参考文献

EVM User's Guide: EV2500

EV2500 用户指南

说明

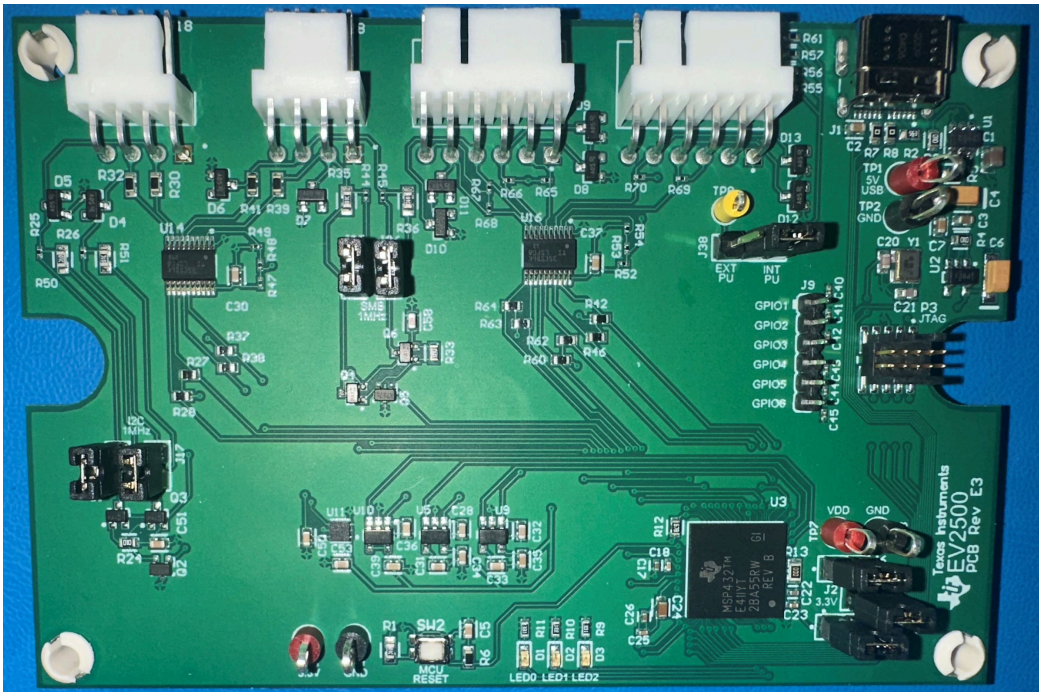
EV2500 EVM 接口板使运行 Microsoft Windows 并带有兼容人机接口器件 (HID) 驱动程序的 PC 能够通过通用串行总线 Type-C (USB-C) 端口与 TI SMBus 和 I^2C 接口电量监测计通信。未来的固件更新将提供 SPI 和 UART 功能。除了该板，还需要 PC 软件来解读电量监测计数据，才能构成完整的评估系统。

特性

- 完全通过 USB-C 端口供电。
- USB 和 SMBus/I^2C 接口之间的使用简单 API 的完整接口。
- 可对使用 1.2V 至 5V 的器件进行全电压转换。
- 支持 1MHz I^2C 和 SMBus 通信。

应用

- 便携式计算机
- 智能手机
- 无线音箱



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1 评估模块概述

1.1 简介

EV2500 EVM 接口板支持用户使用 SMBus 和 I^2C 接口与 TI 电量监测计通信（将来更新将支持 SPI/UART）。因此，在与 Battery Management Studio GUI 配合使用时，用户可以更改配置、日志数据和其他功能。EV2500 是之前 EV2400 的升级版本，支持在 I^2C 和 SMBus 上实现 1MHz 通信速度，备不同的电压上拉选项以及其他新功能。

此电路板仅用于评估目的，不支持生产。

1.2 套件内容

- EV2500 电路模块
- 4 引脚插座到插座连接器

1.3 规格

EV2500 使用 MSP432E411Y 控制器作为通信的主要主机。控制器固件存储在闪存中，并在加电时由内核执行。

1.4 器件信息

EV2500 通过 MSP432E411 从器件和主机发送和接收信息，同时使用 LSF0108DGS 在控制器和所连接器件之间进行电平转换。使用 TPS73618DBVR (1.8V)、TPS73633DBVR (3.3V)、TPS73601DBVR (1.2V) 和 TLV76750DRVT (5V) 创建内部 LDO 系统。

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2 硬件

2.1 电源要求

EV2500 使用连接到主机计算机上的 USB 端口供电。

2.2 设置

图 2-1 显示了计算机和 TI 电池电量计之间使用 EV2500 进行通信的典型设置。以下各节介绍 EV2500 上可用的每一个跳线选项。

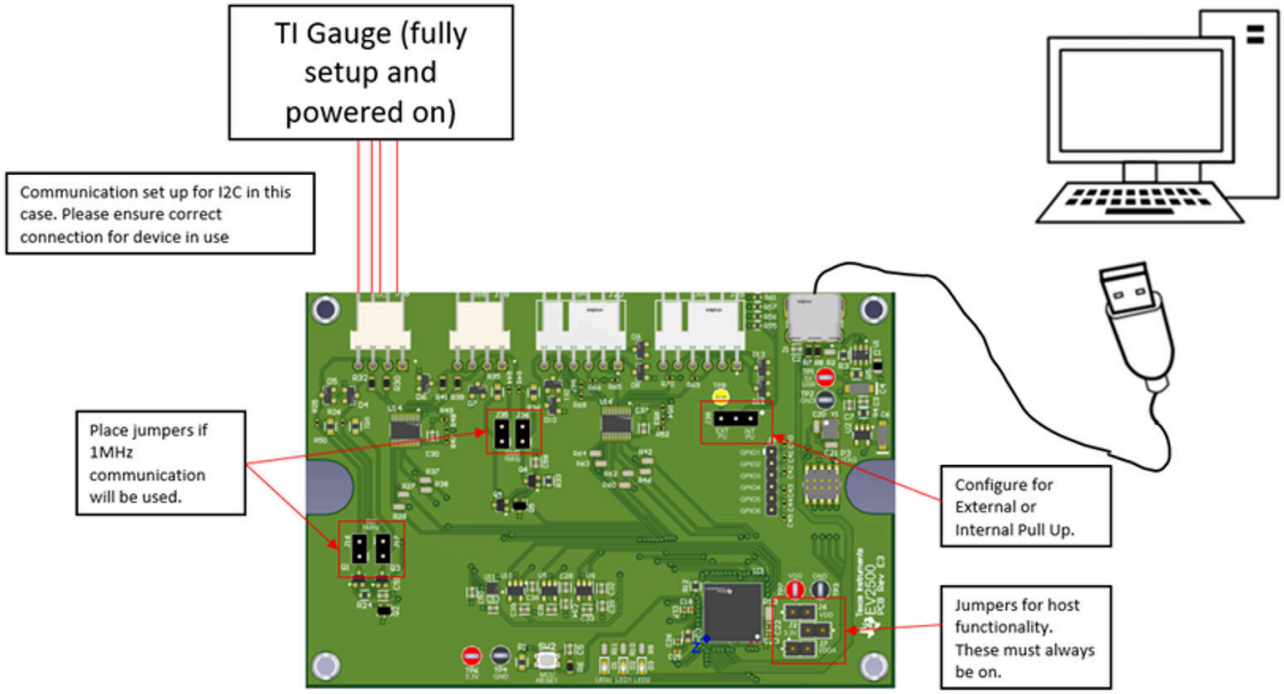


图 2-1. 设置和配置

2.3 接头信息

2.3.1 USB 接口

接口板连接到主机计算机上的 USB 端口，并由该端口供电。USB 上的所有通信均为人机接口设备 (HID) 类。

2.3.2 通信接口

表 2-1 中介绍了 EV2500 接口。

表 2-1. 通信接口

参考指示符	功能	功能
J18：I²C	I²C 接口端口	用于连接目标 I²C 器件的端子块
J28：SMBus	SMBus 接口端口	用于连接目标 SMBUS 器件的端子块
J20：SPI	SPI 接口端口	用于连接目标 SPI 器件的端子块
J15：UART	UART 接口端口	用于连接目标 UART 器件的端子块

2.3.3 GPIO 接口（未来实现）

EV2500 有 6 个连接到 EV2500 主机的可编程 GPIO 引脚。如果用户要对这些引脚进行编程，需要使用 JTAG 连接 (P3) 对 MSP432 主机进行编程或使用引导加载程序对其进行编程。未来的固件更新中会提供 GPIO 支持。

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2.4 跳线信息

2.4.1 上拉接口

EV2500 有两个连接到通信线路的上拉电压选项：内部和外部。J38 接头的方向决定了选择哪个选项。

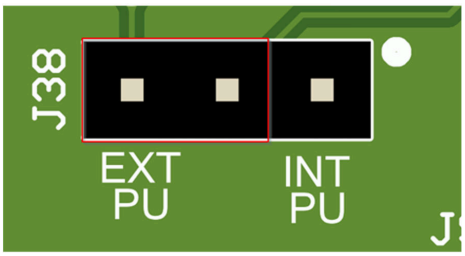


图 2-2. 外部上拉配置

如果配置了外部上拉电阻，则可以选择 1.2V 至 5V 之间的任何电压。电压需要通过连接到 EXT PU 的测试点 TP8 来从外部供电，或通过在每个连接的 VVOD 引脚处连接到目标器件进行外部供电。在提供外部电压之前，请确认 J28 的接头配置正确。

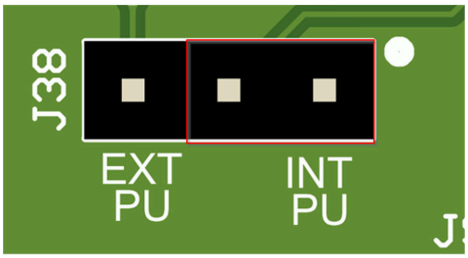


图 2-3. 内部上拉配置

如果选择了内部上拉选项、则 EV2500 使用板载 LDO 系统将电压上拉至 1.2V、1.8V、3.3V 或 5V。可以通过 bqStudio 向主机发送命令来更改这些选项。如果使用了 LDO 系统，请确认已针对此选项正确配置 J38 接头。

2.4.2 1MHz 上拉接口

EV2500 具有可配置选项，在 I^2C 或 SMBus 采用 1MHz 通信速度时，这些选项支持启用更强的上拉电阻。只要使用 1MHz 通信，就必须将跳线置于相应的跳线上。

在此电路板上，J16 和 J17 用于 I^2C 上拉选项，J35 和 J36 用于 SMBus 上拉选项，如图 2-4 所示。

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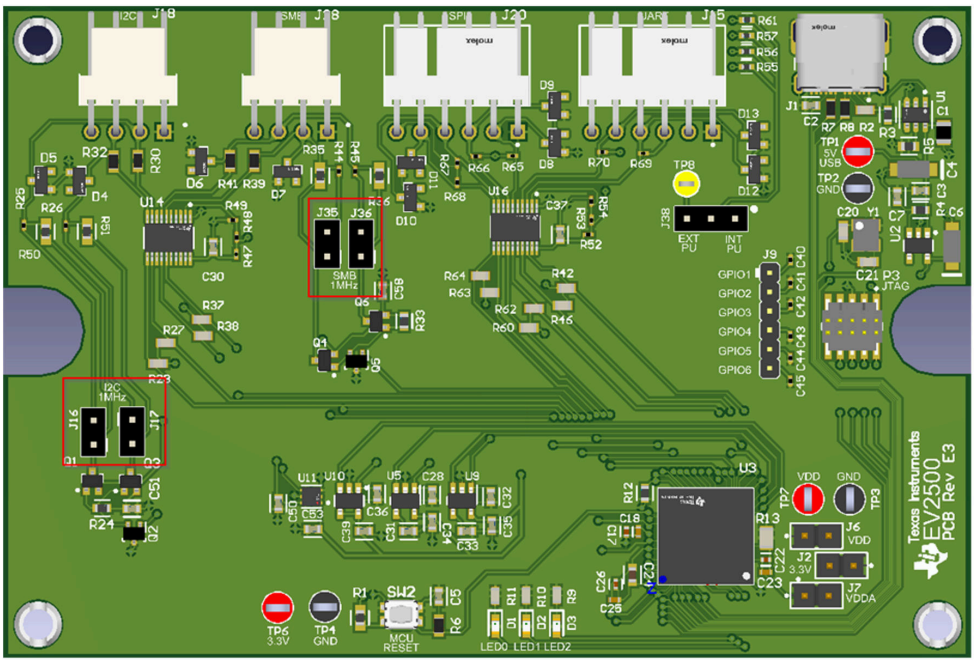


图 2-4. SMBus 和 I2C 1MHz 上拉接头位置

2.4.3 MCU 电源接头

MCU 旁边是三个接头，这些接头允许为 MCU 正确供电。J2、J6 和 J7 接头选项应始终连接跳线。

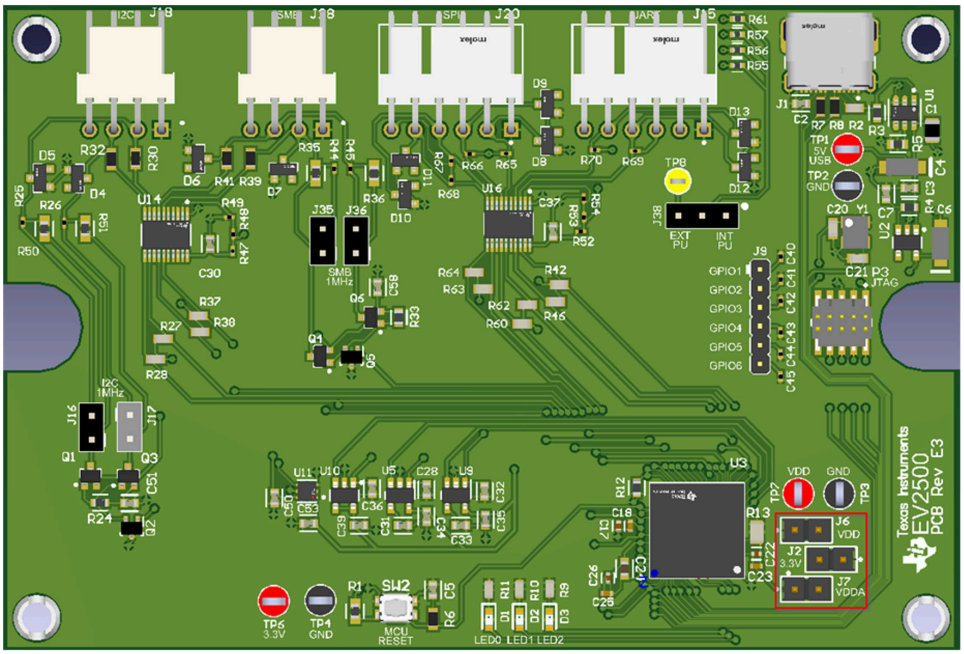


图 2-5. MCU 电源接头位置

2.5 按钮

电路板上的单个按钮为 SW2，这是 MCU 的复位按钮。按下此按钮会使 MCU 复位。

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2.6 接口

2.6.1 概述

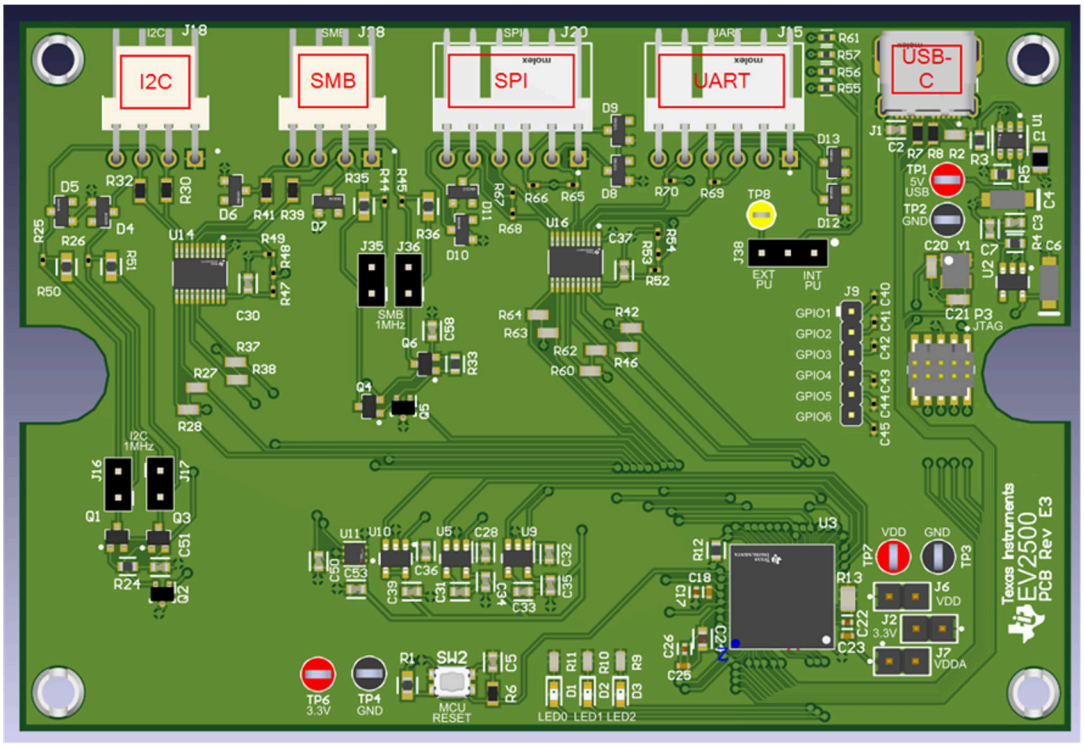


图 2-6. EV2500 接口连接概览

2.6.2 I²C 接口

I²C 接口支持主机计算机通过在 I²C 总线上具有节点的两线制 I²C 接口与电池监控器件和 EEPROM 等 I² C 接口进行交互。将 SCL、SDA 和 GND 连接到目标器件。如果目标使用的电压不是 EV2500 的 LDO 系统提供的电压，VVOD 可用于从外部对线路进行上拉操作。引脚基准位于电路板的背面。

表 2-2. I²C 接口

引脚	名称	说明
1	VSS	I²C 接口的接地。
2	SCL	I²C 时钟连接。该线路可由 EV2500 上拉至 1.2V、1.8V、3.3V 或 5V，也可以通过外部手段上拉至 1.2V 至 5V 范围内的任意电压。通信速度可以在 100kHz、400kHz 和 1MHz 之间变化。
3	SDA	I²C 数据连接。该线路可由 EV2500 上拉至 1.2V、1.8V、3.3V 或 5V，也可以通过外部手段上拉至 1.2V 至 5V 范围内的任意电压。通信速度可以在 100kHz、400kHz 和 1MHz 之间变化。
4	VVOD	可选电压连接。如果选择了外部 PU，此引脚可提供上拉所需的电压。如果选择了内部 PU，请确保此线路上不存在电压。

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2.6.3 SMBus 接口

SMBus 接口使主机计算机能够与采用 SMBUS 协议的节点进行交互。将 SCL、SDA 和 GND 连接至目标器件。如果目标使用的电压不是 EV2500 的 LDO 系统提供的电压，VVOD 可用于从外部对线路进行上拉操作。引脚基准位于电路板的背面。

表 2-3. SMBus 接口

引脚	名称	说明
1	VSS	SMBus 接口的接地。
2	SCL	SMBus 时钟连接。该线路可由 EV2500 上拉至 1.2V、1.8V、3.3V 或 5V，也可以通过外部手段上拉至 1.2V 至 5V 范围内的任意电压。通信速度可以在 100kHz、400kHz 和 1MHz 之间变化。
3	SDA	SMBus 数据连接。该线路可由 EV2500 上拉至 1.2V、1.8V、3.3V 或 5V，也可以通过外部手段上拉至 1.2V 至 5V 范围内的任意电压。通信速度可以在 100kHz、400kHz 和 1MHz 之间变化。
4	VVOD	可选电压连接。如果选择了外部 PU，此引脚可提供上拉所需的电压。如果选择了内部 PU，请确保此线路上不存在电压。

2.6.4 SPI 接口（未来实现）

借助 SPI 接口，主机计算机可以通过 4 线 SPI 接口与 SPI 接口（例如，电池监控器件）进行交互。将 VSS、SPICS、SPICLK、SPIDO 和 SPIDI 连接到目标器件。为确保信号完整性，这些线路连接了上拉电阻器，请确认上拉电压设置正确。如果目标使用的电压不是 EV2500 的 LDO 系统提供的电压，VVOD 可用于从外部对线路进行上拉操作。

表 2-4. SPI 接口

引脚	名称	说明
1	VSS	SPI 接口的接地。
2	SPICS	SPI 芯片选择连接。该线路可由 EV2500 上拉至 1.2V、1.8V、3.3V 或 5V，也可以通过外部手段上拉至 1.2V 至 5V 范围内的任意电压。
3	SPICLK	SPI 时钟数据连接。该线路可由 EV2500 上拉至 1.2V、1.8V、3.3V 或 5V，也可以通过外部手段上拉至 1.2V 至 5V 范围内的任意电压。
4	SPIDO	SPI 数据输出逻辑。此线路包含从 EV2500 主机发送的信息。该线路可由 EV2500 上拉至 1.2V、1.8V、3.3V 或 5V，也可以通过外部手段上拉至 1.2V 至 5V 范围内的任意电压。
5	SPIDI	SPI 数据输入连接。此线路包含从目标器件接收的信息。该线路可由 EV2500 上拉至 1.2V、1.8V、3.3V 或 5V，也可以通过外部手段上拉至 1.2V 至 5V 范围内的任意电压。
6	VVOD	可选电压连接。如果选择了外部 PU，此引脚可提供上拉所需的电压。如果选择了内部 PU，请确保此线路上不存在电压。

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2.6.5 UART 接口（未来实现）

借助 UART 接口，主机计算机可以通过 2 线 UART 接口与 UART 接口（例如，电池监控器件）进行交互。将 VSS、TXD 和 RXD 连接到目标器件。为确保信号完整性，这些线路连接了上拉电阻器，请确认上拉电压设置正确。如果目标使用的电压不是 EV2500 的 LDO 系统提供的电压，VVOD 可用于从外部对线路进行上拉操作。

表 2-5. UART 接口

引脚	名称	说明
1	VSS	UART 接口的接地。
2	开路	开放端口，可以保持悬空和断开。
3	VVOD	可选电压连接。如果选择了外部 PU，此引脚可提供上拉所需的电压。如果选择了内部 PU，请确保此线路上不存在电压。
4	TXD	UART 目标封装的连接线路。此线路包含从 EV2500 主机发送的信息。该线路可由 EV2500 上拉至 1.2V、1.8V、3.3V 或 5V，也可以通过外部手段上拉至 1.2V 至 5V 范围内的任意电压。
5	RXD	UART 接收包的连接线路。此线路包含从目标器件发送的信息。该线路可由 EV2500 上拉至 1.2V、1.8V、3.3V 或 5V，也可以通过外部手段上拉至 1.2V 至 5V 范围内的任意电压。
6	开路	开放端口，可以保持悬空和断开。

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3 软件

3.1 软件说明

EV2500 已经过预编程，包含立即开始测试所需的固件。有关未来更新的编程说明，请参见节 3.5。

3.2 软件安装

3.3 GUI 安装

请访问 Battery Management Studio 页面来查看安装说明。https://www.ti.com/tool/BQSTUDIO

3.4 软件开发

3.5 编程选项

对于未来的实施，可以使用 TI 的 LMFLASHPROGRAMMER 对 EV2500 进行编程。下载此工具，然后再进行下一步。

首先，将 EV2500 置于 ROM 模式。这是通过断开器件电源并在 I2C 接口的 SCL 和 GND 之间放置跳线来完成，如图 3-1 所示。

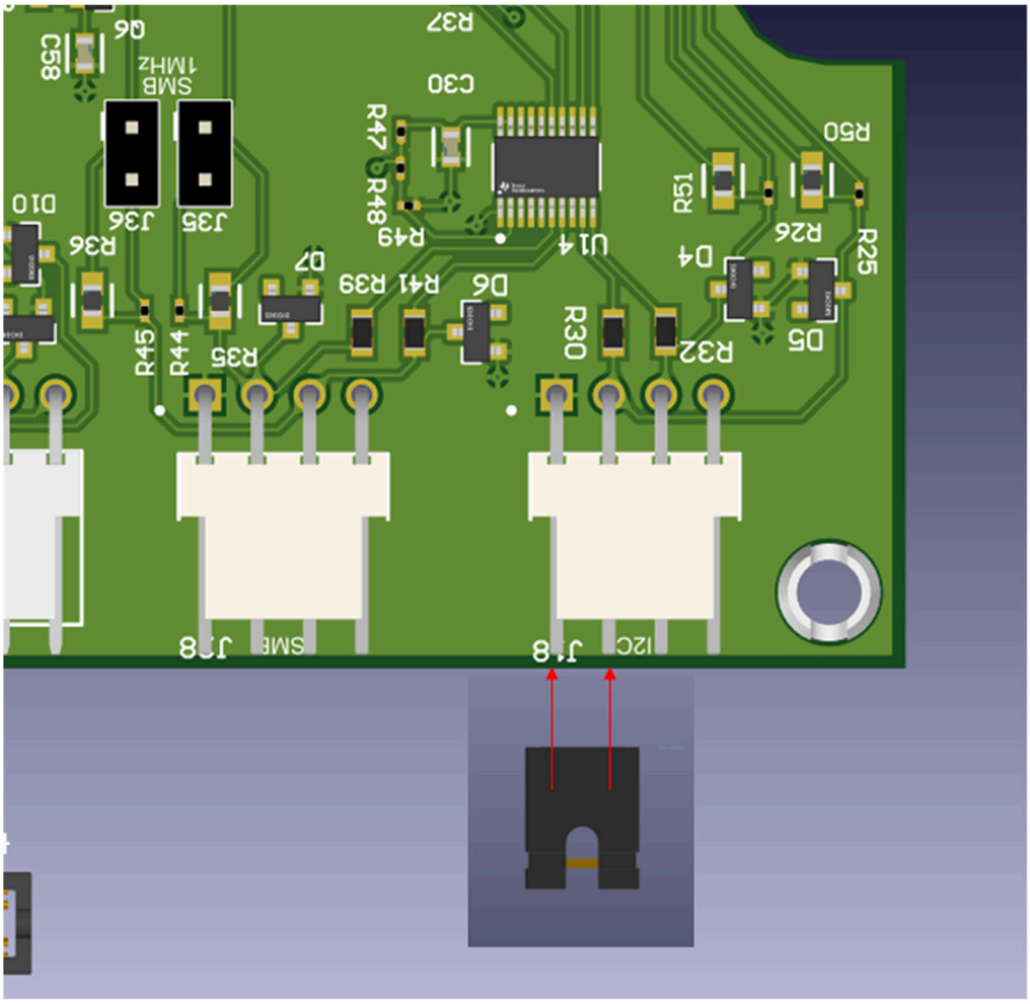


图 3-1. 引导加载程序跳线的放置

放置跳线后，连接到 USB-C 端口为 EV2500 供电。当即使已通电但指示灯仍熄灭时，用户知道 EV2500 处于 ROM 模式。如果 LED 仍然亮起，请重试此过程。

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打开 LMFLASHPROGRAMMER 应用程序并导航至“Configuration”选项卡。在“Interface”下拉列表中，选择“USB DFU”并按“refresh”。如果器件处于 ROM 模式，可以看到“Tiva Device Firmware Update”选项。观察到这一情况后，从 I2C 接口上移除 SCL/GND 跳线，如图 3-2 所示。

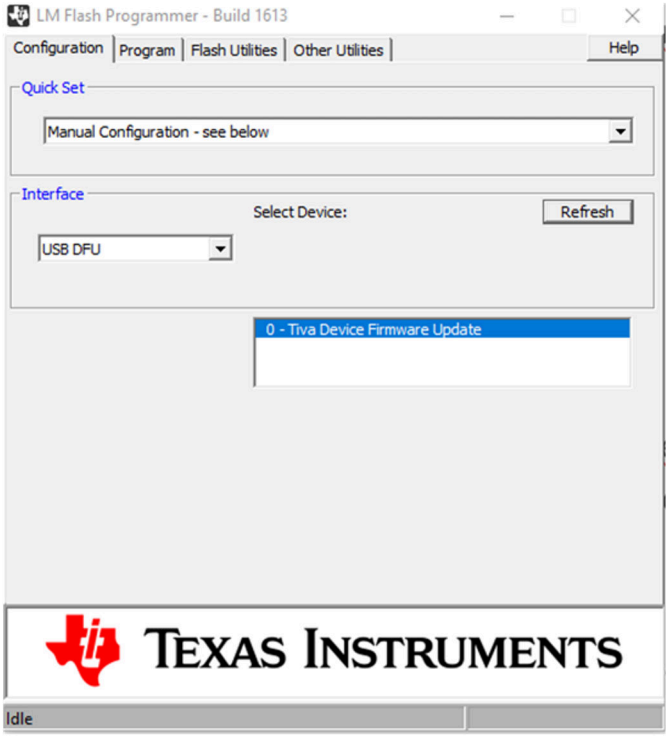


图 3-2. LMFLASHPROGRAMMER 配置

接下来，点击“Program”选项卡，选择包含更新固件的 .bin 文件，然后按“Program”。如果成功完成此操作，则在编程完成后，LED 会重新亮起。

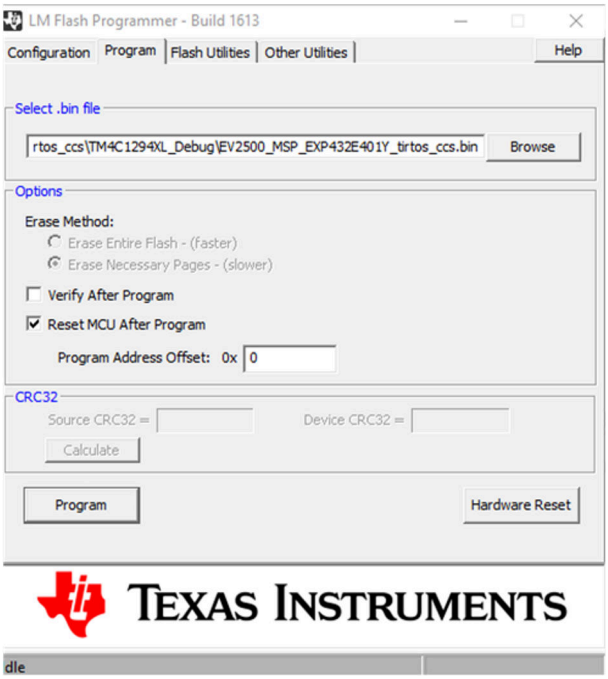


图 3-3. LMFLASHPROGRAMMER 编程

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4 硬件设计文件

4.1 原理图

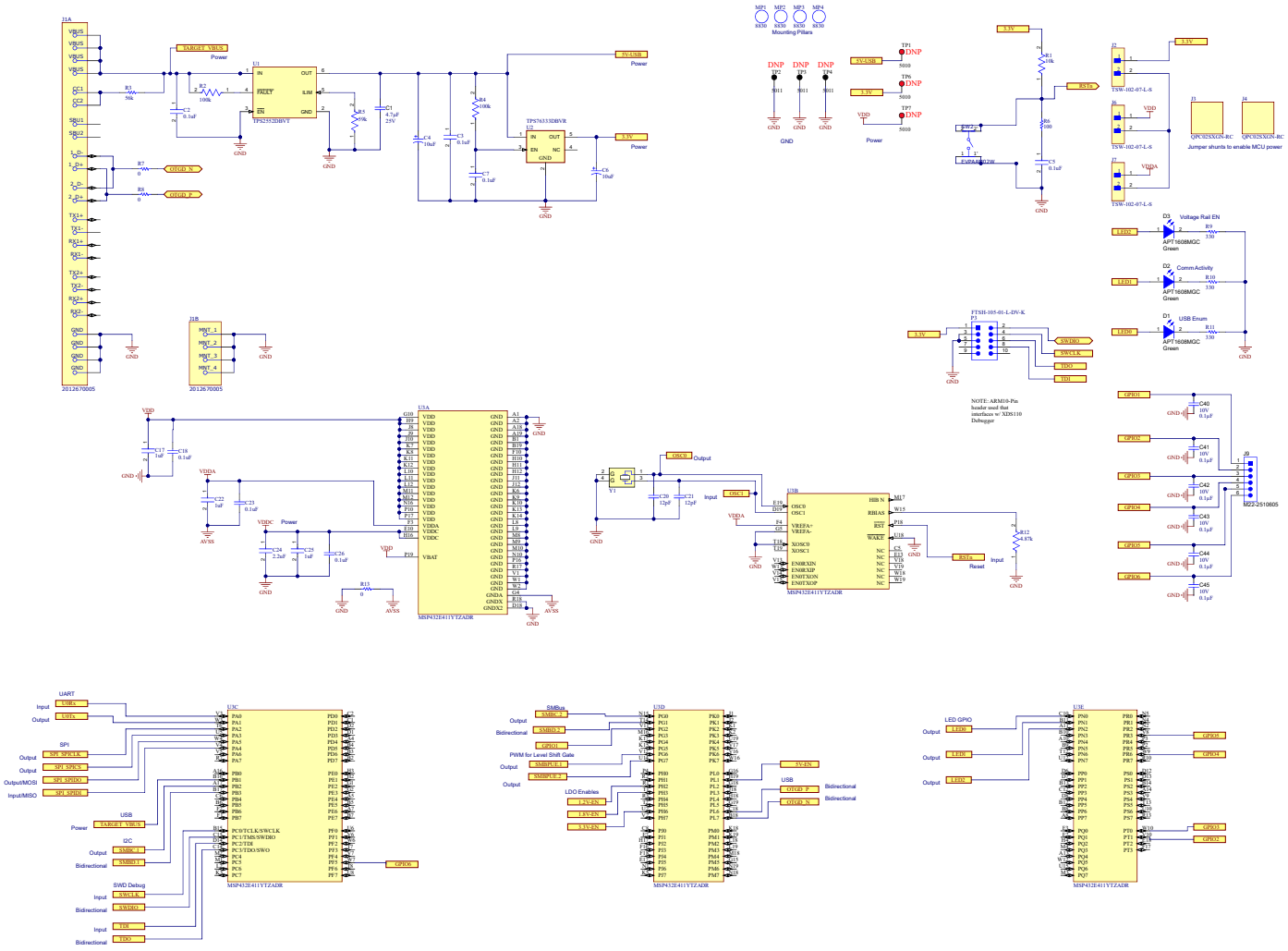


图 4-1. BMS061 MCU 和外设

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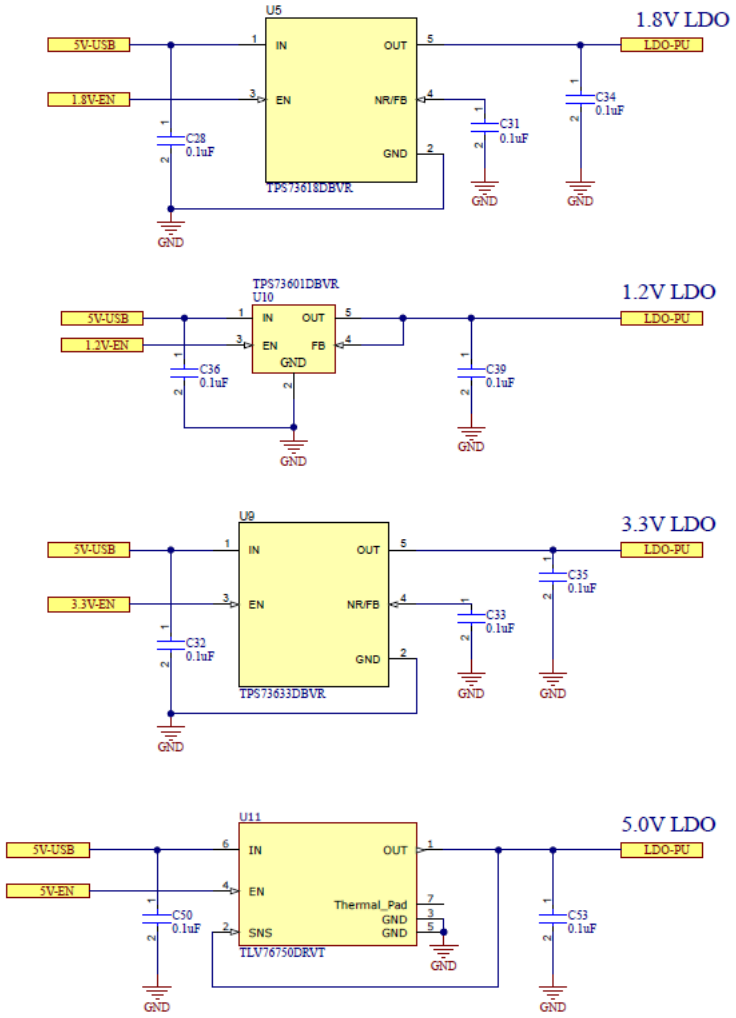


图 4-2. BMS061 偏置电源

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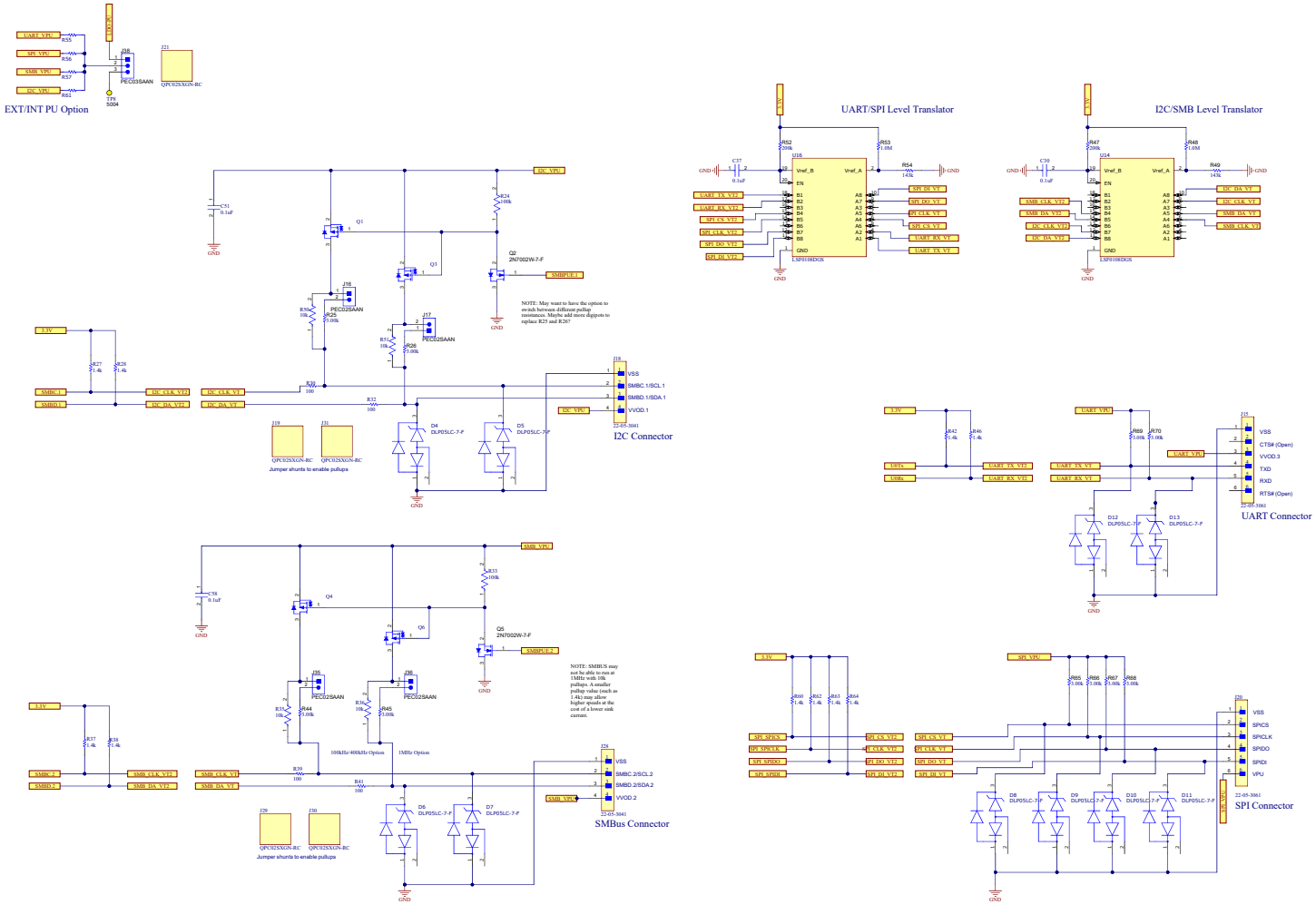


图 4-3. BMS061 串行总线接口

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4.2 PCB 布局

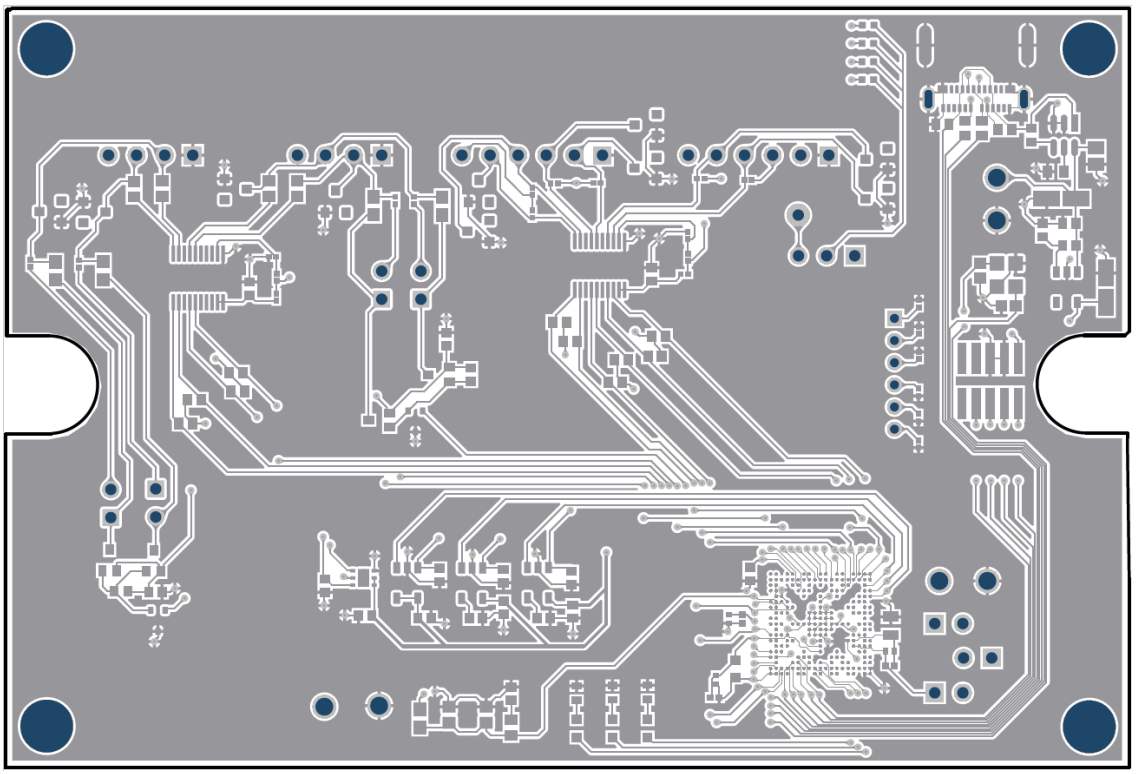


图 4-4. EV2500E3 顶层

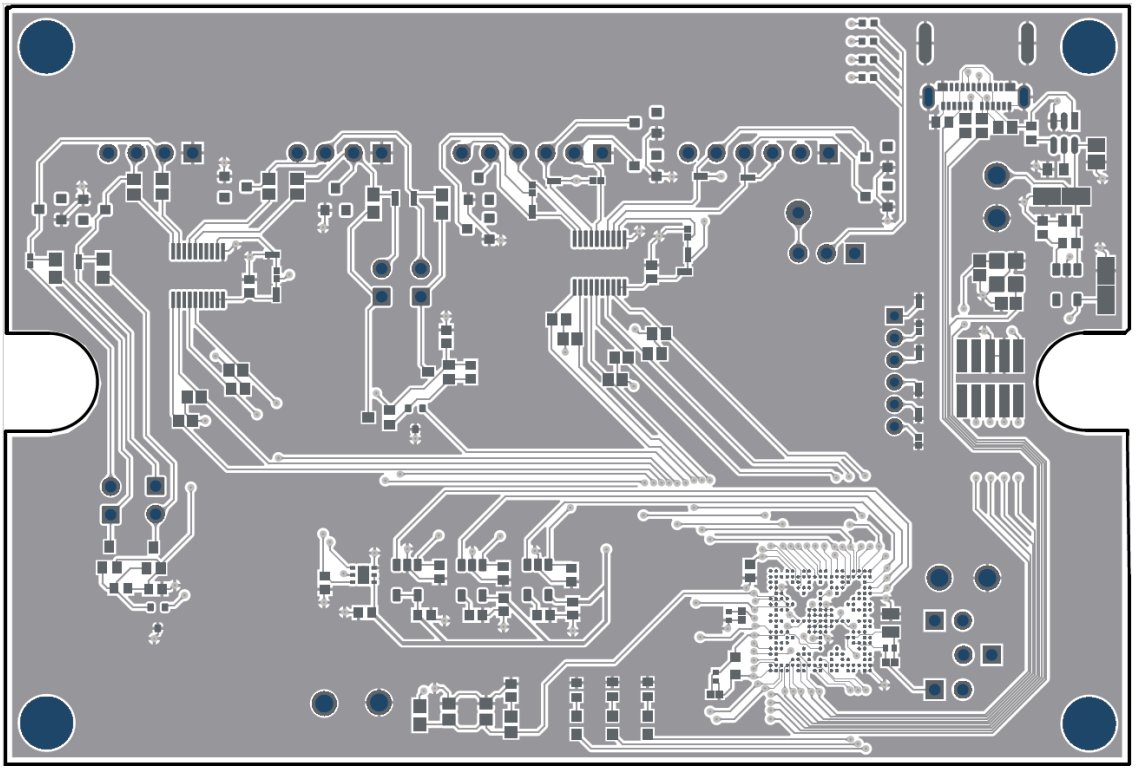


图 4-5. EV2500E3 顶层掩膜

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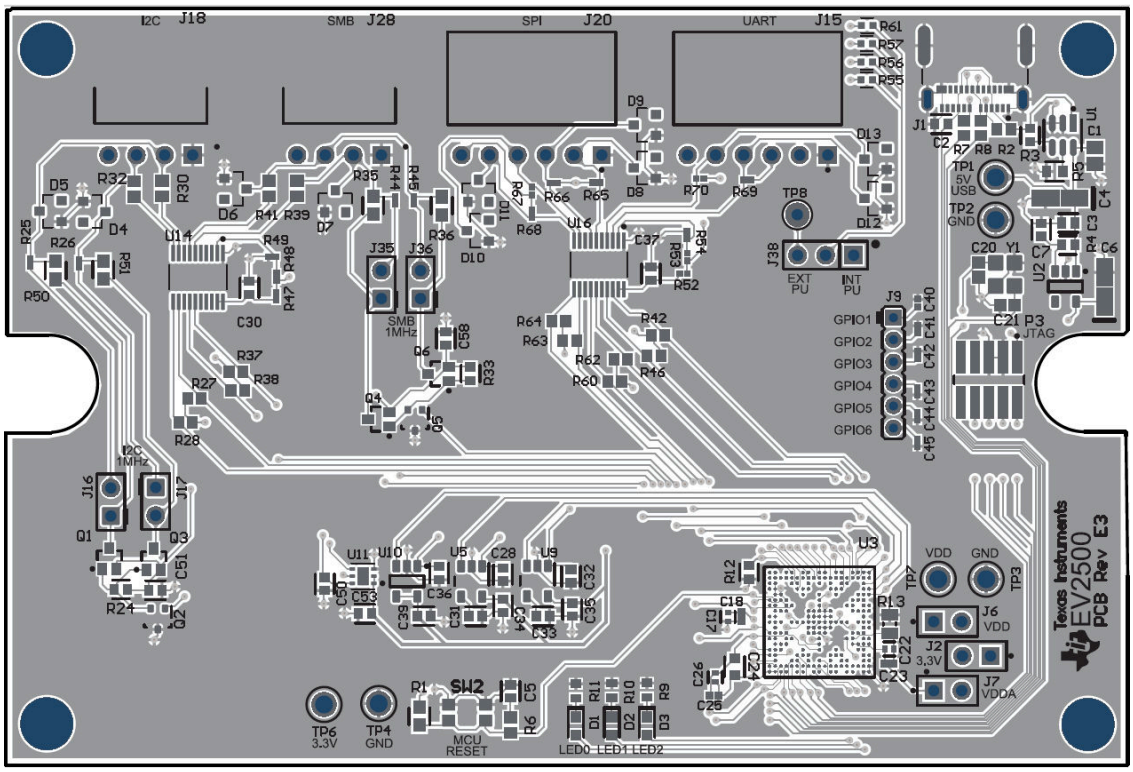


图 4-6. EV2500E3 俯视图合成图

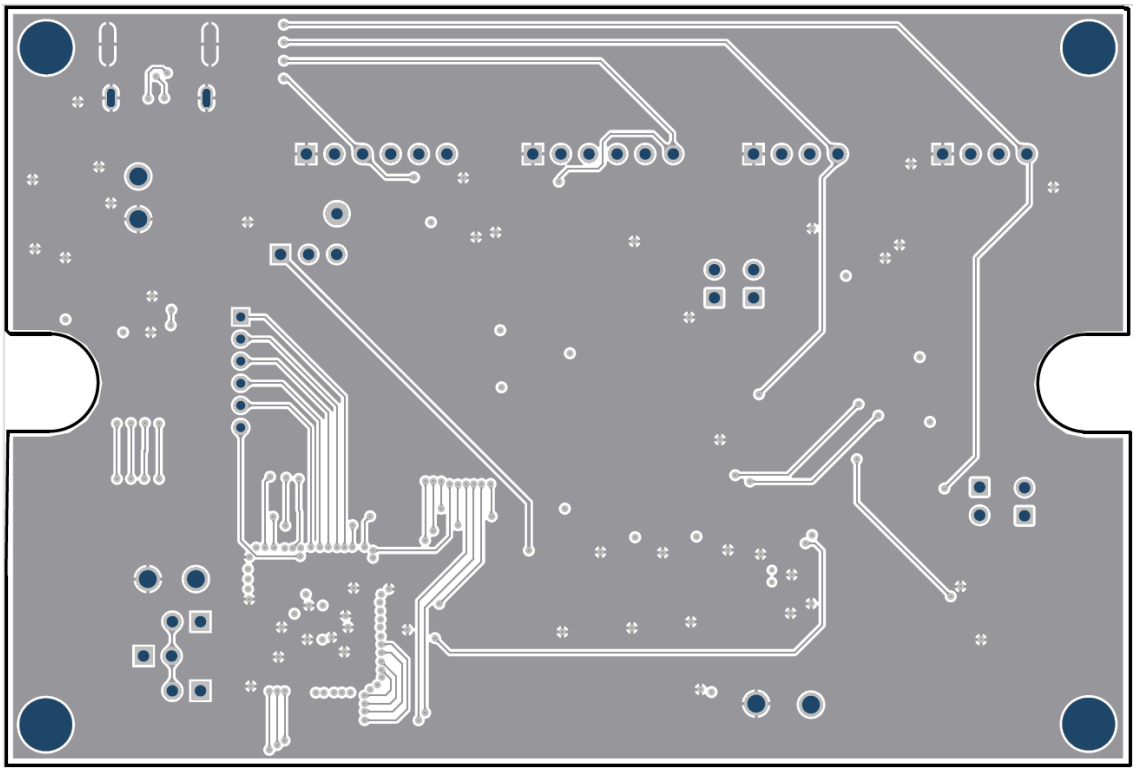


图 4-7. EV2500E3 底层

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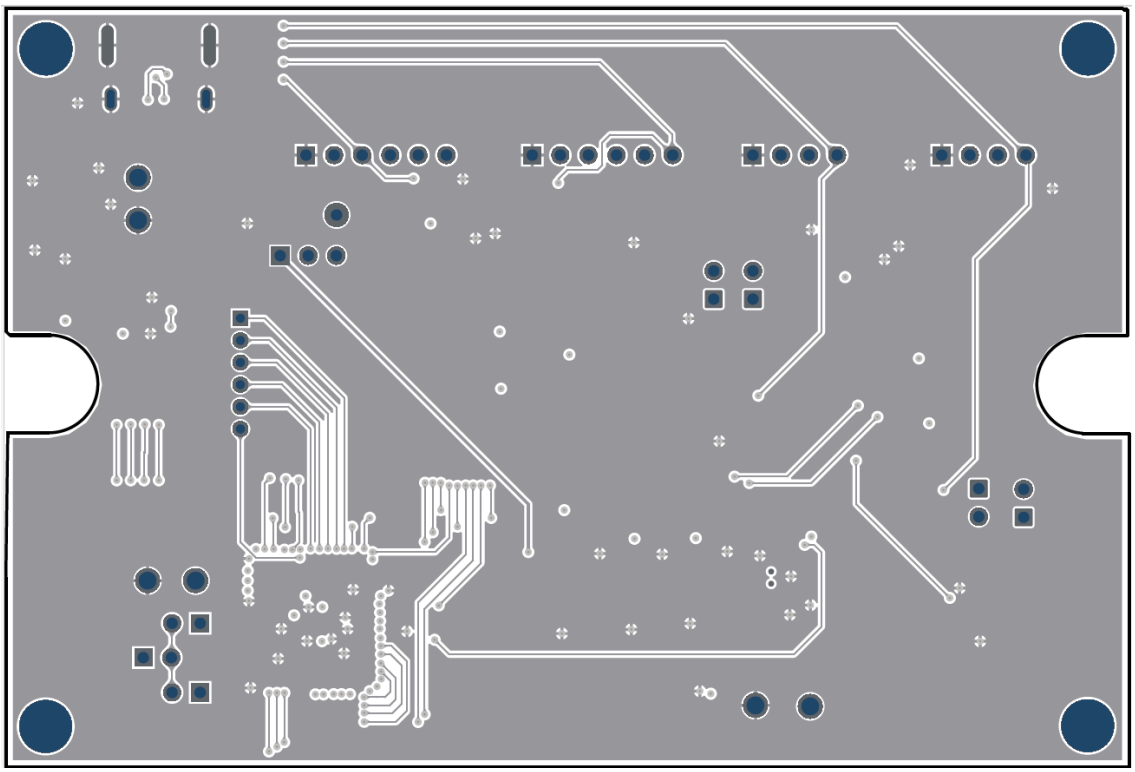


图 4-8. EV2500E3 底层掩膜

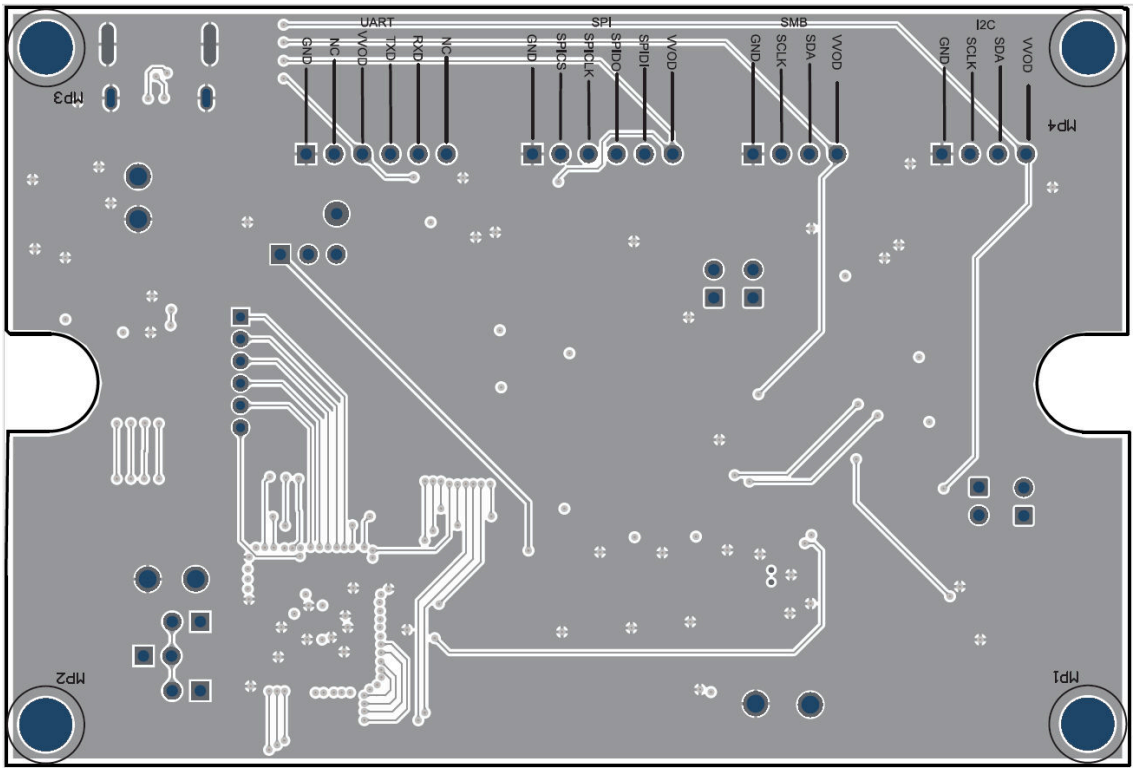


图 4-9. EV2500E3 底部复合视图

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4.3 物料清单 (BOM)

表 4-1. EV2500 REV E3 物料清单

条目	位号	数量	值	器件型号	制造商	说明	封装参考
1	C1	1	4.7μF	CGA4J1X7R1E475K125AC	TDK	电容，陶瓷，4.7μF，25V，+/-10%，X7R，AEC-Q200 1 级，0805	0805
2	C2、C3、C5、C7、C28、C30、C31、C32、C33、C34、C35、C36、C37、C39、C50、C51、C53、C58	18	0.10μF	C0603C104K5RACTU	KEMET	电容，陶瓷，0.1UF，50V，X7R，0603，C0603C104K5RACTU	
3	C4、C6	2		T491A106K010AT	Kemet	钽电容器，10uF，+/- 10%，10V，-55 至 125°C，2 引脚 SMD (1206)，RoHS，卷带包装 T491A106K010AT	
4	C17、C22、C25	3		GRM155R70J105KA12D		通用片状多层陶瓷电容器，0402，1.0uF，X7R，15%，10%，6.3V，GRM155R70J105KA12D	
5	C18、C23、C26	3		GRM155R71A104KA01D	Murata	片式电容器，0.1uF，+/- 10%，10V，-55 至 125°C，0402（公制 1005），RoHS，卷带包装 GRM155R71A104KA01D	
6	C20、C21	2		VJ0603A120JXACW1BC	Vitramon	VJ0603A120JXACW1BC	
7	C24	1		GRM188Z71C225KE43D		通用片状多层陶瓷电容器，0603，2.2uF，X7R，15%，10%，16V，GRM188Z71C225KE43D	
8	C40、C41、C42、C43、C44、C45	6	0.1uF	GRM033R61A104KE84D	MuRata	电容，陶瓷，0.1μF，10V，+/-10%，X5R，0201	0201
9	D1、D2、D3	3	绿色	APT1608MGC	KINGBRIGHT	LED，绿色，SMD	0603(1608)
10	D4、D5、D6、D7、D8、D9、D10、D11、D12、D13	10		DLP05LC-7-F	Diodes Inc	11V 钳位 17A (8/20μs) Ipp Tv 二极管表面贴装 SOT-23-3	SOT-23-3
11	J1	1		2012670005	Molex	USB-C (USB TYPE-C) USB 3.2 第 2 代（USB 3.1 第 2 代，超高速+ (USB 3.1)）母座连接器 24 位置表面贴装，直角；穿孔	CONN_USB_9MM39_8MM21
12	J2、J6、J7	3		TSW-102-07-L-S		连接器接头垂直 2 位 2.54mm	
13	J3、J4、J5、J19、J21、J29、J30、J31	8		QPC02SXGN-RC	Sullins	连接跳线短接 0.100" 金色	

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表 4-1. EV2500 REV E3 物料清单（续）

条目	位号	数量	值	器件型号	制造商	说明	封装参考
14	J9	1		M22-2510605	Harwin	接头，2mm，6x1，金，TH	接头，2mm，6x1，TH
15	J15、J20	2		22053061		连接器接头，R/A，6POS，2.54mm	
16	J16、J17、J35、J36	4		PEC02SAAN	Sullins Connector Solutions	接头，100mil，2x1，锡，TH	接头，2 引脚，100mil，锡
17	J18、J28	2		22053041	Molex	连接器接头，R/A，4POS，2.54mm	
18	J38	1		PEC03SAAN	Sullins Connector Solutions	接头，100mil，3x1，锡，TH	接头，3 引脚，100mil，锡
19	MP1、MP2、MP3、MP4	4		36-8830-ND	Keystone Electronics	板式 SPT 卡扣安装螺钉 MNT 3/16	
20	P3	1		FTSH-105-01-L-DV-K	Samtec	公头接头、间距 1.27mm，2 x 5 位置，高度 6.25mm	
21	Q1、Q3、Q4、Q6	4		DMG1013UW-7	Diodes Inc	P 沟道增强型模式 MOSFET，310mW，20V，-55 至 150°C，3 引脚 SOT-323，RoHS，卷带包装	
22	Q2、Q5	2	60V	2N7002W-7-F	Diodes Inc.	MOSFET，N 沟道，60V，0.115A，SOT-323	SOT-323
23	R1、R35、R36、R50、R51	5		CRCW060310K0FKEC		电阻厚膜，10kΩ，1%，0.1W，100ppm/°C，0603 CRCW060310K0FKEC	
24	R2、R4、R24、R33	4		CRCW0603100KFKEA		电阻厚膜，100kΩ，1%，0.1W，100ppm/°C，0603 CRCW0603100KFKEA	
25	R3	1		CRCW060356K0FKEA	Vishay Dale	CRCW060356K0FKEA	
26	R5	1		CRCW060359K0FKEA		电阻厚膜，59kΩ，1%，0.1W，100ppm/°C，0603 CRCW060359K0FKEA	
27	R6、R30、R32、R39、R41	5		CRCW0603100RFKEA	Vishay Semiconductor	片式电阻器，100 Ohm，+/- 1%，100mW，-55 至 155°C，0603（公制 1608），RoHS，卷带包装 CRCW0603100RFKEA	0603
28	R7、R8	2		CRCW06030000Z0EA	Vishay Semiconductor	片式电阻器，0 Ohm，跳线，100mW，-55 至 155°C，0603（公制 1608），RoHS，卷带包装 CRCW06030000Z0EA	0603
29	R9、R10、R11	3		RC0603JR-07330RL	Yageo	片式电阻器，330 Ohm，+/- 5%，50 V，-55 至 155°C，0603（公制 1608），-40 至 155°C，RoHS，卷带包装 RC0603JR-07330RL	

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表 4-1. EV2500 REV E3 物料清单（续）

条目	位号	数量	值	器件型号	制造商	说明	封装参考
30	R12	1		CRCW06034K87FKEA		电阻厚膜，4.87kΩ，1%，0.1W，100ppm/°C，0603 CRCW06034K87FKEA	
31	R13	1		CRCW08050000Z0EA	Vishay Dale	CRCW08050000Z0EA	
32	R25、R26、R44、R45、R65、R66、R67、R68、R69、R70	10	3.00k	RC0201FR-7D3KL	Yageo America	电阻，3.00k，1%，0.05W，0201	0201
33	R27、R28、R37、R38、R42、R46、R60、R62、R63、R64	10		CRCW06031K40FKEA	Vishay Dale	CRCW06031K40FKEA	
34	R47、R52	2	200k	RC0201DR-07200KL	Yageo America	电阻，200k，0.5%，0.05W，0201	0201
35	R48、R53	2	1.0Meg	RC0201JR-071ML	Yageo America	电阻，1.0M，5%，0.05W，0201	0201
36	R49、R54	2	143k	RC0201FR-07143KL	Yageo America	电阻，143k，1%，0.05W，0201	0201
37	R55、R56、R57、R61	4	0	CRCW04020000Z0EDHP	Vishay Dale	电阻厚膜，0Ω，0.2W，0402	0402
38	SW2	1		EVPAAM02W	Panasonic	触控式开关，单刀单掷-常开 0.02A/15V	SMT_SW_3MM5_2MM9
39	TP1、TP6、TP7	3		36-5010-ND	Keystone	测试点，红色，穿孔，RoHS，大容量	5010
40	TP2、TP3、TP4	3		36-5011-ND	Keystone	测试点，黑色，穿孔，RoHS，大容量	5011
41	TP8	1		5004	Keystone Electronics	测试点，微型，黄色，TH	黄色微型测试点
42	U1	1		TPS2552DBVT		IC 电源开关 N 沟道 1:1 SOT23-6	
43	U2	1		TPS76333DBVR	德州仪器 (TI)	单通道输出 LDO，150mA，固定 3.3V 输出，2.7 至 10V 输入，具有低 IQ，5 引脚 SOT-23 (DBV)，-40 至 125 摄氏度，绿色环保（RoHS，无锑/溴）	DBV0005A
44	U3	1		MSP432E411YTZADR		IC MCU 32 位 1MB 闪存 212NFBGA	
45	U5	1		TPS73618DBVR	德州仪器 (TI)	单路输出 LDO，400mA，可调电压（1.2 至 5.5V），无电容器，低噪声，反向电流保护，DBV0005A (SOT-23-5)	DBV0005A
46	U9	1		TPS73633DBVR	德州仪器 (TI)	单通道输出低噪声 LDO，400mA，固定 3.3V 输出，1.7V 至 5.5V 输入，具有反向电流保护，5 引脚 SOT-23 (DBV)，-40 至 85°C，绿色环保（符合 RoHS 标准，无锑/溴）	DBV0005A

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表 4-1. EV2500 REV E3 物料清单（续）

条目	位号	数量	值	器件型号	制造商	说明	封装参考
47	U10	1		TPS73601DBVR	德州仪器 (TI)	单通道输出低噪声 LDO，400mA，可调 1.2 至 5.5V 输出，1.7 至 5.5V 输入，具有反向电流保护，5 引脚 SOT-23 (DBV)，-40 至 85°C，绿色环保（符合 RoHS 标准，无锑/溴）	DBV0005A
48	U11	1		TLV76750DRVT	德州仪器 (TI)	线性稳压器 IC 1 输出 1A 6-WSON (2x2)	WSON6
49	U14、U16	2		LSF0108DGS	德州仪器 (TI)	汽车类 8 通道多电压电平转换器	VSSOP20
50	Y1	1		603-25-261	Fox Electronics	晶体，25MHz，20ppm，8pF，SMD	封装 3.2x2.5mm
51		1		2177961042	Molex	4 位电缆组件矩形插座到插座 0.984'（300.00mm，11.81"）	

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5 其他信息

5.1 商标

所有商标均为其各自所有者的财产。

6 相关文档

- 德州仪器 (TI)，BQSTUDIO
- 德州仪器 (TI)，LMFLASHPROGRAMMER

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 (July 2026)	Page
• 更新 了图 4-1 和图 4-3 以提高可读性	11

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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。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。 日本テキサス・インスツルメンツ株式会社

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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.

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最后更新日期：2025 年 10 月