User's Guide

DLP5530PROJTGQ1EVM 评估模块

摘要

DLP5530PROJTGQ1EVM 评估模块 (EVM) 是一个完整的电子和光学子系统，专用于对 DLP5530-Q1 芯片组进行控制和交互。DLP5530-Q1 芯片组由 DLP5530-Q1、DLPC230-Q1 和 TPS99000-Q1 组成。此芯片组与照明和投影光学元件、RGB LED 和光电二极管结合使用，可用于开发适用于使用全息光学元件 (HOE) 作为屏幕技术的挡风玻璃仪表组显示和透明车窗显示等应用的汽车级投影仪。此 EVM 使用窄带 LED 照明，旨在更高效地利用 HOE 薄膜。此投影仪采用 1 升左右的紧凑封装，可提供高亮度和高达 2000:1 的高对比度。它具有坚固的金属外壳，全部采用玻璃光学元件，但在量产设计中可能改用更具成本效益的塑料方案。

DLP5530PROJTGQ1EVM 不是量产设计。其仅用于评估目的。

图 1-1. DLP5530PROJTGQ1EVM

DLP5530Q1EVM 电子产品 EVM 可适配 3 种不同的光学模块配置，且均提供独立 EVM 版本。表 1-1 列出了这些不同选项。

表 1-1. 光学模块 EVM 说明

EVM 器件型号	典型应用	主要特性
DLP5530PGUQ1EVM	抬头显示	投射距离短，可在散射屏上创建 HUD 图像
DLP5530PROJQ1EVM	全彩色透明车窗显示	投射距离可变，可创建具有可扩展尺寸的大图像
DLP5530PROJTGQ1EVM	全息仪表组显示	直接绿色 LED，用于全息光学元件的窄带照明

此设计采用了 HDMI® 技术。

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商标

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1 用户指南概述

本用户指南对 DLP5530PROJTGQ1EVM 进行了概述和一般说明，并提供了开始使用该 EVM 的初始步骤。

1.1 DLP5530PROJTGQ1EVM EVM 的组成部分

DLP5530PROJTGQ1EVM 由控制器 PCB、照明驱动器 PCB、电缆和 USB 转 SPI 适配器组成。其还包括一个光学模块，旨在与电子子系统结合，以对汽车环境中功能齐全的投影仪进行评估。

1.1.1 控制器 PCB

图 1-1 中显示的控制器 PCB 包括 DLP5530-Q1 DMD、DLPC230-Q1 DMD 控制器和 TPS99000-Q1。该控制器支持来自 HDMI® 或 OpenLDI 接口的视频输入，并提供格式化和控制功能，以在 DLP5530-Q1 DMD 上显示视频。可通过 SPI 或 I²C 接口控制该 EVM。SPI 或 I²C 接口也可用于对存储 DLPC230-Q1 软件和配置的串行闪存重新编程。提供的第二个可选的 SPI 端口用于监控 TPS99000-Q1。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。还提供了可选的第二个光电二极管输入。该 EVM 包括一个排线接口，用于控制和监测照明驱动器 PCB。它还为红色、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。

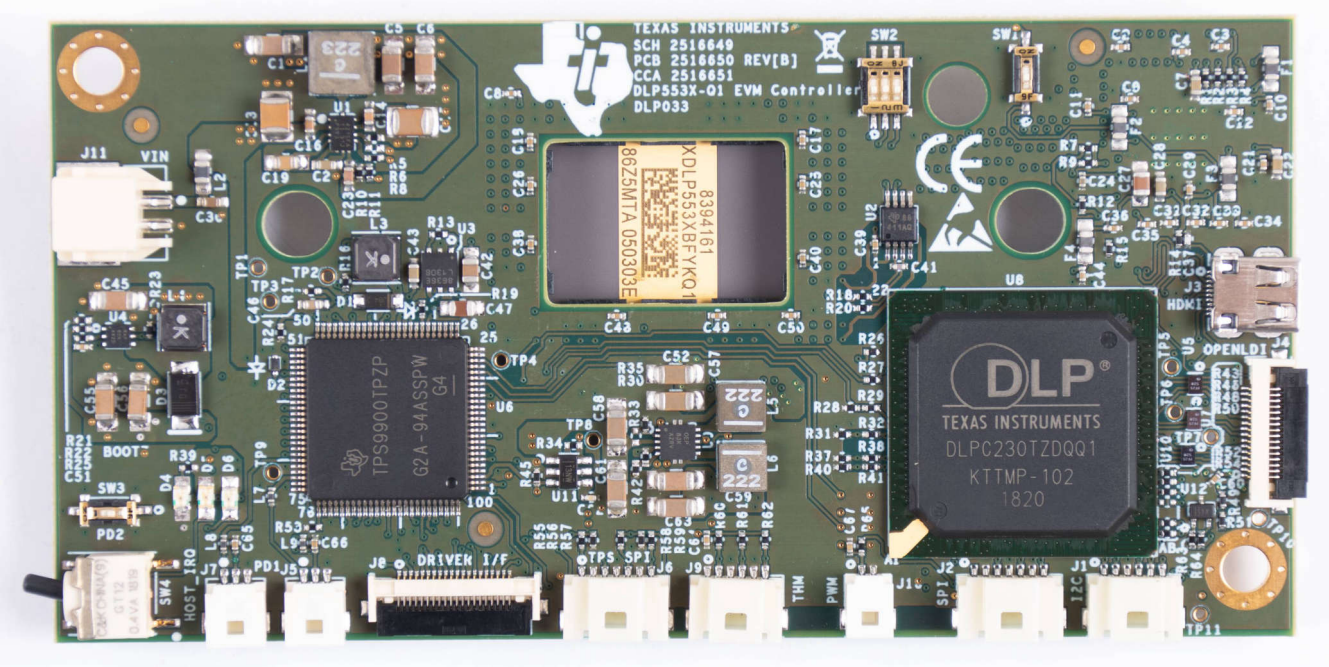


图 1-1. DLP5530PROJTGQ1EVM 控制器 PCB

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 1-1. 控制器 PCB 端口

原理图编号	功能
J1	主机 I²C、PROJ_ON、HOLD_BOOT、HOST_IRQ
J2	主机 SPI
J3	Micro HDMI
J4	OpenLDI（排线连接器）
J5	光电二极管 1
J6	TPS99000-Q1 SPI 调试
J7	光电二极管 2
J8	HUD 驱动器接口
J9	LED 热敏电阻
J10	风扇 PWM 输出(1)
J11	格式化板控制器电源

(1) 用于 RGB 显示应用的未使用端口。未提供电缆。

表 1-2. 控制器 LED 指示灯

原理图编号	功能
D4（绿色）	控制器的输入电源（来自照明驱动器） 关闭：未连接电源 开启：已连接电源
D5（绿色）	PROJ_ON 关闭：系统关闭 开启：系统开启
D6（红色）	HOST_IRQ 关闭：未将中断置为有效 开启：中断已被置为有效

表 1-3 中列出了控制器 PCB 开关。SW4 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 在结束复位后读取的配置信号状态。这些开关应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/信号编号	功能
SW1 (1)	展频启用 关闭：禁用 开启：启用
SW2 (1)	主机端口校验和选择 关闭：CRC 开启：校验和
SW2 (2)	主机接口选择 关闭：主机 SPI 开启：主机 I²C
SW2 (3)	主机 SPI 模式 关闭：模式 0 或 3 开启：模式 1 或 2
SW3	在引导时停止 关闭：在引导时不停止（继续转到主应用程序） 开启：在引导时停止
SW4	PROJ_ON 关闭：关闭系统 开启：开启系统 开启状态朝向电路板外边缘图 1-1

1.1.2 照明驱动器 PCB

图 1-2 中显示的照明驱动器 PCB 由控制器 PCB 通过排线进行控制和监测。电力可从台式电源输入到照明驱动器。照明驱动器提供反向偏置保护并通过单独的电缆为控制器 PCB 供电。在进入 LED 驱动器电路之前，照明驱动器 PCB 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 1.2.1。根据工作条件，PCB 的某些器件和表面可能会很热。

小心

表面高温。接触会导致烫伤。请勿触摸！

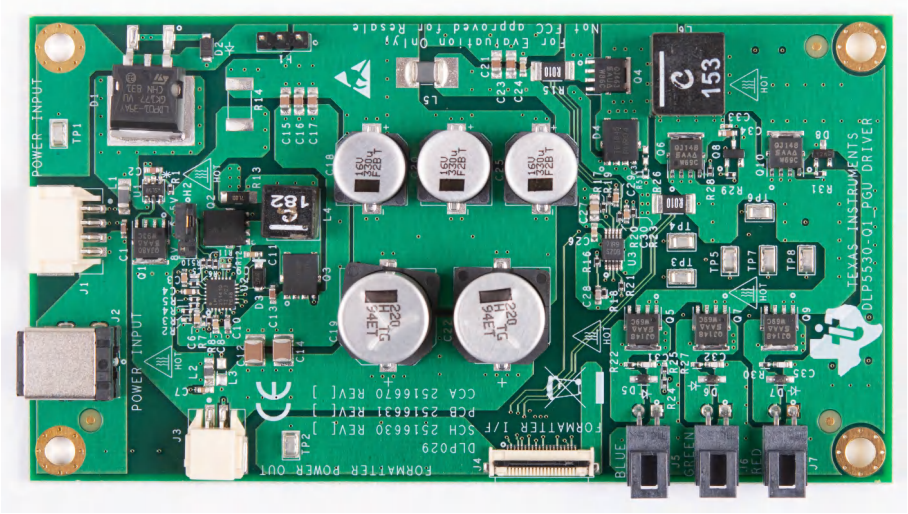


图 1-2. DLP5530PROJTGQ1EVM 照明驱动器 PCB

照明驱动器 PCB 包含表 1-4 中列出的端口。

表 1-4. 照明驱动器 PCB 端口

原理图编号	功能
J1	输入功率
J2	输入电源（可选）
J3	控制器电源
J4	控制器/驱动器控制接口
J5	蓝色照明输出 - 高达 6A 的高电流输出，采用锁定和键控连接器
J6	绿色照明输出 - 高达 6A 的高电流输出，采用锁定和键控连接器
J7	红色照明输出 - 高达 6A 的高电流输出，采用锁定和键控连接器

照明驱动器 PCB 包含表 1-5 中列出的接头。H2 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和更换该跳线。

表 1-5. 照明驱动器接头引脚

接头	PIN1	PIN2	PIN3
H1	预调节驱动电压 (6.5V 或 8V)	GND	GND
H2	用于 6.5V 驱动的 反馈电压连接	前置稳压器反馈电压	用于 8V 驱动的 反馈电压连接

1.1.3 EVM 电缆

DLP5530PROJTGQ1EVM 套件包含表 1-6 中列出和图 1-3 中显示的电缆和 Cheetah USB 转 SPI 适配器。

图 1-3. EVM 电缆

表 1-6. EVM 电缆

名称	基准	数量
输入电源线	A	1
Cheetah™ SPI 主机适配器	B	1
主机 SPI 电缆	C	1
主机 I^2C 电缆 (包括 PROJ_ON、HOLD_BOOT、HOST_IRQ 信号)	D	1
绿色照明器电源线	E	2
蓝色照明器电源线	F	2
红色照明器电源线	G	2
光电二极管电缆	I	1
驱动器转格式化板控制器电源线	J	1
格式化板控制器转驱动器控制排线	K	1
Micro HDMI 电缆	M	1

1.2 规格

1.2.1 电气规格

表 1-7. 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
照明驱动器输出负载				
电压 （每个 LED 颜色输出）			7.5	V
电流 （每个 LED 颜色输出）			6	A
温度				
工作 DMD 温度(3)	-40		105(4)	°C

(1) 标称功率的条件：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 H2 的跳线位置设置。请参阅表 1-5。
(3) 必须注意确保各个元件和 PCB 在驱动大功率负载时不超过其最高温度。
(4) 部分元件的额定温度仅为 85°C。请参阅表 1-8 获取这些元件的列表。

1.2.2 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 DLP5530-Q1、DLPC230-Q1 和 TPS99000-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。表 1-8 列出了额定温度不在 –40°C 和 105°C 之间的 EVM 元件的规格。请参阅 EVM 物料清单，查看 EVM 设计中所用各元件的温度规格。

表 1-8. 额定温度不为 –40°C 至 105°C 的 EVM 元件

电路板	参考	器件型号	制造商	说明	最低温度 (°C)	最高温度 (°C)
控制器	D4、D5	LTST-C171KGKT	Lite-On	LED，绿色，0805	-55	85
控制器	D6	LTST-C171KRKT	Lite-On	LED，红色，0805	-55	85
控制器	J3	685119248123	Wurth	连接器，micro HDMI，直角	-40	85
控制器	SW1	CVS-02TB	Copal Electronics Inc	开关，DIP，滑动式，2 位，1mm，6V	-40	85
控制器	SW2	CVS-03TB	Copal Electronics Inc	开关，DIP，滑动式，3 位，1mm，6V	-40	85
控制器	SW3	CVS-01TB	Copal Electronics Inc	开关，DIP，滑动式，1 位，1mm，6V	-40	85
控制器	SW4	GT12MSCBE	C&K 比较器	开关，SPST，鸥翼式	-30	85
控制器	U5、U7、U10、U503、U504	PCMF2HDMI2SZ	Nexperia	共模扼流圈，4 路，SMD，ESD	-40	85
控制器	U501	TFP401AIPZPRQ1	德州仪器 (TI)	IC PanelBus DVI 接收器，100-HTQFP	-40	85
照明驱动器	J2	PJ-082BH	CUI Inc	连接器电源插孔，2.5mm X 5.5mm，焊接	-25	85

控制器和照明驱动器 PCB 的 UL 火焰等级最高为 130°C。

DLP5530PROJTGQ1EVM 不是量产设计。其仅用于评估目的。DLP5530PROJTGQ1EVM 的设计仅支持在最高 40ºC 的环境温度下工作，但如果采用定制的散热解决方案，DLP5530-Q1 芯片组和随附的光学引擎支持在高达 105ºC 的温度下工作。

1.2.3 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 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，某些计算机可能无法输出所有这些分辨率，尤其是 576 × 288。

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

表 1-9 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 1-9. 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）		
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 和 I²C 时序

有关 SPI 和 I²C 规格的更多信息，请参阅 DLPC230-Q1 数据表。

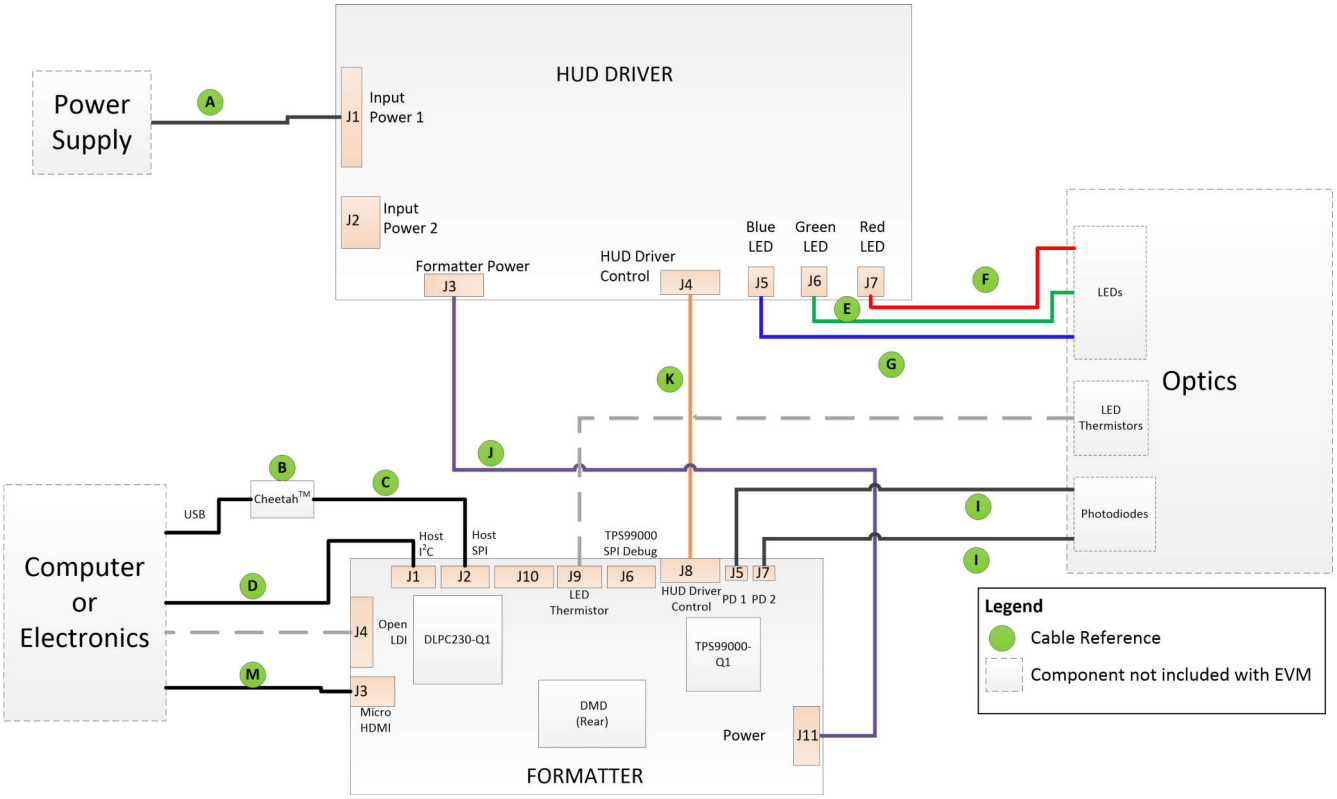
2 快速入门

按照以下说明设置 DLP5530PROJTGQ1EVM 和 PC。

2.1 套件组装说明

图 2-1 显示了所有连接的示意图。

1. 将控制器到驱动器控制接口柔性电缆连接到控制器 PCB (J8) 和照明驱动器 PCB (J4)。
2. 将主机 SPI 电缆连接到控制器 PCB (J2) 和 Cheetah 适配器主机。将 Cheetah 适配器的 USB 电缆连接到 PC。
3. 将控制器电源线连接到控制器 PCB (J11) 和照明驱动器 PCB (J3)。
4. 将照明驱动器 PCB (J5) 的蓝色照明输出电缆连接到光学引擎中的蓝色照明器。
5. 将照明驱动器 PCB (J6) 的绿色照明输出电缆连接到光学元件中的绿色照明器。
6. 将照明驱动器 PCB (J7) 的红色照明输出电缆连接到光学引擎中的红色照明器。
7. 将控制器 PCB (J5) 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。
8. 将 Micro HDMI 电缆连接到控制器 PCB (J3)。将 Micro HDMI 电缆连接到 PC HDMI 端口。
9. 将电源输入电缆连接到照明驱动器 PCB (J1)。



A. 参考字母是指表 1-6 中列出的电缆。

图 2-1. EVM 电缆连接

2.2 软件安装

1. 从 ti.com 下载 DLPC230-Q1 Control Program Lite 并进行安装。
2. 从 Total Phase 网站安装 Total Phase Cheetah USB 适配器驱动程序。

2.3 为 EVM 上电

1. 将输入电源线连接到满足表 1-7 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。
2. 打开电源。上电后，控制器 PCB LED 指示灯 (D4) 应呈绿色亮起。
3. 开启 PROJ_ON 开关 (SW4)。ON 位置远离电路板，OFF 位置朝向电路板。控制器 PCB LED 指示灯 (D5) 应呈绿色亮起。

2.4 将 EVM 连接到 DLPC230-Q1 Control Program

1. 启动 DLPC230-Q1 Control Program Lite。
2. 在 Connection 页面中，将 DLPC230-Q1 Host 设置为 SPI 并从下拉菜单中选择 Cheetah（请参阅图 2-2）。请注意，必须通过 USB 电缆将 Cheetah 连接到计算机才能在下拉框中显示 Cheetah。

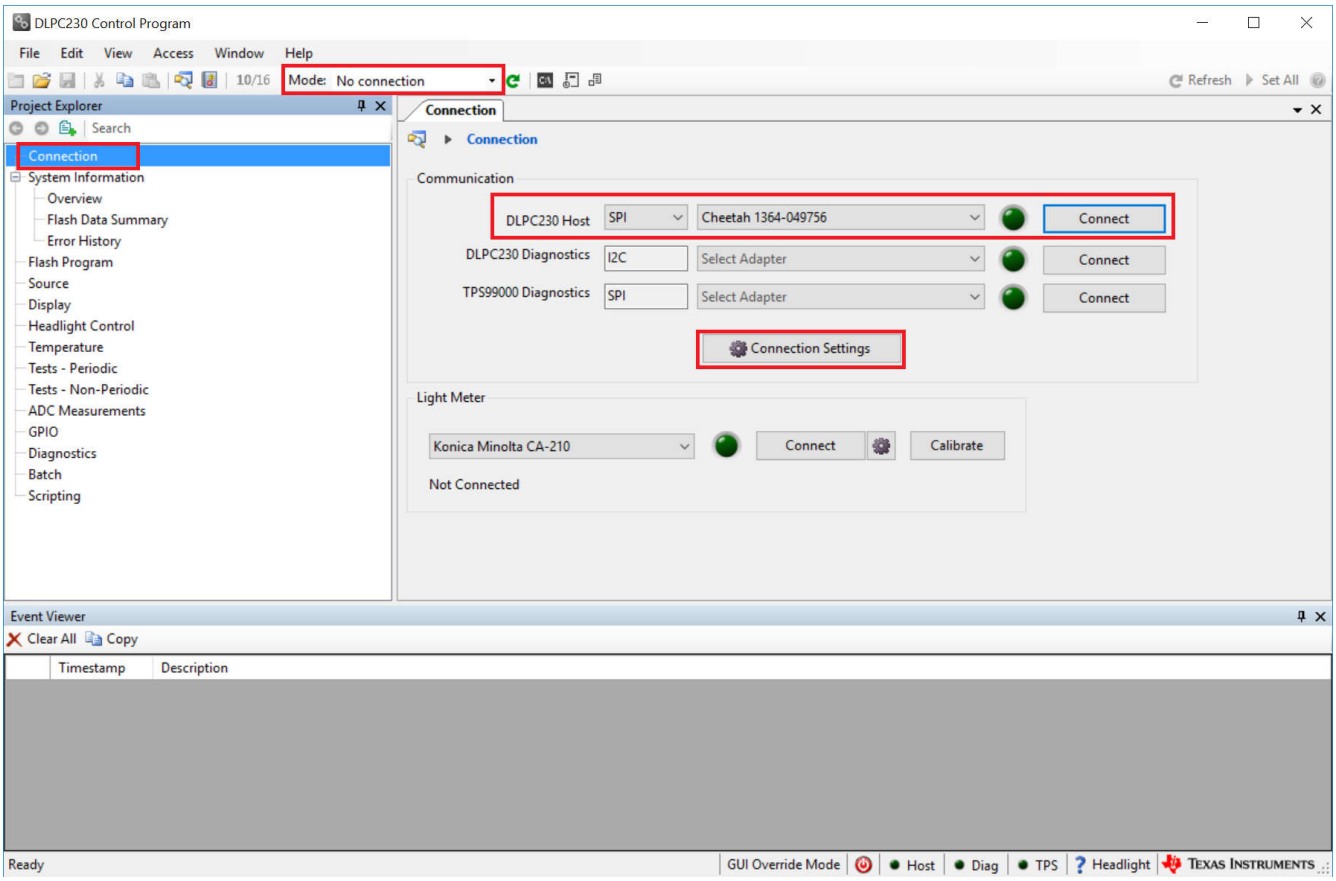


图 2-2. 使用 DLPC230-Q1 Automotive Control Program 连接到 DLPC230-Q1

3. 选择“Connection Settings”以确认图 2-3 中显示的 SPI 配置与表 1-3 中所述的控制器 PCB 开关设置相匹配。具体而言，SPI 模式和 CRC/Checksum 可能因开关设置而异。配置完成后，按“OK”。

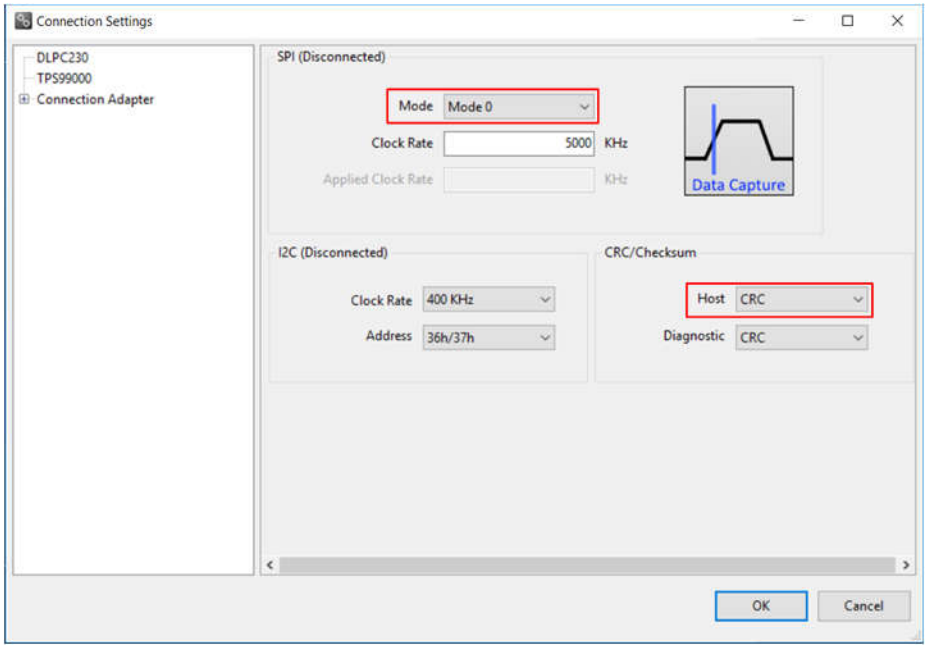


图 2-3. DLPC230-Q1 Automotive Control Program 通信设置

4. 点击 Connect 按钮。Connect 按钮旁边的绿色圆圈应亮起，表示已成功连接 Cheetah 适配器。

2.5 对内部 FLASH 存储器进行重新编程的步骤

DLP5530PROJTGQ1EVM 附带板载串行闪存，其中已预编程了软件和基本配置。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. 使用已连接到 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”。

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

3 光学引擎规格

DLP5530PROJTGQ1EVM 包含一个光学投影系统，该系统可用于挡风玻璃仪表组应用。表 3-1 中列出了光学规格。

图 3-1. DLP5530PROJTGQ1EVM 光学模块

表 3-1. 光学模块规格

参数	最小值	标称值	最大值	单位
光通量输出	95lm			lm
投射比		1.80		
投射距离	355		635	mm
图像宽度	200		350	mm
f/#		2.6		
MTF		40%		
光学图像偏移		100%		
光均匀性	80%			
FOFO 对比度		1800:1		

表 3-2. 包含的 LED

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

小心

本产品可能发出有害的光辐射。请勿直视灯光，可能会伤害眼睛。

4 REACH 合规性

按照 EU REACH 法规第 33 条的规定，我们特此告知，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 4-1. 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
Changsung Metal Co Ltd.	铝棒	AL2011	铅	7439-92-1

5 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 * (November 2019) to Revision A (December 2025) **Page**

- 更新了 HDMI 商标信息 1
- DLPU092 将光通量输出从 170lm 更改为 165lm 12
- DLPU093 将光通量输出从 100lm 更改为 95lm 12

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.

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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。
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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

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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.

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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.

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最后更新日期：2025 年 10 月