EVM User's Guide: UCD91320

UCD91320EVM 用户指南

说明

UCD91320EVM 开发套件是适用于 UCD91320 电源序列发生器器件的易用型评估模块 (EVM)。该 EVM 包含开始使用 TI Sequencer Studio GUI 开发电源序列发生器解决方案所需的一切。此 EVM 采用 UCD91320 以及 4 个板载 LDO，可快速开始对多个电源轨进行时序控制。此 EVM 还具有用于查看信号状态的 LED，以及用于 RC 滤波器以进行裕量调节和电源轨监控的焊盘。使用 PMBus 可以轻松与 EVM 通信。

开始使用

1.在 TI.com 上订购最新版本的 UCD91320EVM。版本号将清楚地标记在电路板的正面。

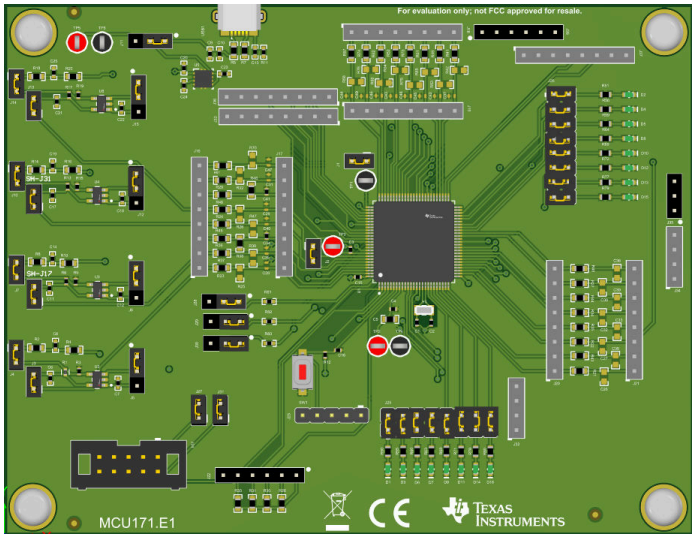
2.下载最新版本的 TI Sequencer Studio GUI，或访问 dev.ti.com/guicomposer 以使用最新的在线版本

3.查看本用户指南中包含的原理图和硬件说明。

4.开始试用 EVM 和 GUI，在 UCD91320 器件上生成您的第一个电源序列发生器设计。

特性

- 电路板上安装的 UCD91320SPM 器件
- USB 电源连接器
- 可轻松访问电路板上每个信号的引脚接头
- 4 个 LDO 用于对各种电源轨进行快速原型设计：3.3V、2.5V、1.8V 和 1.2V。
- 用于轻松启用或禁用每个板载 LDO 的跳线
- 用于裕量反馈的 RC 滤波器、用于其他无源元件的焊盘，以及用于将 LDO 输出连接到监控引脚和非板载器件的跳线。
- 用于 PMBus 连接的引脚接头
- 易于使用的跳线用于 PMBus 地址选择，具有多达 8 个可选地址
- 用于为 UCD91320 供电的板载 LDO
- 用于检查电压基准、电源引脚和外部电源监控的测试点



1 评估模块概述

1.1 简介

UCD91320EVM 作为单一 PCB 发货。它可以与 micro USB 或外部电源一起使用。与器件通信需要一个 PMBus 接口。我们建议使用 TI 的 USB-TO-GPIO2 工具来与该器件通信。

1.2 套件内容

- 1 个 UCD91320EVM

1.3 规格

UCD91320EVM 旨在使用户能够轻松对 UCD91320 器件系列的电源序列发生器设计进行原型开发。EVM 支持器件中设计的所有功能，带有用于监控信号的接头、使能引脚、裕量调节引脚和 LGPO 等。此 EVM 还具有易于使用的焊盘，可向裕量调节电路和用于监控引脚的分压器添加 RC 滤波器。监控引脚具备用于探测分压前后信号的接头。裕量调节引脚具备类似的接头，可用于在滤波之前和之后探测裕量调节信号。使能引脚配备探测用接头，并连接了 LED 指示灯，可轻松观察信号，或通过探头进行更细致的测量。该 EVM 还允许用户使用 micro-USB、外部 5V 电源、外部 3.3V 电源或通过其专用接头使用 USB-TO-GPIO2 供电。该电路板中还包含专用测试点，可轻松检查器件的电源、电压基准和电源引脚。

该 EVM 旨在与 TI Sequencer Studio GUI 搭配使用，可让用户快速开始进行序列发生器设计。我们建议使用 USB-to-GPIO2 器件将 EVM 连接到 GUI，并将新配置发送到 UCD91320 器件。

1.4 器件信息

此 EVM 上的关键器件：

- UCD91320 — TI 电源序列发生器 IC
- TPS73533 — TI LDO 稳压器
- TLV75801 — TI 线性电压稳压 IC（EVM 中包含 4 个）

2 硬件

2.1 电源要求

UCD91320 的建议正电源电压值为 2.9V 至 3.6V。该器件还要求在 VDD 和 VSS 之间使用 10 µ F 大容量电容器和 100nF 去耦合电容器，这些电容器已组装在 EVM 上。BPCAP 引脚还需要一个连接到 EVM 上接地端的 0.47uF 电容器。

要在实际上为器件供电，有 2 种选择：

1. Micro-USB 电缆
2. 外部电源
3. USB-TO-GPIO2

Micro-USB 连接包括一条通过 LDO 的路径，可将电压步降至 UCD91320 器件的正确工作电压。

使用外部电源时，可以使用 5V 并配置器件跳线，从而继续使用与 Micro-USB 电源相同的 LDO。或者，您可以使用跳线为器件供电并绕过 LDO。有关如何正确配置跳线的具体信息，请查看跳线配置部分。

2.2 设置

此器件的开箱即用设置应尽可能少。您可以检查跳线，确保将它们配置为适合您选择的电源，然后您应该能够插入器件并接通电源。下一步是连接 PMBus 接口，开始与器件通信。在此阶段，我们建议启动您的 TI Sequencer Studio GUI 并插入 USB-TO-GPIO2 器件以开始使用。此时，您已准备好开始排序。

2.3 跳线信息

表 2-1. 跳线说明

跳线标签	说明
J1	VREF 配置 — J1 允许用户根据使用的是内部还是外部 VREF，来配置 VREF 电路。使用内部 VREF 时，该跳线应闭合，以使用 VREF 旁路电容器 C3。使用外部 VREF 时，该跳线应处于未组装状态。
J2	VREF 配置 — J2 允许用户根据使用的是内部还是外部 VREF，来配置 VREF 电路。使用内部 VREF 时，该跳线应处于开路状态。当使用外部 VREF 时，可以闭合此跳线以使用 PCB 上的 VDD 电源轨，也可以不连接，从而使用连接到测试点 (TP3) 的电压基准。
J3	LDO 输出跳线 — 用于将 3.3V LDO 输出连接到监控电路。
J4	LDO 反馈跳线 — 用于将 UCD91320 裕量调节输出连接到 3.3V LDO 的反馈引脚
J5	LDO 使能配置 — 允许用户选择如何使用并联跳线启用 3.3V LDO。1-2 从 UCD91320 选择 EN1 信号，2-3 选择 5V 电源轨，从而始终启用 LDO。
J6	LDO 输出跳线 — 用于将 2.5V LDO 输出连接到监控电路。
J7	LDO 反馈跳线 — 用于将 UCD91320 裕量调节输出连接到 2.5V 的反馈引脚 LDO
J8	LDO 使能配置 — 允许用户选择如何使用并联跳线启用 2.5V LDO。1-2 从 UCD91320 选择 EN2 信号，2-3 选择 5V 电源轨，从而始终启用 LDO。
J9	LDO 输出跳线 — 用于将 1.8V LDO 输出连接到监控电路。
J10	LDO 反馈跳线 — 用于将 UCD91320 裕量调节输出连接到 1.8V 的反馈引脚 LDO
J11	5V 电源配置跳线 — 使用并联跳线选择器件的电源。1-2 选择 Micro-USB 连接器作为电源。2-3 选择外部 5V 电源。
J12	LDO 使能配置 — 允许用户选择如何使用并联跳线启用 1.8V LDO。1-2 从 UCD91320 选择 EN3 信号，2-3 选择 5V 电源轨，从而始终启用 LDO。
J13	LDO 输出跳线 — 用于将 1.2V LDO 输出连接到监控电路。
J14	LDO 反馈跳线 — 用于将 UCD91320 裕量调节输出连接到 1.2V 的反馈引脚 LDO

表 2-1. 跳线说明（续）

跳线标签	说明
J15	LDO 使能配置 — 允许用户选择如何使用并联跳线启用 1.8V LDO。1-2 从 UCD91320 选择 EN4 信号，2-3 选择 5V 电源轨，从而始终启用 LDO。
J27	GPIO1 — 用于实现 GPIO1 和 USB-to-GPIO2 器件之间连接的额外引脚。闭合此跳线可允许 USB-to-GPIO2 与 UCD91320 的 GPIO1 连接
J28	PMBus 地址选择器 2 — 请参阅 PMBus 地址配置
J29	PMBus 地址选择器 1 — 请参阅 PMBus 地址配置
J30	PMBus 地址选择器 0 — 请参阅 PMBus 地址配置
J31	GPIO2 — 用于实现 GPIO2 和 USB-to-GPIO2 器件之间连接的额外引脚。闭合此跳线可允许 USB-to-GPIO2 与 UCD91320 的 GPIO2 连接

2.4 PMBus 地址配置

PMBus 地址选择

PMBUS_ADDR2	PMBUS_ADDR1	PMBUS_ADDR0	UCD91320 PMBUS 地址
L	L	L	0x11
L	L	H	0x13
L	H	L	0x17
L	H	H	0x31
H	L	L	0x33
H	L	H	0x71
H	H	L	0x73
H	H	H	0x77

2.5 接头信息

表 2-2. 引脚接头

引脚接头标签	说明
J16	监控引脚的预滤波和分频。如果您想在滤波之前连接外部电路以查看监控值，请使用这些引脚。它们在 J17 的右侧与标记过的器件监控引脚对齐。 J16 包含 MON1 至 MON7 和 MON16。
J17	监控引脚后滤波和分频。如果您想在滤波后将外部电路连接到监控引脚，请使用这些引脚。这些引脚标有它们所连接的器件引脚。 J17 包含 MON1 至 MON7 和 MON16。
J18	监控引脚的预滤波和分频。如果您想在滤波之前连接外部电路以查看监控值，请使用这些引脚。它们与下方 J19 中标记过的器件监控引脚对齐。 J18 包含 MON8 至 MON15
J19	监控引脚后滤波和分频。如果您想在滤波后将外部电路连接到监控引脚，请使用这些引脚。这些引脚标有它们所连接的器件引脚。 J19 包含 MON8 至 MON15。
J20	裕量调节输出预滤波。这些引脚可用于将外部电路连接到裕量调节引脚的原始 PWM 输出。 J20 包含 MAR1 至 MAR8。
J21	裕量调节输出后滤波。这些引脚可用于将外部电路连接到经过滤波后的裕量调节信号。每个引脚都与 J22 中左侧标记过的引脚对齐。 J21 包含 MAR1 到 MAR8。

表 2-2. 引脚接头（续）

引脚接头标签	说明
J22	PMBus 信号 — 1x6 引脚接头，展示 PMBus 数据、时钟、警报和控制引脚。VDD 和 GND 也会进行引脚输出。
J23	特殊功能接头 — 包括用于 SYNC_OUT 引脚、VREF+/- 和 nReset 引脚的引脚。
J24	PMBus 接头 — 对所有 PMBus 信号进行引脚输出。全部 4 个 PMBus 引脚上的相邻 2.2kΩ 上拉电阻器。另请注意，VDD 和 GND 也在 J24 上进行引脚输出。
J25	ENx 输出 — 2x8 引脚接头，展示来自 UCD91320 的 ENx 信号。可以保持开路以跳转到另一个引脚，也可以关闭以点亮 LED，从而直观地评估引脚状态。
J26	ENx 输出 — 2x8 引脚接头，展示来自 UCD91320 的 ENx 信号。可以保持开路以跳转到另一个引脚，也可以关闭以点亮 LED，从而直观地评估引脚状态。
J32 - J38	具有混合功能的附加引脚接头可实现到所有 UCD91320 引脚的连接。

2.6 按钮

该器件上唯一可用的按钮是 SW1。SW1 按钮用于将 UCD91320 器件复位。请注意，RST 信号处于低电平有效状态。

2.7 接口

UCD91320 器件必须使用 PMBus 接口。TI 建议使用 USB-TO-GPIO2 器件以便与 UCD91320 通信。通过将 USB-TO-GPIO2 器件连接到 J24 接头，您可以将 TI Sequencer Studio GUI 轻松连接到 UCD91320EVM。

您还可以使用另一个 PMBus 主机与器件连接。更多有关手动连接 UCD91320EVM 的信息，请参阅 PMBus 用户指南。

2.8 调试信息

UCD91320EVM 使用 TI Sequencer Studio GUI 将新配置应用于器件，以便在 EVM 上进行调试。

为了使用 EVM 调试设计，我们建议使用外部逻辑分析仪或示波器来探测器件引脚，并监控器件上是否产生了预期的电压时序控制。该 EVM 还配备了 LED，可为简单信号（例如器件上的使能引脚）提供方便的高级视觉辅助。

UCD91320EVM 将裕量调节、滤波以及 LDO 输入和输出的各个步骤均引出到引脚，以便从多个角度观察和评估器件功能。

2.9 测试点

UCD91320EVM 提供多个测试点，可有效监控某些板载信号。这些测试点的描述如下表所示。

表 2-3.

测试点标签	说明
TP1	UCD91320 VREF-
TP2	UCD91320 VDD
TP3	UCD91320 VREF+
TP4	UCD91320 VSS
TP5	5V 外部电源测试点
TP6	GND 外部电源测试点

3 软件

3.1 软件说明

与此 EVM 相关的软件仅限于具有单独 GUI 用户指南的 TI Sequencer Studio GUI。请参阅本文档，了解 GUI 功能的详细说明。

3.2 GUI 安装

Sequencer Studio GUI 可以从 TI.com 下载，也可以使用 dev.ti.com 上的 GUI Composer 库访问。

3.3 编程选项

要在 UCD91320EVM 上对 UCD91320 的新配置进行编程，我们建议使用 USB-TO-GPIO2 器件（在 ti.com 上单独出售）。

4 硬件设计文件

4.1 原理图

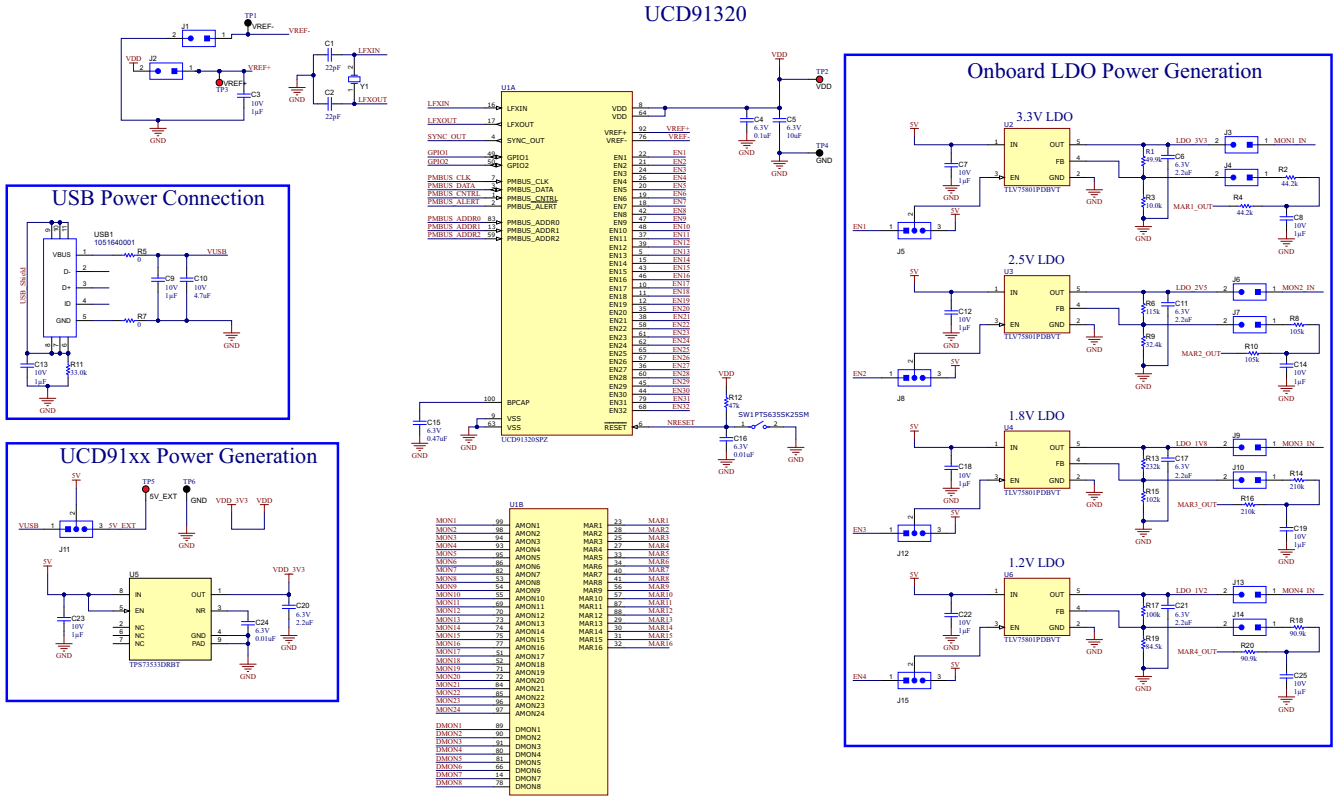
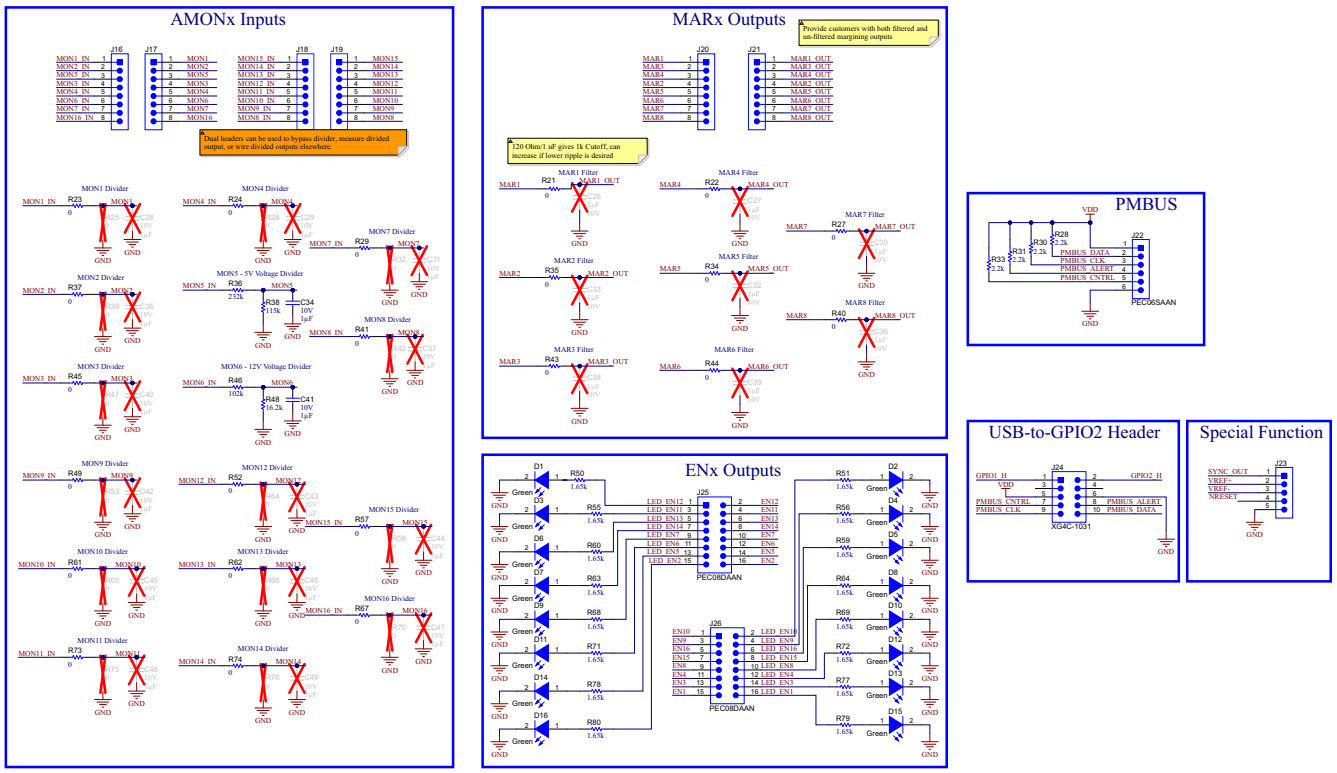
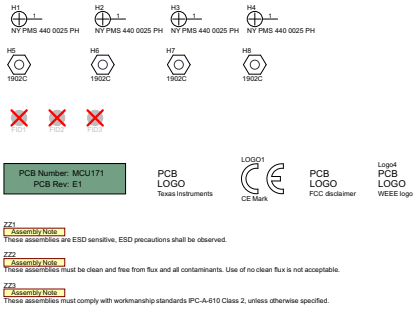
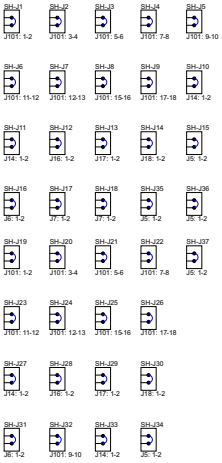
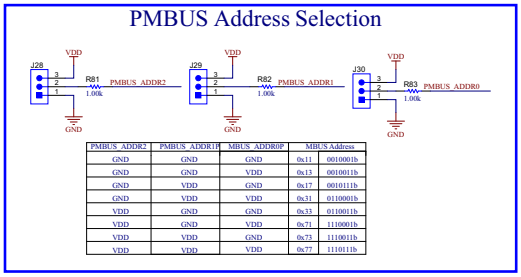


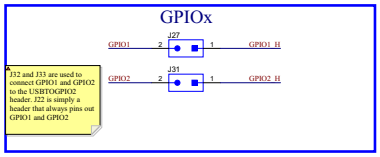
图 4-1. UCD91320EVM 原理图

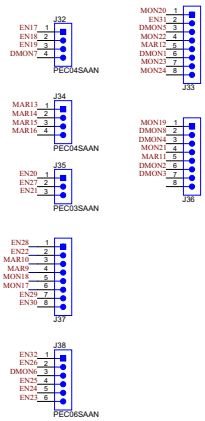












4.2 PCB 布局

展示 UCD91320EVM 布局的基本方框图

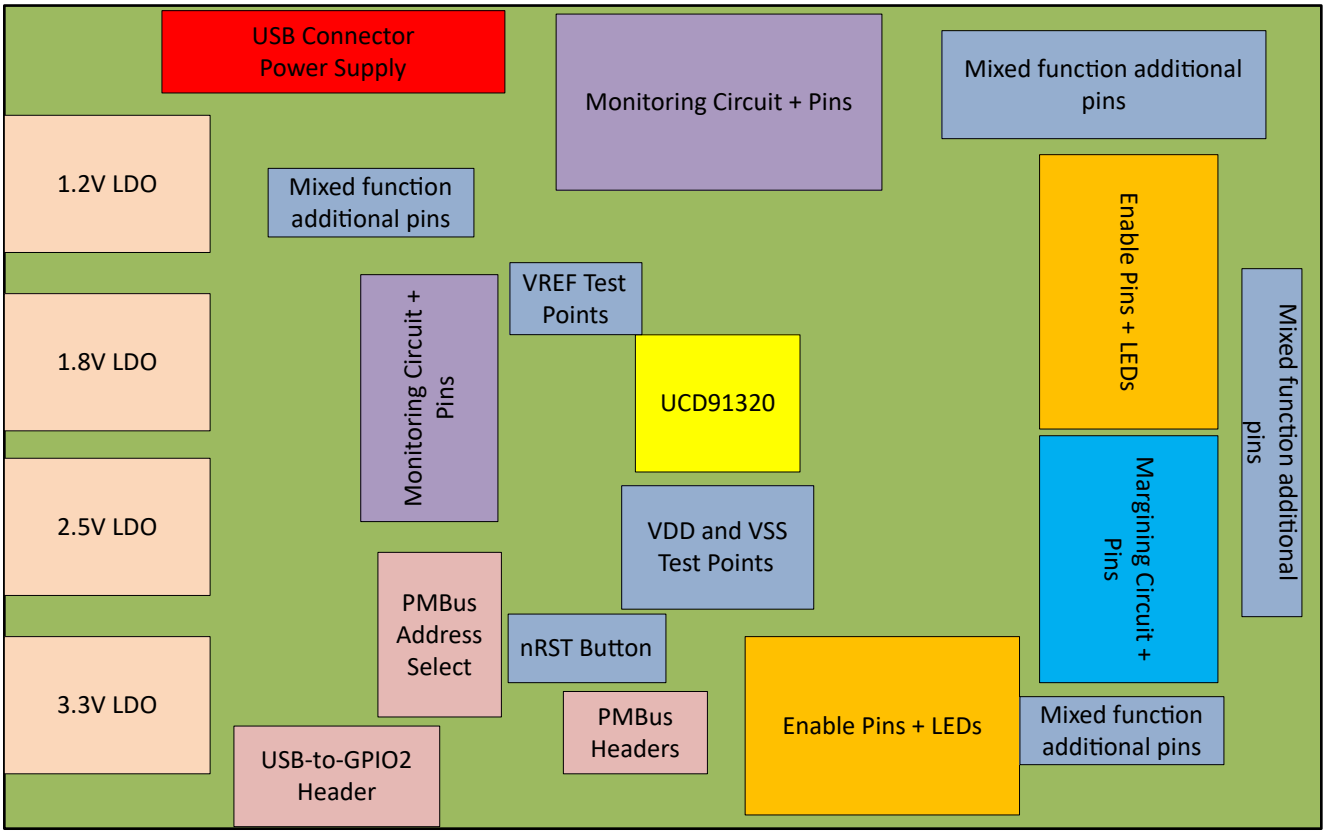


图 4-2. UCD91320 方框图

4.3 物料清单 (BOM)

表 4-1. UCD91320EVM 物料清单

位号	数量	值	说明	封装参考	器件型号	制造商
!PCB1	1		印刷电路板		MCU171	不限
C1, C2	2	22pF	电容，陶瓷，22pF，50V，+/-5%，C0G/NP0，0402	0402	GRM1555C1H220JA01D	MuRata
C3、C7、C8、C9、C12、C13、C14、C18、C19、C22、C23、C25、C34、C41	14	1µF	电容，陶瓷，1µF，10V，+/-10%，X7S，AEC-Q200 1 级，0402	0402	GRT155C71A105KE13D	MuRata
C4	1	0.1uF	电容，陶瓷，0.1µF，6.3V，+/-10%，X5R，0402	0402	GRM155R60J104KA01D	MuRata

表 4-1. UCD91320EVM 物料清单（续）

C5	1	10µF	电容，陶瓷，10µF，6.3V，+/-20%，X5R，0603	0603	GRM188R60J106ME84	MuRata
C6、C11、C17、C20、C21	5	2.2uF	电容，陶瓷，2.2µF，6.3V，+/-10%，X5R，0402	0402	GRM155R60J225KE95D	MuRata
C10	1	4.7µF	电容，陶瓷，4.7uF，10V，+/-20%，X5R，0402	0402	GRM155R61A475MEAAD	MuRata
C15	1	0.47µF	电容，陶瓷，0.47 µ F，6.3V，+/-10%，X5R，0402	0402	GRM155R60J474KE19D	MuRata
C16、C24	2	0.01uF	电容，陶瓷，0.01µF，6.3V，+/- 10%，X5R，0402	0402	GRM155R60J103KA01D	MuRata
D1、D2、D3、D4、D5、D6、D7、D8、D9、D10、D11、D12、D13、D14、D15、D16	16	绿色	LED，绿色，SMD	1.7x0.65x0.8mm	LG L29K-G2J1-24-Z	OSRAM
H1、H2、H3、H4	4		机械螺钉，圆头，#4-40 x 1/4，尼龙，飞利浦盘形头	螺钉	NY PMS 440 0025 PH	B&F Fastener Supply
H5、H6、H7、H8	4		六角螺柱，0.5"L #4-40，尼龙	螺柱	1902C	Keystone
J1、J2、J3、J4、J6、J7、J9、J10、J13、J14、J27、J31	12		接头，100mil，2x1，锡，TH	接头，2 引脚，100mil，锡	PEC02SAAN	Sullins Connector Solutions
J5、J8、J11、J12、J15、J28、J29、J30、J35	9		接头，100mil，3x1，锡，TH	接头，3 引脚，100mil，锡	PEC03SAAN	Sullins Connector Solutions
J16、J17、J18、J19、J20、J21、J33、J36、J37	9		接头，100mil，8x1，锡，TH	接头，8x1，100mil，TH	PEC08SAAN	Sullins Connector Solutions
J22、J38	2		接头，100mil，6x1，锡，TH	TH，6 引线，接头体 608x100mil，间距 100mil	PEC06SAAN	Sullins Connector Solutions
J23	1		接头，2.54mm，5x1，锡，TH	接头，2.54mm，5x1，TH	PEC05SAAN	Sullins Connector Solutions

表 4-1. UCD91320EVM 物料清单（续）

J24	1		接头（有罩），100mil，5x2，金，TH	TH，10 引线，接头体 8.5mm x 20mm，间距 2.54mm	XG4C-1031	Omron Electronic Components
J25、J26	2		接头，2.54mm，8x2，锡，垂直，TH	接头，2.54mm，8x2，TH	PEC08DAAN	Sullins Connector Solutions
J32、J34	2		接头，100mil，4x1，锡，TH	接头，4x1，100mil，TH	PEC04SAAN	Sullins Connector Solutions
R1	1	49.9k	49.9kOhm，±0.5% 0.063W，0.1W 片上电阻 0402（1005 公制），汽车 AEC-Q200 薄膜	0402	RNCF0402DTE49K9	Stackpole Electronics
R2、R4、R21	3	44.2k	电阻，44.2k，1%，0.1W，0603	0603	RC0603FR-0744K2L	Yageo
R3	1	10.0k	电阻，10.0k，0.1%，0.0625W，0402	0402	RT0402BRD0710KL	Yageo America
R5、R7、R23、R24、R27、R29、R34、R37、R40、R41、R44、R45、R49、R52、R57、R61、R62、R67、R73、R74	20	0	电阻，0，5%，0.1W，0603	0603	RC0603JR-070RL	Yageo
R6	1	115k	电阻，115k，1%，0.063W，0402	0402	RC0402FR-07115KL	Yageo America
R8、R10、R35	3	105k	电阻，105k，1%，0.1W，0603	0603	RC0603FR-07105KL	Yageo
R9	1	32.4k	电阻，32.4k，1%，0.063W，AEC-Q200 0 级，0402	0402	CRCW040232K4FKED	Vishay-Dale
R11	1	33.0k	电阻，33.0k，1%，0.063W，0402	0402	RC0402FR-0733KL	Yageo America
R12	1	47k	电阻，47k，5%，0.063W，AEC-Q200 0 级，0402	0402	CRCW040247K0JNED	Vishay-Dale
R13	1	232k	电阻，232k，1%，0.063W，AEC-Q200 0 级，0402	0402	CRCW0402232KFKED	Vishay-Dale

表 4-1. UCD91320EVM 物料清单（续）

R14、R16、R43	3	210k	电阻，210k，1%，0.1W，0603	0603	RC0603FR-07210KL	Yageo
R15	1	102k	电阻，102k，1%，0.063W，AEC-Q200 0 级，0402	0402	CRCW0402102KFKED	Vishay-Dale
R17	1	100k	电阻，100k，1%，0.0625W，0402	0402	RC0402FR-07100KL	Yageo America
R18、R20、R22	3	90.9k	电阻，90.9kΩ，1%，0.1W，0603	0603	RC0603FR-0790K9L	Yageo
R19	1	84.5k	电阻，84.5k，1%，0.063W，AEC-Q200 0 级，0402	0402	CRCW040284K5FKED	Vishay-Dale
R28、R30、R31、R33	4	2.2k	电阻，2.2k，5%，0.1W，0603	0603	RC0603JR-072K2L	Yageo
R36	1	232k	电阻，232k，0.5%，0.1W，0603	0603	RT0603DRE072322KL	Yageo America
R38	1	115k	电阻，115k，0.5%，0.1W，0603	0603	RT0603DRE07115KL	Yageo America
R46	1	102k	电阻，102k，0.1%，0.1W，0603	0603	RT0603BRD07102KL	Yageo America
R48	1	16.2k	电阻，16.2k，0.5%，0.1W，0603	0603	RT0603DRE0716K2L	Yageo America
R50、R51、R55、R56、R59、R60、R63、R64、R68、R69、R71、R72、R77、R78、R79、R80	16	1.65k	电阻，1.65k，1%，0.1W，0603	0603	RC0603FR-071K65L	Yageo
R81、R82、R83	3	1.00k	电阻，1.00k，1%，0.0625W，0402	0402	RC0402FR-071KL	Yageo America
SH-J1、SH-J19	2	J101：1-2	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J2、SH-J20	2	J101：3-4	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J3、SH-J21	2	J101：5-6	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec

表 4-1. UCD91320EVM 物料清单（续）

SH-J4、SH-J22	2	J101：7-8	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J5、SH-J32	2	J101：9-10	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J6、SH-J23	2	J101：11-12	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J7、SH-J24	2	J101：12-13	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J8、SH-J25	2	J101：15-16	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J9、SH-J26	2	J101：17-18	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J10、SH-J11、SH-J27、SH-J33	4	J14：1-2	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J12、SH-J28	2	J16：1-2	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J13、SH-J29	2	J17：1-2	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J14、SH-J30	2	J18：1-2	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J15、SH-J34、SH-J35、SH-J36、SH-J37	5	J5：1-2	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J16、SH-J31	2	J6：1-2	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SH-J17、SH-J18	2	J7：1-2	分流器，100mil，镀金，黑色	分流器	SNT-100-BK-G	Samtec
SW1	1		触控式开关，单刀单掷-常开 0.05A/12V	SMT_SWITCH_TACT_6MM1_3MM7	PTS635SK25SM	C&K Components
TP1、TP4	2		测试点，紧凑型，黑色，TH	黑色紧凑型测试点	5006	Keystone Electronics
TP2、TP3	2		测试点，紧凑，红色，TH	红色紧凑型测试点	5005	Keystone Electronics
TP5	1		测试点，多用途，红色，TH	红色通用测试点	5010	Keystone Electronics
TP6	1		测试点，多用途，黑色，TH	黑色通用测试点	5011	Keystone Electronics
U1	1		UCD91320SPZ	LQFP100	UCD91320SPZ	德州仪器 (TI)
U2、U3、U4、U6	4		线性稳压器 IC 1 输出 500mA SOT-23-5	SOT-23-5	TLV75801PDBVT	德州仪器 (TI)

表 4-1. UCD91320EVM 物料清单（续）

U5	1		500mA、可调节、低静态电流、低噪声、高 PSRR、单路输出 LDO 稳压器、DRB0008A (VSON-8)	DRB0008A	TPS73533DRBT	德州仪器 (TI)
USB1	1		插座，USB 2.0，Micro B，5 个位置，R/A，SMT	插座，USB 2.0，Micro B，5 位，0.65mm 间距，R/A，SMT	1051640001	Molex
Y1	1		晶振，32.768KHz，12.5pF，SMD	SMD，2 引线，主体 3.2mm x 1.5mm	X1A0001410014	Epson
C26、C27、C30、C32、C33、C36、C38、C39	0	1µF	电容，陶瓷，1µF，10V，+/-10%，X7R，AEC-Q200 1 级，0603	0603	LMK107B7105KAHT	Taiyo Yuden
C28、C29、C31、C35、C37、C40、C42、C43、C44、C45、C46、C47、C48、C49	0	1µF	电容，陶瓷，1µF，10V，+/-10%，X7S，AEC-Q200 1 级，0402	0402	GRT155C71A105KE13D	MuRata
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
R25、R26、R32、R39、R42、R47、R53、R54、R58、R65、R66、R70、R75、R76	0	0	电阻，0，5%，0.1W，0603	0603	RC0603JR-070RL	Yageo

5 其他信息

5.1 商标

所有商标均为其各自所有者的财产。

6 相关文档

6.1 补充内容

有关将 GUI 与此 EVM 搭配使用的更多信息，请参阅 TI Sequencer Studio GUI 用户指南。

7 参考资料

1) UCD91320 数据表

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
2025 年 12 月	*	初始发行版

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software

   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI’s recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI’s recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI’s instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 *Regulatory Notices:*

3.1 *United States*

3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。 技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

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

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

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西新宿三井ビル

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

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

3.4 *European Union*

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

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

4 *EVM Use Restrictions and Warnings:*

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

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

4.3 *Safety-Related Warnings and Restrictions:*

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

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

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

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

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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