EVM User's Guide: TPSM8D7620, TPSM8D7420

TPSM8D7620 双路降压转换器评估模块

说明

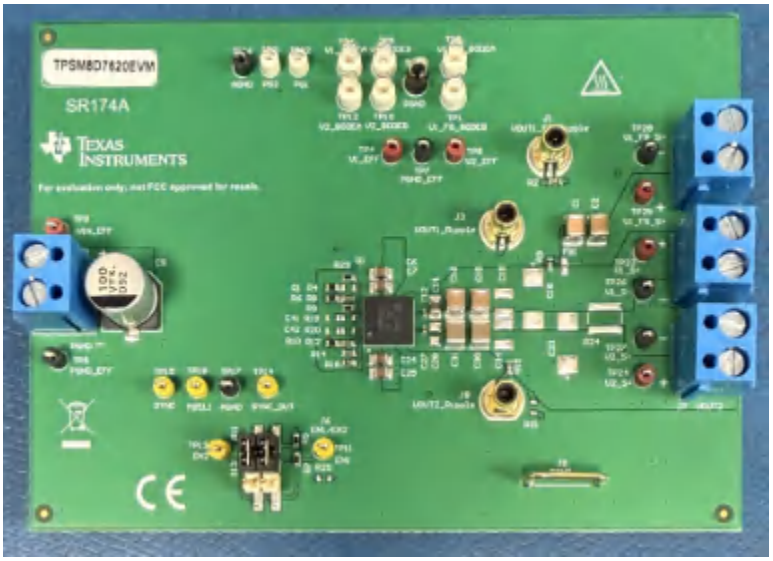
TPSM8D7620 (SR174) 评估模块 (EVM) 利于评估 6.4mm x 7mm 注塑成型 BGA 封装中的 TPSM8D7620 (6A) 和 TPSM8D420 (4A) 引脚到引脚兼容降压转换器。SR174-001 使用 6A TPSM8D7620 来输出两个电压轨：输入电压高达 17V 时，可支持 1.2Vout 和 2.5Vout。可修改 SR174 EVM 以支持各种多相和多输出配置。

特性

- 输入电压范围：4V 至 17V
- 输出电压范围：0.6V 至 11V
- 多功能多相（堆叠多达两个通道）和多输出配置
- 支持 400kHz 至 2.2MHz（或外部时钟）的可调频率
- 可选择的内部或外部补偿

应用

- 测试和测量
- 航天和国防



TPSM8D7620EVM

1 评估模块概述

1.1 简介

TPSM8D7620 使用固定频率峰值电流模式控制来调节输出电压，在 400kHz 至 2.2MHz 的可调开关频率范围内运行。

本用户指南介绍了 TPSM8D7620EVM 评估模块的特性和操作。本文档提供了有关如何使用评估模块的说明。本文档中的评估板、评估模块和 EVM 等术语均指 TPSM8D7620EVM。本文档还包含原理图、参考印刷电路板 (PCB) 布局和完整的物料清单 (BOM)。

小心

表面高温！接触会导致烫伤。请勿触摸！

1.2 套件内容

表 1-1 列出了 EVM 套件的内含物。如果缺少任何元件，请与离您最近的德州仪器 (TI) 产品信息中心联系。TI 强烈建议用户查看 TI 网站，验证是否使用了相关软件的最新版本。

表 1-1. 套件内容

条目	数量
TPSM8D7620EVM	1

1.3 规格

表 1-2 提供了 TPSM8D7620EVM 性能特性的汇总。

表 1-2. 性能规格

在 25°C 环境温度下进行测试

测试条件		最小值	典型值	最大值	单位
输入电压			12		V
输出电压 VOUT1	TPSM8D7620EVM，V_{IN} = 12V		2.5		V
输出电压 VOUT2	TPSM8D7620EVM，V_{IN} = 12V		1.2		V
每个输出的输出电流	V_{IN} = 12V			6	A

1.4 器件信息

TPSM8D7620 是一款高功率密度的双通道降压电源模块，设计用于为 0.6V 至 11V 的宽输出电压范围提供高效可靠的电源转换。该模块集成了 MOSFET、电感器和选择电容器，以缩小布板空间并降低布局复杂性。该模块可配置为两相单输出或 2 个输出电源轨。在稳态条件下，该模块以 FCCM 模式运行，其固定频率可在 400kHz 至 2.2MHz 之间调节，并可与外部时钟同步。TPSM8D7620 模块采用具有内部和外部补偿的电流模式控制。借助外部软启动、有源输出放电、可调 EN 和电源正常特性，可轻松满足时序要求。此外，该器件还包括一整套保护特性（过压保护 (OVP)、欠压保护 (UVP)、输入欠压锁定 (UVLO)、过热 (OT)、过流 (OC)），以确保稳健性。

2 硬件

2.1 设置

本节介绍了如何正确连接、设置和使用 TPSM8D7620EVM。

2.1.1 输入和输出连接器说明

参考指示符	说明
J1-VOUT1_FB_Ripple	正极连接 (SMA)，用于在可选次级输出上测量 VOUT1_FB 纹波
J2-VOUT1_FB	可选次级输出电压 VOUT1_FB (2.5V/6A) 的正极 (+) 和负极 (-) 连接
J3-VOUT1_Ripple	用于 VOUT1 纹波测量的正极连接 (SMA)
J4-VIN	输入电压 VIN (5V 至 17V) 的正极 (+) 和负极 (-) 连接
J5-VOUT1	输出电压 VOUT1 (2.5V/6A) 的正极 (+) 和负极 (-) 连接
J6-EN1/EN2	跳线，用于在外部电压 (EN1_A/EN2_A) 和源自 VIN 的分压器之间选择 EN1 和 EN2 输入电压，以便在 4V VIN 下启动 EN
J7-VOUT2	输出电压 VOUT2 (1.2V/6A) 的正极 (+) 和负极 (-) 连接
J8-VOUT2_Ripple	用于 VOUT2 纹波测量的正极连接 (SMA)
J9-PGND	EVM 上两个 PGND 铜区域之间的接地回路跳线
TP1 和 TP2、TP5 和 TP6、TP10 和 TP12	用于波特测量的注入测试点。TP1 和 TP2 - 可选次级 VOUT1_FB。TP5 和 TP6 - VOUT1。TP10 和 TP12 - VOUT2。
TP3-VIN_EFF	用于测量输入电压以进行效率测量的测试点
TP4、TP8	用于测量输出电压以进行效率测量的测试点。TP4 - VOUT1。TP8 - VOUT2。
TP7、TP19	用于测量相对于输出的接地电压以进行效率测量的测试点 (PGND_EFF/PGND)
TP9-PGND_EFF	用于测量相对于输入的接地电压以进行效率测量的测试点
TP11、TP13	用于测量 EN 引脚电压的测试点。TP11 - EN1。TP13 - EN2。
TP18-MSEL1	用于测量 MSEL1 电压 (器件配置引脚配置和模拟结温输出) 的测试点
TP15-SYNC	用于注入 SYNC 外部时钟信号的测试点
TP14-SYNC_OUT	用于测量 SYNC_OUT 时钟信号的测试点
TP16、TP17	用于测量模拟接地 (AGND) 基准的测试点
TP21、TP22	用于测量电源正常信号的测试点。TP21 - PG2。TP22 - PG1。
TP23、TP24、TP25	遥感正极测试点。TP23 - V1_S+ (VOUT1)。TP24 - V2_S+ (VOUT2)。TP25 - V1_FB_S+ (VOUT1_FB)。
TP26、TP27、TP28	遥感负极测试点。TP26 - V1_S- (VOUT1)。TP27 - V2_S- (VOUT2)。TP28 - V1_FB_S- (VOUT1_FB)。

2.1.2 修改

EVM 旨在支持用户进行的一些修改。输入电容器、输出电容器、反馈电阻器等外部元件可以根据实际应用更换。请遵循数据表中的元件设计和选择指导原则。

该 EVM 可以采用各种多相和多输出配置。默认 EVM 配置为两个独立输出。下面是在各种可能配置中配置 EVM 所需的元件连接指南。

要在两相配置中配置单个输出，请执行以下操作：

1. 将 R23（MSEL 搭接）从 9.53kΩ 更改为 41.2kΩ（选择 2+0；有关外部补偿的更多信息，请参阅 TPSM8D7620 数据表的*器件配置引脚 (MSEL)* 部分）。
2. 安装 R19 (10.5kΩ) 和 C41 (1200pF) 以在 COMP1 上启用外部补偿网络。保留 R20/C42 DNP。
3. 在“可选的并行运行跳线”块中安装 0Ω 跳线 R24、R25、R26、R27、R28，以连接 VOUT1↔VOUT2、EN1↔EN2、COMP1↔COMP2 和 SS1↔SS2。
4. 移除 FB2 分压器（R10 和 R12）或使其悬空；PG2 上拉 R22 可以不安装。使用 J4/J5（或 J7）作为单路组合输出。

完成这些步骤后，VOUT1 和 VOUT2 会合并到一个支持 12A 的两相输出电源轨。

2.1.3 输入电容器

除了提供纹波电流并将开关噪声与其他电路隔离，陶瓷输入电容器还为稳压器提供低阻抗源。TPSM8D7620 的每个输入/接地引脚对需要最低 10µF 的陶瓷电容。使用两个 10µF 或更大的陶瓷电容器，以提高 EMI 性能。输入电容器的额定电压必须至少为应用所需的最大输入电压。最好具有两倍的最大输入电压，以减少直流偏置降额。

2.1.4 输出电容器

输出电容器容值和 ESR 决定了输出电压纹波和负载瞬态性能。负载瞬态要求通常会限制输出电容器，而不是输出电压纹波。有关更多详细指南，请参阅 *TPSM8D7620 3V 至 17V、4A、6A 双路降压电源模块*数据表。

3 硬件设计文件

3.1 原理图

图 3-1 显示了 EVM 原理图。

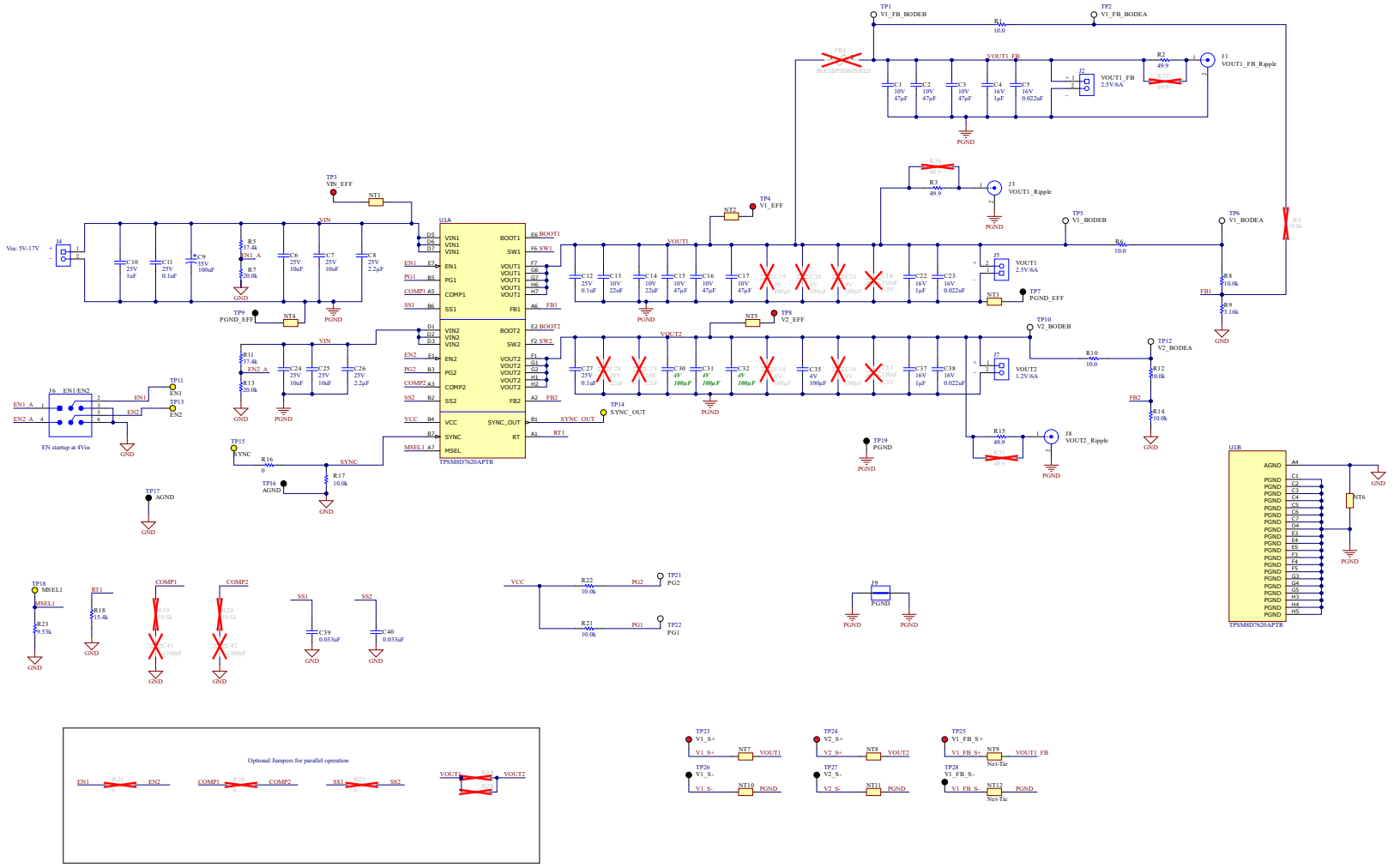


图 3-1. TPSM8D7620EVM 原理图

3.2 PCB 布局

TPSM8D7620EVM 的 PCB 有六层。图 3-2 和 图 3-3 分别展示了 PCB 布局的顶部和底部。图 3-4、图 3-5、图 3-6 和 图 3-7 分别展示了内层 1、内层 2、内层 3 和内层 4。

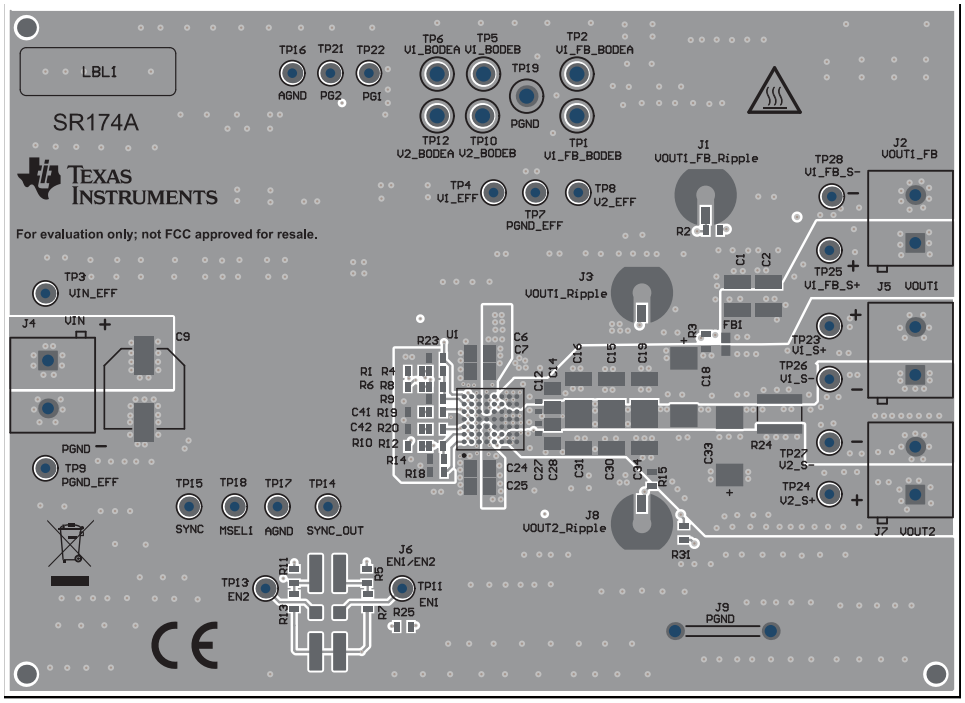


图 3-2. 顶部复合视图

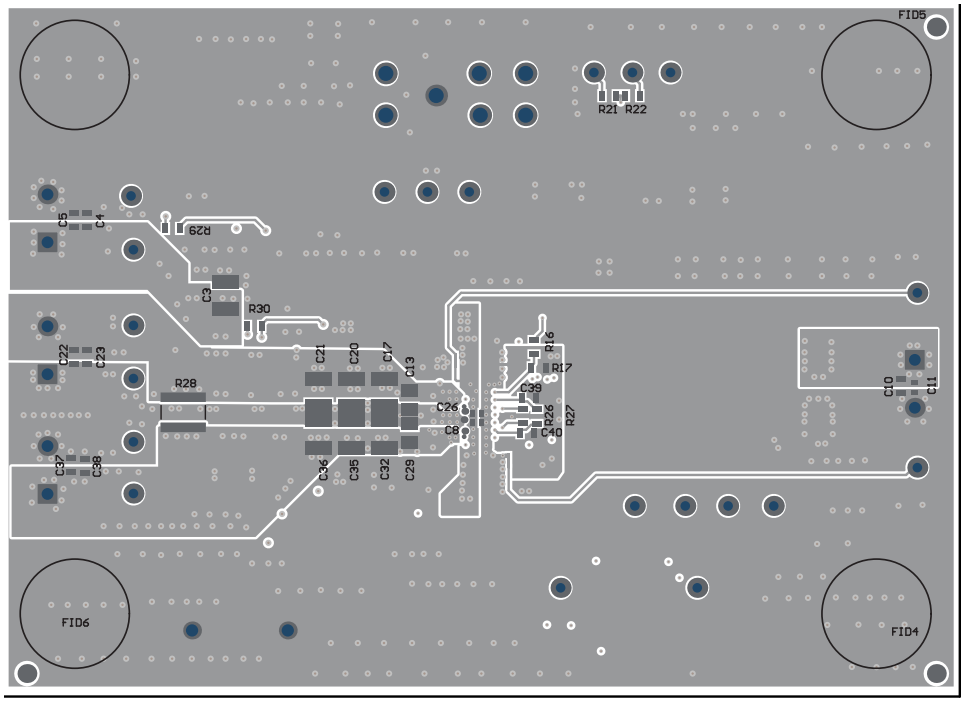


图 3-3. 底部复合视图

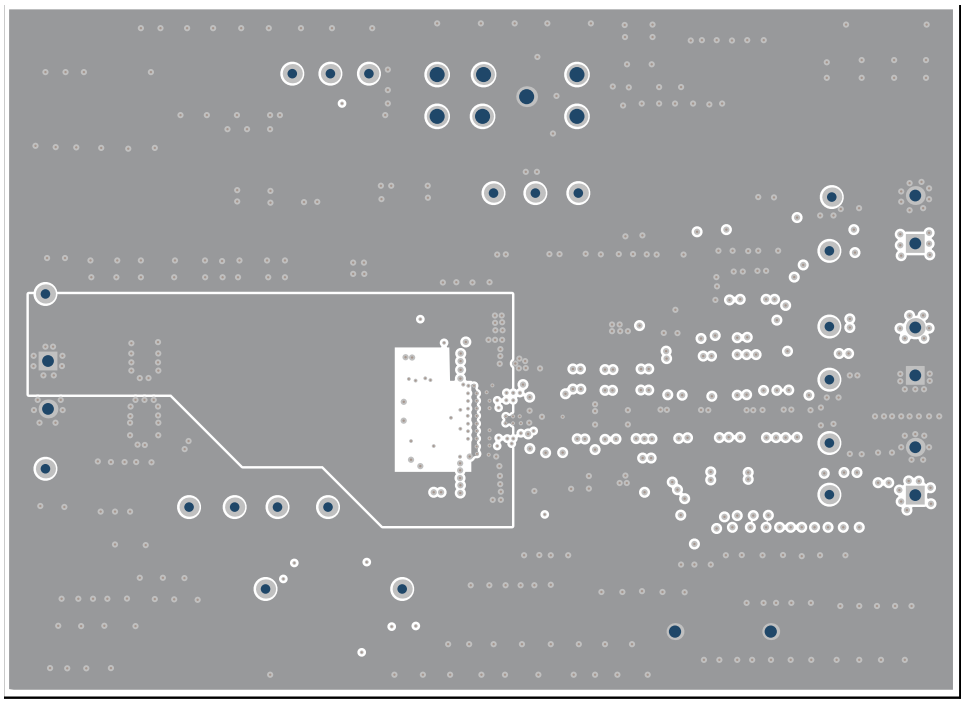


图 3-4. 内层 1 布局

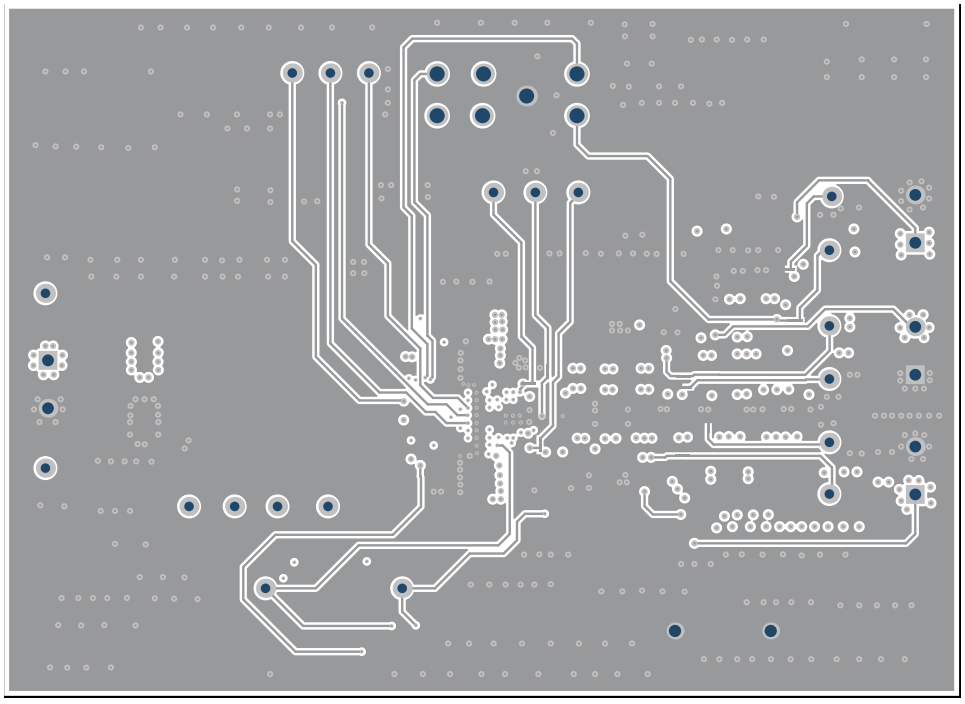


图 3-5. 内层 2 布局

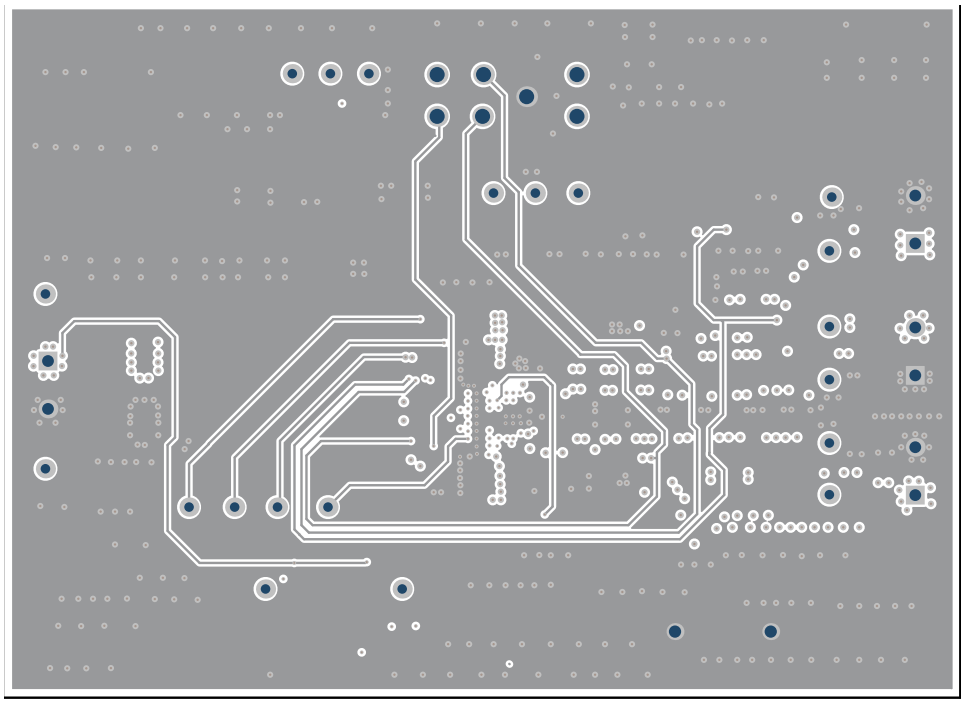


图 3-6. 内层 3 布局

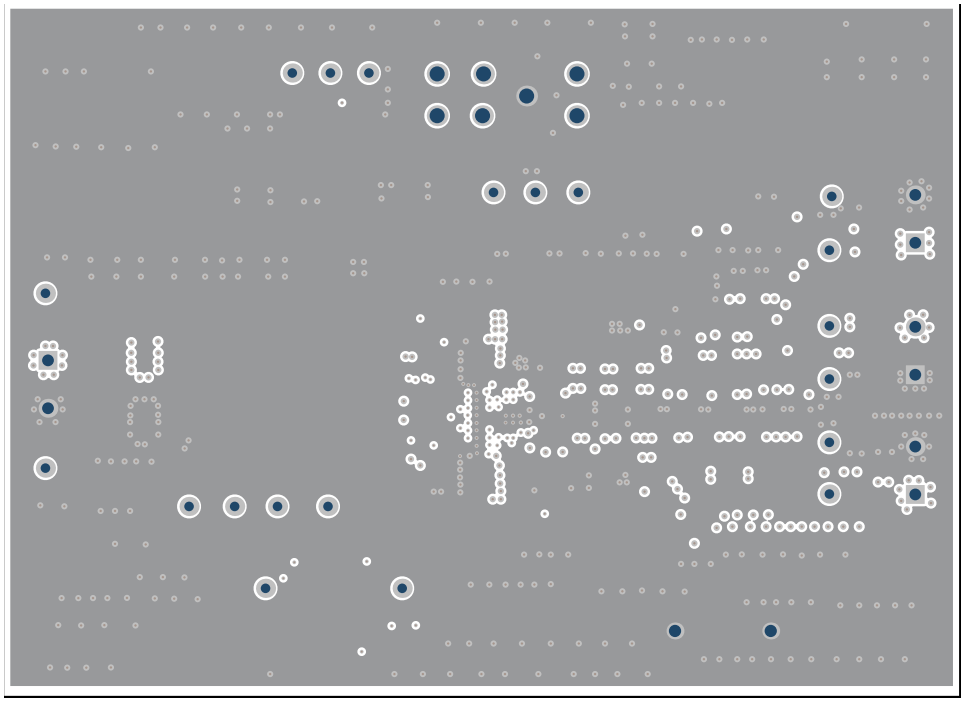


图 3-7. 内层 4 布局

3.3 物料清单

表 3-1 展示了 EVM 物料清单。

表 3-1. TPSM8D7620EVM 物料清单

位号	数量	值	说明	封装参考	器件型号	制造商
C1、C2、C3、C15、C16、C17	6	47µF	电容，陶瓷，47µF，10V，±20%，X7R，1210	1210	LMK325B7476MM-PR	Taiyo Yuden®
C4、C22、C37	3	1uF	电容，陶瓷，1µF，16V，±10%，X7R，AEC-Q200 1 级，0603	0603	CL10B105KO8VPNC	Samsung Electro-Mechanics
C5、C23、C38	3	0.022uF	电容，陶瓷，0.022uF，16V，±10%，X7R，0603	0603	GRM188R71C223KA01D	muRata™ muRata
C6、C7、C24、C25	4	10uF	电容，陶瓷，10uF，25V，±10%，X7S，0805	0805	GRM21BC71E106KE11L	muRata
C8、C26	2	2.2µF	电容，陶瓷，2.2µF，25V，±20%，X5R，0402	0402	GRM155R61E225ME15D	muRata
C9	1	100uF	电容，铝制，100uF，35V，±20%，0.16Ω，AEC-Q200 2 级，SMD	SMT 径向 F	EEE-FK1V101P	Panasonic
C10	1	1uF	电容，陶瓷，1uF，25V，±10%，X7R，0603	0603	C1608X7R1E105K080AB	TDK
C11、C12、C27	3	0.1uF	电容，陶瓷，0.1uF，25V，±10%，X7R，0402	0402	GRM155R71E104KE14D	muRata
C13、C14	2	22uF	电容，陶瓷，22µF，10V，±20%，X7S，0805	0805	C2012X7S1A226M125AC	TDK
C30、C31、C32、C35	4	100uF	电容，陶瓷，100µF，4V，±20%，X7S，1210	1210	GRM32EC70G107ME15L	muRata
C39、C40	2	0.033uF	电容，陶瓷，0.033uF，16V，±10%，X7R，0603	0603	GRM188R71C333KA01D	muRata
H1、H2、H3、H4	4		Bumpon，半球形，0.44 × 0.20，透明	透明 Bumpon	SJ-5303 (CLEAR)	3M®
J1、J3、J8	3		连接器，插座，50Ω，TH	SMB 连接器	SMBR004D00	JAE Electronics
J2、J4、J5、J7	4		端子块，5.08mm，2x1，黄铜，TH	2x1 5.08mm 端子块	ED120/2DS	On-Shore Technology
J6	1		接头，2.54mm，2x3，金（带锡尾线），SMT	接头，2.54mm，2x3，SMT	TSM-102-01L-TV	Samtec®
J9	1		1mm 非绝缘短路插头，10.16mm 间距，TH	短路插头，10.16mm 间距，TH	D3082-05	Harwin®
LBL1	1		热转印打印标签，0.650"（宽）x 0.200"（高）- 10,000/卷	PCB 标签 0.650x 0.200 英寸	THT-14-423-10	Brady®
R1、R6、R10	3	10	电阻，10.0，1%，0.25W，AEC-Q200 0 级，0603	0603	CRCW060310R0FKEAHP	Vishay®-Dale
R2、R3、R15	3	49.9	电阻，49.9，1%，0.1W，0603	0603	RC0603FR-0749R9L	Yageo®

表 3-1. TPSM8D7620EVM 物料清单（续）

位号	数量	值	说明	封装参考	器件型号	制造商
R5、R11	2	37.4k	电阻，37.4k，1%，0.1W，AEC-Q200 0 级，0603	0603	CRCW060337K4FKEA	Vishay-Dale
R7、R13	2	20.0k	电阻，20.0k，1%，0.1W，AEC-Q200 0 级，0603	0603	CRCW060320K0FKEA	Vishay-Dale
R8、R12、R14、R17、R21、R22	6	10.0k	电阻，10.0k，1%，0.1W，AEC-Q200 0 级，0603	0603	CRCW060310K0FKEA	Vishay-Dale
R9	1	3.16k	电阻，3.16k，1%，0.1W，AEC-Q200 0 级，0603	0603	CRCW06033K16FKEA	Vishay-Dale
R16	1	0	电阻，0，5%，0.1W，AEC-Q200 0 级，0603	0603	CRCW06030000Z0EA	Vishay-Dale
R18	1	15.4k	电阻，15.4k，1%，0.1W，AEC-Q200 0 级，0603	0603	CRCW060315K4FKEA	Vishay-Dale
R23	1	9.53k	电阻，9.53k，1%，0.1W，AEC-Q200 0 级，0603	0603	CRCW06039K53FKEA	Vishay-Dale
SH-J1、SH-J2	2	1x2	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
TP1、TP2、TP5、TP6、TP10、TP12	6		测试点，通用，白色，TH	白色通用测试点	5012	Keystone Electronics®
TP3、TP4、TP8、TP23、TP24、TP25	6		测试点，微型，红色，TH	红色微型测试点	5000	Keystone Electronics
TP7、TP9、TP16、TP17、TP26、TP27、TP28	7		测试点，微型，黑色，TH	黑色微型测试点	5001	Keystone Electronics
TP11、TP13、TP14、TP15、TP18	5		测试点，微型，黄色，TH	黄色微型测试点	5004	Keystone Electronics
TP19	1		测试点，多用途，黑色，TH	黑色通用测试点	5011	Keystone Electronics
TP21、TP22	2		测试点，微型，白色，TH	白色微型测试点	5002	Keystone Electronics
U1	1		4V 至 17V、6A、双路降压电源模块	FCBGA56	TPSM8D7620APTR	德州仪器 (TI)

4 其他信息

4.1 商标

muRata™ is a trademark of Murata Manufacturing Co., Ltd..
Taiyo Yuden® is a registered trademark of Taiyo Yuden Co., Ltd..
3M® is a registered trademark of 3M Company.
Samtec® is a registered trademark of Samtec Inc..
Harwin® is a registered trademark of Harwin Plc.
Brady® is a registered trademark of Brady Corporation.
Vishay® is a registered trademark of Vishay Intertechnology, Inc..
Yageo® is a registered trademark of Yageo Corperation.
Keystone Electronics® is a registered trademark of Keystone Electronics Corp..
所有商标均为其各自所有者的财产。

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

日期	修订版本	注释
May 2026	*	初始发行版

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

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

TI“按原样”提供技术和可靠性数据（包括数据表）、设计资源（包括参考设计）、应用或其他设计建议、网络工具、安全信息和其他资源，不保证没有瑕疵且不做出任何明示或暗示的担保，包括但不限于对适销性、与某特定用途的适用性或不侵犯任何第三方知识产权的暗示担保。

这些资源可供使用 TI 产品进行设计的熟练开发人员使用。您将自行承担以下全部责任：(1) 针对您的应用选择合适的 TI 产品，(2) 设计、验证并测试您的应用，(3) 确保您的应用满足相应标准以及任何其他安全、安保法规或其他要求。

这些资源如有变更，恕不另行通知。TI 授权您仅可将这些资源用于研发本资源所述的 TI 产品的相关应用。严禁以其他方式对这些资源进行复制或展示。您无权使用任何其他 TI 知识产权或任何第三方知识产权。对于因您对这些资源的使用而对 TI 及其代表造成的任何索赔、损害、成本、损失和债务，您将全额赔偿，TI 对此概不负责。

TI 提供的产品受 TI 销售条款)、TI 通用质量指南 或 ti.com 上其他适用条款或 TI 产品随附的其他适用条款的约束。TI 提供这些资源并不会扩展或以其他方式更改 TI 针对 TI 产品发布的适用的担保或担保免责声明。 除非德州仪器 (TI) 明确将某产品指定为定制产品或客户特定产品，否则其产品均为按确定价格收入目录的标准通用器件。

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