EVM User's Guide: DRV8374S-29EVM, DRV8374H-29EVM, DRV8374-23EVM, DRV8378S-29EVM, DRV8378H-29EVM, DRV8378-23EVM

DRV8374 和 DRV8378 评估模块

说明

DRV8374 和 DRV8378 评估模块 (EVM) 是用于三相电机驱动应用的集成驱动器 IC 评估模块，为需要驱动 4.5V 至 35V (DRV8374) 和 4.5V 至 65V (DRV8378) 无刷直流电机的客户提供单芯片功率级设计。

开始使用

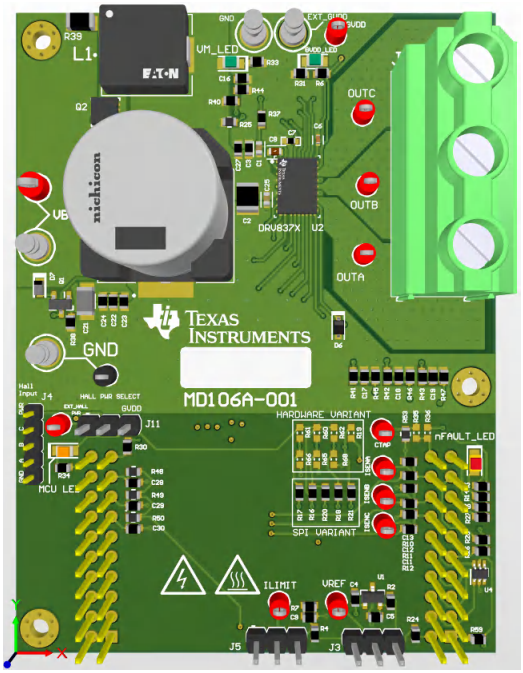
1. 订购 DRV874EVM 或 DRV8378EVM 的适用型号（请参阅 表 2-1 ）和 LAUNCHXLF280049C
2. 从 DRV8376EVM 工具页面下载综合参考设计文件
3. 要获得问题解答和支持服务，请参阅 DRV8374 和 DRV8378 三相集成式 FET 电机驱动器数据表或者请参阅 E2E.ti.com

1 特性

- 4.5V 至 65V 工作电压，峰值电流能力为 16A (DRV8378EVM)
- 4.5V 至 35V 工作电压，峰值电流能力为 40A (DRV8374EVM)
- GVDD 稳压器
- 用于三相低侧电流测量的集成 CSA
- 电源和故障 LED
- 可提供具有含传感器梯形算法的 C2000™ (LAUNCHXL-F280049C) 固件

应用

- 汽车级 HVAC 控制和 HMI 模块
- 无刷直流 (BLDC) 电机模块
- 家用打印机
- HVAC 电机控制
- 移动机器人电机控制
- 多功能打印机



电路板图片

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2 评估模块概述

2.1 简介

本文档旨在用作 DRV8374EVM 和 DRV8378EVM 以及 LAUNCHXL-F280049C 设计的入门指南，且本文档随 DRV8374EVM 和 DRV8378EVM 一起提供，作为 DRV8374 和 DRV8378 三相集成式 FET 电机驱动器数据表的补充。本文档适用于参与设计、实现和验证 DRV8374、DRV8378 和 TMS320F280049C 参考软件的工程师。

本文档旨在为用户提供使用 TMS320F280049C 隔离式电路板评估 DRV8374 和 DRV8378 器件的指南。本文档解释了电路板与外部电机和电源之间所需的硬件连接。硬件连接完成后，用户需要下载必要的工具和软件以旋转电机。

此参考软件包含用于 BLDC 电机控制、具有含传感器梯形算法的 GUIComposer 软件。

小心

根据设计，DRV8374EVM 和 DRV8378EVM 仅可使用 LAUNCHXL-F280049C MCU PCB（必须单独订购）进行评估。

警告

电压超过数据表中所指定的标准 EVM 额定值时，会导致人身伤害、电击危险、EVM 损坏等一种或几种后果。

此外，请勿在 EVM 不运行时使其连接电源。

警告

	**表面高温**	接触会导致烫伤。请勿触摸。

警告

	**高压**	为安全起见，强烈建议使用具有过压和过流保护功能的隔离式测试设备。 将电路板连接到火线时可能会触电。电路板应由专业人员小心处理。

2.2 套件内容

条目	说明	数量
DRV8374EVM 或 DRV8378EVM	PCB	1
盒	纸板盒	1
标签	标准标签	1
泡沫	防静电泡沫	2
文献	EVM 免责声明	1

2.3 规格

表 2-1 针对每台 EVM 的电压和电流承受能力，为防止 IC 和 EVM 同时受损，请确认这些电压和电流规格未被超过。

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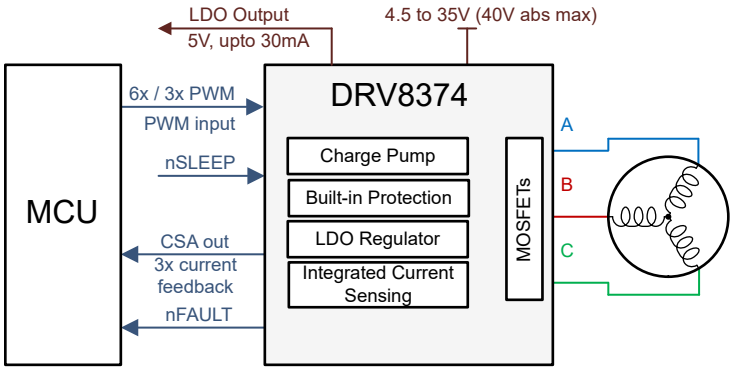


图 2-1. DRV8374H/S 的简化原理图

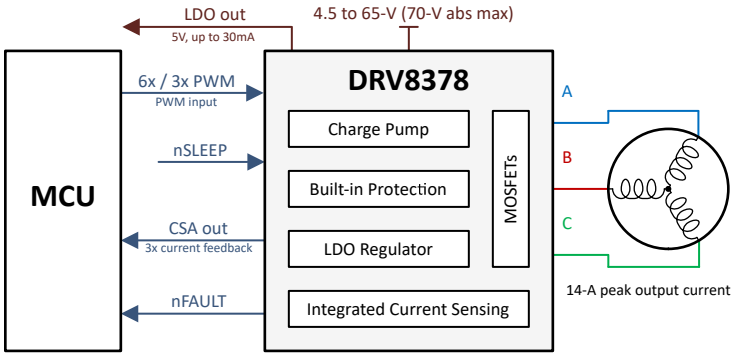


图 2-2. DRV8378H/S 的简化原理图

2.4 器件信息

DRV8374 和 DRV8378 集成了三个半 H 桥，具有超低的 RDS (ON)，可实现高功率驱动能力，并允许客户驱动 4.5V 至 35V (DRV8374) 和 4.5V 至 65V (DRV8378) 无刷直流电机。表 2-1 展示了器件型号和规格。

使用集成电流检测功能来检测电流，无需外部电流检测电阻器。带有集成式 LDO 的电源管理功能为器件生成必要的电压轨，可用于为外部电路供电。

DRV8374 和 DRV8378 能够驱动高达 200kHz 的 PWM 频率。该控制方案具有高度可配置性，可通过硬件引脚或寄存器设置进行配置，涵盖范围从电机电流限制行为到故障响应。

表 2-1. EVM 型号

EVM	器件	封装	电压	峰值电流	RDSon (HS + LS)	接口
DRV8374S-29EVM	DRV8374S	29 引脚 VQFN (7 × 5mm)	4.5V 至 35V	40A	17mΩ	SPI
DRV8374H-29EVM	DRV8374H	29 引脚 VQFN (7 × 5mm)				硬件
DRV8374H-23EVM	DRV8374H	23 引脚 VQFN (6 × 4mm)				硬件
DRV8378S-29EVM	DRV8378S	29 引脚 VQFN (7 × 5mm)	4.5V 至 60V	16A	58mΩ	SPI
DRV8378H-29EVM	DRV8378H	29 引脚 VQFN (7 × 5mm)				硬件
DRV8378H-23EVM	DRV8378H	23 引脚 VQFN (6 × 4mm)				硬件

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3 硬件

下面部分介绍了 EVM 硬件以及与外部电源、霍尔传感器、PC（通过 USB）和电机的连接。图 2-1 显示了每个 EVM 型号的器件额定值。图 2-1 和 图 2-2 显示 DRV8374 和 DRV8378 器件的主要模块

3.1 硬件连接概述 – DRV8363-Q1EVM 和 LAUNCHXL-F280049C

下面部分介绍了 EVM 硬件以及与外部电源、霍尔传感器、PC（通过 USB）和电机的连接。

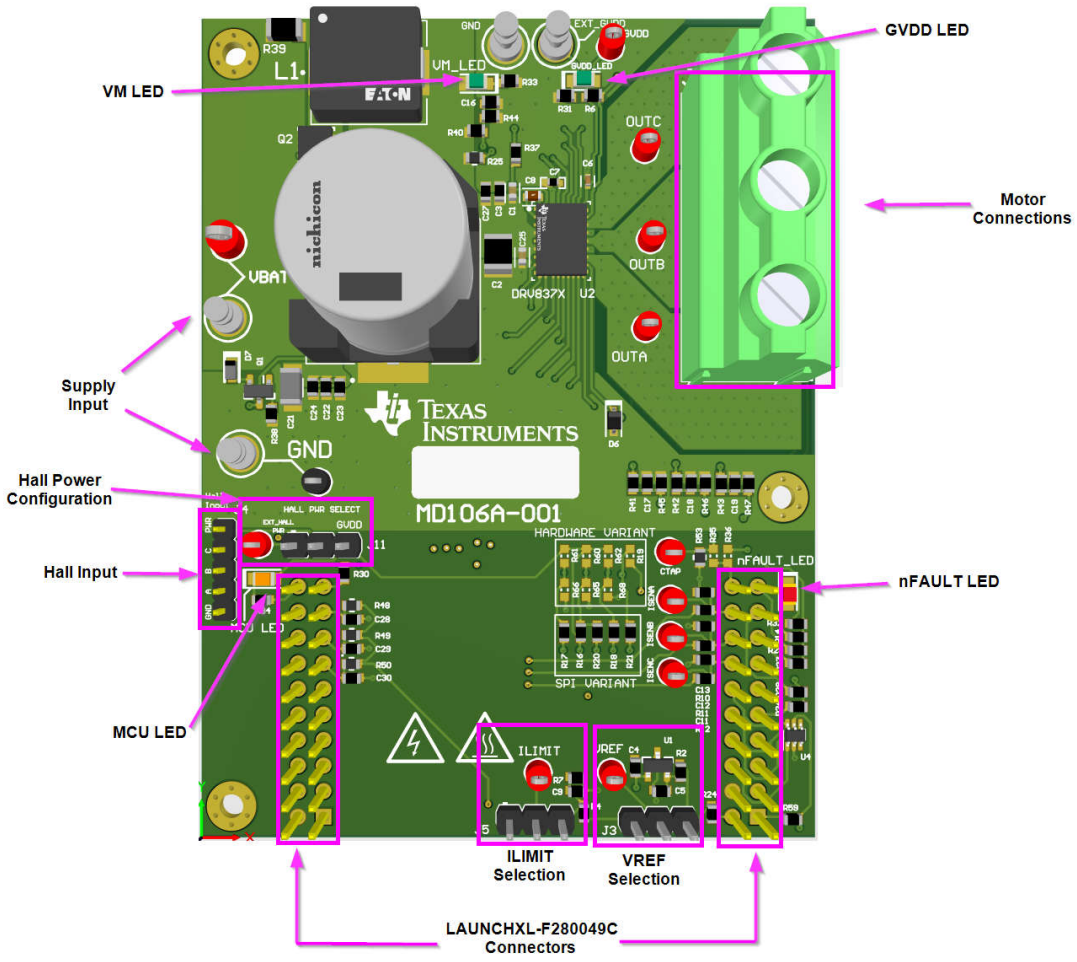


图 3-1. DRV837x EVM 上的 LAUNCHXL-F280049C 连接概述

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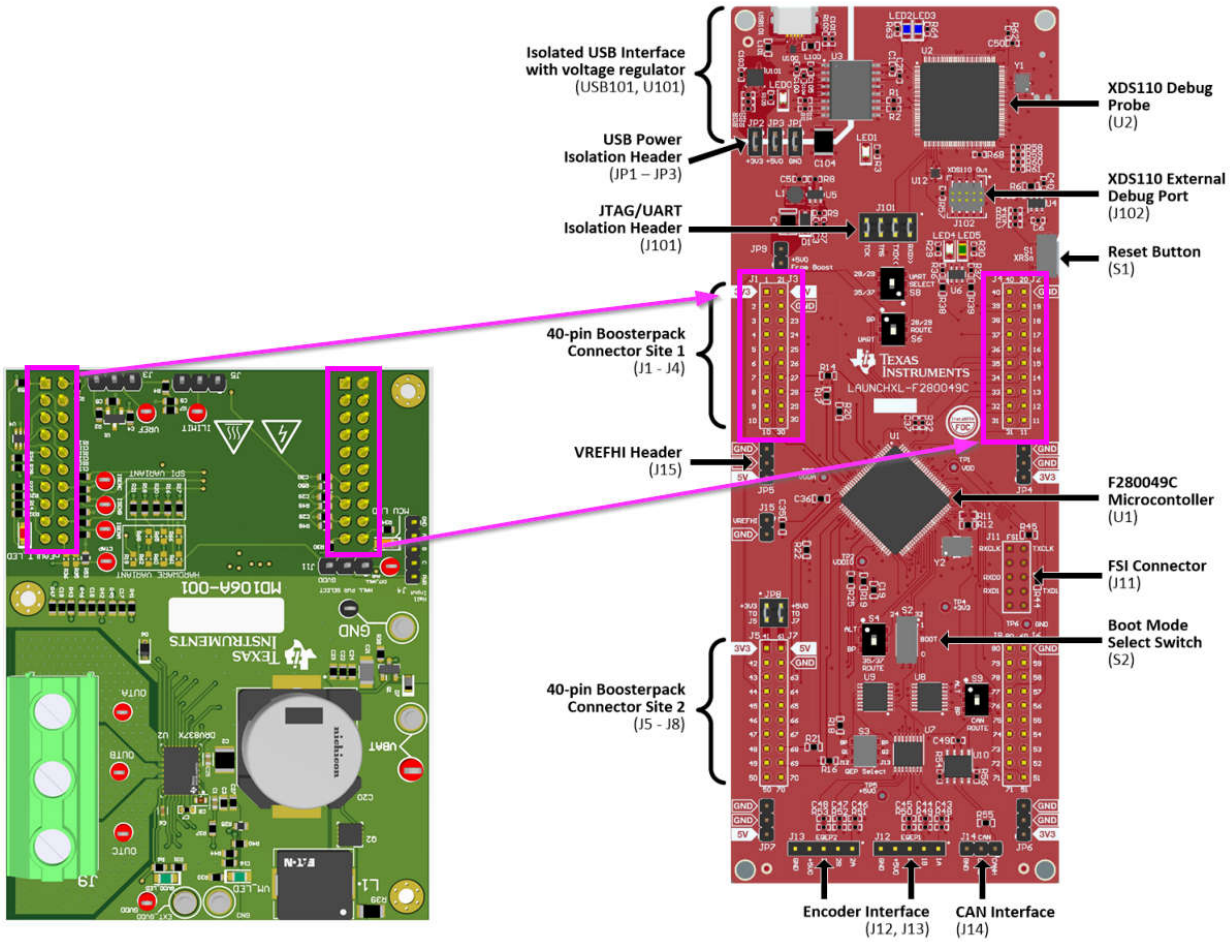


图 3-2. LAUNCHXL-F280049C 附件

将 DRV837x EVM 连接到 LAUNCHXL-F280049C，如 图 3-2 和 图 3-3 所示

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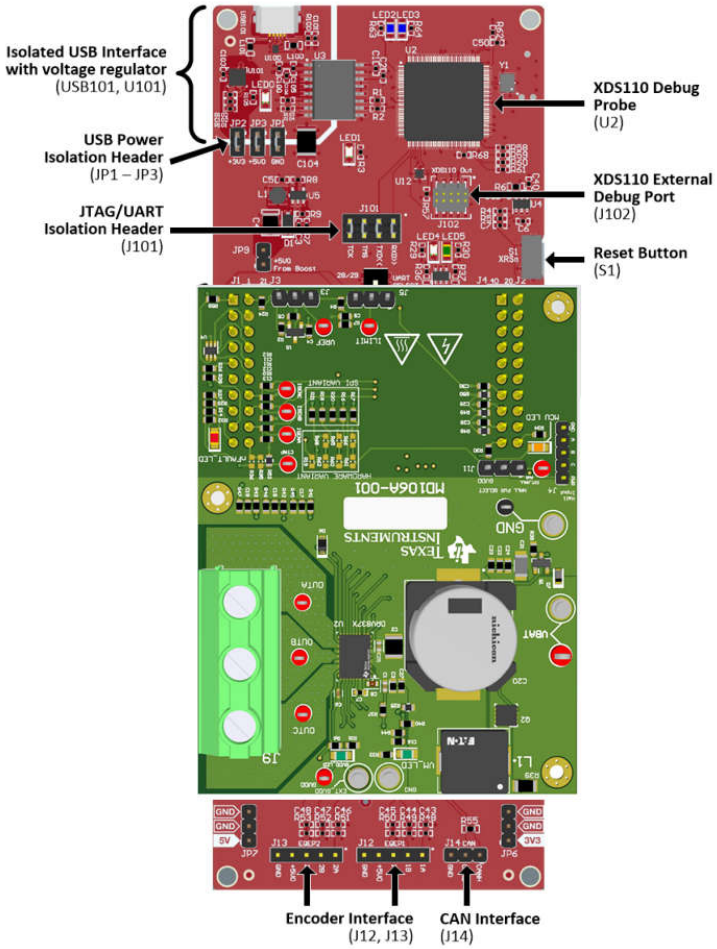


图 3-3. 连接 LaunchPad 后

为 VBAT 和 GND 端子供电，如 图 3-4 所示。表 2-1 列出了可帮助您选择正确电源电压的 EVM 型号。

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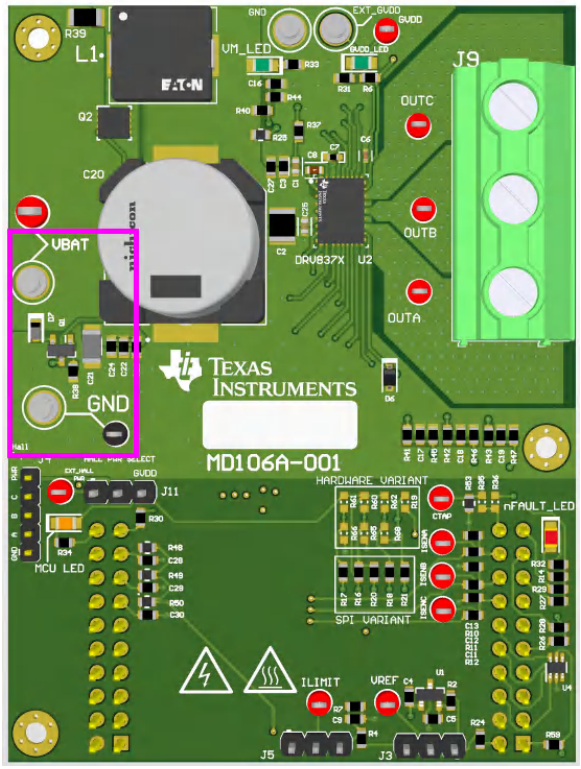


图 3-4. EVM 电源输入

警告

为了更大限度降低潜在的电击危险和人身伤害的风险，请在不使用 DRV837xEVM 时移除所有电源连接和接口。

将 EVM 和 LaunchPad™ 相互连接并连接到电源后，打开 dev.ti.com 上的 EVM GUI



图 3-5. LaunchPad GUI

GUI 允许用户控制 EVM、监测故障、旋转电机和配置 SPI 设置（适用于 SPI 型号）。

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4 硬件设计文件

4.1 原理图

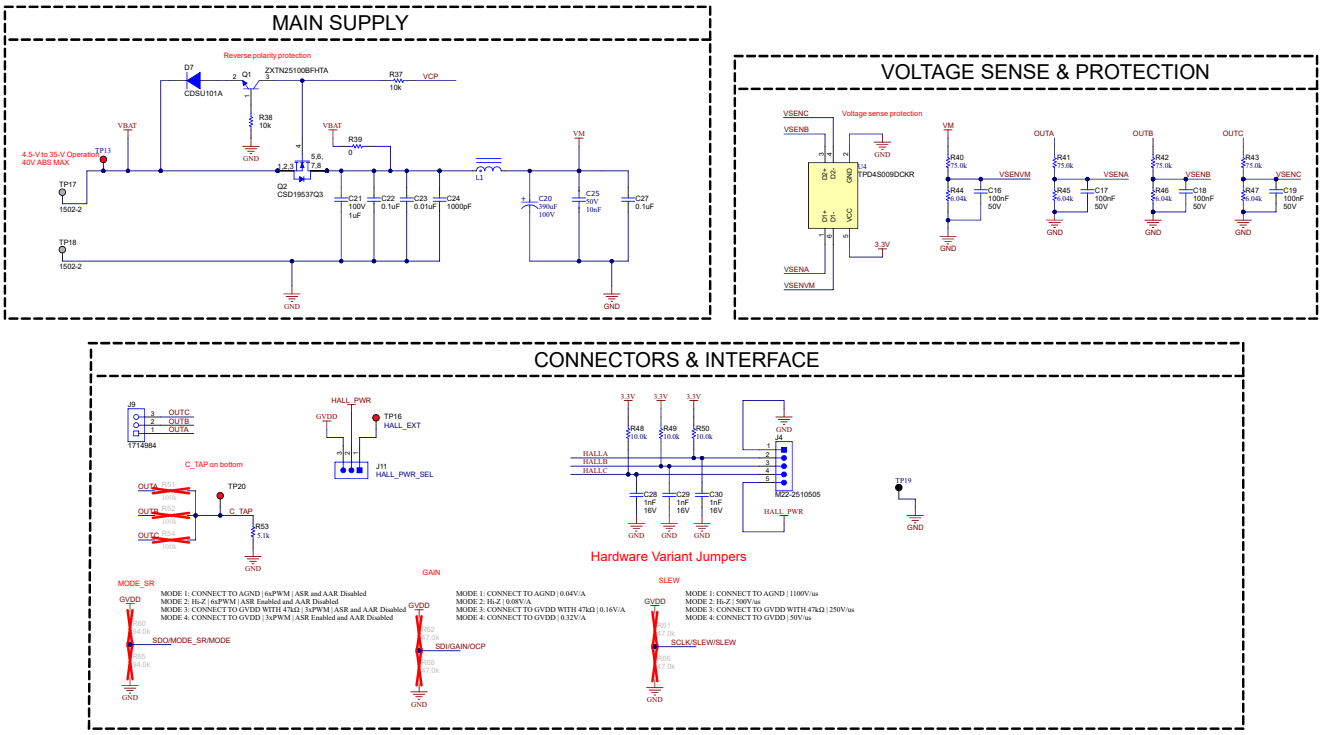


图 4-1. 主电源、电压检测、保护、连接器和接口

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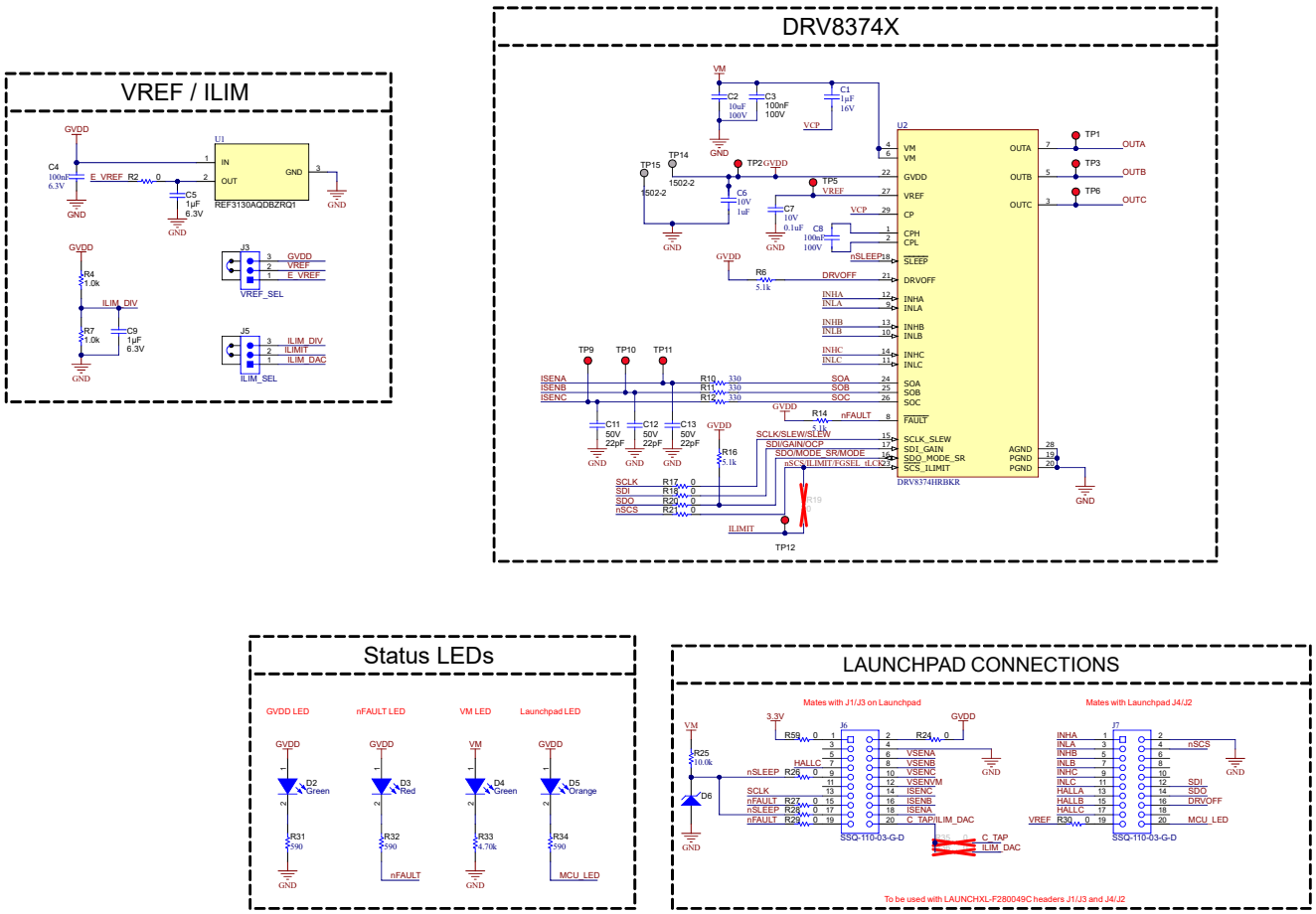


图 4-2. IC、VREF/ILIMT、状态 LED 和 LaunchPad™ 连接

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4.2 PCB 布局

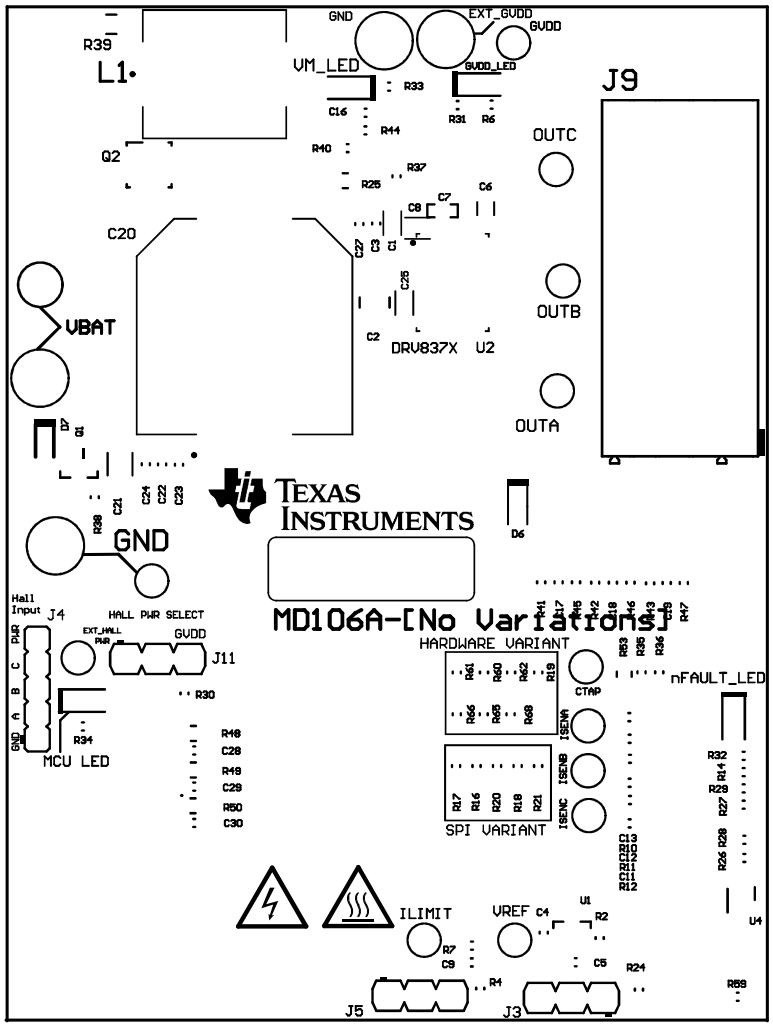


图 4-3. 顶层丝印层

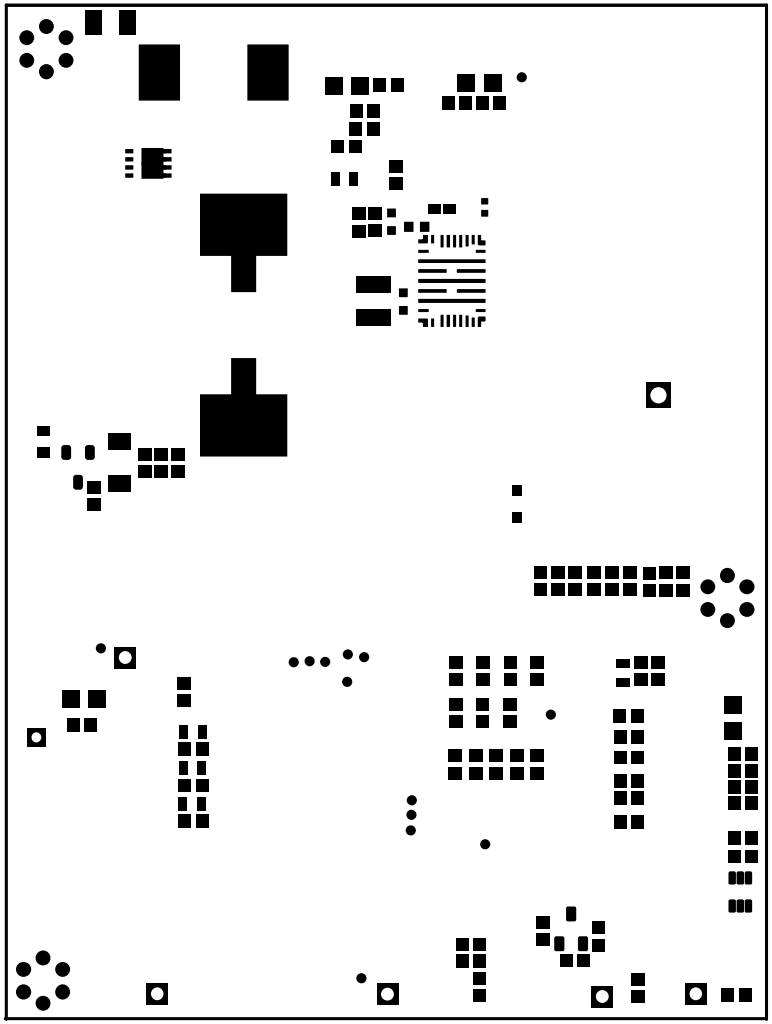


图 4-4. 顶部粘贴

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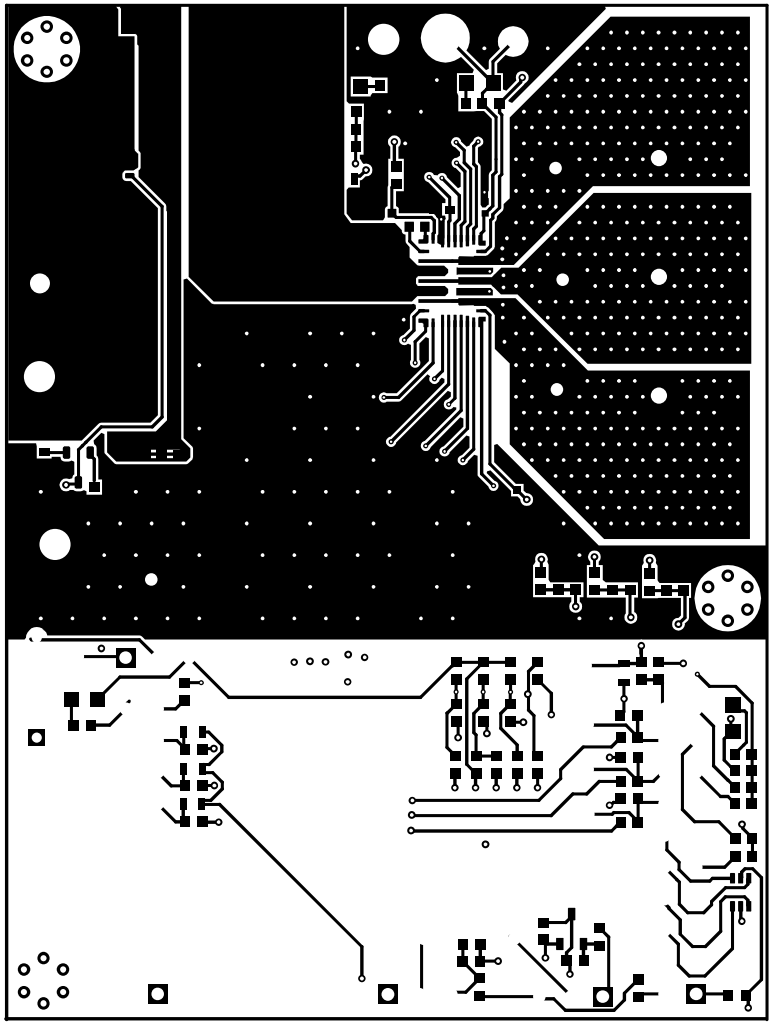


图 4-5. 顶层

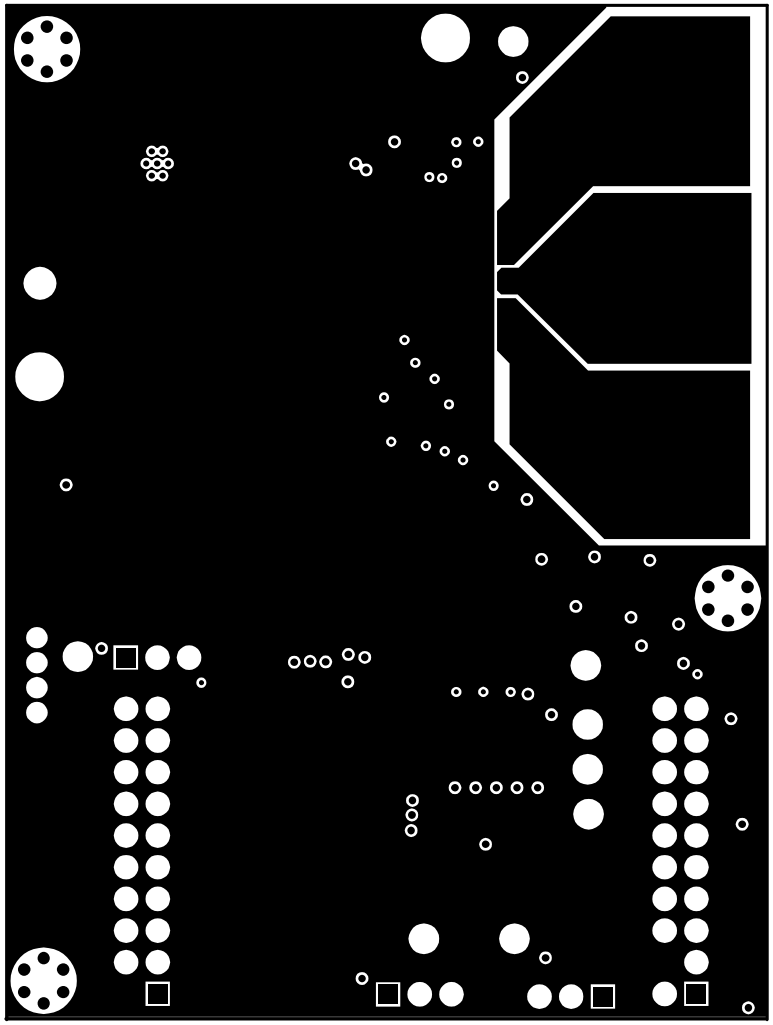


图 4-6. 接地层

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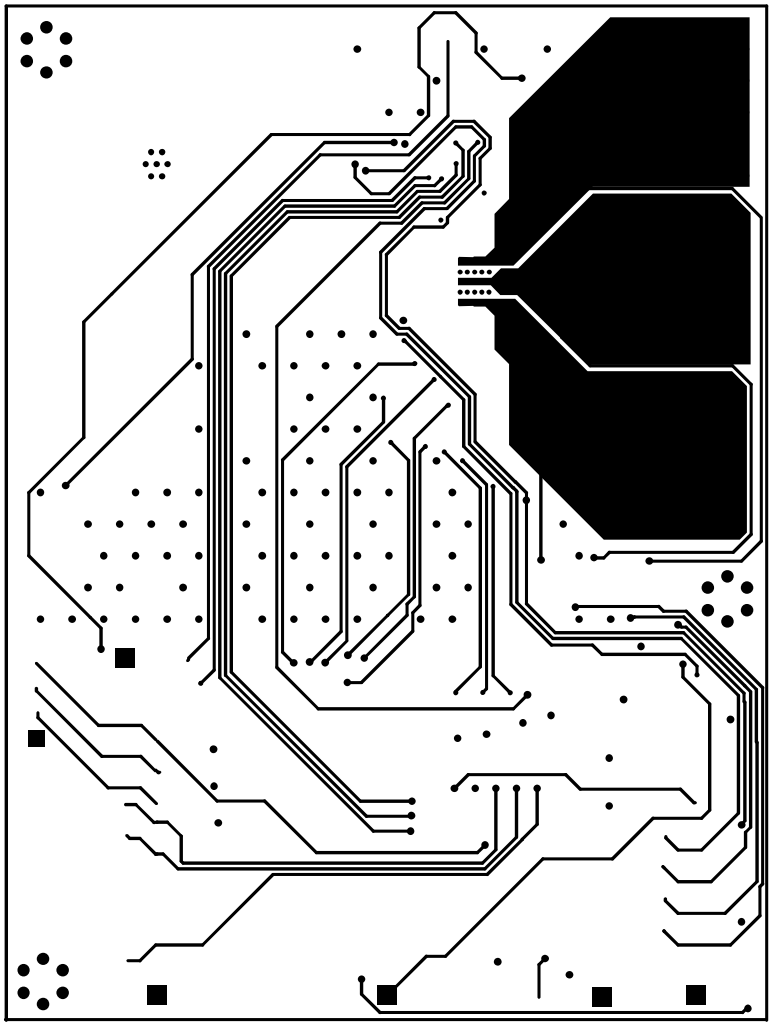


图 4-7. 电源层

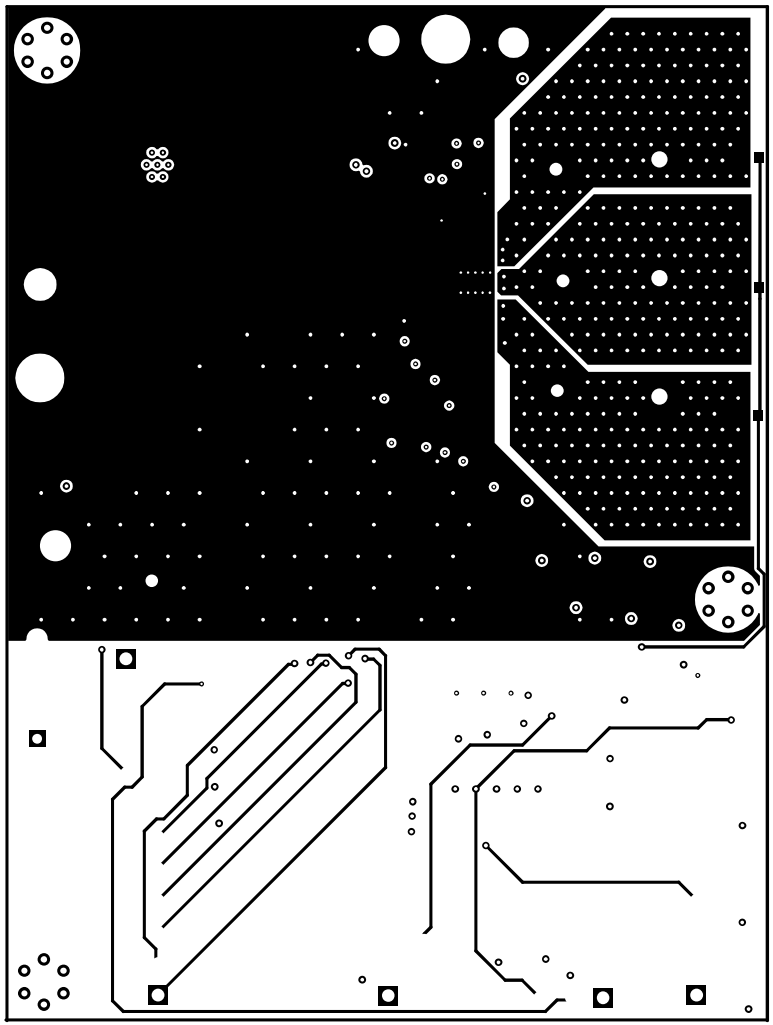


图 4-8. 底层

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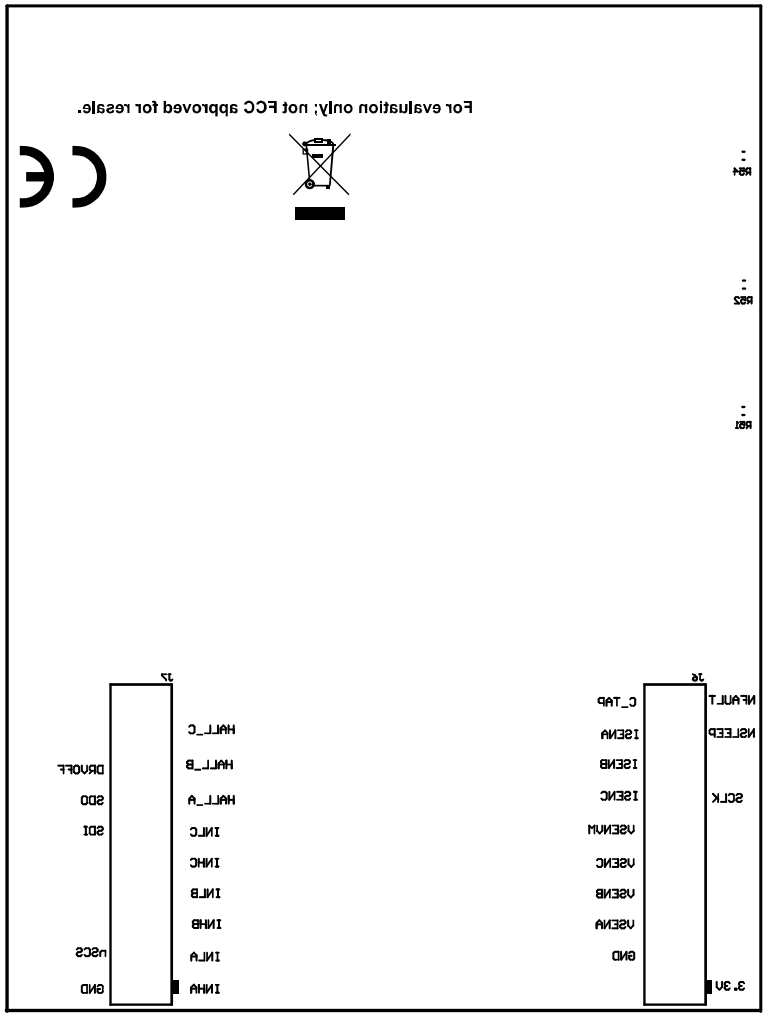


图 4-9. 底层丝印层

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4.3 物料清单 (BOM)

项目编号	指示符	数量	值	器件型号	制造商	说明	封装参考
1	!PCB1	1	MD106	不限	-	印刷电路板	-
2	C1	1	1μF	CGA3E1X7R1C105M080AC	TDK	电容，陶瓷，1 μ F，16V，X7R，20%，焊盘 SMD，0603，+125°C，汽车 T/R	0603
3	C2	1	10 μ F	GRM32ER71J106KA12L	MuRata™	电容，陶瓷，10 μ F，63V，±10%，X7R，1210	1210
4	C3	1	0.1 μ F	0603BB104KW101	Passive Plus	电容，陶瓷，0.1μF，100V，±10%，X7R，0603	0603
5	C4	1	0.1 μ F	GRM188R70J104KA01D	MuRata	电容，陶瓷，0.1 μ F，6.3V，±10%，X7R，0603	0603
6	C5、C9	2	1μF	CL10B105KQ8NNNC	Samsung Electro-Mechanics	电容，陶瓷，1 μ F，6.3V，±10%，X7R，0603	0603
7	C6	1	1μF	GMC04X7R105K10NT	Cal-Chip Electronics	1μF ±10% 10V 陶瓷电容器 X7R 0402（公制 1005）	0402
8	C7	1	0.1 μ F	GRM155R71A104KA01D	MuRata	电容，陶瓷，0.1 μ F，10V，±10%，X7R，0402	0402
9	C8	1	100nF	CL10B104KC8NNNC	Samsung	电容，陶瓷，100nF，100V，X7R，±10%，焊盘 SMD，0603，+125°C，T/R	0603
10	C11、C12、C13	3	22pF	CGA3E2C0G1H220J080AA	TDK	电容，陶瓷，22pF，50V，±5%，C0G/NP0，AEC-Q200 1 级，0603	0603
11	C16、C17、C18、C19	4	0.1 μ F	06035C104JAT2A	AVX	电容，陶瓷，0.1μF，50V，±5%，X7R，0603	0603
12	C20	1	390μF	UCM2A391MNS1MS	Nichicon	390μF 100V 铝制电解电容器，径向，Can - SMD 5000 小时，105°C	SMT_CAP_17MM1_17MM1
13	C21	1	1μF	C3216X7R2A105K160AA	TDK	电容，陶瓷，1 μ F，100V，±10%，X7R，1206	1206
14	C22、C27	2	0.1 μ F	CGA3E3X7S2A104K080AB	TDK	电容，陶瓷，0.1 μ F，100V，±10%，X7S，AEC-Q200 1 级，0603	0603
15	C23	1	0.01uF	CGA3E2X7R2A103K080AA	TDK	电容，陶瓷，0.01 μ F，100V，±10%，X7R，AEC-Q200 1 级，0603	0603
16	C24	1	1000pF	CGA3E2X7R2A102K080AA	TDK	电容，陶瓷，1000pF，100V，±10%，X7R，AEC-Q200 1 级，0603	0603
17	C25	1	10nF	CGA3E2X7R1H103K080AE	TDK	电容，陶瓷，10nF，50V，X7R，10%，焊盘 SMD，0603，+125°C，汽车 T/R	0603
18	C28、C29、C30	3	1000pF	8.85012E+11	Würth Elektronik™	电容，陶瓷，1000pF，16V，±10%，X7R，0603	0603
19	D2、D4	2	绿色	LTST-C170KGKT	Lite-On	LED，绿色，SMD	LED_0805
20	D3	1	红色	LTST-C170KRKT	Lite-On	LED，红色，SMD	LED_0805
21	D5	1	橙色	LTST-C170KFKT	Lite-On	LED，橙色，SMD	LED_0805
22	D6	1	3.3V	SZMM3Z3V3ST1G	ON Semiconductor	二极管，齐纳，3.3V，300mW，AEC-Q101，SOD-323	SOD-323

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项目编号	指示符	数量	值	器件型号	制造商	说明	封装参考
23	D7	1	90V	CDSU101A	Comchip Technology	二极管，开关，90V，0.1A，SOD-523F	SOD-523F
24	J3、J5、J11	3	-	68001-403HLF	FCI	接头，2.54mm，3x1，锡，TH	接头，2.54mm，3x1，TH
25	J4	1	-	M22-2510505	Harwin®	接头，2mm，5x1，金，TH	接头，2mm，5x1，TH
26	J6、J7	2	-	SSQ-110-03G-D	Samtec®	插座，2.54mm，10x2，金，TH	插座，2.54mm，10x2，TH
27	J9	1	-	1714984	Phoenix Contact	端子块，3x1，9.52MM，TH	端子块，3x1，9.52mm，TH
28	L1	1	1 μ H	HCMA1104-1R0-R	Eaton	1μH，屏蔽鼓芯，绕线电感器，18A，最大 3.3mΩ	非标准 SMD2
29	LBL1	1	-	THT-14-423-10	Brady®	热转印可打印标签，0.650" (宽) × 0.200" (高) - 10,000/卷	PCB 标签 0.650 × 0.200 英寸
30	Q1	1	100V	ZXTN25100BFHTA	Diodes Inc.	晶体管，NPN，100V，3A，AEC-Q101，SOT-23	SOT-23
31	Q2	1	100V	CSD19537Q3	德州仪器 (TI)	MOSFET，N 沟道，100V，50A，DQG0008A (VSON-CLIP-8)	DQG0008A
32	R2、R17、R18、R20、R21、R24、R26、R27、R28、R29、R30、R59	12	0	ERJ-3GEY0R00V	Panasonic®	电阻，0，5%，0.1W，AEC-Q200 0 级，0603	0603
33	R4、R7	2	1.0k	RCA06031K00JNEA	Vishay®-Dale	电阻，1.0k，5%，0.1W，AEC-Q200 0 级，0603	0603
34	R6、R14、R16	3	5.1k	CRCW06035K10JNEA	Vishay-Dale	电阻，5.1k，5%，0.1W，0603	0603
35	R10、R11、R12	3	330	RG1608P-331-B-T5	Susumu Co Ltd	电阻，330，0.1%，0.1W，0603	0603
36	R25、R48、R49、R50、R53	5	10.0k	TNPW060310K0BEEA	Vishay-Dale	电阻，10.0k，0.1%，0.1W，AEC-Q200 1 级，0603	0603
37	R31、R32、R34	3	590	RC0603FR-07590RL	Yageo®	电阻，590，1%，0.1W，0603	0603
38	R33	1	4.70k	RT0603BRD074K7L	Yageo America	电阻，4.70k，0.1%，0.1W，0603	0603
39	R37、R38	2	10k	CRCW060310K0JNEA	Vishay-Dale	电阻，10k，5%，0.1W，AEC-Q200 0 级，0603	0603
40	R39	1	0	RCA12060000ZSEA	Vishay-Dale	电阻，0，5%，0.25W，AEC-Q200 0 级，1206	1206
41	R40、R41、R42、R43	4	75.0k	CRCW060375K0FKEA	Vishay-Dale	电阻，75.0k，1%，0.1W，AEC-Q200 0 级，0603	0603
42	R44、R45、R46、R47	4	6.04k	RT0603DRE076K04L	Yageo America	电阻，6.04k，0.5%，0.1W，0603	0603
43	SH-J2、SH-J3	2	1x2	SNT-100-BK-G	Samtec®	分流器，100mil，镀金，黑色	分流器

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项目编号	指示符	数量	值	器件型号	制造商	说明	封装参考
44	TP1、TP2、TP3、TP5、TP6、TP9、TP10、TP11、TP12、TP16、TP20	11	5000	-	Keystone	测试点，微型，红色，TH	红色微型测试点
45	TP13	1	5005	-	Keystone	测试点，紧凑，红色，TH	红色紧凑型测试点
46	TP14、TP15、TP17、TP18	4	1502-2	-	Keystone	引脚，双转塔，TH	Keystone1502-2
47	TP19	1	5001	-	Keystone	测试点，微型，黑色，TH	黑色微型测试点
48	U1	1	-	REF3130AQDBZRQ1	德州仪器 (TI)	汽车级 20ppm/°C（最大值），100 µA，SOT23-3 系列电压基准，DBZ0003A (SOT-23-3)	DBZ0003A
49	U2	1	-	DRV8374HRBKR	德州仪器 (TI)	三相集成 FET 电机驱动器	VQFN29
50	U4	1	-	TPD4S009DCKR	德州仪器 (TI)	适用于高速差分接口的 4 通道 ESD 解决方案，DCK0006A (SOT-SC70-6)	DCK0006A
51	R19、R35、R36	0	0	ERJ-3GEY0R00V	Panasonic	电阻，0，5%，0.1W，AEC-Q200 0 级，0603	0603
52	R51、R52、R54	0	100k	ERA-3AEB104V	Panasonic	电阻，100k，0.1%，0.1W，AEC-Q200 0 级，0603	0603
53	R60、R61、R62、R65、R66、R68	0	47.0k	MCT0603MD4702DP500	Vishay/Beyschlag	电阻，47.0k，0.5%，0.15W，AEC-Q200 0 级，0603	0603

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5 其他信息

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6 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
September 2026	*	初始发行版

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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.

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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。
3. 技術基準適合証明を取得後ご使用いただく。

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

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東京都新宿区西新宿 6 丁目 2 4 番 1 号

西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html

3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

   8.1 *General Limitations*. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

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