EVM User's Guide: DLP4620SPGUQ1EVM

DLP4620SPGUQ1EVM 评估模块

说明

德州仪器 (TI) DLP4620SPGUQ1EVM 评估模块 (EVM) 是一个完整的电子和光学子系统，专用于对 DLP4620S-Q1 芯片组进行控制和交互。DLP4620S-Q1 芯片组包含 DLP4620S-Q1 DMD、DLPC23xS-Q1 DMD 控制器、TPS99000S-Q1 PMIC、投影光学元件、三个红色、绿色和蓝色的 Osram Q8 LED 以及一个光电二极管。EVM 可用于开发适用于增强现实抬头显示 (AR HUD) 等应用的汽车级投影仪或图片生成单元 (PGU)。此投影仪提供超过 100 流明的高亮度。此投影仪的典型对比度为 1800:1，在紧凑的封装中还具有高对比度。EVM 具有坚固的金属外壳和光学元件，但在量产设计中可以替换为更具成本效益的塑料方案。

开始使用

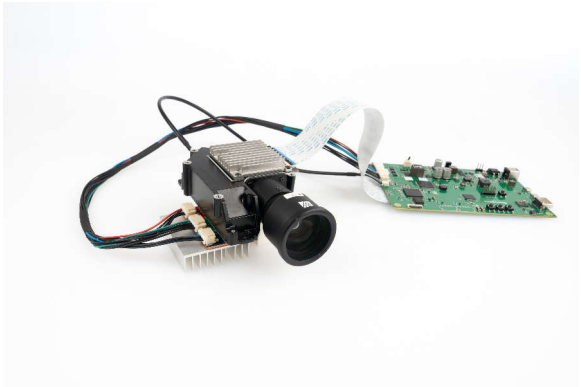
1. 订购 DLP4620SPGUQ1EVM。
2. 下载并安装以下内容：
   a. DLPC23x Automotive Control Program GUI
   b. 有关更多详细信息，请参阅 DLP4620S-Q1、DLPC23xS-Q1 和 TPS99000S-Q1 的最新文档
3. 有关如何运行系统的信息，请参阅 节 2.1 和 节 3.1 部分。
   a. 如需进一步培训，请访问 DLP4620SPGUQ1EVM 产品页面中的 德州仪器 (TI) 资源管理器 (TIREX)

特性

- 适用于 DLP4620S-Q1 DMD 和 DLPC231S-Q1 DMD 控制器的具有投影光学元件的光学 EVM 模块
- 600MHz SubLVDS DMD 接口，可实现低功耗和低发射
- DMD 具有 0.46 英寸对角线微镜阵列
  - 7.6 µ m 微镜间距
  - ±12° 微镜倾斜角
  - 底部照明可实现高效率和更小的引擎尺寸
- 视频输入接口
  - 单 openLDI (FPD-Link I) 端口，频率高达 110MHz
  - 24 位 RGB 并行接口，频率高达 110MHz
  - 60Hz 下的视频分辨率高达 1358 × 566
- 可配置 SPI (10MHz)

应用

- 增强现实抬头显示 (AR HUD)
- 透明窗口显示



DLP4620SPGUQ1EVM

1 评估模块概述

1.1 简介

本用户指南对 DLP4620SPGUQ1EVM 进行了概述和一般说明，并提供了开始使用此光学评估模块的入门步骤。本文档中的演示套件、评估板、评估模块和 EVM 等术语指的是 DLP4620SPGUQ1EVM。

DLP4620SPGUQ1EVM 并非产品设计，仅用于评估。

1.2 套件内容

DLP4620SPGUQ1EVM 包含控制器或照明 PCB 和电缆。该套件还包括一个光学模块，可与电子子系统结合，用于评估汽车环境中功能齐全的投影仪。

图 1-1. DLP4620SPGUQ1EVM 套件

1.2.1 驱动程序板

图 1-2 中显示的控制器或照明板包括 DLP4620S-Q1 DMD、DLPC231S-Q1 DMD 控制器和 TPS99000S-Q1。在本文档的其余部分中，该板可以互换称为 *驱动程序* 板和 *控制器 PCB*。该驱动程序板支持来自 HDMI™ 或 OpenLDI 接口的视频输入，并提供格式化和控制功能，以在 DLP4620S-Q1 DMD 上显示视频。EVM 可以通过 USB 转 SPI 端口进行控制，该端口也可用于对存储 DLPC231S-Q1 软件和配置的串行闪存重新编程。该 EVM 具有一个外部光电二极管输入，用于在宽调光范围内控制白点和亮度。可通过柔性电缆连接到此套件中的光学引擎或光源引擎。如此，驱动程序板就可以与光学或光源引擎内的 DMD 进行通信。该驱动程序板还为红色、绿色和蓝色照明器 PCB 提供了可选的热敏电阻接口，可用于监测照明器的温度。

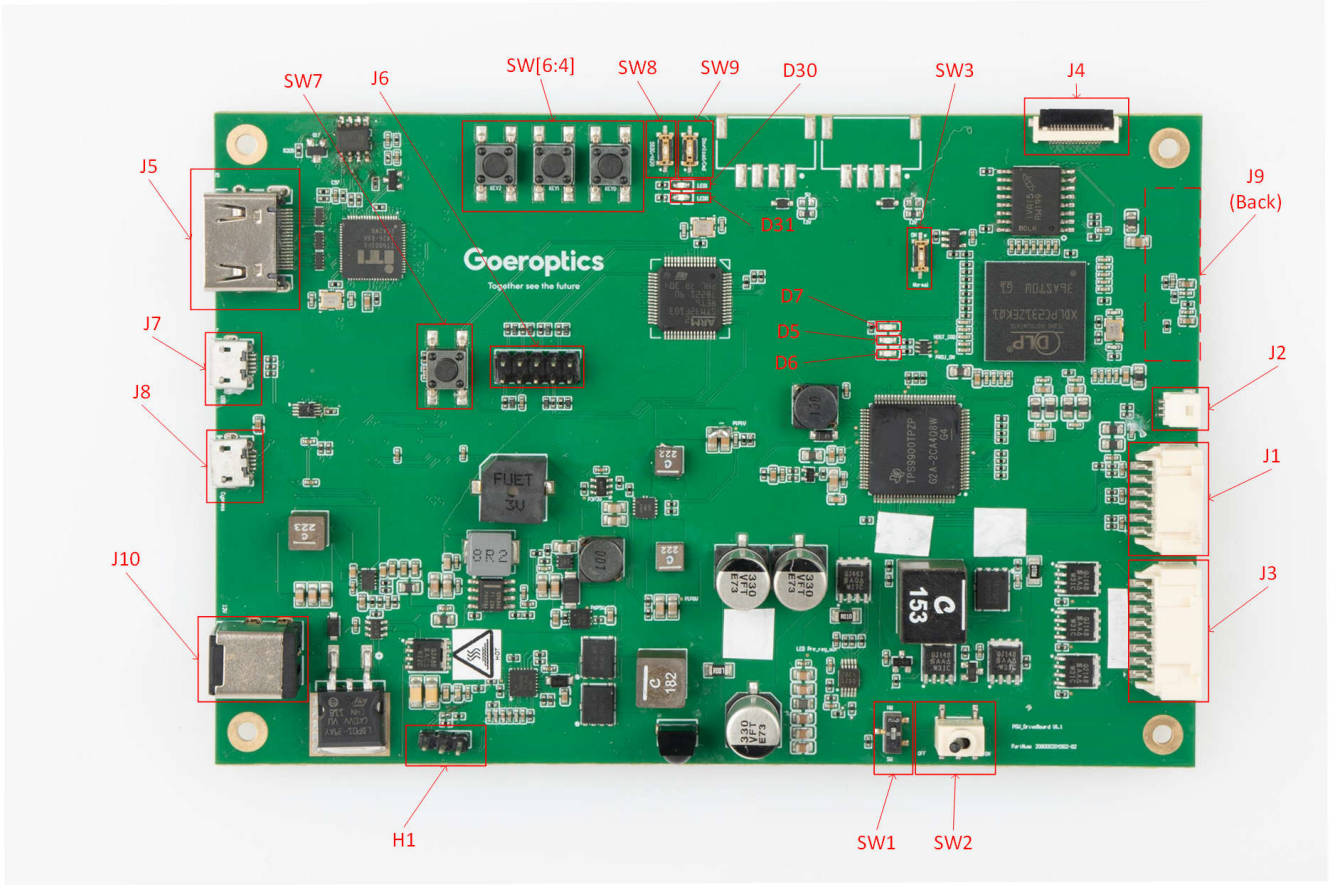


图 1-2. DLP4620SPGUQ1EVM 驱动程序板

控制器 PCB 包含表 1-1 中列出的端口。表 1-2 中列出了指示灯 LED。表 1-3 中定义了开关。

表 1-1. 控制器 PCB 端口

原理图参考	功能
J1	LED 共阳极（6 引脚）— 高达 6A 的高电流输出，采用锁定和键控连接器
J2	光电二极管（3 引脚）
J3	RGB LED 和热敏电阻（8 引脚）
J4	OpenLDI（排线连接器）
J5	HDMI
J6	接头（6 引脚）：德州仪器 (TI) 内部使用
J7	USB：德州仪器 (TI) 内部使用
J8	USB 转 SPI（Micro USB-B 连接器）
J9	DMD（柔性连接器）
J10	12V 电源输入

表 1-2. 控制器 LED 指示灯

原理图参考	功能
D5（红色）	HOST_IRQ 关闭：中断未置为有效 亮：中断已被置为有效
D6（绿色）	PROJ_ON — 指示 PGU 电源已打开
D7（绿色）	3.3V 电源正常 — 驱动程序板的输入电源 关闭：未连接电源 亮：已连接电源
D30（绿色）	LED0 系统检测信号
D31（蓝色）	LED1 MCU 电源正常

表 1-3 中列出了控制器 PCB 开关。SW2 是 PROJ_ON 的拨动开关，用于开启和关闭电子产品。请注意，当 PROJ_ON 处于关闭位置时，电路板的某些器件仍然通电。SW1、SW2 和 SW3 是 DIP 开关，用于控制 DLPC230-Q1 结束复位后器件读取的配置信号状态。这些开关必须根据所需的配置选项进行设置。

表 1-3. 控制器 PCB 开关

原理图编号或信号编号	功能
SW1	硬件/软件 PROJ_ON 切换选择开关 HW 模式：使用物理切换开关 (SW2) 切换 PROJ_ON SW 模式：使用软件命令切换 PROJ_ON
SW2	PGU 电源（切换）— 当 SW1 设置为硬件控制模式时打开系统
SW3	HOLD_BOOTZ（DIP 开关） ON：低电平状态 — 在引导加载程序中暂停软件 正常：高电平状态 — 正常运行
SW4	Key0：德州仪器 (TI) 内部使用
SW5	Key1：德州仪器 (TI) 内部使用
SW6	Key2：德州仪器 (TI) 内部使用
SW7	MCU 复位（瞬时开关）
SW8	DMD 选择：设置为 DLP4620 — 德州仪器 (TI) 内部使用
SW9	SPI 下载或命令： 设置为 OFF 位置 — 德州仪器 (TI) 内部使用

1.2.1.1 驱动程序板 — 照明驱动程序

照明驱动程序由驱动程序板进行控制和监测。电力可从台式电源输入到驱动程序板。在进入照明驱动程序电路之前，照明驱动程序将输入电源调节至 6.5V 或 8V。照明驱动器具有适合红色、绿色和蓝色照明器的输出。这些照明器通常是 LED，但也可以使用其他照明器。有关该 EVM 的输入和输出规格，请参阅节 1.3.1。根据工作条件，PCB 的某些器件和表面可能会很热。TI 不建议在未进行适当冷却的情况下长时间使用 EVM 的最大或接近最大亮度设置。

警告

表面高温。接触会导致烫伤。请勿触摸！为降低人身伤害的风险，确保已启用适当冷却。

警告

大功率 LED。务必考虑并使用有效的光过滤器及防护墨镜。在查看强光源时，请充分了解周围的实验室环境，以最大程度降低或消除相关风险，从而避免与暂时性失明相关的事故。

照明驱动程序包含 表 1-1 中列出的端口。

H1 选择照明驱动电压。在引脚 1 和 2 上放置一根跳线可实现 6.5V 驱动。在引脚 2 和 3 上放置一根跳线可实现 8V 驱动。请勿热插拔该跳线；仅在已将电路板断电的情况下拆除或更换该跳线。

1.2.2 EVM 电缆

DLP4620SPGUQ1EVM 套件包含 表 1-4 中列出和 图 1-3 中显示的电缆。

表 1-4. EVM 电缆

名称	基准	数量
输入电源线	A	1
LED 和 热敏电阻电缆 (RGB)	B	1
光电二极管电缆	C	1
格式化板控制器到驱动程序控制文件	D	1
OpenLDI 电缆	E	1

图 1-3. DLP4620SPGUQ1EVM 套件列表 — 电缆标识符

1.3 规格

1.3.1 电气规格

表 1-5. 电气规格

参数	最小值	标称值	最大值	单位
输入				
电压	8	12	18	V
功率(1)		12	40	W
LED 前置稳压器输出				
电压		6.5 或 8(2)		V
照明驱动程序输出负载				
电压 (每个 LED 输出颜色)			7.5	V
电流 (每个 LED 输出颜色)			6	A

(1) 额定功率的条件：白平衡 LED 电流高达 6A，LED 正向电压 = 3.5V，显示占空比 = 90/10。
(2) 前置稳压器输出电压由接头 H1 的跳线位置设置。在引脚 1 和 2 上放置一根跳线可实现 6.5V 操作。

1.3.2 元件温度额定值

PCB 材料和大多数 PCB 元件的额定工作温度是 –40°C 至 105°C，包括 DLP4620S-Q1、DLPC231S-Q1 和 TPS99000S-Q1。

一些板载元件 (如开关、连接器和指示灯 LED) 不满足该温度额定值。

DLP4620SPGUQ1EVM 并非量产设计，仅用于评估。

1.3.3 输入视频规格

HDMI 和 OpenLDI 接口支持以下输入视频分辨率。这些输入视频分辨率已编程到 EVM 的 HDMI 接口的扩展显示标识数据 (EDID) EEPROM 中，使连接的计算机能够读取支持的分辨率和时序。请注意，某些计算机无法输出所有这些分辨率，尤其是 480 × 240。有关 DLPC23xS-Q1 芯片组支持的更多时序分辨率，请参阅 DLPC23xS-Q1 汽车类数字微镜器件控制器数据表。

表 1-6 中指定了 EVM 的 HDMI 接口 EDID 中指定的输入源时序。也建议将这些时序参数用于 OpenLDI 接口。

表 1-6. 支持的源分辨率的典型时序

水平分辨率	垂直分辨率	水平消隐				垂直消隐				垂直频率 (Hz)	像素时钟 (MHz)
		总计	同步 (像素时钟数)	后沿 (像素时钟数)	前沿 (像素时钟数)	总计	同步 (行数)	后沿 (行数)	前沿 (行数)		
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 和 I²C 时序

有关 SPI 和 I²C 规格的更多信息，请参阅 DLPC23xS-Q1 汽车级数字微镜器件控制器数据表。

1.4 器件信息

DLP4620SPGUQ1EVM 使用 DLP4620S-Q1 DMD，由 DLPC231S-Q1 DMD 控制器控制。当 DMD 和控制器与相应的 LED 驱动程序单元和投影光学元件配对使用时，用户可通过 USB 端口控制 PGU。

SPI 允许用户向 DLPC231S-Q1 控制器发送命令，以更改输出到 DLP4620S-Q1 DMD 的显示和校准数据。随后，该器件随附的投影和照明光学元件将光照射到 DMD 上，并重定向到用户的漫射屏进行显示。

图 2-1 概述了 DLP4620SPGUQ1EVM 系统硬件的主要硬件元件。

2 硬件

2.1 快速入门

按照以下说明设置 DLP4620SPGUQ1EVM 和主机。

2.1.1 套件组装说明

图 2-1 显示了所有连接的示意图。

1. 将 DMD 柔性电缆 (J9) 连接到光学 或 光源引擎。
2. 将 micro-USB 连接到控制器 PCB (J8) 和主机。
3. 将 RGB 照明线束连接到驱动程序板 (J1 和 J3) 和光学引擎。光学引擎的颜色与 LED 线束的颜色相对应。
4. 将控制器 PCB (J2) 的光电二极管电缆连接到位于光学引擎照明路径中的光电二极管。
5. 将 HDMI 电缆连接到控制器 PCB (J5)。将 HDMI 电缆连接到 PC HDMI 端口。
6. 将电源输入电缆连接到驱动程序板 (J10)。

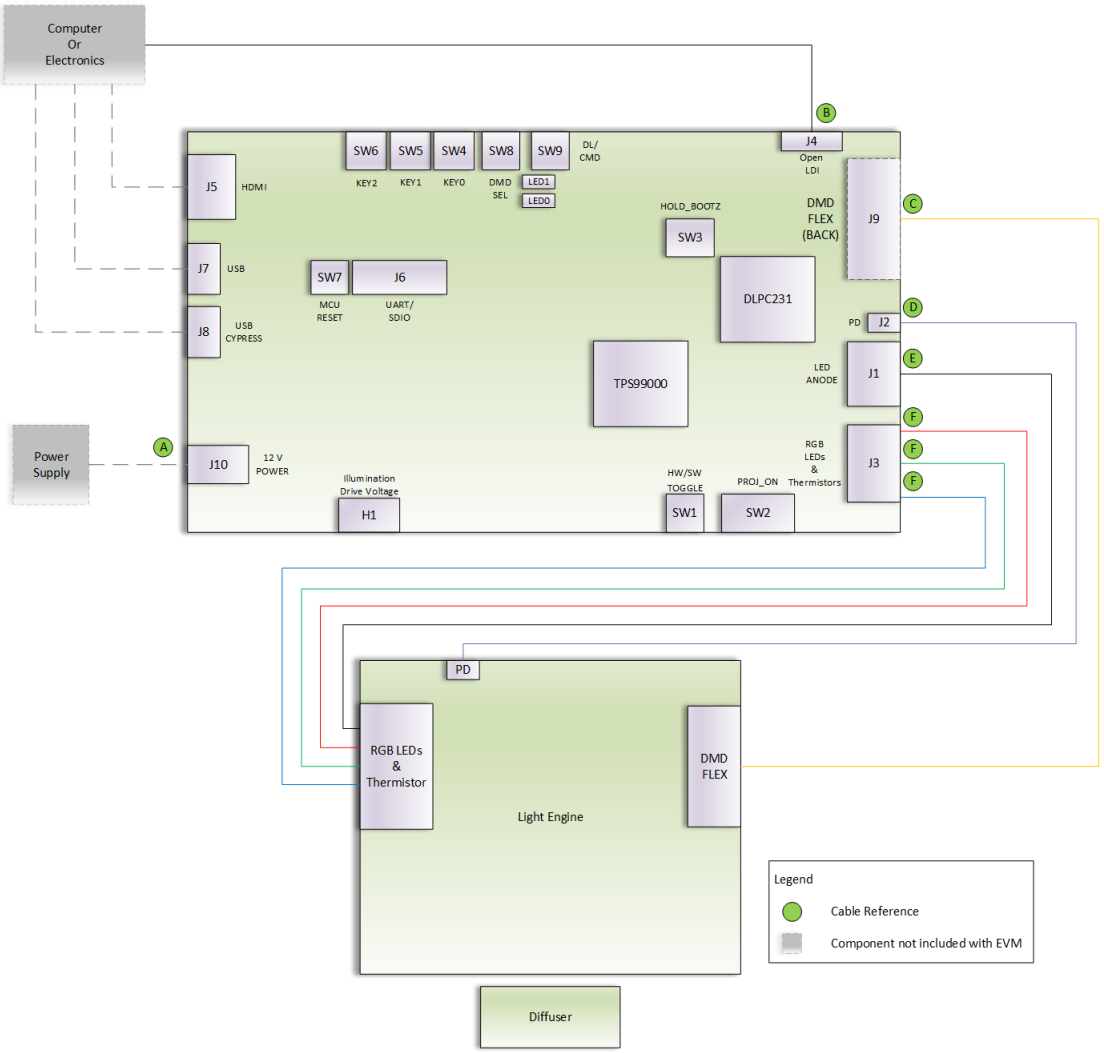


图 2-1. DLP4620SPGUQ1EVM 方框图

图 2-2. 套件列表参考

2.1.2 为 EVM 上电

1. 将硬件/软件 DIP (SW1) 开关拨到 HW 位置，以启用对 PROJ_ON 开关的手动控制。
2. 将输入电源线连接到满足表 1-5 中定义的输入电源规格的电源。红线是 V+ 端子、黑线是 V – 端子。
3. 打开电源。上电后，控制器 PCB LED 指示灯 (D7) 呈绿色亮起。除此 LED 外，MCU 电源正常 LED (D31) 和心跳 LED (D30) 分别亮起蓝色和绿色。心跳 LED 闪烁。
4. 开启 PROJ_ON 开关 (SW2)。ON 位置远离电路板，OFF 位置朝向电路板。丝印指示这些位置。控制器 PCB LED 指示灯 (D6) 呈绿色亮起。

2.2 光学引擎规范

DLP4620SPGUQ1EVM 包含一个可用于抬头显示 (HUD) 应用的光学投影系统。表 2-1 中列出了光学规规范。

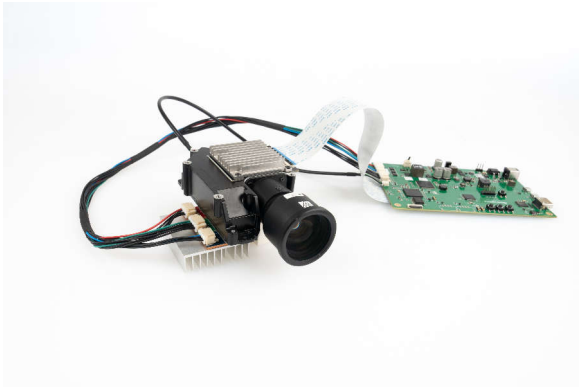


图 2-3. DLP4620SPGUQ1EVM 光模块

表 2-1. 光学模块规格

参数	最小值	标称值	最大值	单位
光通量输出	120lm			lm
投射比		1.68		
投射距离		127		mm
图像宽度		98.8		mm
f/#		2.4		
MTF		35%		
光学图像偏移		100%		
光均匀性	90%			
FOFO 对比度		1800:1		

表 2-2. 包含的 LED

颜色	制造商	器件型号
红色	Osram	Q8WP LE A
绿色	Osram	Q8WP LE CG
蓝色	Osram	Q8WP LE B

警告

大功率 LED。务必考虑并使用有效的光过滤器及防护墨镜。在查看强光源时，请充分了解周围的实验室环境，以最大程度降低或消除相关风险，从而避免与暂时性失明相关的事故。

3 软件

3.1 软件安装

1. 下载并安装 DLPC230 Control Program Lite
2. 下载并安装 图 3-1 中所示的 Cypress USB 驱动程序

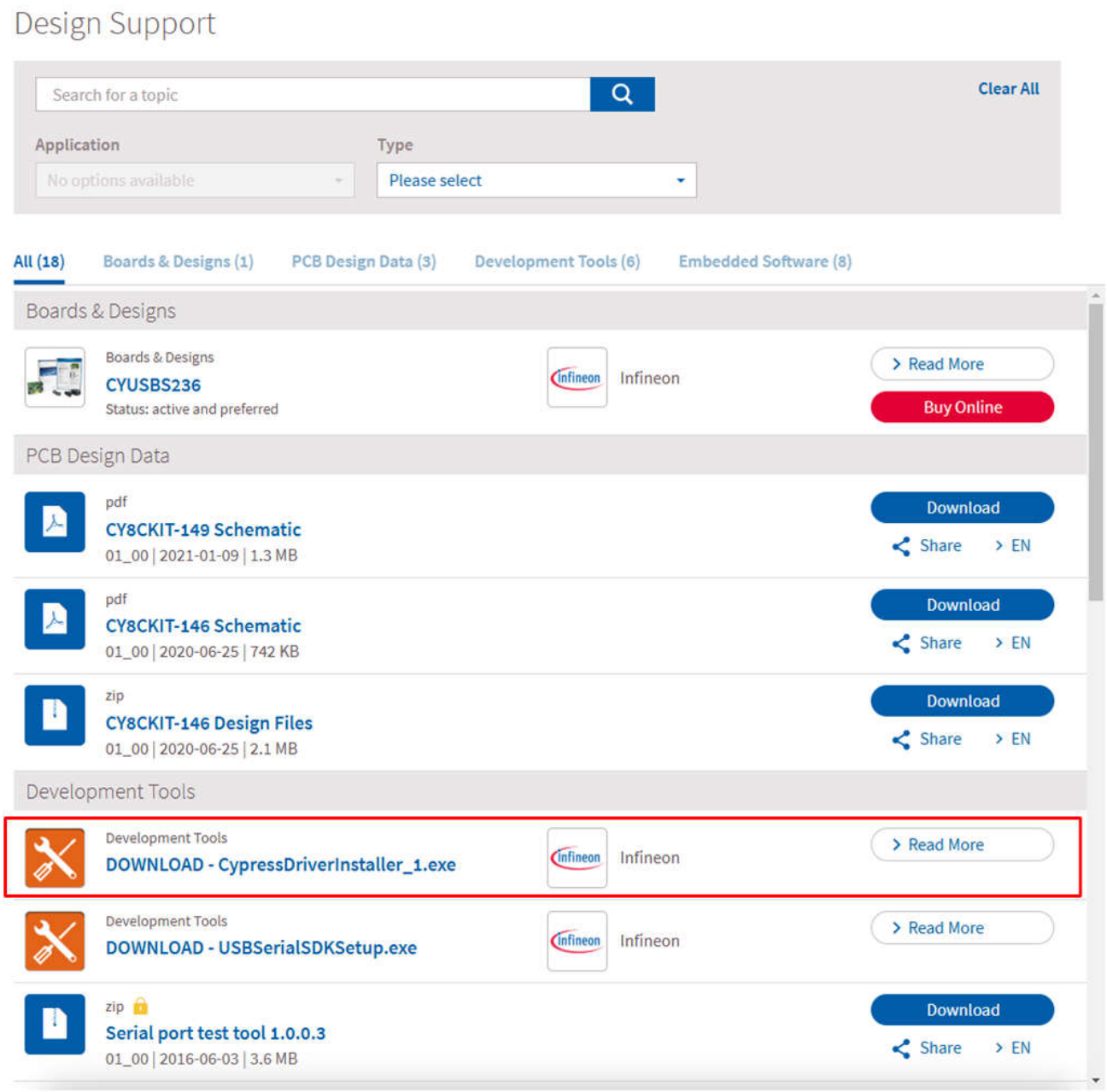


图 3-1. Cypress USB 驱动程序

3.2 将产品选项更改为 HUD 模式

1. 启动 DLPC230-Q1 Control Program Lite。
2. 在图形用户界面 (GUI) 左上角的 File 菜单中，选择 *Preferences...*

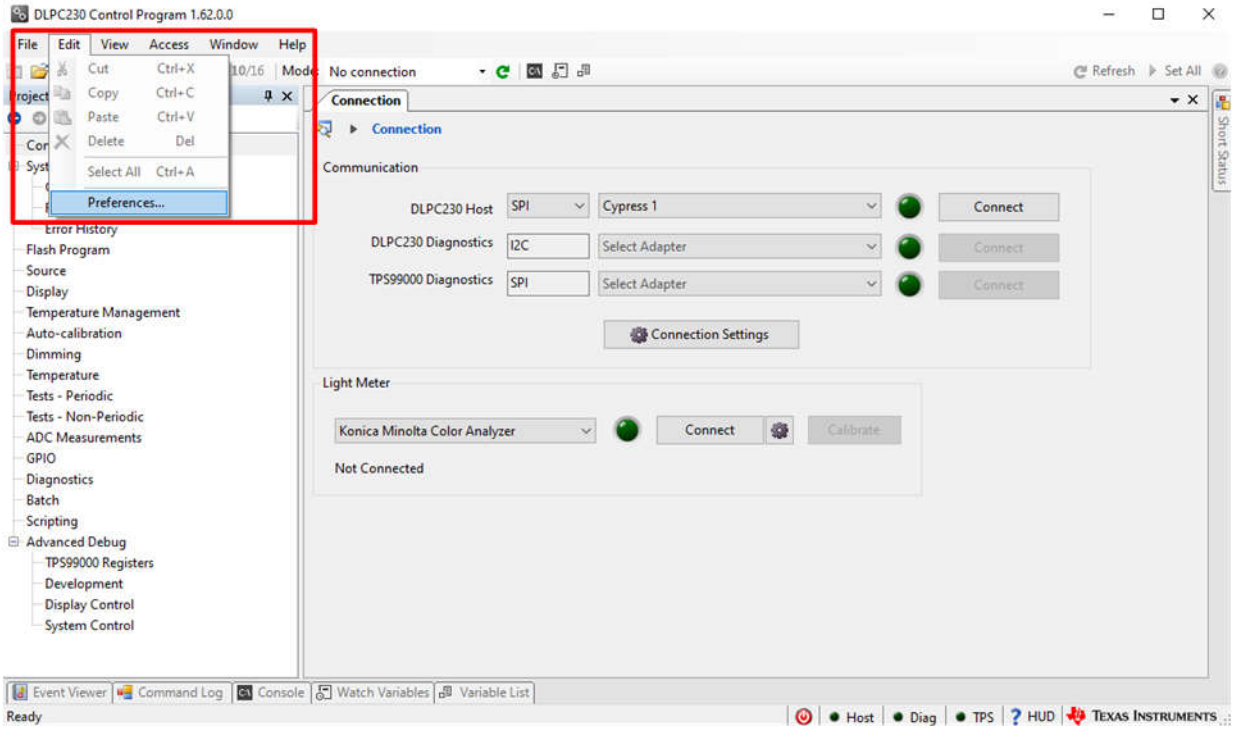


图 3-2. 更改为 HUD 产品选项 — File 菜单

3. 此时会打开一个新的 *Preferences* 窗口。选择 *Product Options*，然后使用 图 3-2 中显示的下拉框为 PGU 选择 HUD 产品选项。

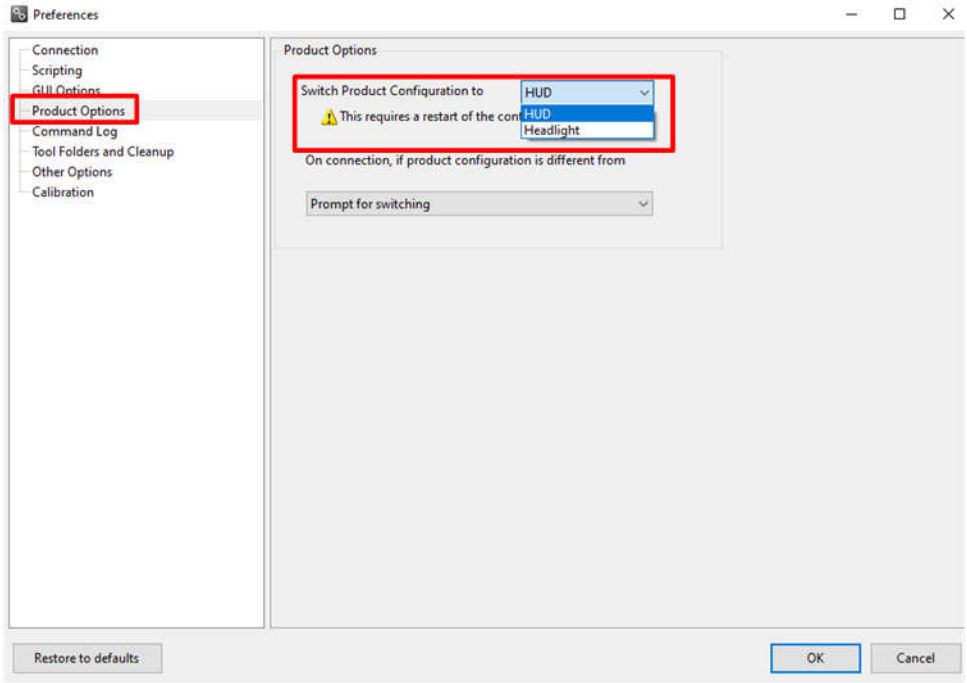


图 3-3. 选择产品选项

3.3 将 EVM 连接到 DLPC230-Q1 Control Program

1. 在 Connection 页面中，将 DLPC230-Q1 Host 设置为 SPI 并从下拉菜单中选择 *Cypress*（请参阅 图 3-4）。请注意，必须通过 micro-USB 电缆将 Cypress 连接到计算机才能在下拉菜单中显示。

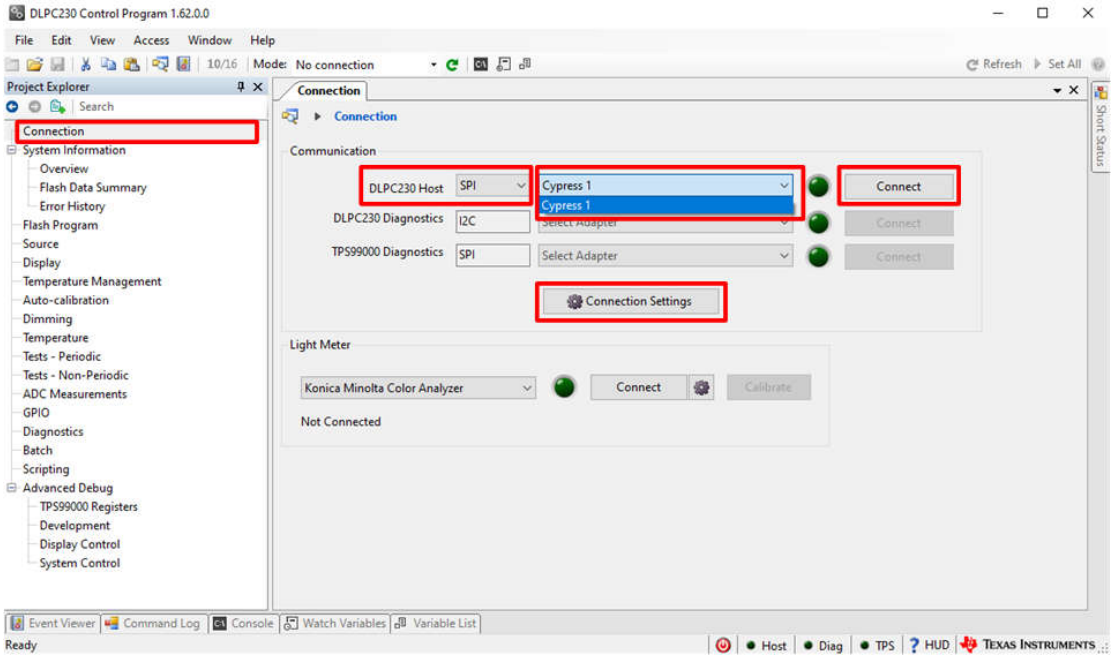


图 3-4. 通过 DLPC230-Q1 Automotive Control Program 连接到 DLPC231-Q1

2. 选择 *Connection Settings* 以确认 SPI 配置，如 图 3-5 所示。配置完成后，按 *OK*。

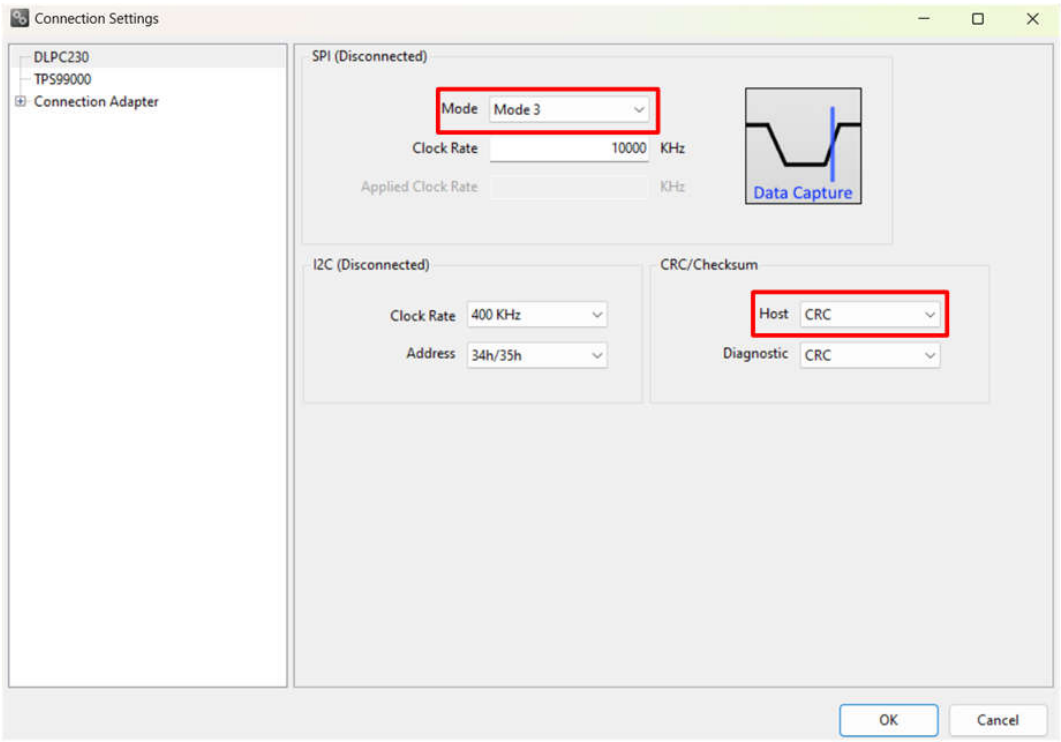


图 3-5. DLPC230-Q1 Automotive Control Program 通信设置

3. 点击 *Connect* 按钮。*Connect* 按钮旁边的绿色圆圈会亮起，表示已成功连接 DLP4620SPGUQ1EVM。

3.4 对内部 FLASH 存储器进行重新编程的步骤

DLP4620SQ1PGU EVM 配备了预编程软件和基本配置的板载串行闪存。可以使用 DLPC230-Q1 Automotive Control Program 对串行闪存进行重新编程，从而更新软件和配置。下面列出了对串行闪存重新编程的步骤。

1. 使用连接到 EVM 的 DLPC230-Q1 Automotive Control Program 导航到 *Flash Program* 选项卡。
2. 使用文件夹图标选择图像文件 (.bin) 并打开。
3. 点击 *Program and Verify Flash Memory*。

备注

请注意，如果器件处于 Display 模式，则器件会在编程期间自动切换至 Standby 模式。

4 硬件设计文件

4.1 原理图

请访问德州仪器 (TI) 的 DLP®E2E 论坛了解原理图，或者咨询应用或系统工程师。将 DLP4620SPGUQ1EVM 作为产品列出。

4.2 PCB 布局

请访问德州仪器 (TI) 的 DLP® E2E 论坛获取布局文件，或者咨询应用或系统工程师。将 DLP4620SPGUQ1EVM 作为产品列出。

在 DLP4620SQ1EVM 工具文件夹中也可以找到德州仪器 (TI) 针对 0.46" DMD 设计的仅电子元件 EVM 示例。

备注

请注意，PGU 设计与 DLP4620SQ1EVM（仅电子产品套件）类似，但不完全相同。

4.3 物料清单 (BOM)

请访问德州仪器 (TI) 的 DLP®E2E 论坛以获取 BOM，或者咨询应用或系统工程师。将 DLP4620SPGUQ1EVM 作为产品列出。

5 合规信息

5.1 REACH 合规性

按照 EU REACH 法规第 33 条的规定，TI 特此告知，此 EVM 的元件中至少含有一种含量高于 0.1% 的高度关注物质 (SVHC)。在德州仪器 (TI)，这类物质的年使用量不超过 1 吨。SVHC 是：

表 5-1. 光学引擎 SVHC 元件

元件制造商	元件类型	元件器件型号	SVHC 物质	SVHC CAS
C&K	切换 开关	GT11MSCBETR	铅	7439-92-1

6 其他信息

6.1 商标

HDMI™ is a trademark of HDMI Licensing LLC.
所有商标均为其各自所有者的财产。

7 修订历史记录

注：以前版本的页码可能与当前版本的页码不同

Changes from Revision * (April 2025) to Revision A (October 2025)	Page
• 将流明输出和屏幕宽度更新至第 2 代规范	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 DEGREDATION 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/lsds/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のご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

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

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

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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/lsds/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, INDEMITY 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

重要通知和免责声明

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TI 反对并拒绝您可能提出的任何其他或不同的条款。

最后更新日期：2025 年 10 月