EVM User's Guide: TMP115EVM

TMP115 评估模块

说明

TMP115 是一款与 I2C 兼容的数字温度传感器，采用超小型 (0.72mm2) 5 引脚 DPW 封装以及 1.6mm × 1.6mm 6 引脚 DRL 封装。TMP115 评估模块 (EVM) 可供用户评估 TMP115 数字温度传感器的性能。

开始使用

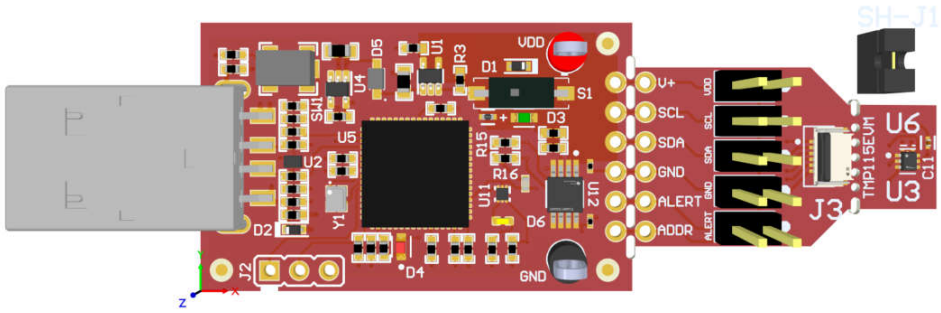
1. 订购 TMP115EVM
2. 拆下传感器分接 PCB 部分（可选）
3. 将 EVM 连接到计算机或用户系统
4. 前往 dev.ti.com 上的 TMP115EVM 库页面，下载 GUI 或在 Web 上运行
5. 有关 IC 详细信息，请参阅 TMP115 数据表
6. 访问我们的 E2E 论坛寻求支持或提问

特性

- 易于使用、基于云的图形用户界面 (GUI) 可在线使用，也可下载供离线使用
- 展示了具有警报功能的超小型数字温度传感器
- 可拆式传感器板具有 0.1" 间距接头封装，可与 TMP115 连接
- 用于柔性 PCB 板温度感测选项的可附加连接器
- 提供硬件可选寻址
- 使用 GUI 进行数据记录

应用

- 楼宇自动化
  - 占位检测
  - 可视门铃
  - HVAC：无线环境传感器
- 工厂自动化和控制
  - 机器视觉摄像机
  - 电力输送单元
  - 工业 PC：单板计算机
  - CPU（PLC 控制器）
- 医疗设备
  - 连续血糖监测仪
- 数据中心和企业级计算
  - 固态硬盘 (SSD)
  - 机架式服务器主板
- 个人电子产品
  - PC 和笔记本电脑、平板电脑
  - 数码相机与数码摄像机
  - 增强现实眼镜
  - 智能扬声器



TMP115EVM

1 评估模块概述

1.1 简介

TMP115EVM 可按原样使用，并可搭配评估模块图形用户界面 (GUI)。或者，可以拆下传感器，从而在用户系统中进行评估。为此，可以通过多种方法来与传感器连接，以便提供出色的用户体验。

该 EVM 具有 USB 记忆棒大小，其板载 MSP430F5528 微控制器通过一个互联集成电路 (I2C) 接口与主机和 TMP115 器件相连接。该模块在 EVM 板上的传感器和主机控制器之间设计有穿孔。利用穿孔，用户可以灵活地进行评估：

- 用户可以将 TMP115 传感器分接部分连接到其系统/主机。
- 用户可使用 TMP115 器件将 EVM 主机和软件与用户系统连接。
- 小型独立电路板允许用户将传感器放置在用户系统或温度受控环境中来评估性能。
- 孔间距与常见的 0.1 英寸原型设计试验电路板兼容。

本用户指南介绍了 TMP115EVM 评估版的特性、操作和使用，具体来说，说明了如何设置和配置软件、介绍了硬件并探讨了软件操作的各个方面。本文档中的评估板、评估模块和 EVM 等所有术语均指 TMP115EVM。本用户指南还提供了有关操作过程、输入和输出连接、电气原理图、印刷电路板 (PCB) 布局图和 EVM 器件列表的信息。

1.2 套件内容

下面展示了 EVM 套件的内容。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 https://www.ti.com，以验证是否已下载相关软件的最新版本。

- 1 - TMP115EVM
- 1 - 接头，100mil，3×1，金，TH

1.3 规格

表 1-1 定义了 EVM 每个部分的绝对最大热性能条件。主要的 2 个部分是控制器部分和传感器分接部分。评估器件在极端温度下的性能时，必须考虑这些限值。在这种情况下，如果设置条件超过控制器绝对最大热性能规格，则必须分离传感器分接部分，以便在这些温度下仅评估传感器（而不是 MCU）。

表 1-1. 热性能规格

板部分	条件	温度范围
控制器板	建议的自然通风条件下的工作温度范围 (T_A)	-40°C 至 85°C
	绝对最高结温 T_J	95°C
TMP115 分接部分	建议的自然通风条件下的工作温度范围 (T_A)	-55°C 至 175°C

1.4 器件信息

TMP115 是一款采用小型 6 引脚 WCSP 封装的数字输出温度传感器，该传感器在生产环境中进行了校准，可实现高精度。该器件采用与 SMBus 和 I²C 接口兼容的两线制环境进行通信，并具有 4 个使用地址选择引脚的 I²C 地址选项。该器件可设置为进行连续转换或单次转换，此外还具有警报功能。有关该 IC 的更多信息，请参阅器件数据表。

2 硬件

2.1 概述

该 EVM 分为两个部分：控制器部分和传感器分接部分。传感器分接部分可以分离，以便在以下情况下使用传感器：

- 在通过焊接电线/连接器连接传感器部分的情况下，使用控制器部分来在极端温度或其他条件下从远离控制器和 PC 的位置评估传感器。
- 通过 TMP115 的 I²C 将传感器部分连接用户系统。
- 将控制器部分与用户系统中的 TMP115 传感器结合使用。

TMP115EVM 电路板部分 突出显示了用户必须识别的 EVM 各部分以及一些元件，以便了解其用途和使用方法。后续几节将详细说明这些元件。

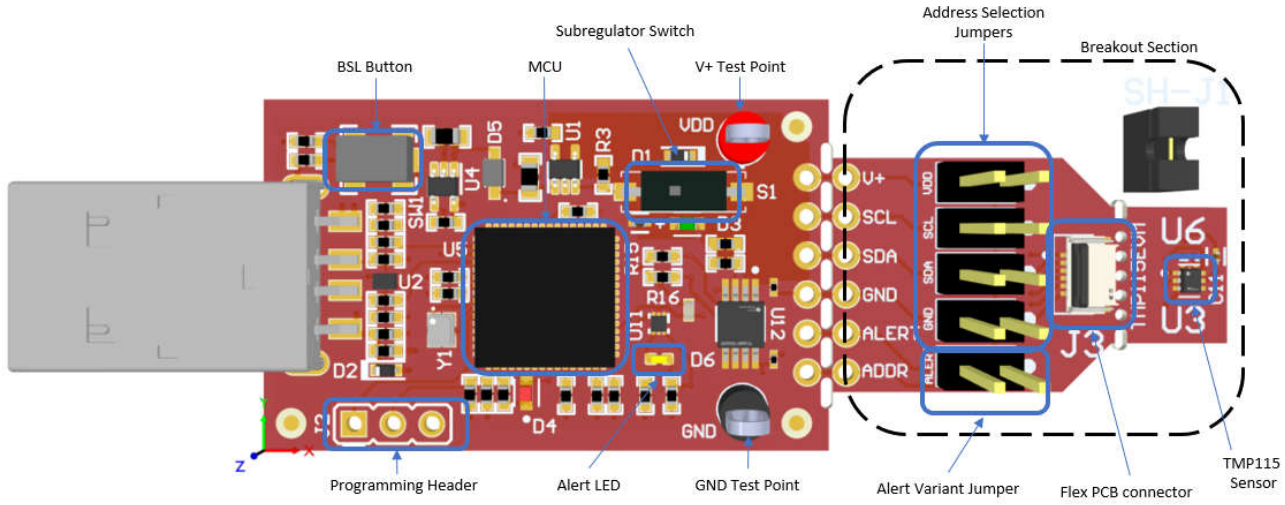


图 2-1. TMP115EVM 电路板部分

2.2 穿孔和连接

USB 控制器和 TMP115 传感器分接部分之间的穿孔在电路板底部两侧均进行了标记，以用于引脚连接。将传感器部分与控制器部分分离后，用户可以通过焊线或 0.1 英寸接头连接器来连接传感器部分。通过这种方法，用户可以访问该器件的所有 6 个引脚。

请注意，上拉电阻器和保护二极管位于控制器部分上。因此，当连接其他控制器板时，TI 建议验证任何控制器板上是否存在上拉电阻器和保护电路，以确保功能安全且正常。

此外，EVM 配置允许通过跳线选择不同的地址。DPW 封装具有警报或者地址变体。根据 DPW 型号的不同，您可以选择一个地址或带有跳线的警报，如图 2-1 所示。此配置允许您访问 GUI 特性，同时将器件更改为 EVM 上的 DPW 封装。

TMP115EVM 可选择将柔性 PCB 与附加的 TMP115 连接。TMP115 柔性 PCB 连接具有不同的在线可订购产品，需要单独订购。可以连接默认 FR-4 可拆部分，也可以连接柔性 PCB。两者不能同时连接到 USB。

2.3 状态 LED 和子稳压器

为 VDD 供电后，绿色 LED D3 亮起。由于 VDD 用于器件电源和通信线路上拉电压，因此必须为 VDD 供电才能确保 TMP115EVM 正常运行。可以通过板载子稳压器 U1 或外部电源为 VDD 供电。有关更多详细信息，请参阅节 2.5。

当 ALERT 引脚为低电平时，黄色 LED D6 亮起。ALERT 引脚的默认软件配置为低电平有效，当 ALERT 变为有效或“跳闸”时，LED 将亮起。

红色 LED D4 是 MSP430F5528 状态 LED。表 2-1 显示了器件如何通过 LED 状态显示不同的工作模式。

表 2-1. LED 状态与工作模式

D4 LED 状态	MSP430F5528 的工作模式
关闭	EVM 已连接到 EVM GUI
连续闪烁 4 次	EVM 已插入 PC，未连接到 EVM GUI
持续闪烁	已连接到 USB 电源

2.4 地址选择

TMP115EVM 的分接部分有一个“地址选择”部分。可以将跳线移至 ALERT、GND、SDA、SCL 或 VDD 以便进行地址选择。请参阅数据表，了解器件配置的 I2C 地址。注意一次只能安装 1 根跳线，以避免短路。您可以通过跳线选择地址或警报，具体取决于 DPW 型号。此配置允许您访问 GUI 特性，同时将器件更改为 EVM 上的 DPW 封装。

2.5 电源

VDD 对 TMP115 器件供电并提供通信线路的上拉电压。电源电压范围已在数据表中列出。板载稳压器 U1 将 USB 功率调低至 3.3V。用户还可以禁用子稳压器以施加不同的电源电压。要使用外部电源，请按照以下说明操作：

1. 切换开关 S1 以禁用子稳压器；绿色 LED D3 熄灭
2. 使用 V+ 和 GND 测试点连接外部电源，或通过分接部分的焊接接头或焊线连接外部电源
3. 电源 VDD；绿色 LED D3 亮起
4. 正常使用 GUI

2.6 编程接头

TMP115EVM 预先加载了正常运行 USB 接口和 PC GUI 软件所必需的固件。提供了未填充的接头 J2，用于对 MSP430F5528 进行 Spy-Bi-Wire 访问。TI 不建议用户访问该接头或对器件进行重新编程。

2.7 BSL 按钮

TMP115EVM 具有用于进入 USB BSL 模式的按钮 SW1。可将其用于固件更新。要进入 USB BSL 模式，请在按住 SW1 的同时将 EVM 连接到 PC USB 端口。

3 软件

3.1 软件下载

TMP115EVM 的 PC GUI 软件在 TI 的 GUI Composer 框架上运行。该软件可作为在您的浏览器中运行的实时版本提供，也可以下载以供离线使用。该软件与 Windows®、Mac® 和 Linux® 操作系统兼容。

3.1.1 dev.ti.com 上的实时软件

在线软件当前可以在 Chrome、Firefox 和 Safari 中工作。不支持 Internet Explorer。用户可以通过以下操作之一访问实时版本：

- 转到 EVM 工具页面并点击“View”按钮。
- 转到 https://dev.ti.com/gallery/search/tmp115

点击库中的应用程序图标以启动该软件。点击提示以安装 TI Cloud Agent Bridge 浏览器插件。

3.1.2 离线软件

3.1.2.1 从 dev.ti.com 下载

如上所述，用户可以通过导航到实时版本来访问最新版本的离线软件。找到下载图标 并下载适用于操作系统的应用程序和运行时，如库下载中所示。

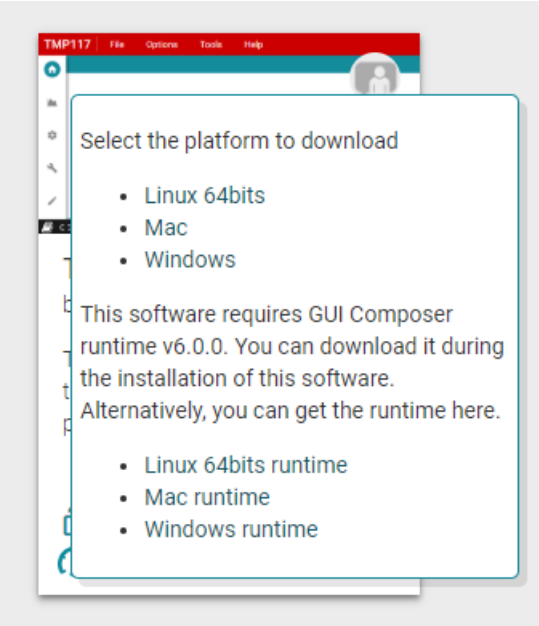


图 3-1. 下载弹出窗口

3.2 主页选项卡

“Home”选项卡会在软件启动时显示。在这里，您可以访问“Getting Started”、“Information”、“Data”、“Registers”和“Collateral”选项卡，如下所述。屏幕左侧的图标是这些选项卡的快捷方式。

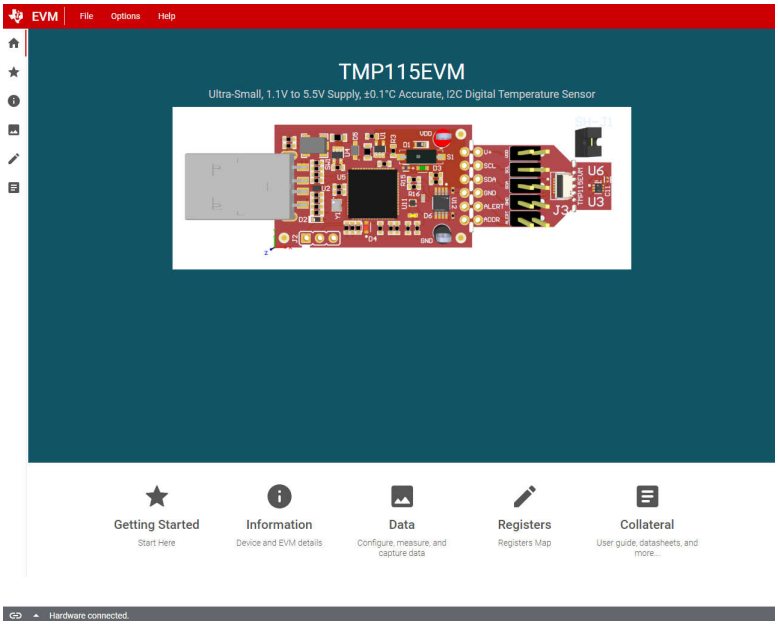


图 3-2. 主页

3.3 入门

“Getting Started”选项卡用于根据 ADDR 引脚连接来设置目标 I²C 地址。默认设置假设 ADDR 引脚连接到 GND。要更改 I²C 配置，请从下拉列表中进行适当的选择。然后，点击 GUI 左下角的按钮以重新初始化通信。

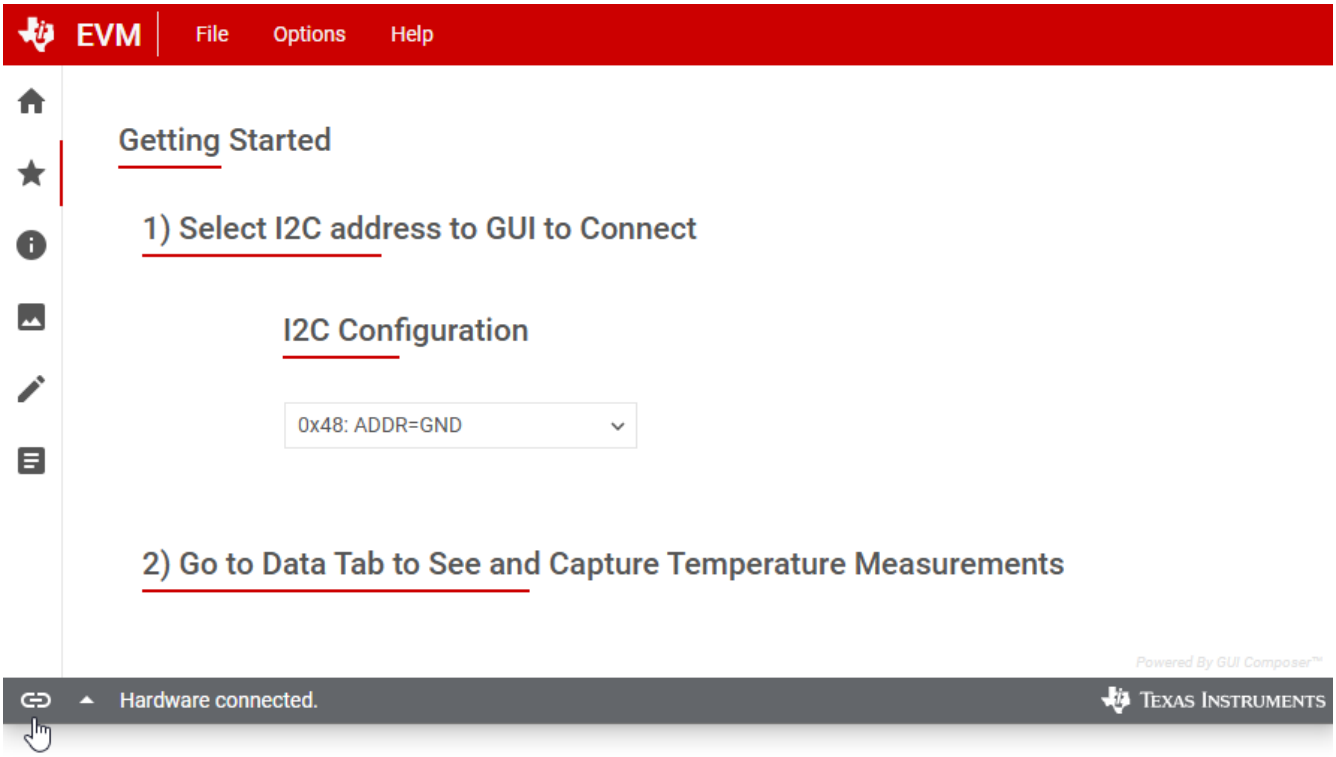


图 3-3. 入门

3.4 “Information”选项卡

Information 选项卡显示 TMP115 的器件详细信息和特性以及 EVM。Device Information & Features 子选项卡包含规格摘要、器件方框图和功能模式说明。EVM Details 子选项卡包含 EVM 原理图和图例。

3.5 数据选项卡

“Data Capture”选项卡报告 TMP115EVM 中包含的 TMP115 器件的温度。默认情况下，连接 EVM 且 GUI 已正确加载并运行后，器件会以连续转换模式启动，并且 MCU 开始轮询器件。转换结果会自动报告并显示在“Data”选项卡图中。

在该选项卡的右侧，用户可以查看最新的温度读数值。此外，还有一个“Chart Controls”框允许用户：

- 设置轮询速率。从下拉列表中选择一个值后，MCU 会自动开始以设定的轮询速率读取 TMP115。
- 使用“Device Rate”字段写入转换率位。从下拉列表中选择一个值后，MCU 会自动写入 TMP115，然后开始以编程的速率转换。
- 开始和停止轮询数据读取，可将数据导出为 CSV 格式，以便进行温度监测。用户必须通过点击“Start”按钮开始轮询。一旦点击“Stop”按钮，数据 (CSV) 会自动导出。

用户可以使用“Alert Config”框轻松配置 TMP115 的警报功能设置，例如极性、模式和限值。可在左侧框中以十进制格式写入限值，对应的十六进制值会自动显示在右侧框中，以供参考。一旦选定或更新，所有设置都由 MCU 自动写入 TMP115。

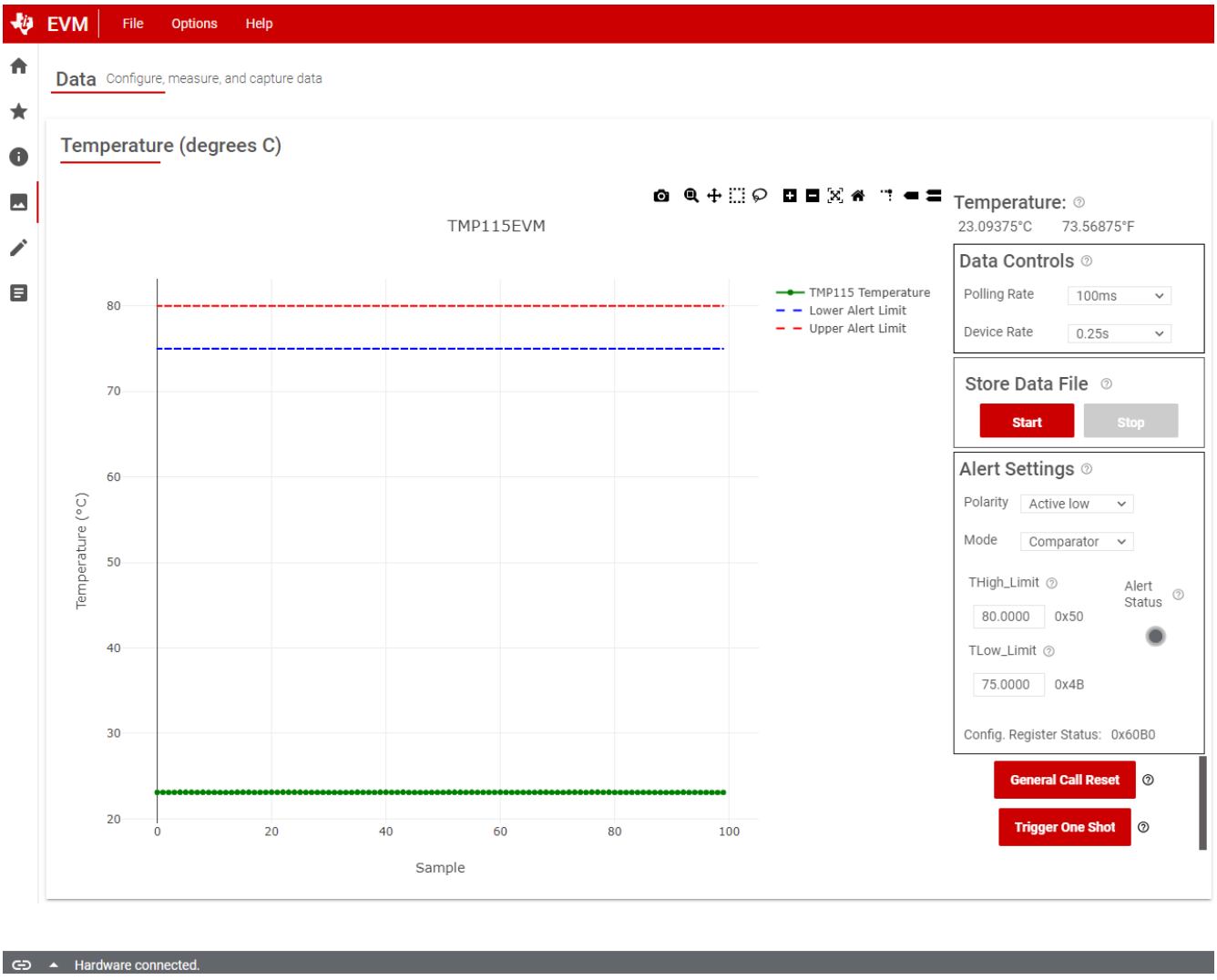


图 3-4. 数据采集

3.6 “Registers”选项卡

“Registers”选项卡提供 TMP115 器件中寄存器和位的交互。有关每个寄存器或位的更多信息，请选择寄存器名称以查看每个位的定义。

“Auto Read”下拉框配置寄存器内容的轮询速率。默认情况下，MCU 以 100ms 的延迟轮询寄存器。当“Auto Read”关闭时，请选择“Read Register”来获取选定寄存器的内容。“Read All Registers”可用于立即获取所有寄存器的内容。

默认情况下，当“Write Mode”按钮被设置为“Immediate”时，“Write Register”按钮将显示为灰色并被禁用。每次修改寄存器时，Immediate 模式都会触发写入操作。选择“Deferred”模式时，会启用“Write Register”按钮，除非点击“Write Register”按钮，否则不会执行写入操作。

这些设置使用户可以完全控制 I^2C 总线活动，并可以使用示波器、逻辑分析仪或总线监听器件轻松观察各个事务。

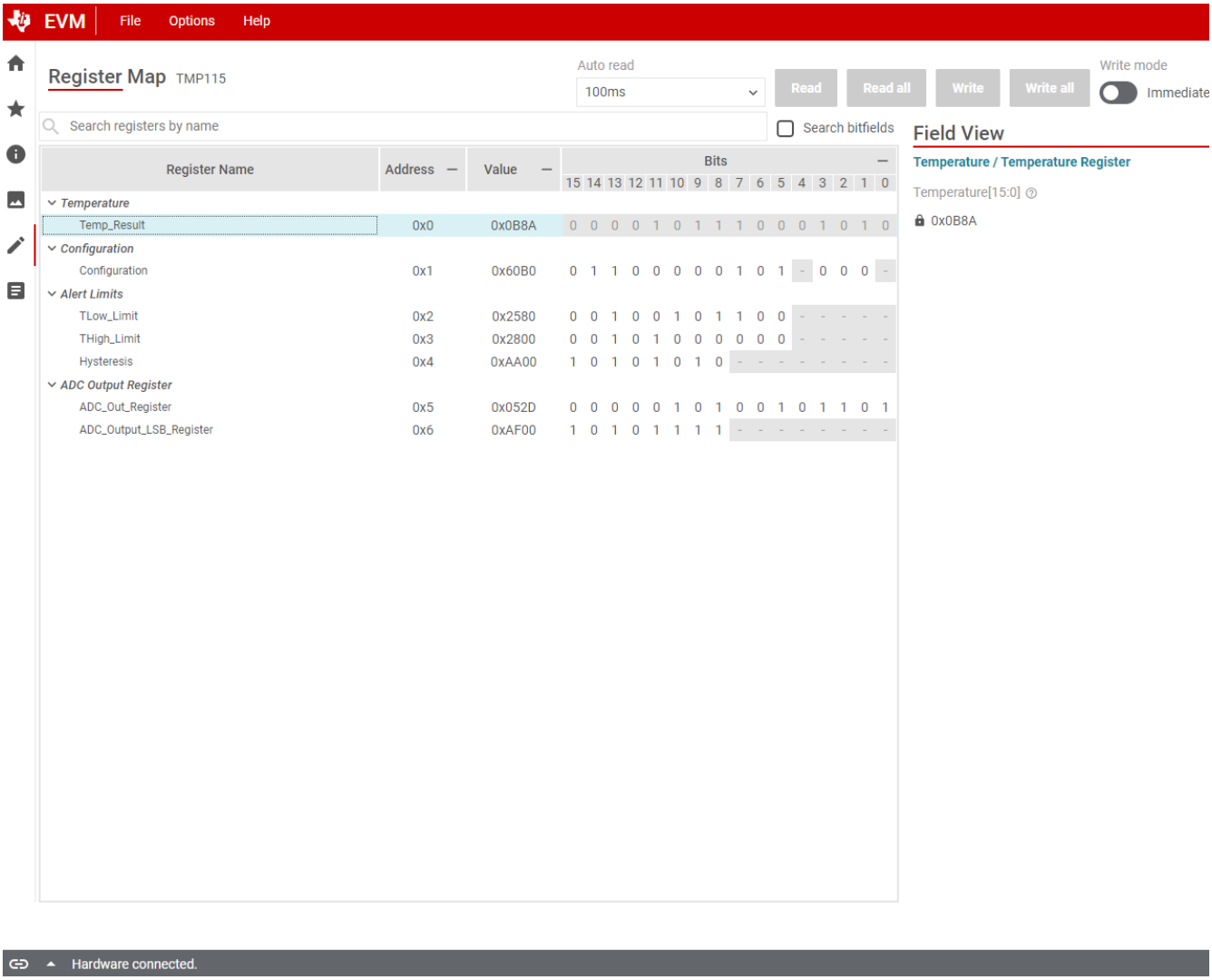


图 3-5. 寄存器

3.7 配套资料选项卡

“Collateral”选项卡包含 EVM 用户指南链接、ti.com 工具页面链接、产品数据表链接以及其他相关链接。

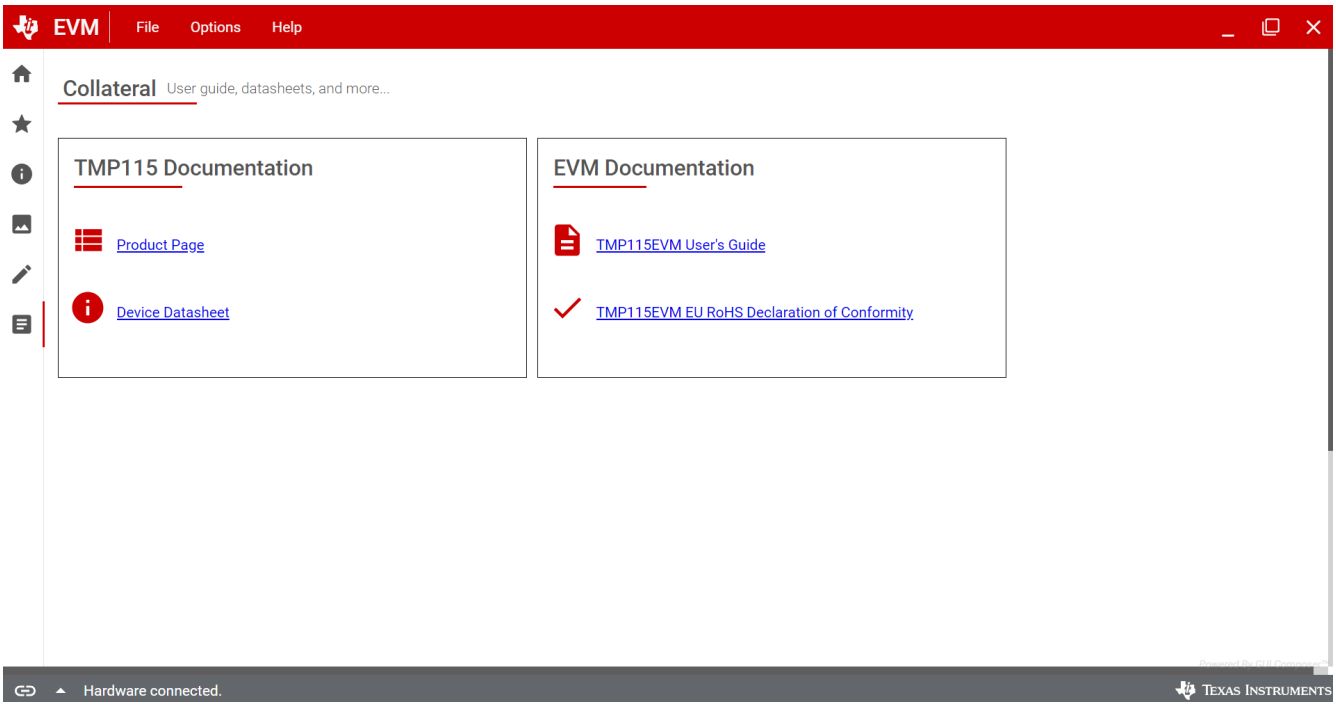


图 3-6. 配套资料

4 硬件设计文件

4.1 原理图

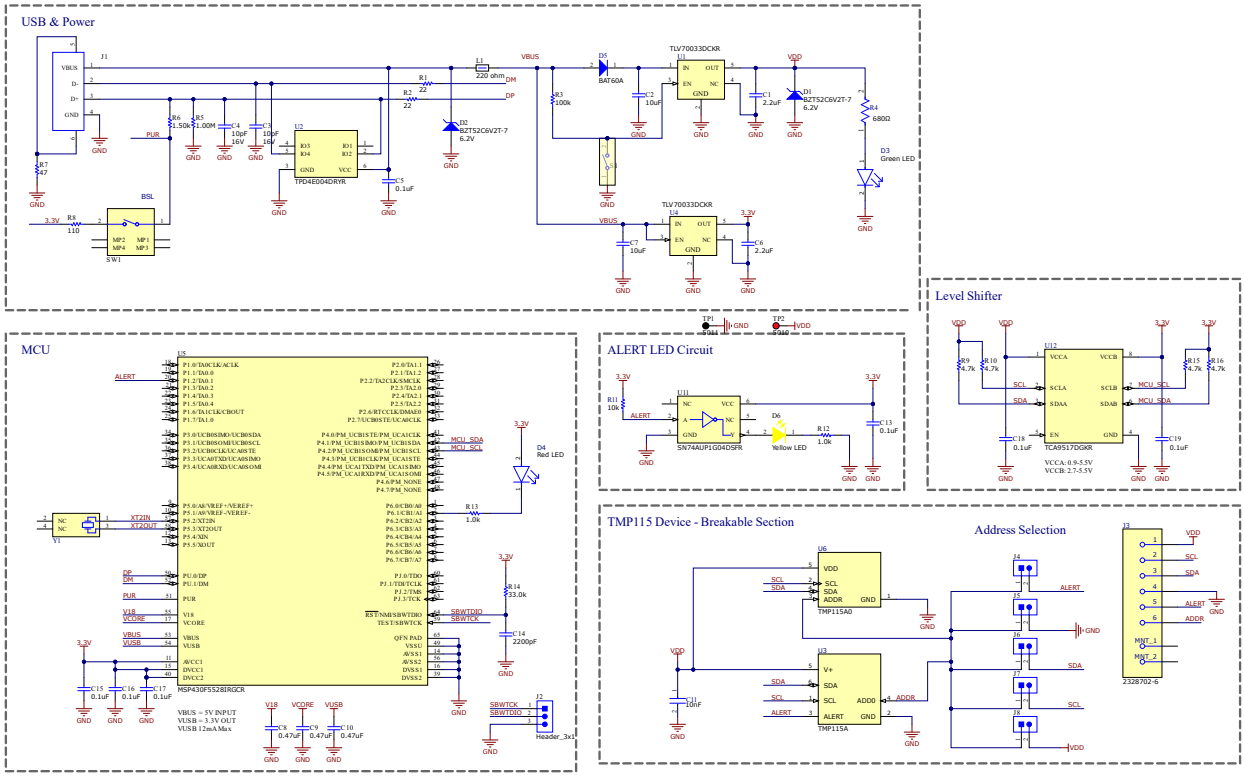


图 4-1. 原理图

4.2 PCB 布局

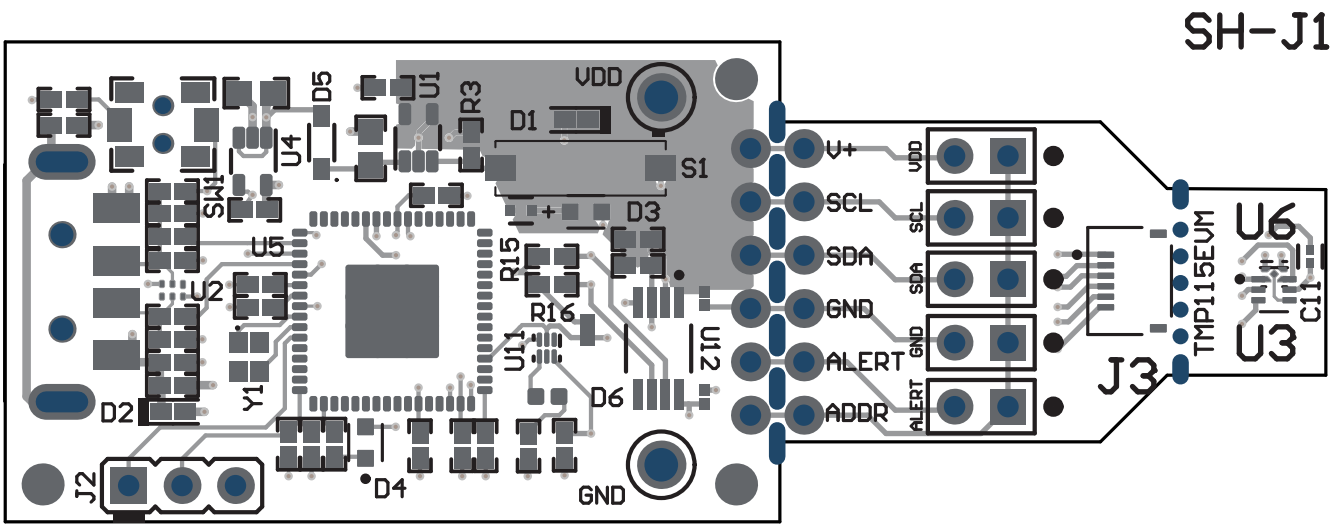


图 4-2. 顶视图

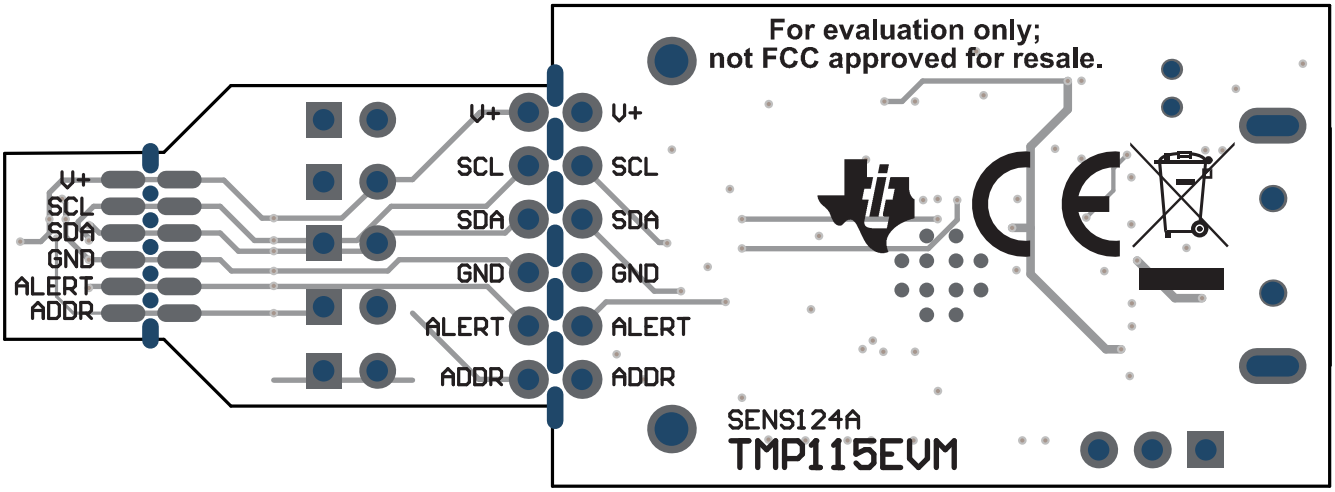


图 4-3. 底视图

4.3 物料清单

表 4-1. 物料清单

已安装	说明	指示符	器件型号	数量	制造商	封装参考	值
已安装	印刷电路板	!PCB1	SENS124	1	不限		
已安装	电容，陶瓷，2.2 µF，16V，+/-10%，X5R，0402	C1、C6	GRM155R61C225KE11D	2	MuRata	0402	2.2 µF
已安装	电容，陶瓷，10 µF，10V，+/-20%，X5R，0603	C2、C7	C1608X5R1A106M080AC	2	TDK	0603	10 µF
已安装	电容，陶瓷，10pF，16V，+/-10%，C0G，0402	C3、C4	C0402C100K4GACTU	2	Kemet	0402	10pF
已安装	电容，陶瓷，0.1 µF，10V，+/-10%，X5R，0402	C5、C13、C15、C16、C17	LMK105BJ104KV-F	5	Taiyo Yuden	0402	0.1 µF
已安装	电容，陶瓷，0.47 µF，6.3V，+/-10%，X7R，0402	C8、C9、C10	JMK105B7474KVHF	3	Taiyo Yuden	0402	0.47 µF
已安装	通用片状多层陶瓷电容器，0201，10000pF，X7R，15%，10%，10V	C11		1			
已安装	电容，陶瓷，2200pF，50V，+/-5%，X7R，0402	C14	CL05B222JB5NNNC	1	Samsung Electro-Mechanics	0402	2200pF
已安装	电容，陶瓷，0.1 µF，10V，+/-10%，X5R，0201	C18、C19	CL03A104KP3NNNC	2	Samsung Electro-Mechanics	0201	0.1 µF
已安装	二极管，齐纳，6.2V，300mW，SOD-523	D1、D2	BZT52C6V2T-7	2	Diodes Inc.	SOD-523	6.2V
已安装	绿色 LED 指示 - 分立式 2.2V 0603（公制 1608）	D3	SML-LX0603GW-TR	1	Lumex	0603	

表 4-1. 物料清单（续）

已安装	说明	指示符	器件型号	数量	制造商	封装参考	值
已安装	红色 - LED 指示 - 分立式 2V 0603（公制 1608）20mA 时 2V，71.5mcd 48mW	D4	SML-LX0603SIW-TR	1	Lumex	0603	
已安装	硅肖特基二极管，-55°C 至 85°C，SOD323，卷带，绿色环保	D5	BAT60A	1	Infineon	SOT323	
已安装	LED，黄色，SMD	D6	150040YS73240	1	Wurth Elektronik	1x0.5mm	黄色
已安装	连接器，插头，USB Type-A，R/A，顶部安装 SMT	J1	48037-1000	1	Molex	USB Type-A 直角	
已安装	Conn FPC 连接器 SKT 6 POS 0.51mm 焊接 RA SMD T/R	J3	2328702-6	1	TE Connectivity	CONN_FPC_6	
已安装	接头，100mil，2x1，金，TH	J4、J5、J6、J7、J8	5-146261-1	5	TE Connectivity	接头，2x1，100mil	
已安装	铁氧体磁珠，220ohm（在 100MHz 时），0.45A，0402	L1	BLM15AG221SN1D	1	MuRata	0402	220ohm
已安装	电阻，22，5%，0.1W，AEC-Q200 0 级，0402	R1、R2	ERJ-2GEJ220X	2	Panasonic	0402	22
已安装	电阻，100k，5%，0.1W，AEC-Q200 0 级，0402	R3	ERJ-2GEJ104X	1	Panasonic	0402	100k
已安装		R4		1			
已安装	电阻，1.00M，1%，0.063W，AEC-Q200 0 级，0402	R5	RMCF0402FT1M00	1	Stackpole Electronics Inc	0402	1.00Meg
已安装	电阻，1.50k，1%，0.063W，AEC-Q200 0 级，0402	R6	RMCF0402FT1K50	1	Stackpole Electronics Inc	0402	1.50k

表 4-1. 物料清单（续）

已安装	说明	指示符	器件型号	数量	制造商	封装参考	值
已安装	电阻，47，5%，0.1W，AEC-Q200 0 级，0402	R7	ERJ-2GEJ470X	1	Panasonic	0402	47
已安装	电阻，110，1%，0.1W，AEC-Q200 0 级，0402	R8	ERJ-2RKF1100X	1	Panasonic	0402	110
已安装	电阻，4.7k，5%，0.063W，AEC-Q200 0 级，0402	R9、R10、R15、R16	CRCW04024K70JNED	4	Vishay-Dale	0402	4.7k
已安装		R11		1	KOA Speer		10k
已安装	电阻，1.0k，5%，0.1W，AEC-Q200 0 级，0402	R12、R13	ERJ-2GEJ102X	2	Panasonic	0402	1.0k
已安装	电阻，33.0k，1%，0.063W，0402	R14	RC0402FR-0733KL	1	Yageo America	0402	33.0k
已安装	开关，滑动式，SPST，顶部滑动，SMT	S1	CHS-01TB	1	Copal Electronics	开关，单个顶部滑动，2.5x8x2.5mm	
已安装	单操作 2.54mm 间距开顶跳线插座	SH-J1	M7582-05	1	Harwin	单操作 2.54mm 间距开顶跳线插座	
已安装	开关，SPST-NO，Off-Mom，0.05A，12VDC，SMD	SW1	PTS820J20M SMTR LFS	1	C&K Components	3.9x2.9mm	
已安装	测试点，黑色，穿孔，RoHS，大容量	TP1		1	Keystone	5011	
已安装	测试点，红色，穿孔，RoHS，大容量	TP2		1	Keystone	5010	

表 4-1. 物料清单（续）

已安装	说明	指示符	器件型号	数量	制造商	封装参考	值
已安装	单路输出 LDO，200mA，固定 3.3V 输出，2 至 5.5V 输入，具有低 IQ，5 引脚 SC70 (DCK)，-40 至 125 摄氏度，绿色环保（RoHS，无锑/溴）	U1、U4	TLV70033DCKR	2	德州仪器 (TI)	DCK0005A	
已安装	适用于高速数据接口的 4 通道 ESD 保护阵列，DRY0006A (USON-6)	U2	TPD4E004DRYR	1	德州仪器 (TI)	DRY0006A	
已安装	超小型，1.1V 至 5.5V 电源，±0.2°C 精度，I2C 数字温度传感器	U3	TMP115A	1	德州仪器 (TI)	SOT6	
已安装	16 位超低功耗微控制器，128KB 闪存，8KB RAM，USB，12 位 ADC，2 个 USCI，32 位硬件乘法器，RGC0064B (VQFN-64)	U5	MSP430F5528IRGCR	1	德州仪器 (TI)	RGC0064B	
已安装	低功耗单路反相门，DSF0006A，LARGE T&R	U11	SN74AUP1G04DSFR	1	德州仪器 (TI)	DSF0006A	
已安装	IC TRNSLTR 双向 8VSSOP	U12		1	德州仪器 (TI)		
已安装	晶体，24MHz，SMD	Y1	XRCGB24M000F2P00R0	1	MuRata	2x1.6mm	
未安装	接头，2.54mm，3x1，金，TH	J2	GBC03SAAN	0	Sullins Connector Solutions	接头，2.54mm，3x1，TH	
未安装	超小型，1.1V 至 5.5V 电源，±0.2°C 精度，I2C 数字温度传感器	U6	TMP115A0	0	德州仪器 (TI)	X2SON5	

5 其他信息

5.1 商标

Windows® is a registered trademark of Microsoft Corporation.
Mac® is a registered trademark of Apple Inc.
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所有商标均为其各自所有者的财产。

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

Changes from Revision A (October 2025) to Revision B (January 2026) **Page**

- 更新了整个文档地址选择的说明 1
- 整个文档中更新了硬件映像，以反映 EVM 的更改 1
- 更新了*概述*部分 *TMP115EVM 电路板部分*中的图 3
- 更新了*物料清单* 13

Changes from OCTOBER 13, 2025 to OCTOBER 22, 2025 (from Revision * (October 2025) to Revision A (October 2025)) **Page**

- 更正了标题之中 EVM 器件的 GPN。 1
- 更改了表 1-1 中 TMP115 分接部分的温度值。 2

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。

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

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

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