参考文献

EVM User's Guide: XTR10X-120-EVM

XTR1xx 评估模块

说明

XTR10X-120-EVM 是一个用于评估 XTR1xx 产品（XTR100、XTR102 和 XTR120）的开发平台。XTR1xx（XTR100、XTR102 和 XTR120）系列是微功耗信号调理器，具有精密放大器和集成的高度匹配缩放电阻器。该评估模块设计用于作为两线制 4mA 至 20mA 变送器驱动器进行测试。

开始使用

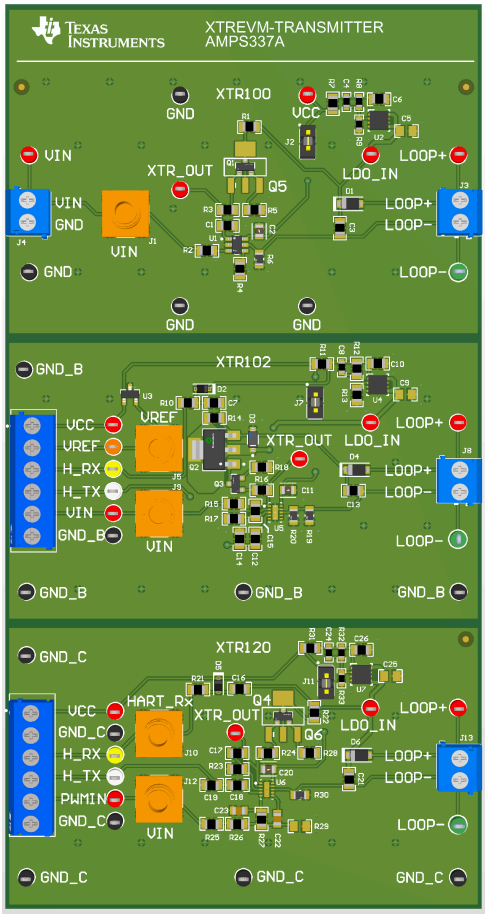
1. 订购评估模块 (EVM)。
2. 下载 EVM 用户指南。
3. 下载数据表：SLVSL52。

特性

- 两线制 4mA 至 20mA 电流环路变送器电路
- 拼板设计，便于评估
- 多个输入和输出连接器
- 用于监测 XTR1xx 器件静态电流的排针选项
- XTR100 封装兼容 5 引脚 SOT23 运算放大器引脚排列

应用

- 流量变送器
- 温度变送器
- 压力变送器
- 液位变送器



XTR10X-120-EVM 顶视图

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1 评估模块概述

1.1 简介

XTR10X-120-EVM 是一款用于测试 XTR1xx 系列的评估模块 (EVM)。XTR100 是一款集成高匹配度比例电阻器的精密放大器。该放大器针对低功耗、高精度应用进行了优化，专为精密两线制 4mA 至 20mA 变送器驱动应用而设计。

该 EVM 可对采用 XTR100 的两线制 4mA 至 20mA 现场变送器应用进行系统级评估。回路电源由外部供电，并通过低压降稳压器 (LDO) 进行稳压，为电路板提供本地电源。电路板提供多个输入和输出接口，便于进行评估。

本用户指南包含 XTR10X-120-EVM 的信息和支持文档。本指南包括电路说明、所需连接、印刷电路板 (PCB) 原理图、布局和物料清单。本文档中的*评估模块*、*评估板* 和 *EVM* 等术语指的是 XTR10X-120-EVM。

1.2 套件内容

XTR10X-120-EVM 装有 XTR100 以及回路电源、输入和输出的连接器。

表 1-1. XTR10X-120-EVM 套件内容

条目	说明	数量
XTR10X-120-EVM	PCB	1

1.3 规格

XTR10X-120-EVM 是一款评估模块，它提供了一种评估 XTR1xx 系列的方法。印刷电路板 (PCB) 的尺寸为 3.00in × 5.70in，使用 FR4 材料。输入、输出和回路电源均可通过螺钉接线端子或测试点接入。输入或输出信号可通过 SMA 连接器或测试点接入。

1.4 器件信息

XTR100 是一款精密放大器，集成了匹配电阻器，主要针对精密两线制变送器应用进行了优化。该放大器采用精密零漂移技术，具有极低的输入偏移电压和偏移漂移，工作电源电压范围为 1.7V 至 5.5V。XTR100 集成了两个电阻器，阻值分别为 10kΩ 和 40kΩ，电阻比为 1:4。

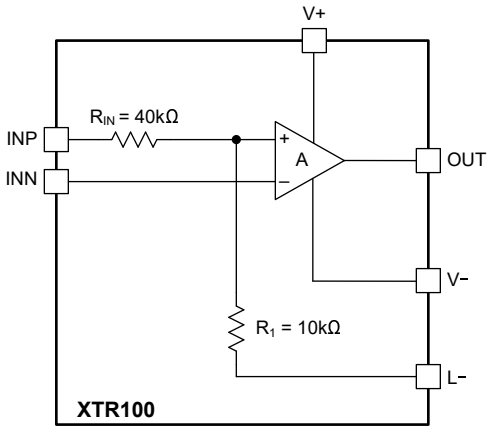


图 1-1. XTR100 方框图

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2 硬件

2.1 电源要求

XTR10X-120-EVM 通过 J3 端子块（LOOP+ 和 LOOP-）进行回路供电。为获得最佳性能，请使用浮动电源，并将电源电压设为 5V 至 36V。

回路电源为可调低压降稳压器 (LDO) 供电。默认情况下，LDO 配置为输出 3.3V。

取下跳线并串联接入万用表，即可测量 XTR 器件的静态电流。更多详细信息，请参见节 2.4。

2.2 设置

XTR10X-120-EVM 已配置为用于 4mA 至 20mA 两线制电流变送器应用。对于 XTR100 电路板，可通过 J4 端子块、VIN 和 GND 测试点或 SMA 连接器 J1 输入信号。输入信号可以来自 DAC 输出，也可以来自独立电压源，例如波形发生器或源测量单元 (SMU)。可将万用表与 LOOP+ 和浮动电源串联，以测量输出电流。图 2-1 展示了电路板设备设置示例。

电路板上设有多个测试点，便于调试。节 2.5 更详细地介绍了各测试点的功能。

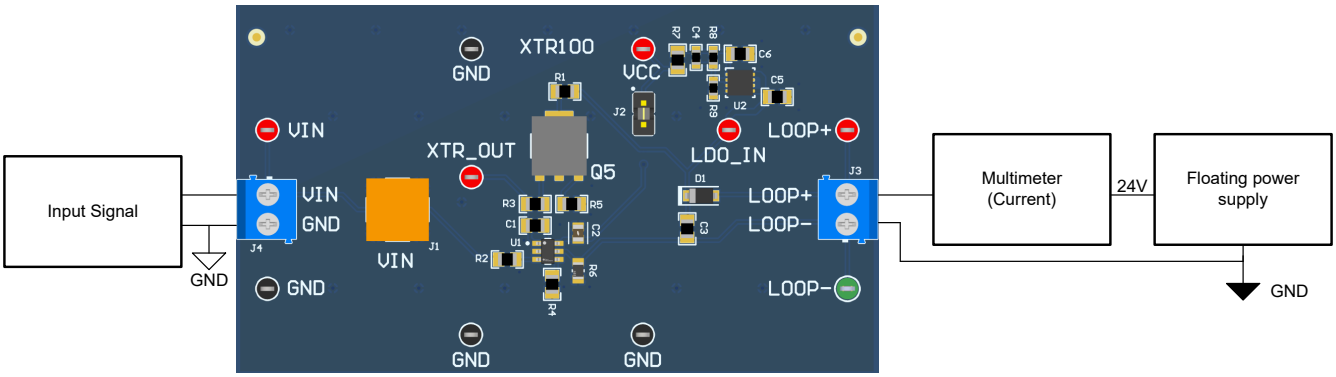


图 2-1. 设置示例

2.3 接头信息

表 2-1 详细介绍了电路板三个部分的接头信息。XTR102 和 XTR120 部分均提供可选的电源连接端，可连接外部 DAC 或 MCU。每个部分均为独立的电路板，不同部分之间的信号相互隔离。不得混用不同电路板部分的电源和 GND。

表 2-1. 接头信息

部分	接头	功能
XTR100	J3	回路电源：LOOP+、LOOP-
	J4	输入信号：VIN、GND
XTR102	J6	输入信号：VIN、GND HART 接口：HART_Rx、HART_Tx 输出功率（可选）：VCC、VREF
	J8	回路电源：LOOP+、LOOP-
XTR120	J13	回路电源：LOOP+、LOOP-
	J14	输入信号：PWM_IN、GND HART 接口：HART_Rx、HART_Tx 输出功率（可选）：VCC

2.4 跳线信息

表 2-2 描述了 EVM 上可用的跳线。

图 2-2 展示了如何配置 EVM，以便仅测量 XTR 器件的静态电流。

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表 2-2. 跳线信息

跳线	默认	功能
J2、J7、J11	闭合	XTR1xx 器件的静态电流测量 **闭合：**正常运行 **断开：**可选择串联接入万用表，仅测量 XTR 的 I_Q。**请勿断开跳线并使其处于悬空状态。器件将无法上电。**

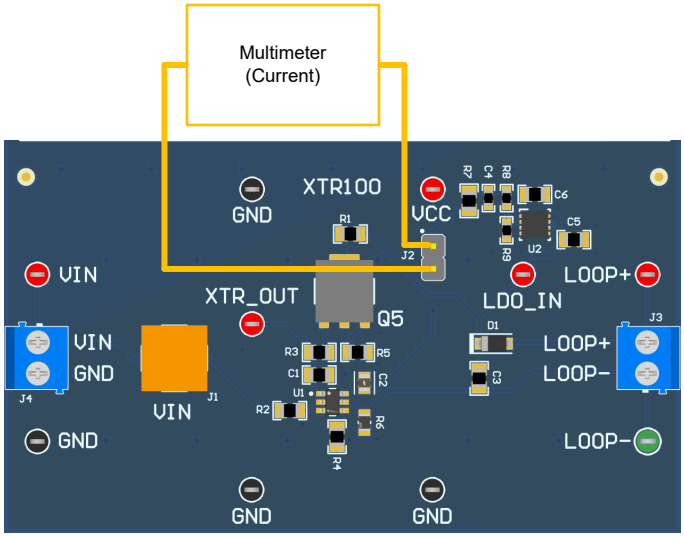


图 2-2. 静态电流测量

2.5 测试点

表 2-3 描述了各测试点的功能。

表 2-3. 测试点信息

部分	测试点	名称	说明
XTR100	TP1	LOOP+	环路电源 (LOOP+)
	TP2	VIN	输入信号
	TP3	XTR_OUT	XTR 输出
	TP4	LOOP-	环路电源 (LOOP-)
	TP6	LDO_IN	LDO 输入
	TP7	VCC	XTR 的电源电压（LDO 输出）
	TP8、TP9、TP10	GND	XTR100 的 GND
XTR102	TP11	H_RX	HART 接收
	TP12	VCC	XTR 的电源电压（LDO 输出）
	TP13	LDO_IN	LDO 输入
	TP14	VREF	参考输出
	TP15	LOOP+	环路电源 (LOOP+)
	TP16	H_TX	HART 发送
	TP17	XTR_OUT	XTR 输出
	TP18	LOOP-	环路电源 (LOOP-)
	TP19	VIN	输入信号
	TP20、TP21、TP22、TP23、TP24	GND_B	XTR102 的 GND

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表 2-3. 测试点信息（续）

部分	测试点	名称	说明
XTR120	TP25	H_RX	HART 接收
	TP26	H_TX	HART 发送
	TP27	LOOP+	环路电源 (LOOP+)
	TP28	XTR_OUT	XTR 输出
	TP29	LOOP-	环路电源 (LOOP-)
	TP30	PWM_IN	输入信号 (PWM)
	TP31	LDO_IN	LDO 输入
	TP32	VCC	XTR 的电源电压（LDO 输出）
	TP33、TP34、TP35、TP36、TP37、TP38	GND_C	XTR120 的 GND

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3 硬件设计文件

3.1 原理图

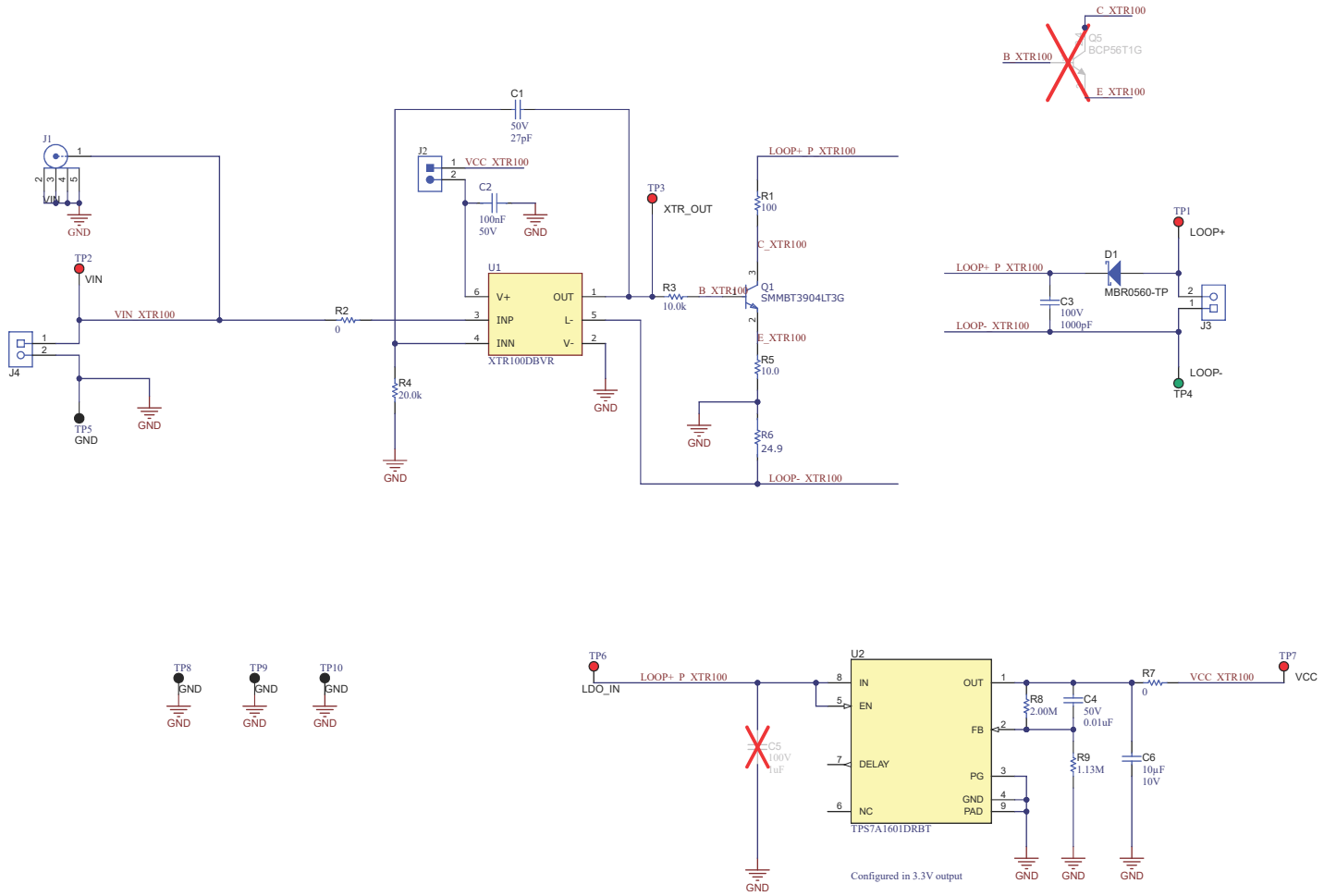


图 3-1. XTR100 原理图

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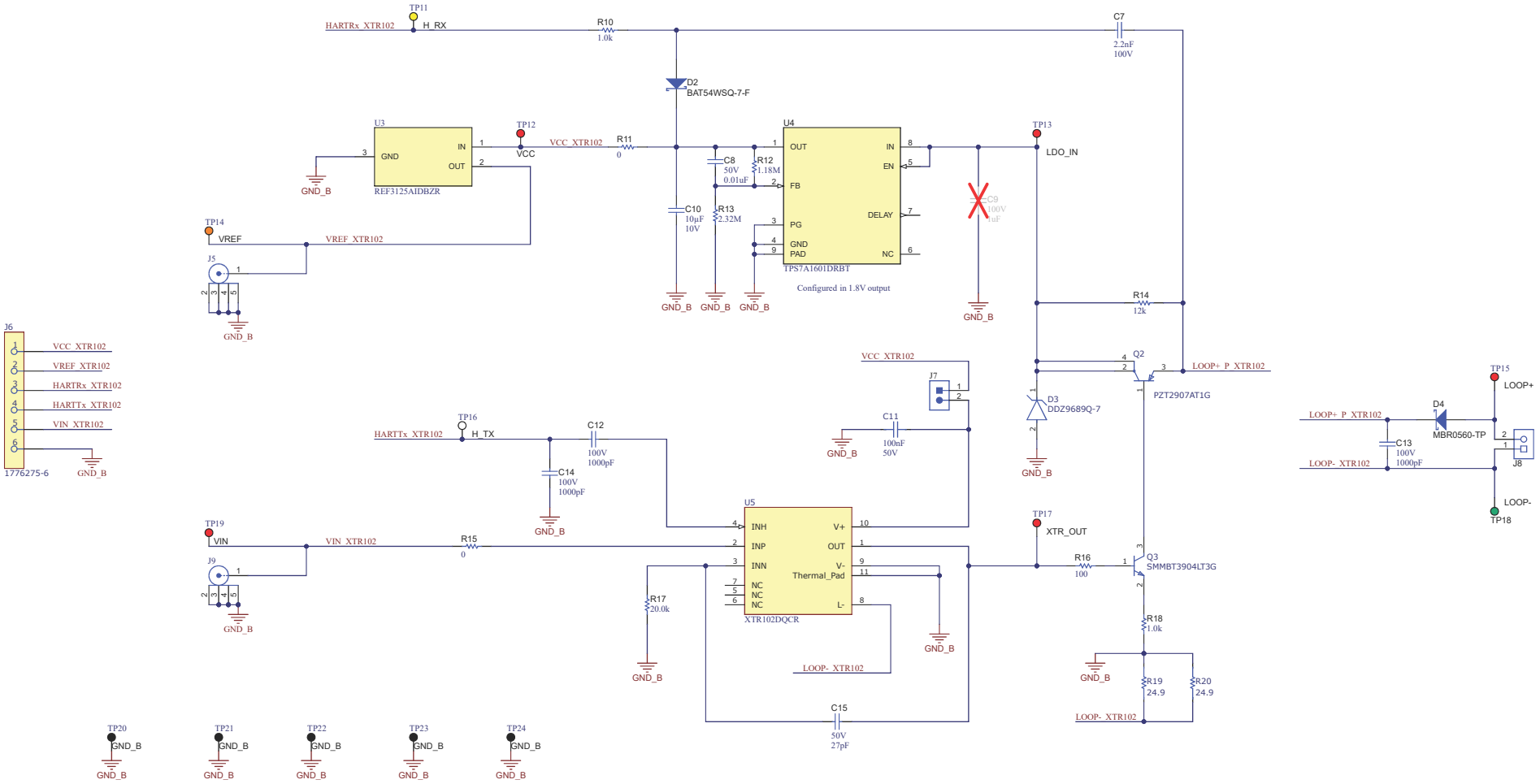


图 3-2. XTR102 原理图

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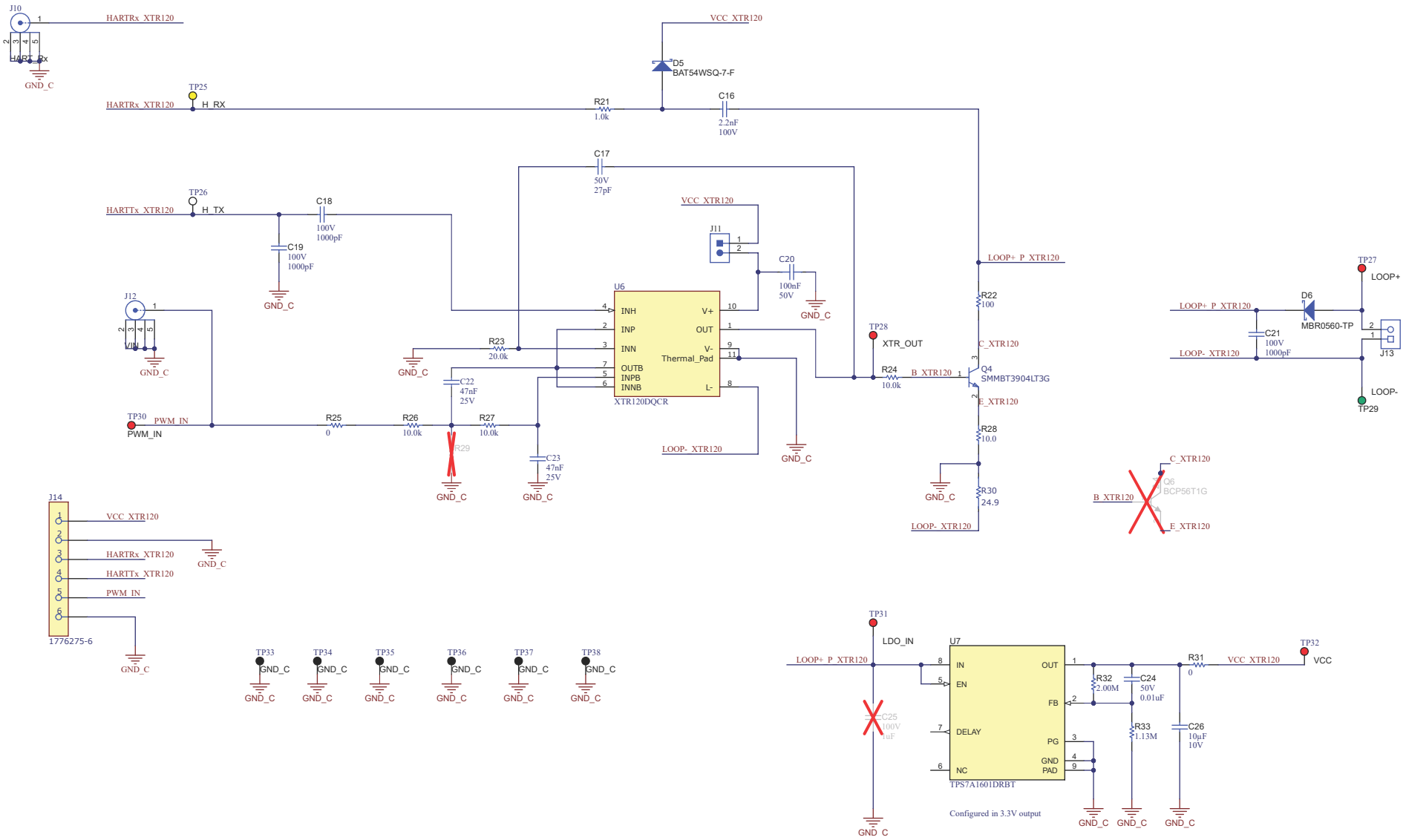


图 3-3. XTR120 原理图

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3.2 PCB 布局

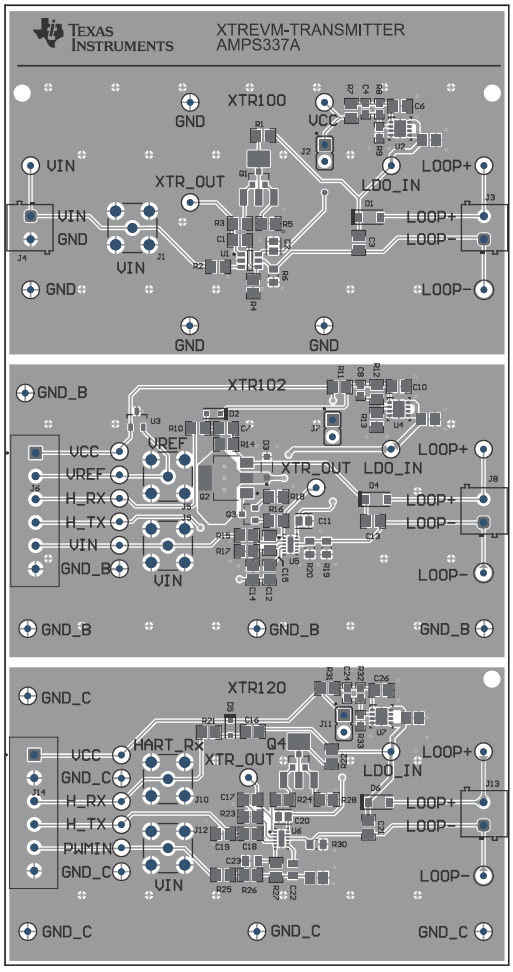


图 3-4. 顶层

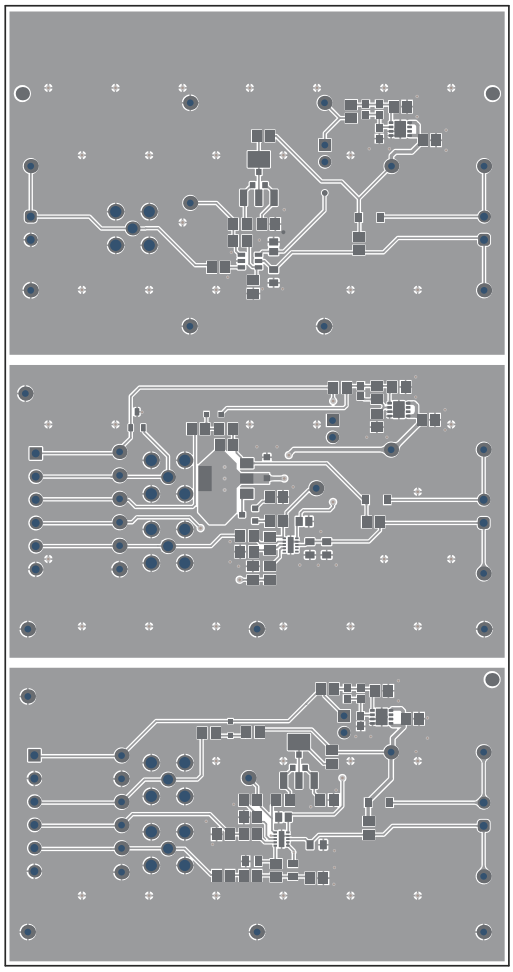


图 3-5. 顶层掩模

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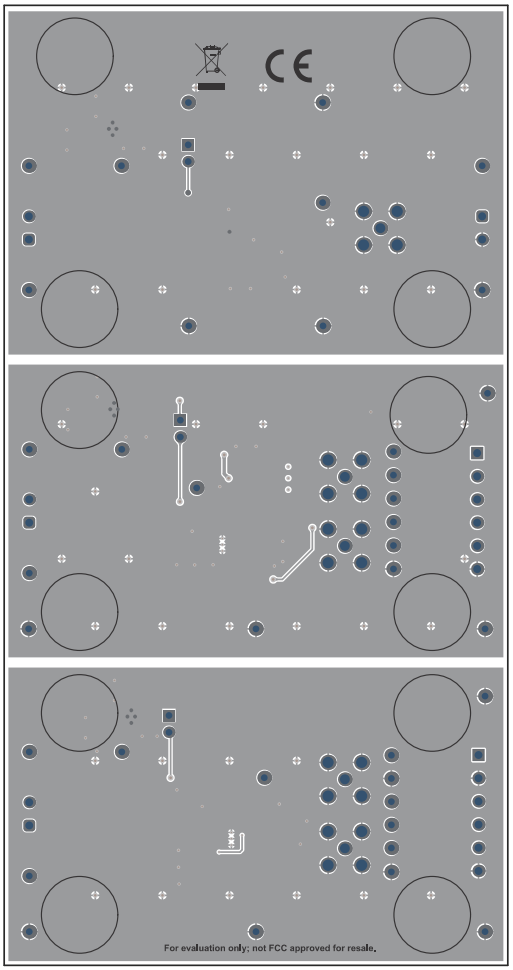


图 3-6. 底层

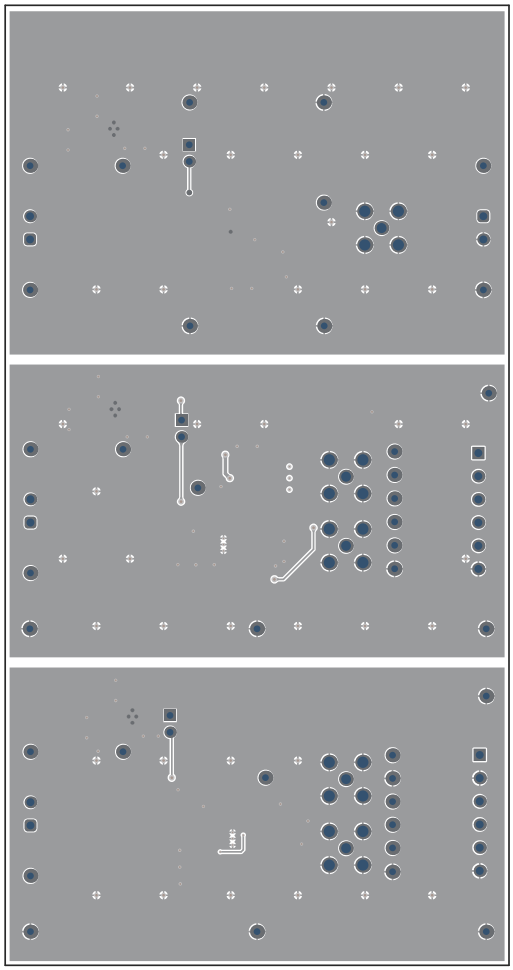


图 3-7. 底层掩模

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3.3 物料清单 (BOM)

表 3-1. 物料清单

指示符	数量	值	说明	封装参考	器件型号	制造商
!PCB1	1		印刷电路板		AMPS337	不限
C1、C15、C17	3	27pF	电容，陶瓷，27pF，50V，+/-5%，C0G/NP0，0805	0805	C0805C270J5GACTU	Kemet
C2、C11、C20	3	100nF	CL21 系列 0805 100nF 50V ±10% 容差 X7R 多层陶瓷片式电容器	0805	CL21B104KBCNNNC	Samsung
C3、C12、C13、C14、C18、C19、C21	7	1000pF	电容，陶瓷，1000pF，100V，+/-5%，C0G/NP0，0805	0805	08051A102JAT2A	AVX
C4、C8、C24	3	0.01uF	电容，陶瓷，0.01µF，50V，+/-5%，C0G/NP0，0603	0603	C1608NP01H103J080AA	TDK
C6、C10、C26	3	10uF	电容，陶瓷，10µF，10V，+/-5%，X7R，AEC-Q200 1 级，0805	0805	C0805C106J8RACAUTO	Kemet
C7、C16	2	2200pF	电容，陶瓷，2200pF，100V，+/-10%，X7R，0805	0805	08051C222KAT2A	AVX
C22、C23	2		0.047µF ±10% 25V 陶瓷电容器 X7R 0805（公制 2012）	0805	885012207070	Wurth Elektronik
D1、D4、D6	3	60V	二极管，肖特基，60V，3A，SOD-123	SOD-123	MBR0560-TP	Micro Commercial Components
D2、D5	2	30V	二极管 30V 200mA 表面贴装 SOD-323	SOD-323	BAT54WS-E3-18	Diodes Inc.
D3	1		齐纳二极管，5.1V，500mW，±6%，表面贴装 SOD-123	SOD-123	BZT52C5V1-TP	Micro Commercial Components
H1、H2、H3、H4、H5、H6、H7、H8、H9、H10、H11、H12	12		Bumpon，半球形，0.44 X 0.20，透明	透明 Bumpon	SJ-5303 (CLEAR)	3M
J1、J5、J9、J10、J12	5		SMA 直式插孔，金，50Ω，TH	SMA 直式插孔，TH	901-144-8RFX	Amphenol RF
J2、J7、J11	3		接头，100mil，2x1，金，TH	Sullins 100mil，1x2，绝缘体上方 230mil	PBC02SAAN	Sullins Connector Solutions
J3、J4、J8、J13	4		端子块，3.5mm，2x1，锡，TH	端子块，3.5mm，2x1，TH	1776275-2	TE Connectivity

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表 3-1. 物料清单（续）

指示符	数量	值	说明	封装参考	器件型号	制造商
J6、J14	2		连接器端子块，公头，6 位，3.5mm 螺钉式，直插，电缆安装，每触点额定电流为 7A	TERM_BLK_6	1776275-6	TE Connectivity
Q1、Q3、Q4	3	40V	双极 (BJT) 晶体管 NPN 40V 200mA 300MHz 300mW 表面贴装 SOT-23-3 (TO-236)	SOT23	SMMBT3904LT3G	On Semiconductor
Q2	1	-60V	转型 GP BJT PNP 60V 0.6A 1500mW 4 引脚 (3+Tab) SOT-223 T/R	SOT-223	PZT2907AT1G	onsemi
R1、R16、R22	3	100	电阻，100，5%，0.125W，0805	0805	CRCW0805100RJNEA	Vishay-Dale
R2、R7、R11、R15、R25、R31	6	0	电阻，0，5%，0.125W，0805	0805	CRCW08050000Z0EA	Vishay-Dale
R3、R24、R26、R27	4	10.0k	电阻，10.0k，1%，0.25W，AEC-Q200 0 级，0805	0805	RNCP0805FTD10K0	Stackpole Electronics Inc
R4、R17、R23	3	20.0k	电阻，20.0k，1%，0.125W，AEC-Q200 0 级，0805	0805	ERJ-6ENF2002V	Panasonic
R5、R28	2	10	电阻，10.0，1%，0.5W，AEC-Q200 0 级，0805	0805	ERJ-P06F10R0V	Panasonic
R6、R19、R20、R30	4	24.9	24.9Ω，±0.01%，0.125W，1/8W 片上电阻 0805（公制 2012），汽车 AEC-Q200，薄膜	0805	RNCF0805TKY24R9	Stackpole Electronics
R8、R32	2	2.00Meg	电阻，2.00M，1%，0.1W，AEC-Q200 0 级，0603	0603	CRCW06032M00FKEA	Vishay-Dale
R9、R33	2	1.13Meg	电阻，1.13M，1%，0.1W，0603	0603	CRCW06031M13FKEA	Vishay-Dale
R10、R18、R21	3	1.0k	电阻，1.0k，5%，0.125W，0805	0805	CRCW08051K00JNEA	Vishay-Dale
R12	1	1.18Meg	电阻，1.18M，1%，0.125W，0805	0805	CRCW08051M18FKEA	Vishay-Dale
R13	1	2.32Meg	电阻，2.32M，1%，0.125W，0805	0805	CRCW08052M32FKEA	Vishay-Dale
R14	1	12k	电阻，12k，5%，0.125W，AEC-Q200 0 级，0805	0805	ERJ-6GEYJ123V	Panasonic
SH-J2、SH-J7、SH-J11	3		单操作 2.54mm 间距开顶跳线插座	单操作 2.54mm 间距开顶跳线插座	M7582-05	Harwin

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表 3-1. 物料清单（续）

指示符	数量	值	说明	封装参考	器件型号	制造商
TP1、TP2、TP3、TP6、TP7、TP12、TP13、TP15、TP17、TP19、TP27、TP28、TP30、TP31、TP32	15		测试点，微型，红色，TH	红色微型测试点	5000	Keystone
TP4、TP18、TP29	3		测试点，微型，白色，TH	绿色微型测试点	5116	Keystone
TP5、TP8、TP9、TP10、TP20、TP21、TP22、TP23、TP24、TP33、TP34、TP35、TP36、TP37、TP38	15		测试点，微型，黑色，TH	黑色微型测试点	5001	Keystone
TP11、TP25	2		测试点，微型，黄色，TH	黄色微型测试点	5004	Keystone Electronics
TP14	1		测试点，微型，橙色，TH	橙色微型测试点	5003	Keystone Electronics
TP16、TP26	2		测试点，微型，白色，TH	白色微型测试点	5002	Keystone
U1	1		XTR100DBVR	SOT23-6	XTR100DBVR	德州仪器 (TI)
U2、U4、U7	3		具有使能端和电源正常状态指示的 60V、5uA Iq、100mA 低压降 (LDO) 稳压器，DRB0008B (VSON-8)	DRB0008B	TPS7A1601DRBT	德州仪器 (TI)
U3	1		20ppm/°C（最大值），100uA 串联电压基准，DBZ0003A (SOT-23-3)	DBZ0003A	REF3125AIDBZR	德州仪器 (TI)
U5	0		XTR102DQCR	WSON10	XTR102DQCR	德州仪器 (TI)
U6	0		XTR120DQCR	WSON10	XTR120DQCR	德州仪器 (TI)
C5、C9、C25	0	1uF	电容，陶瓷，1μF，100V，+/-10%，X7S，0805	0805	C2012X7S2A105K125AB	TDK
FID1、FID2、FID3	0		基准标记。没有需要购买或安装的元件。	不适用	不适用	不适用
Q5、Q6	0	80V	晶体管，NPN，80V，1A，AEC-Q101，SOT-223	SOT-223	BCP56T1G	ON Semiconductor

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表 3-1. 物料清单（续）

指示符	数量	值	说明	封装参考	器件型号	制造商
R29	0	0	电阻，0，5%，0.125W，0805	0805	CRCW08050000Z0EA	Vishay-Dale

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4 其他信息

4.1 商标

所有商标均为其各自所有者的财产。

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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

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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