supported Resolutions	960×480, 480×240	960×960, 960×480, 480×240	1358×566, 1220×610
480×240	YES	YES	N/A
960×480	YES	YES	N/A
960×960	N/A	YES	N/A
1358×566	N/A	N/A	YES
1220×610	N/A	N/A	YES

The input source timing specified in the EVM's HDMI interface EDID 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	480	240	96	120	24	20	10	7	3	60	36
480	240	320	32	240	48	200	10	187	3	60	21.12
960	960	160	32	80	48	28	10	15	3	60	66.39

1.3.5 SPI and I^2C Timing

For more information on SPI and I^2C specifications, see the DLPC231S-Q1 data sheet (DLPS201) or the DLPC231-Q1 (DLPS054) data sheet.

1.4 Device Information

The DLP4620SQ1EVM kit contains the electronics required to drive a DLP4620S-Q1 DMD board for HUD applications while the DLP4621Q1EVM kit contains the electronics to drive a DLP4621-Q1 DMD board for headlight applications.

The DLP4620SQ1EVM offers interface options for I2C, SPI, and USB.

The DLP4621Q1EVM headlight kit, however, includes I2C, SPI, USB, and OpenLDI interfaces.

2 Hardware

2.1 DLP4620SQ1EVM Block Diagram

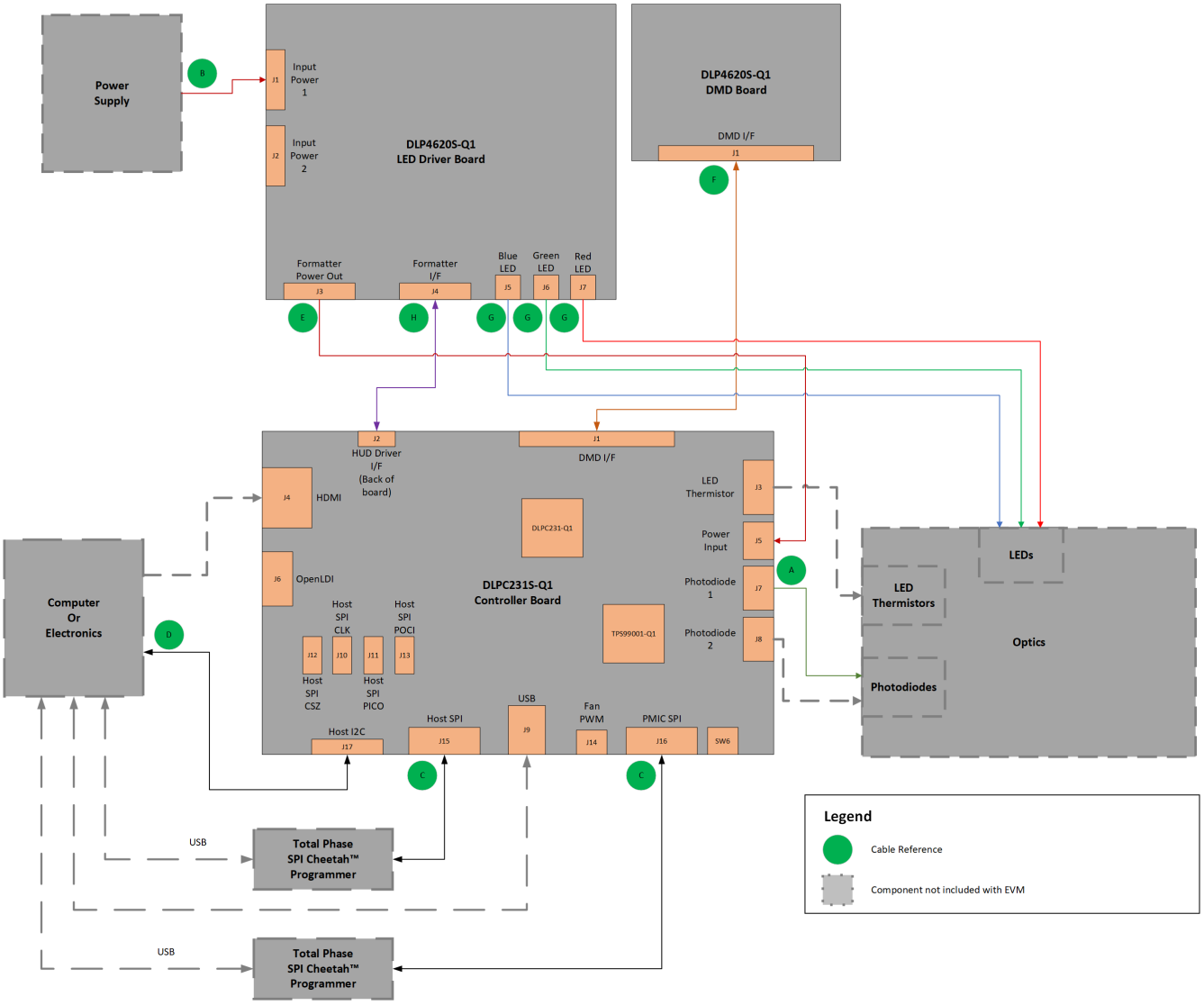
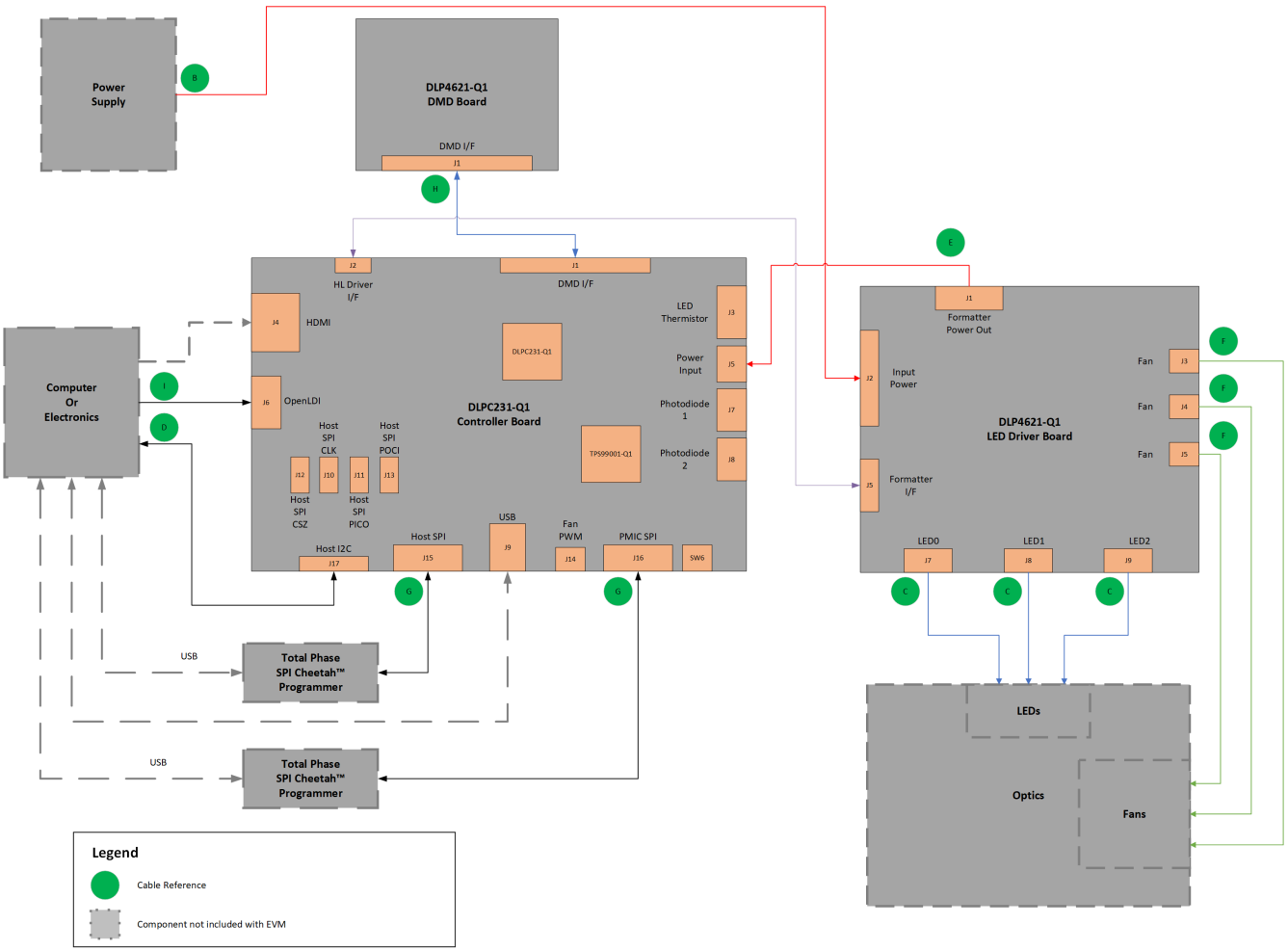


Figure 2-1. DLP4620SQ1EVM Cable Connections

A. Cable references can be seen in Figure 2-5 and are listed in Table 2-6.

2.2 DLP4621Q1EVM Block Diagram



A. Cable references can be seen in Figure 2-8 and are listed in Table 2-10.

Figure 2-2. EVM Cable Connections

2.3 Controller PCB

The controller PCB shown in Figure 2-3 includes the DLPC231-Q1 DMD Controller and the TPS99001-Q1. The controller PCB supports video inputs from either a HDMI or OpenLDI interface and provides the formatting and control to display the video on the DLP4620S-Q1 and DLP4621-Q1 DMDs.

The controller board has a SPI port for users who wish to use a Cheetah™ SPI host adapter. However, the Cheetah host adapter must be bought separately from the EVM. This port allows for high-speed SPI communication between the controller board and host. An optional second SPI port is provided for monitoring the TPS990001-Q1 or the TPS99000S-Q1.

The controller board has an additional I2C port. The provided I2C cable includes PROJ_ON, HOLD_BOOT, and HOST_IRQ, signals readily available to allow indirect control and monitoring of the EVM.

If direct SPI or I2C is not preferred, there is an on-board Cypress chip that allows for USB to SPI or USB to I2C communication.

Each of these communication ports allow the user to communicate to the controller from the external world via a PC or the Automotive Control Program reference software, which speeds up the development of supported automotive EVMs. Some features include flashing new firmware onto the controller, changing test pattern generator (TPG) images, changing sources (such as TPG to HDMI), or obtaining controller or PMIC (TPS99000-Q1) diagnostics.

The controller board has an external photodiode input that is used to control white point and brightness over a wide dimming range. An optional second photodiode input is also provided for the DLP4620SQ1EVM kit.

The LED thermistor on the board can be used to measure the temperatures of the red, green, and blue LEDs when using the DLP4620SQ1EVM.

The headlight interface port helps control the LED brightness and PWM output from the controller for the DLP4621Q1EVM.

On the opposite side of the EVM is a HUD interface port, which helps control and monitor an illumination design such as the RGB LED driver provided in the kit. This is used for the DLP4620SQ1EVM.

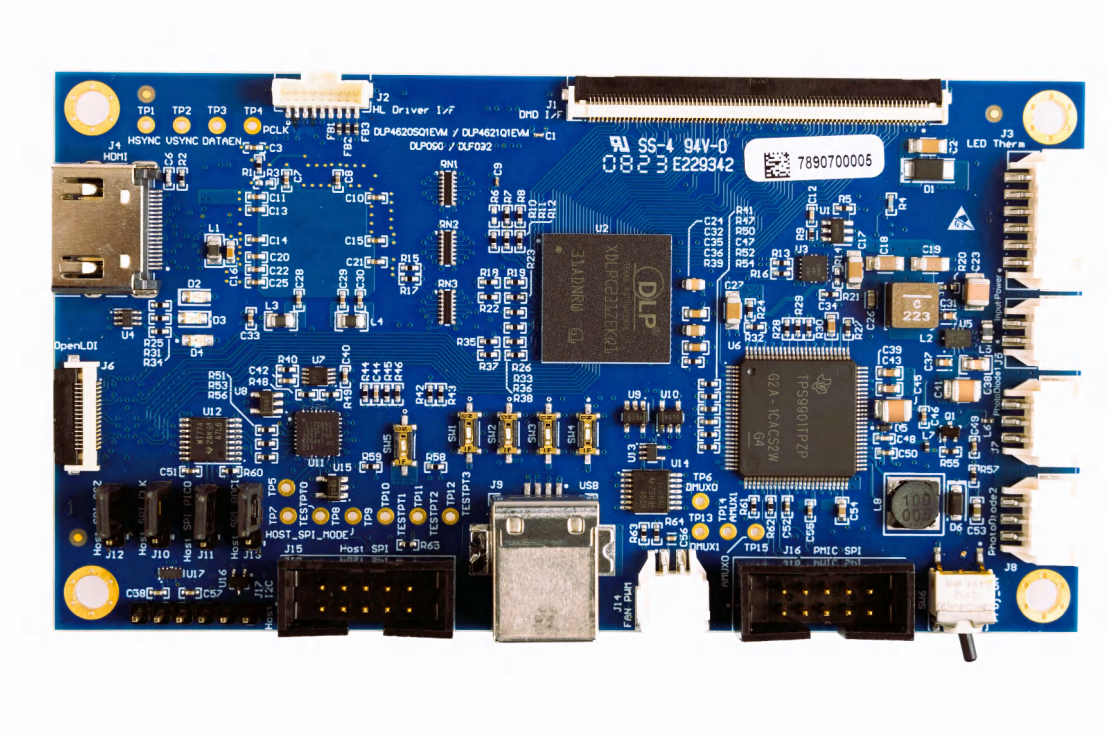


Figure 2-3. DLPC231SQ1EVM Controller PCB

The controller PCB contains the ports listed in Table 2-1. Indicator LEDs are listed in Table 2-2.

Table 2-1. Controller PCB Ports

SCHEMATIC REFERENCE	FUNCTION
J1	DMD flex cable interface
J2	Headlight driver interface
J3	LED thermistor
J4	HDMI input
J5	Driver controller power
J6	OpenLDI input
J7	Photodiode 1
J8	Photodiode 2
J9	USB Input
J10	Host 1/2 SPI_CLK select
J11	Host 1/2 SPI_PICO select(1)
J12	Host 1/2 SPI_CSZ select
J13	Host 1/2 SPI_POCI select(1)
J14	Fan PWM output

Table 2-1. Controller PCB Ports (continued)

SCHEMATIC REFERENCE	FUNCTION
J15	Host SPI
J16	PMIC SPI

(1) PICO and POCI are used for *Peripheral In, Controller Out* and *Peripheral Out, Controller In*, respectively.

Table 2-2. Controller LED Indicators

SCHEMATIC REFERENCE	FUNCTION
D2 (Green)	PROJ_ON Off: System Off On: System On
D3 (Green)	Input power to controller (from LED driver) Off: No power connected On: Power connected
D4 (Red)	HOST_IRQ Off: Interrupt not asserted On: Interrupt asserted

The controller PCB switches are listed in Table 2-3. 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 the DLPC230-Q1 comes out of reset. These switches must be set based on the desired configuration options.

Table 2-3. Controller PCB Switches

SCHEMATIC REFERENCE / SIGNAL NUMBER	FUNCTION
SW1	CHKSUM_SEL Off: Disabled On: Enabled
SW2	HOST_IF_SEL Off: CRC On: Checksum
SW3	HOST_SPI_MODE Off: Host SPI On: Host I^2C
SW4	SPREAD SPECTRUM ENABLE Off: Mode 0 or 3 On: Mode 1 or 2
SW5	HOLD_BOOTZ Off: Do not hold in boot (continue to main application) On: Hold in boot
SW6	PROJ_ON Off: Turn off system On: Turn on system

2.4 RGB LED Driver PCB - DLP4620SQ1

The DLP4620SQ1EVM can operate as a standalone system with just the controller board and the DMD board, but the EVM can be combined with an RGB LED design. The LED driver board shown in Figure 2-4 is controlled and monitored by the controller PCB over a flex cable. Power can be input to the LED driver board from a bench top supply or through a 12V, 5A barrel jack power supply. Depending on operating conditions, some parts and surfaces of the PCB can be hot.

The LED driver board has the following primary functions:

- Provides reverse bias protection and supplies power to controller board over a separate cable.
- Regulates input power to 6.5V or 8V prior to the LED driver circuitry.
- Has outputs for red, green, and blue LEDs, but other LEDs can be used.

CAUTION

The LED driver board can reach temperatures above 55°C without proper cooling and airflow. Contact can cause burns!

CAUTION

LED drivers (J5, J6, J7) can produce high currents of 6.5A or 8A. Do not remove these headers, and do not touch the contact points during operation!

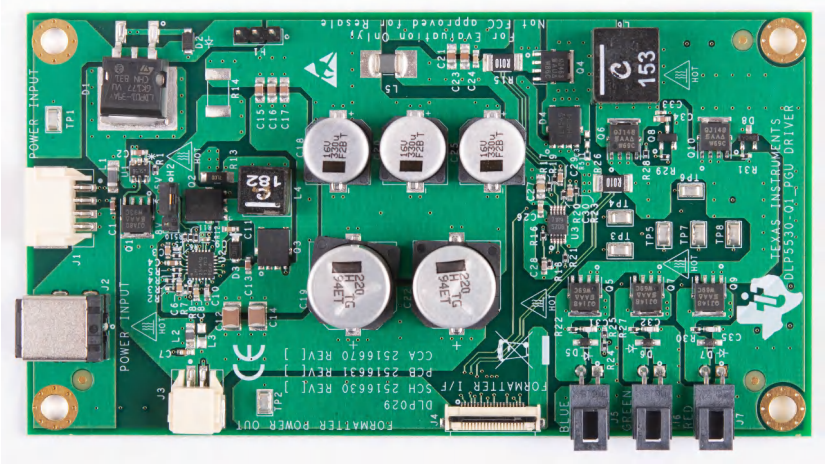


Figure 2-4. LED Driver PCB - DLP4620SQ1EVM

The LED driver PCB contains the ports listed in Table 2-4.

Table 2-4. RGB LED Driver PCB Ports

SCHEMATIC REFERENCE	FUNCTION
J1	Input power
J2	Input power (optional)
J3	Controller power
J4	Controller-driver control interface
J5	Blue LED output - high current output up to 6A, locking and keyed connector
J6	Green LED output - high current output up to 6A, locking and keyed connector
J7	Red LED output - high current output up to 6A, locking and keyed connector

The LED driver PCB contains the headers listed in Table 2-5. H2 selects the LED 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 and replace only with power disconnected from the board.

Table 2-5. LED Driver Header Pins

HEADER	PIN1	PIN2	PIN3
H1	Pre-regulated drive voltage (6.5V or 8V)	GND	GND
H2	Feedback voltage connection for 6.5V drive	Pre-regulator feedback voltage	Feedback voltage connection for 8V drive

2.5 Cables - DLP4620SQ1EVM

The DLP4620SQ1EVM kit contains the cables and Cheetah USB to SPI adapter listed in Table 2-6 and shown in Figure 2-5.

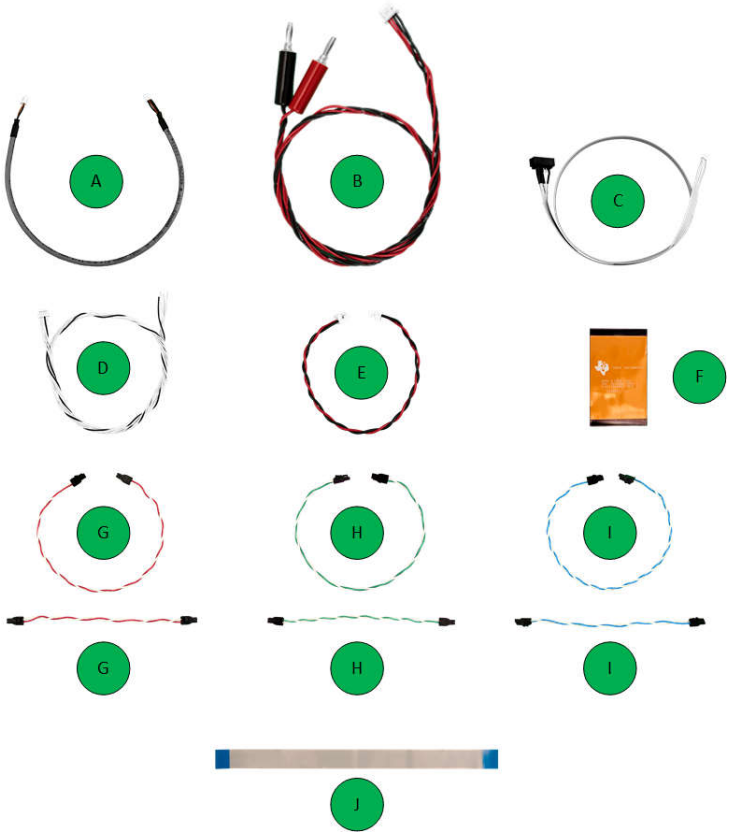


Figure 2-5. DLP4620SQ1EVM Cables

Table 2-6. DLP4620SQ1EVM Cables

NAME	REFERENCE	QUANTITY
Photodiode cable	A	1
Input power cable	B	1
Host SPI cable	C	1
Host I^2C Cable (includes PROJ_ON, HOLD_BOOT, HOST_IRQ signals)	D	1
LED driver to controller board power cable	E	1
Controller to DMD board flex cable	F	1
Red illuminator power cables	G	2
Green illuminator power cables	H	2
Blue illuminator power cables	I	2
LED driver to controller board HUD interface flex cable	J	1

A block diagram for the DLP4620SQ1EVM can be found in Figure 2-1.

2.6 LED Driver PCB - DLP4621Q1EVM

The DLP4621Q1EVM can be used as a standalone system with just the controller and DMD boards, but can be combined with an LED driver board. The LED driver board shown in Figure 2-6 is designed for monochrome (white light) designs. The LED brightness can be controlled through PWM output from the DLPC231-Q1. Using the Automotive Control Program reference software *Headlight Control* tab, the PWM slider bars (PWM0, PWM1, and PWM2) control the current through each LED driver channel. Note that the PWM control can exceed the maximum current specification of some LEDs in certain LED configurations.

Note

Some current continues to flow through the LED with a PWM level of 0, and light output can still be visible. To fully remove LED current, the system must be set to standby mode.

CAUTION

The LED driver can reach temperatures above 55°C without proper cooling and airflow. Contact can cause burns!

CAUTION

LED drivers (J7, J8, J9) can produce high currents up to 8A. Do not remove these headers, and do not touch the contact points during operation!

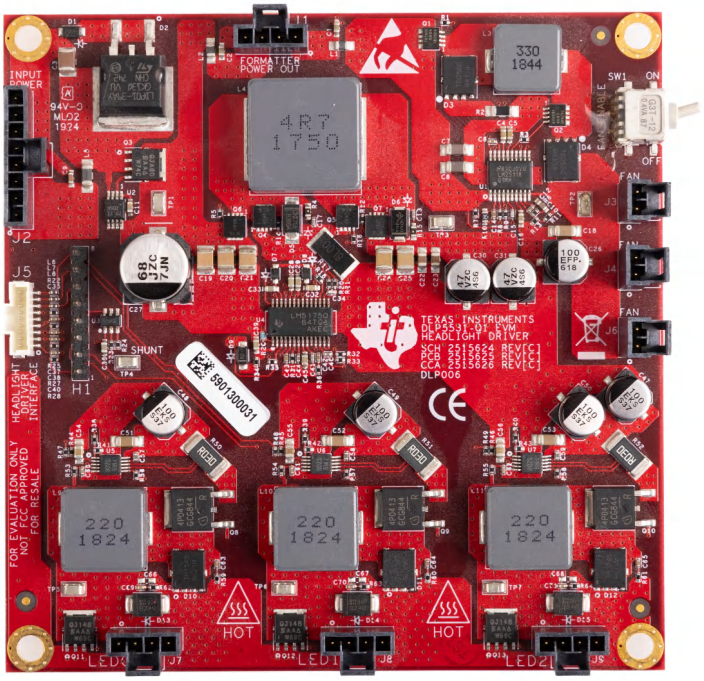


Figure 2-6. LED Driver PCB - DLP4621Q1EVM

The LED driver PCB contains the ports listed in Table 2-7.

Table 2-7. LED Driver PCB Ports

SCHEMATIC REFERENCE	FUNCTION
J1	Controller power
J2	Input power
J3	Fan
J4	Fan
J5	Headlight driver interface
J6	Fan
J7	LED0 - High current output up to 8A, locking connector
J8	LED1 - High current output up to 8A, locking connector
J9	LED2 - High current output up to 8A, locking connector

The LED driver PCB contains the following ports and switches. SeeTable 2-5.

Table 2-8. LED Driver Header Pins

Schematic Reference / Signal Number	PIN1
SW1	Fan enable On position is down in Figure 2-6

2.7 Driver Requirements - DLP4621Q1EVM

The DLP4621-Q1 chipset, used with LED illumination, requires illumination modulation. This LED modulation turns off the light output during micromirror reset, which improves system contrast. For the system timing specifications of the DLP462`1-Q1 electronics EVM, see Figure 2-7

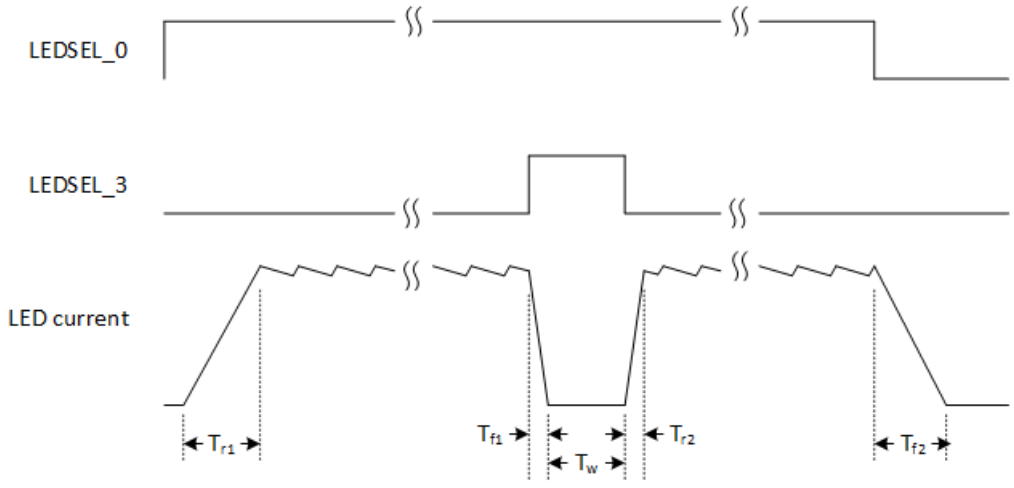


Figure 2-7. DLP4621-Q1 Electronics EVM LED Driver Board Timing Specifications

Table 2-9. LED Driver Board Timing Specifications

Parameter	Value
T_{r1}, T_{f2}	< 50µs
T_{f1}, T_{r2}	< 2µs
T_w	minimum = 1µs

2.8 Cables - DLP4621Q1EVM

The DLP4621Q1EVM kit contains the cables and Cheetah USB to SPI adapter listed in Table 2-10 and shown in Figure 2-5.

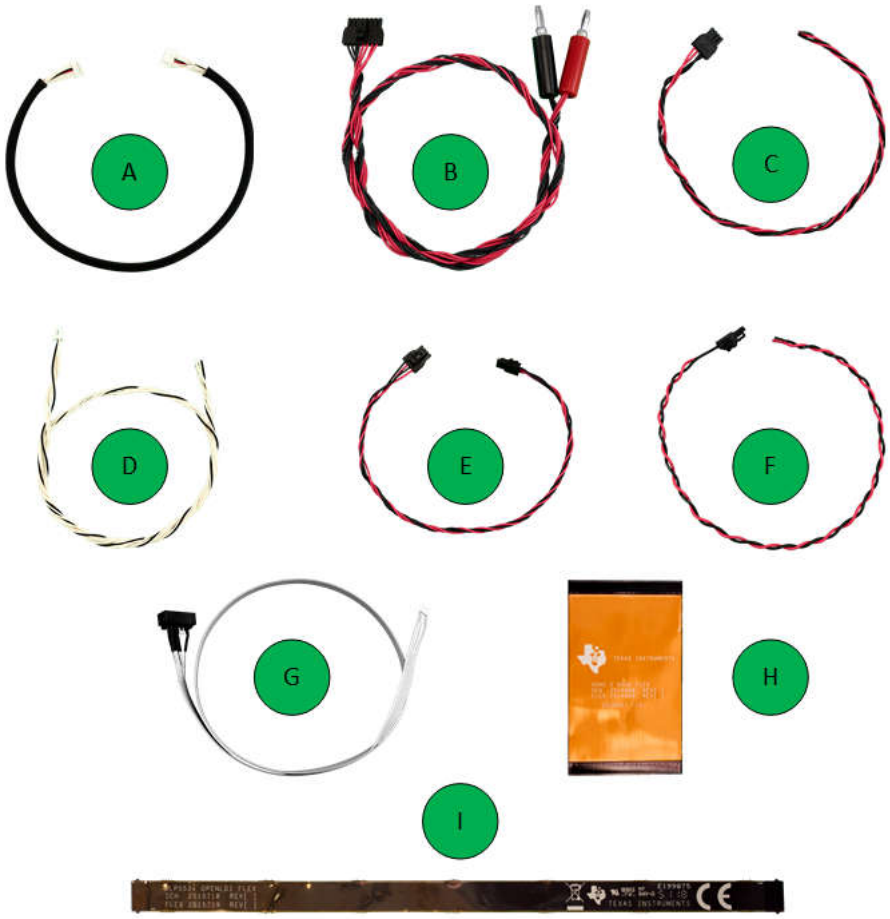


Figure 2-8. DLP4620SQ1EVM Cables

Table 2-10. DLP4621Q1EVM Cables

NAME	REFERENCE	QUANTITY
Headlight driver interface cable	A	1
LED driver power cable	B	1
LED power cable	C	1
Host I^2C Cable (Includes PROJ_ON, HOLD_BOOT, HOST_IRQ signals)	D	1
LED driver to controller board power cable	E	1
Fan power cable	F	1
Host SPI cable	G	1
Controller to DMD flex cable	H	1
Open LDI flex cable	I	1

A block diagram of the DLP4621Q1EVM can be found in Figure 2-2.

2.9 Optical Engine Requirements

The DLP4620SQ1EVM can be coupled to an optical engine (not included) to implement a head-up display function or an automotive interior projection system. The detailed requirements of the optical engine are beyond the scope of this document, but the optical engine must have separate red, green and blue illuminators. These are typically LEDs. The optical engine also needs to provide a photodiode in the illumination path before the DLP4620S-Q1 DMD. The photodiode is used to control white point and brightness output. A heat sink for the DLP4620S-Q1 DMD can be needed for operation in high temperature ambient environments, but is not included in the DLP4620S-Q1 Electronics EVM.

Similarly for the DLP4621Q1EVM, optics and mechanics are not included in the kit.

CAUTION

When choosing your LED or laser component (not included with this EVM) the end user must consult the data sheet supplied by the manufacturer of the illuminator to identify the EN62471 Risk Group Rating and review any potential eye hazards associated with the illuminator chosen. Always consider and implement the use of effective light filtering and darkening protective eye wear and be fully aware of surrounding laboratory-type set-ups when viewing intense light sources that can be required to minimize or eliminate such risks to avoid accidents related to temporary blindness.

REACH-Affected Components

In compliance with Article 33 provision of the EU REACH regulation, we are notifying you 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 2-11. DLP4620SQ1EVM

Component Manufacturer	Component Type	Component Part Number	SVHC Substance	CAS Number
ITT C&K	Switch	GT12MSABETR	Lead	7439-92-1

3 Software

3.1 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.

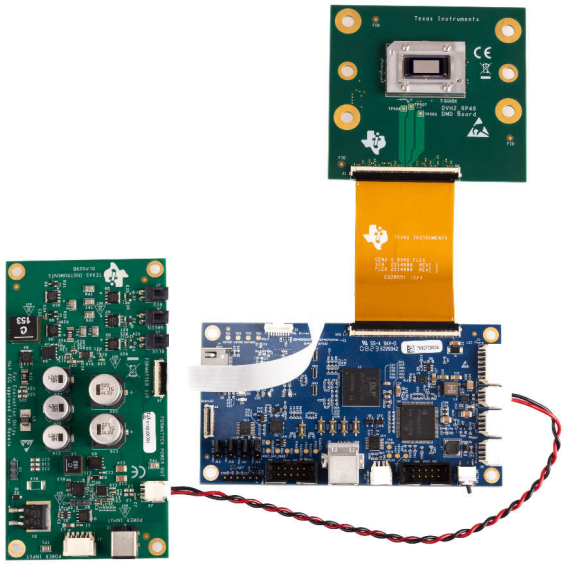
3.2 Quick Start - DLP4620SQ1EVM

Use the following instructions to set up the DLP4620SQ1EVM and PC.

3.2.1 Kit Assembly Instructions - DLP4620SQ1EVM

An example image of the DLP4620SQ1EVM without a power supply and optics is shown in Figure 3-1.

1. Connect the DMD Flex Cable to the controller PCB (J1) and the DMD PCB (J1). Pin 1 is marked on the DMD flex cable. Make sure the controller side of the flex cable is aligned with the controller PCB.
2. Connect the controller to driver control interface flex to the controller PCB (J8) and the illumination driver PCB (J4).
3. Connect your host communication cable to the controller PCB and your host computer.
   a. If using the Total Phase Cheetah SPI Adapter, follow the jumper configuration found in Section 3.4.
   b. If using a direct USB connection, then follow the jumper configuration found in Section 3.5.
4. Connect the controller power cable to the controller PCB (J5) and the illumination driver PCB (J3).
5. Connect the blue illumination output cable to the illumination driver PCB (J5) to the blue illuminator in the optics engine.
6. Connect the green illumination output cable to the illumination driver PCB (J6) to the green illuminator in the optics.
7. Connect the red illumination output cable to the illumination driver PCB (J7) to the red illuminator in the optics engine.
8. Connect the photodiode cable to the controller PCB (J7) to a photodiode located in the illumination path of the optics engine.
9. Connect the HDMI cable to the controller PCB (J4). Connect the HDMI cable to PC HDMI port.
10. Connect the power input cable to the illumination driver PCB (J1).



A. If communicating with the controller, then be sure to always check what the jumper configuration is. Jumpers J10, J11, J12, and J13 determine whether or not the controller recognizes SPI or USB communication.

Figure 3-1. DLP4620SQ1EVM Cable Connections

3.2.2 Powering-Up EVM

1. Connect input power cable to a power supply that meets input power specifications defined in Table 1-1. The red wire is the V+ terminal and black wire is the V– terminal.
2. Turn on the supply power. Once powered up, controller PCB LED indicators (D3) illuminates green.
3. Turn the PROJ_ON switch (SW6) ON. The ON position is away from the board, and OFF is toward the board. A controller PCB LED indicator (D2) illuminates green.

3.2.3 Steps to Reprogram the Onboard Flash Memory

The DLP4620SQ1EVM and DLP4621Q1EVMQ1EVM come with onboard serial Flash that is pre-programed 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 that if the device is in *Display* mode, then the device automatically switches to *Standby* during programming.

3.3 Quick Start - DLP4621Q1EVM

Use the following instructions to set up the DLP4621Q1EVM and PC.

3.3.1 Kit Assembly Instructions - DLP4621Q1EVM

An example image of the DLP4620SQ1EVM without a power supply and optics is shown in Figure 3-2.

1. Connect the DMD Flex Cable to the controller PCB (J1) and the DMD PCB (J1). Pin 1 is marked on the DMD flex cable. Make sure the controller side of the flex cable is aligned with the controller PCB.
2. Connect the controller to driver control interface flex to the controller PCB (J2) and the illumination driver (J5).
3. Connect your host communication cable to the controller PCB and your host computer.
   a. If using the Total Phase Cheetah SPI Adapter, follow the jumper configuration found in Section 3.4.
   b. If using a direct USB connection, follow the jumper configuration found in Section 3.5.
4. Connect the controller power cable to the controller PCB (J2) and the illumination driver (J1).
5. Connect the LED power cable to any of the LED Driver Board LED ports (J7, J8, J9). Note that some ports can be disabled by flash setting. LED0 (J7) is in the ON position.
6. Connect the Fan Power cable to any of the illumination driver fan ports (J3, J5, J6). Confirm the fan switch on the illumination driver (SW1) is in the ON position.
7. Connect the micro HDMI cable to the controller board (J4). Connect the micro HDMI cable to the PC HDMI port.
8. Connect the Power Input cable to the illumination driver (J2).

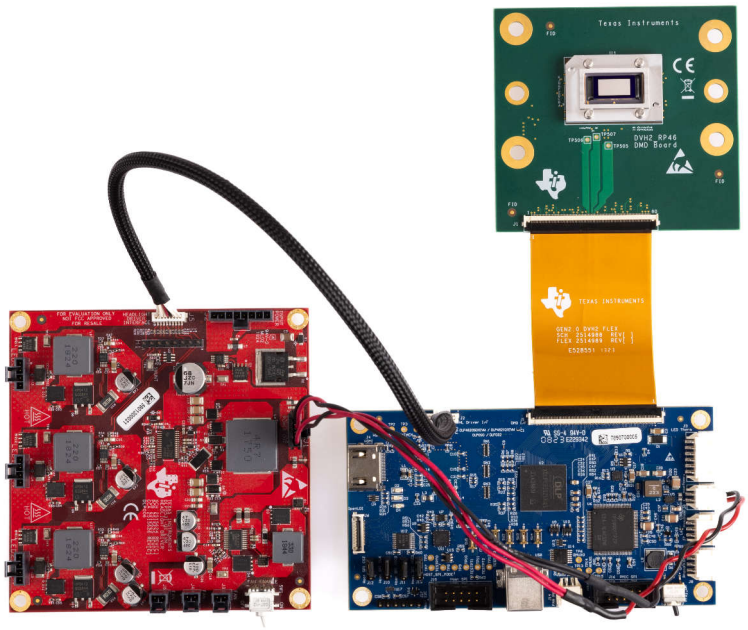


Figure 3-2. DLP4621Q1EVM EVM Cable Connections

A. If communicating with the controller, then be sure to always check what the jumper configuration is. Jumpers J10, J11, J12, and J13 determine whether or not the controller recognizes SPI or USB communication.

3.3.2 Powering-Up EVM

1. Connect input power cable to a power supply that meets input power specifications defined in Table 1-1. The red wire is the V+ terminal and black wire is the V– terminal.
2. Turn on the supply power. Once 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.

3.3.3 Steps to Reprogram the Onboard Flash Memory

The DLP4620SQ1EVM and DLP4621Q1EVMQ1EVM come with onboard serial Flash that is pre-programed 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 that if the device is in *Display* mode, then the device automatically switches to *Standby* during programming.

3.4 Connecting EVM to the DLPC230-Q1 Control Program via SPI

1. Start the DLPC230-Q1 Control Program Lite.
2. With the controller board powered off, short or populate pins 1 and 2 of J10, J11, J12, and J13 together with a jumper and then plug the SPI adapter into J2 of the controller board.
3. -On the *Connection* page, set the DLPC230-Q1 Host to SPI and select the Cheetah from the drop down menu (see Figure 3-3). Note, the Cheetah must be connected to computer with USB cable for the Cheetah to show up in the drop-down menu.

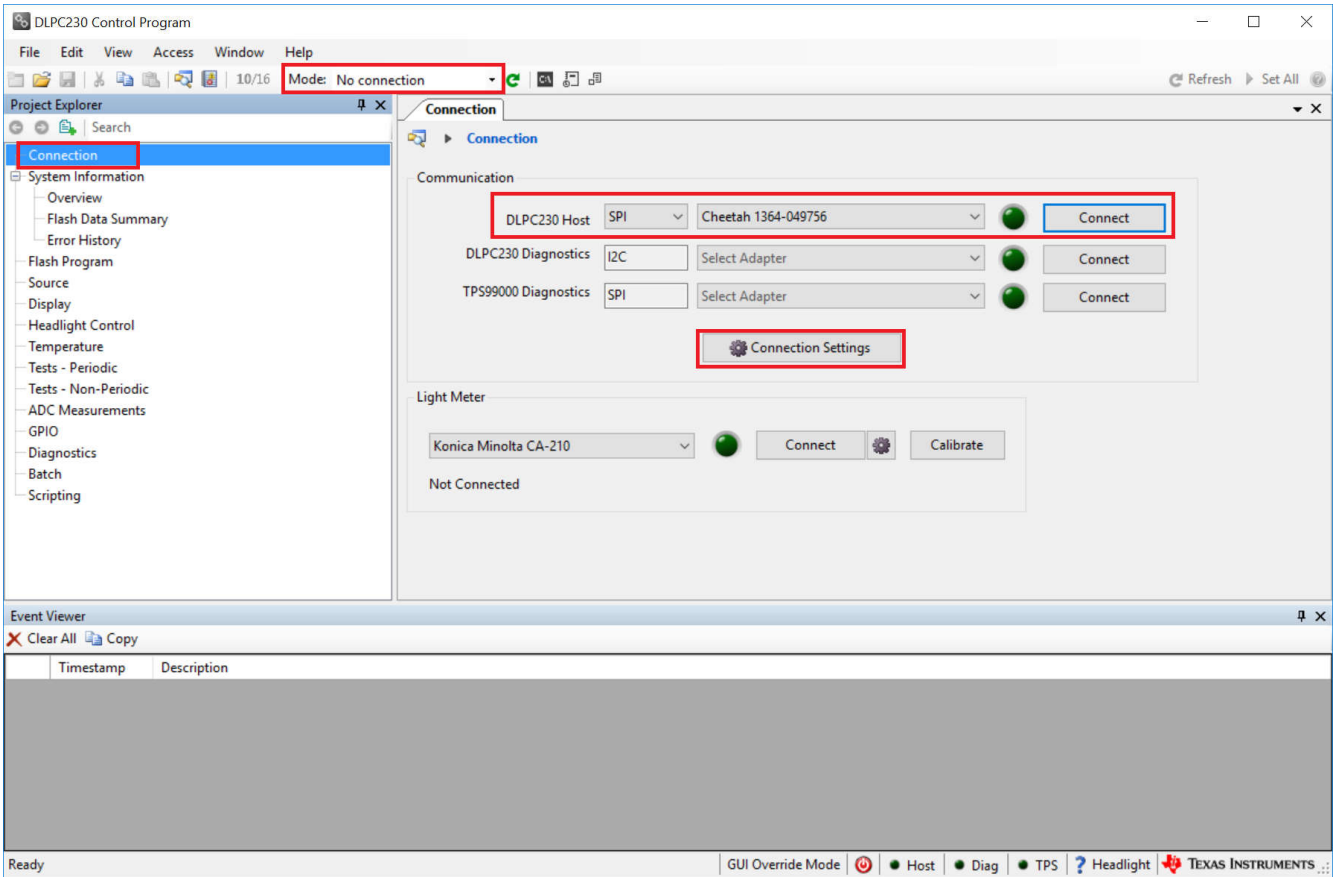


Figure 3-3. Connecting to the DLPC230-Q1 Using the DLPC230-Q1 Automotive Control Program

4. Select *Connection Settings* to confirm the SPI configuration shown in Figure 3-4 matches the controller PCB switch settings described in Table 2-3. Specifically, SPI mode and CRC/Checksum can vary based on switch settings. Press *OK* once configuration is complete.

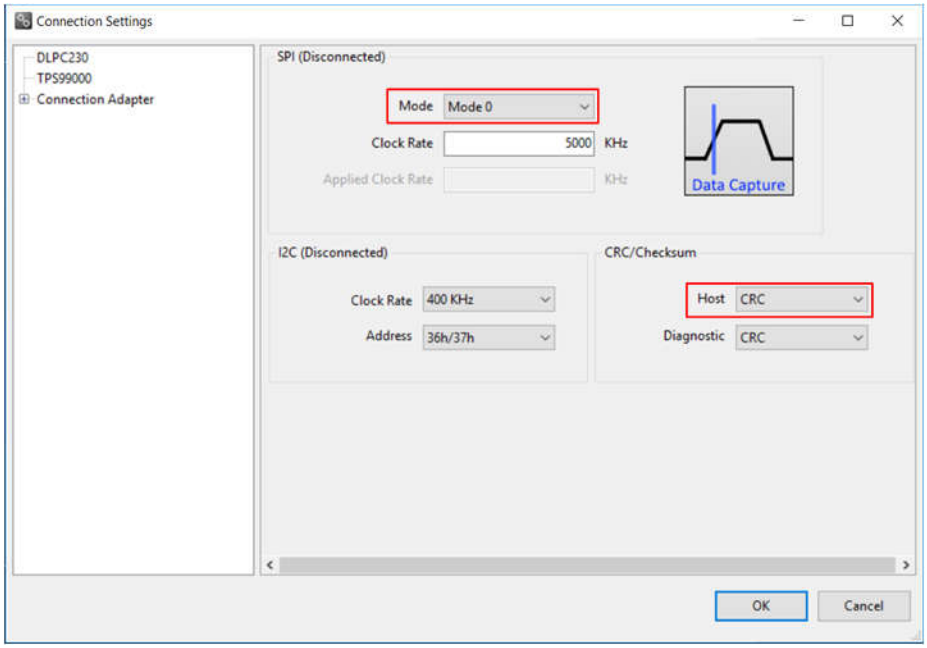


Figure 3-4. DLPC230-Q1 Automotive Control Program Communication Settings

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

3.5 Connecting EVM to the DLPC230-Q1 Control Program via USB

Setting up communication via a USB interface for the controller board is similar to the set up for SPI communication via the Cheetah™ host adapter.

1. Start the DLPC230-Q1 Control Program Lite.
2. With the DLPC231 controller board off, short pins 2-3 together on jumpers J10, J11, J12, and J13 of the controller board using a jumper
3. On the connection page, set the DLPC230-Q1 Host to SPI and select the Cypress option from the drop down menu.
4. The "Connection" Settings can be left the same way they were previously for SPI communication.
5. Click the *Connect* button. The green circle next to the Connect button then lights up to indicate that connection was successful to USB.

4 Hardware Design Files

4.1 Schematics

Schematics for the DLP4620SQ1EVM are available for download on the product page of the EVM: DLP4620SQ1EVM Design Files.

Schematics for the DLP4621Q1EVM are available for download on the product page of the EVM: DLP4621Q1EVM Design Files.

4.2 PCB Layouts

Layouts for the DLP4620SQ1EVM are available for download on the product page of the EVM: DLP4620SQ1EVM Design Files.

Layouts for the DLP4621Q1EVM are available for download on the product page of the EVM: DLP4621Q1EVM Design Files.

4.3 Bill of Materials (BOM)

The bill of materials for the DLP4620SQ1EVM are available for download on the product page of the EVM: DLP4620SQ1EVM Design Files.

The bill of materials for the DLP4621Q1EVM are available for download on the product page of the EVM: DLP4621Q1EVM Design Files.

5 Additional Information

5.1 Trademarks

HDMI™ is a trademark of HDMI Licensing LLC.
Cheetah™ is a trademark of Total Phase, Inc.
All trademarks are the property of their respective owners.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), 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 will 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 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.

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

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265