EVM User's Guide: LP-MSPM0C1106EVM

LP-MSPM0C1106 评估模块

说明

MSPM0C1106 LaunchPad™ 开发套件是适用于 MSPM0C1106 微控制器 (MCU) 的易于使用的评估模块。LaunchPad 套件包含在 MSPM0C1106 微控制器平台上开始开发所需要的全部资源，包括用于编程、调试和 EnergyTrace™ 技术的板载调试探针。该板还具有两个用于快速集成简单用户界面的板载按钮和两个 LED。

开始使用

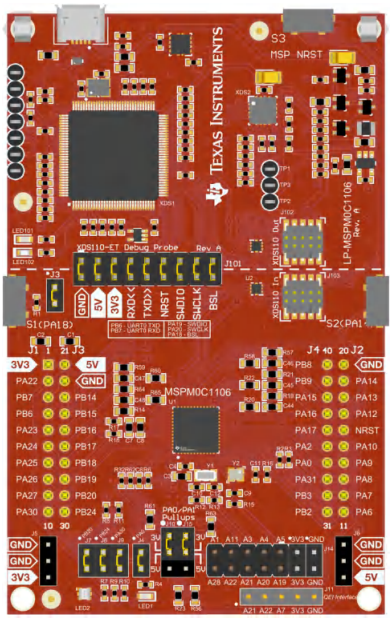
1. 从 ti.com 订购 LP-MSPM0C1106。
2. 转到 dev.ti.com 浏览代码示例。
3. 使用 USB 电缆将 LP-MSPM0C1106 插入 PC。
4. 使用 CCS Cloud 将代码直接从浏览器下载到 LP-MSPM0C1106。
5. 下载用于桌面集成开发环境的 CCS Theia。
6. 下载用于桌面存储示例、演示和软件库的 MSPM0 SDK。

特性

- 板载 XDS110 调试探针
- 反向通道 UART，通过 USB 连接到 PC
- USB 供电型
- 40 引脚 BoosterPack™ 接头
- 硬件用户接口：两个按钮、一个 RGB LED 和一个红色 LED
- 外部时钟晶体
- 可用于超低功耗调试的 EnergyTrace 技术

应用

- 电池充电和管理
- 电源和电力输送
- 个人电子产品
- 楼宇安防与防火安全
- 联网外设和打印机
- 电网基础设施
- 智能抄表
- 通信模块
- 医疗和保健
- 照明



LP-MSPM0C1106

1 评估模块概述

1.1 简介

MSPM0C1106 是具有存储器保护单元且频率高达 32MHz 的 Arm® Cortex® M0+ 32 位 CPU。该器件可用于各种任务，从个人电子设备到智能计量。开始使用 MSPM0C1106 的简单方法是使用 LP-MSPM0C1106 LaunchPad。该 LaunchPad 具有加载代码、调试和原型设计所需的所有开箱即用功能。

40 引脚 BoosterPack 插件模块接头简化了快速原型设计，支持市面上的多种 BoosterPack 插件模块。用户可以快速添加环境检测等功能。您还可以设计您自己的 BoosterPack 插件模块，或者从 TI 和第三方开发商已提供的众多插件模块中进行选择。

为使原型设计更加轻松，TI 在 MSPM0C1106 SDK 全面发布后提供了 MSPM0 软件开发套件 (SDK)，该套件包含各种用于演示如何使用内部外设的代码示例。

还提供免费的软件开发工具，例如 TI 的 Code Composer Studio™ IDE。TI 还支持 IAR Embedded Workbench® IDE 和 Arm Keil® µ Vision® IDE 等第三方 IDE。在与 MSPM0C1106 LaunchPad 开发套件配套使用时，Code Composer Studio IDE 支持 EnergyTrace 技术。有关 LaunchPad 开发套件、配套 BoosterPack 插件模块和可用资源的更多信息，请访问 TI LaunchPad 开发套件门户。要快速入门并了解 MSPM0 软件开发套件 (SDK) 中的可用资源，请访问 TI 开发人员专区。MSPM0 MCU 还有各种在线配套资料、MSPM0 Academy 培训，以及通过 TI E2E 支持论坛提供的在线支持。

1.2 套件内容

- LP-MSPM0C1106 LaunchPad 开发套件
- USB 线缆
- 快速入门指南

1.3 规格

LP-MSPM0C1106 旨在与运行 Code Composer Studio (CCS) 的 PC、Mac® 或 Linux® 工作站配合使用。CCS 可以在工作站上独立运行，也可通过 Web (CCS Cloud) 访问，无需安装软件。此外，LP-MSPM0C1106 附带一个已加载的示例，可以通过 GUI 进行控制。请参阅下面的开箱即用说明。

该器件可以由内置 USB 电源以外的电源供电。这允许用户放弃 PC 连接。电源可直接施加到 3.3V 电压轨。使用外部电源时，请确保不能超过 3.3V。利用板载 Arm 10 引脚连接器，可以使用单独的 XDS110 外部调试器从外部完成编程。

1.4 器件信息

LP-MSPM0C1106 使用德州仪器 (TI) 的以下器件：

表 1-1. 器件信息

器件名称	说明	用途
MSP432E401YTPDT	具有以太网™、CAN、1MB 闪存和 256kB RAM 的 SimpleLink™ 32 位 ARM Cortex-M4F MCU	XDS110 主机器件
MSP430G2452IRSA16R	具有 16 位 RISC CPU、8kB 闪存和 256B SRAM 的混合信号微控制器	用于 EnergyTrace 技术的直流/直流控制器
MSPM0C1106SRGZR	具有 32MHz Arm Cortex 32 位 M0+ CPU、64kB 闪存和 8kB SRAM 的混合信号微控制器	评估器件
TPS73533DRBT	500mA、可调节、低静态电流、低噪声、高 PSRR、单路输出 LDO 稳压器	3.3V 电源 XDS110 和 MSPM0C1106
TPD4E004DRYR	用于高速数据接口的 4 通道 ESD 保护阵列	通过 USB 连接器保护 LP-MSPM0C1106 免受 ESD 损坏
TPD6E004RSER	用于高速数据接口的 6 通道 ESD 保护阵列	通过调试器连接器保护 LP-MSPM0C1106 免受 ESD 损坏
TPS2102DBVR	2.7V 至 4V 电源多路复用器、双输入、单输出电源开关	切换 XDS110 电源
LM4040B25IDCKR	精密微功耗并联电压基准	用于 XDS110 调试器的电压基准

2 硬件

2.1 硬件概述

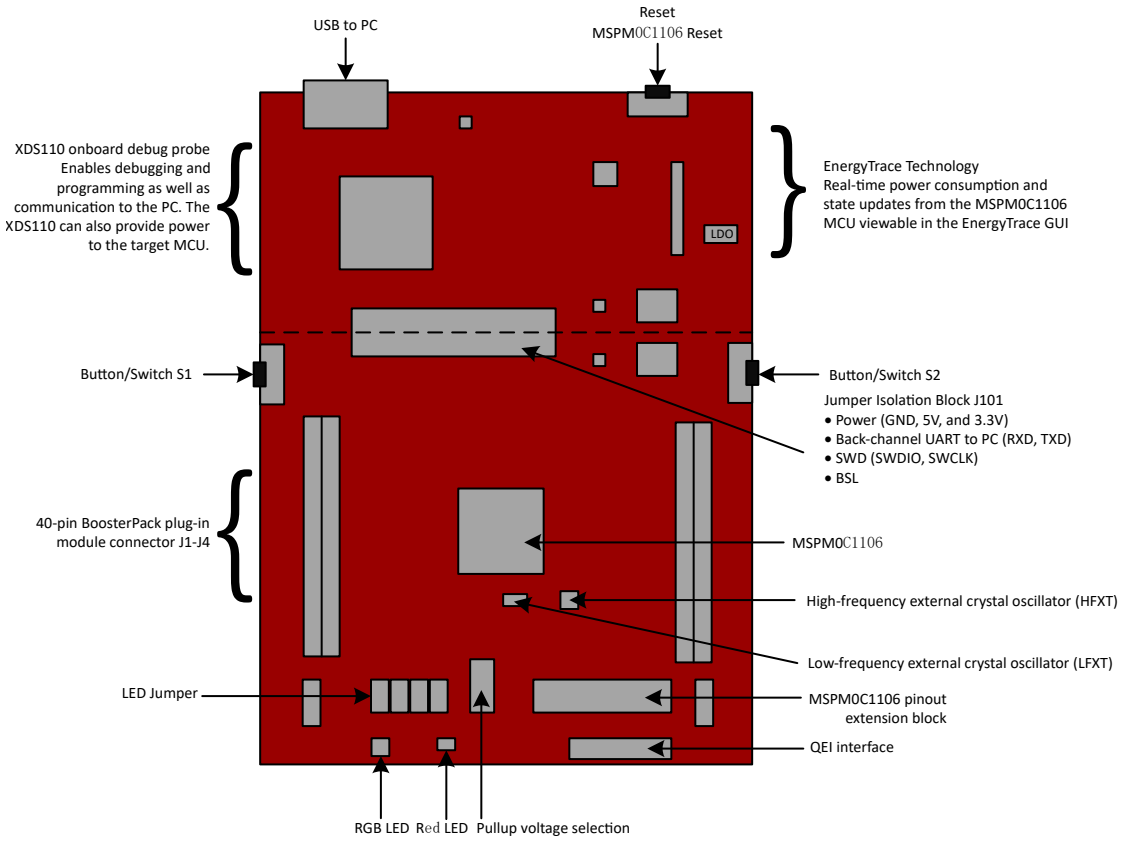


图 2-1. LP-MSPM0C1106 跳线和连接图

LP-MSPM0C1106 具有许多硬件特性，允许用户完全访问 MSPM0C1106 引脚，同时仍提供板载连接以方便使用。分流连接为用户提供了一种轻松更改 LaunchPad 配置的方法。图 2-1 展示了这些分流器的位置。表 2-1 描述了每个分流器的连接。默认配置是组装所有分流器。

表 2-1. 跳线信息

跳线	说明	默认设置	连接的信号
J1 和 J3	BoosterPack 接头块 1	未组装	引脚 1 至 20 的 BoosterPack 标准连接
J2 和 J4	BoosterPack 接头块 2	未组装	引脚 21 至 40 的 BoosterPack 标准连接
J3	BSL 调用	已组装	将 PA18 连接到 S1 按钮
J4	红色 LED	已组装	将 PA0 连接到红色 LED
J7	RGB (蓝色) LED	已组装	将 PB20 连接到 RGB (蓝色) LED
J8	RGB (红色) LED	已组装	将 PB24 连接到 RGB (红色) LED
J9	RGB (绿色) LED	已组装	将 PA30 连接到 RGB (绿色) LED
J10	开漏上拉选择器	已组装：顶部和中间 (1-2)	用于 PA0 的 3.3V 或 5V 连接的上拉选择器
J15	开漏上拉选择器	已组装：顶部和中间 (1-2)	用于 PA1 的 3.3V 或 5V 连接的上拉选择器

2.2 电源要求

LP-MSPM0C1106 只需插入 USB 并填充调试器跳线块即可为器件供电。通过板载 LDO，5V USB 电源转换为 3.3V，并提供 500mA 电源电流。也可以通过外部电源并使用 3.3V 或 5V 接头为 LaunchPad 供电。3.3V 轨上的电压不能超过 3.3V，5V 轨上的电压不能超过 5V。

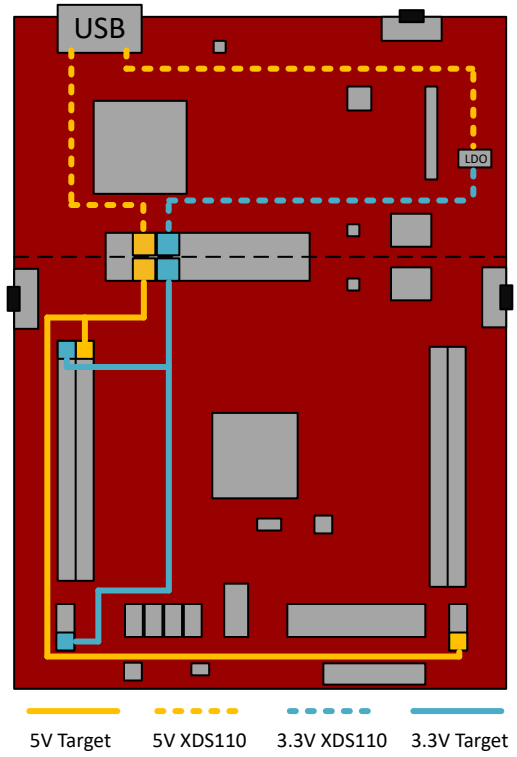


图 2-2. LP-MSPM0C1106 电源接头

2.3 XDS110 调试探针

LP-MSPM0C1106 具有板载调试探针，可简化原型设计。此 LaunchPad 上使用的调试器是 XDS110 型号，它支持所有 MSPM0 器件衍生产品。集成式 XDS110 调试探针与 MSPM0C1106 电路的其余部分分离，如 LaunchPad 上的虚线丝印所示。除了公共接地之外，XDS110 只能通过经过 J101 的信号进行连接。

2.3.1 隔离跳线块

利用隔离跳线块 J101，用户可以连接或断开从 XDS110 域进入 MSPM0C1106 目标域的信号。这包括 XDS110 SWD 信号、应用 UART 信号、3.3V 和 5V 电源以及复位信号。

表 2-2. 隔离跳线块

跳线	说明
5V	来自 USB 的 5V 电源轨
3V3	来自 LDO 的 3.3V 电源轨
RXD<<	反向通道 UART：目标 MSPM0C1106 通过该信号接收数据。箭头指示信号的方向。
TXD>>	反向通道 UART：目标 MSPM0C1106 通过该信号发送数据。箭头指示信号的方向。
NRST	复位信号
SWDIO	串行线调试：SWDIO 数据信号
SWCLK	串行线调试：SWCLK 时钟信号
BSL	为引导加载程序调用引脚。允许 XDS110 调用 BSL。

2.4 测量 MSPM0C1106 的电流消耗

要使用万用表测量 MSPM0C1106 MCU 的电流消耗，请使用 J101 跳线隔离块上的 3V3 跳线。测量的电流包括目标器件和 LaunchPad 电路消耗的电流以及任何通过 BoosterPack 插件模块接头消耗的电流。要测量超低功耗，请按照下列步骤操作：

1. 拆下 J101 隔离块中的 3V3 跳线，并在该 3V3 跳线上连接一个电流表。
2. 应考虑反向通道 UART 和任何连接到 MSPM0C1106 的电路可能对电流消耗产生的影响。考虑在隔离跳线块上断开反向通道 UART，或者至少在最终测量中考虑灌电流和拉电流能力。
3. 确保 MSPM0C1106 上没有悬空输入或输出 (I/O)。这会引起不必要的额外电流消耗。每个 I/O 都会进行驱动，如果 I/O 是输入，则将其拉或驱动至高电平或低电平。
4. 开始执行目标。
5. 要实现更准确的电流测量，请将器件置于“Free Run”模式，并断开 MSPM0C1106 与电路板调试部分（接头 J101）之间的编程信号。
6. 测量电流。请记住，如果电流出现波动，则可能难以获得稳定的测量结果。在静态状态下进行测量会更轻松。

2.5 时钟

内部 SYSOSC 默认为 32MHz (精度为 2.5%) 。默认情况下，MCLK 由 SYSOSC 提供。CPUCLK 在 RUN 模式下直接以 MCLK 为源，在其他模式下禁用。低功耗时钟 (ULPCLK) 可以 MCLK 为源，并通过配置在 RUN 和 SLEEP 模式下激活。该器件还包含内部 32kHz 振荡器 LFOSC，这是默认的低频源。该 LaunchPad 包含两个时钟晶体选项，即一个高频 32MHz 晶体 (HFXT) 和一个低频 32.768kHz 晶体 (LFXT)。在应用程序编程期间，可以选择晶体作为高频和低频时钟的时钟源。有关时钟树的更多详细信息，请参阅 MSPM0 C 系列微控制器技术参考手册的“时钟模块 (CKM)”一节。

2.6 BoosterPack 插接模块引脚布局

LaunchPad 开发套件遵循 40 引脚 LaunchPad 开发套件引脚排列标准 (如果引脚可用) 。对于 TI 生态系统而言，创建标准旨在帮助实现 LaunchPad 开发套件与 BoosterPack 插件模块之间的兼容性。

虽然大多数 BoosterPack 插接模块符合该标准，但仍有些不符合标准。如果 BoosterPack 插件模块的经销商或所有者没有明确指出该模块与 MSPM0C1106 LaunchPad 开发套件的兼容性，请将候选 BoosterPack 插件模块的原理图与 LaunchPad 开发套件进行比较，以验证兼容性。可以通过在软件中更改 MSPM0C1106 器件的引脚功能配置来解决冲突。

3 软件

3.1 软件开发选项

使用 LP-MSPM0C1106 进行原型设计的方法有多种：

- 开箱即用 GUI：选择此选项可轻松演示 LP-MSPM0C1106。
- CCS：选择此选项可快速开始。
- CCS Cloud：选择此选项可快速开始，只需极少的安装。

3.2 开箱即用 GUI

借助 LP-MSPM0C1106 上的开箱即用示例开始使用。只需转到开箱即用 GUI 并将 LP-MSPM0C1106 插入 PC、Mac 或 Linux 工作站。此 GUI 提供对内置 LED 的控制以及 LP-MSPM0C1106 当前状态的仪表板。GUI 功能可能需要 TI Cloud Agent 浏览器扩展。

更多有关 GUI 的信息将在完整版发布后提供，并且可以在 TI 开发人员专区中找到。

3.3 CCS Cloud

1. 前往 dev.ti.com。用户需要安装 CCS Cloud Agent。如果尚未安装 CCS Cloud Agent，请按照以下步骤完成安装。
2. 使用 micro-USB 电缆插入 LP-MSPM0C1106。TI 开发人员专区会自动检测 LPMSPM0C1106 是否已插入。
3. 点击 Browse Software And Examples，会在新窗口中打开 MSPM0 SDK。在左侧栏中，转到基于 Arm 的微控制器 > Embedded Software > MSPM0 SDK > Examples > Development Tools > DriverLib > gpio_toggle_output > No RTOS > TI Clang Compiler > gpio_toggle_output。
4. 点击屏幕右上角的 Import 按钮。此操作会将工程导入到 CCS Cloud 中并在新窗口中打开。
5. 在 CCS Cloud 中，点击左侧栏中的调试图标以打开调试视图。
6. 点击 *play* 按钮将代码部署到器件并打开调试会话。默认情况下，调试器会暂停第一行代码。
7. 点击蓝色的 *play* 按钮启动应用程序。
8. LP-MSPM0C1106 上的 LED 需要闪烁。

现在，用户可以通过修改代码或导入不同的示例代码来开始原型设计。

4 硬件设计文件

4.1 原理图

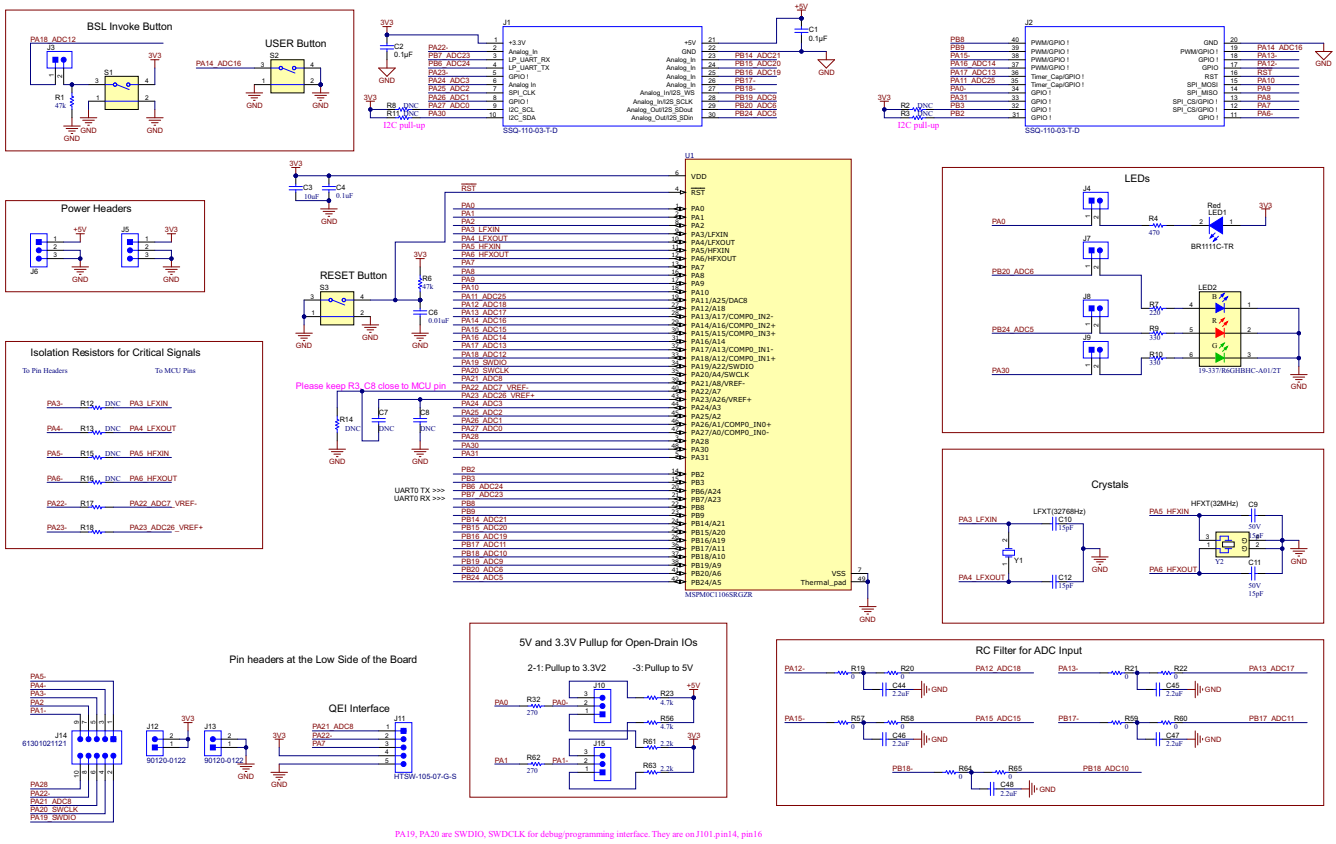


图 4-1. LP-MSPM0C1106 目标器件原理图

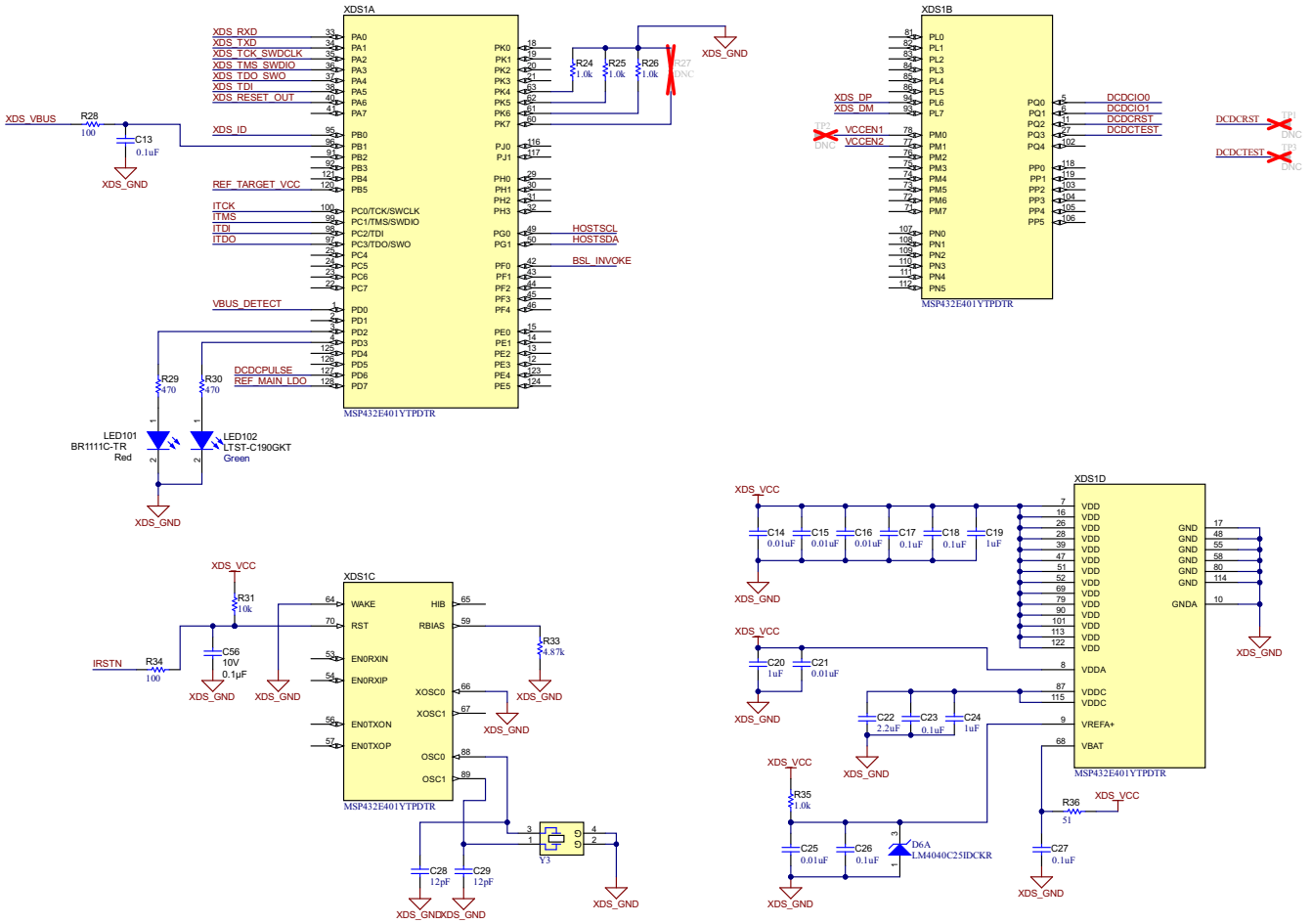


图 4-2. LP-MSPM0C1106 目标器件原理图

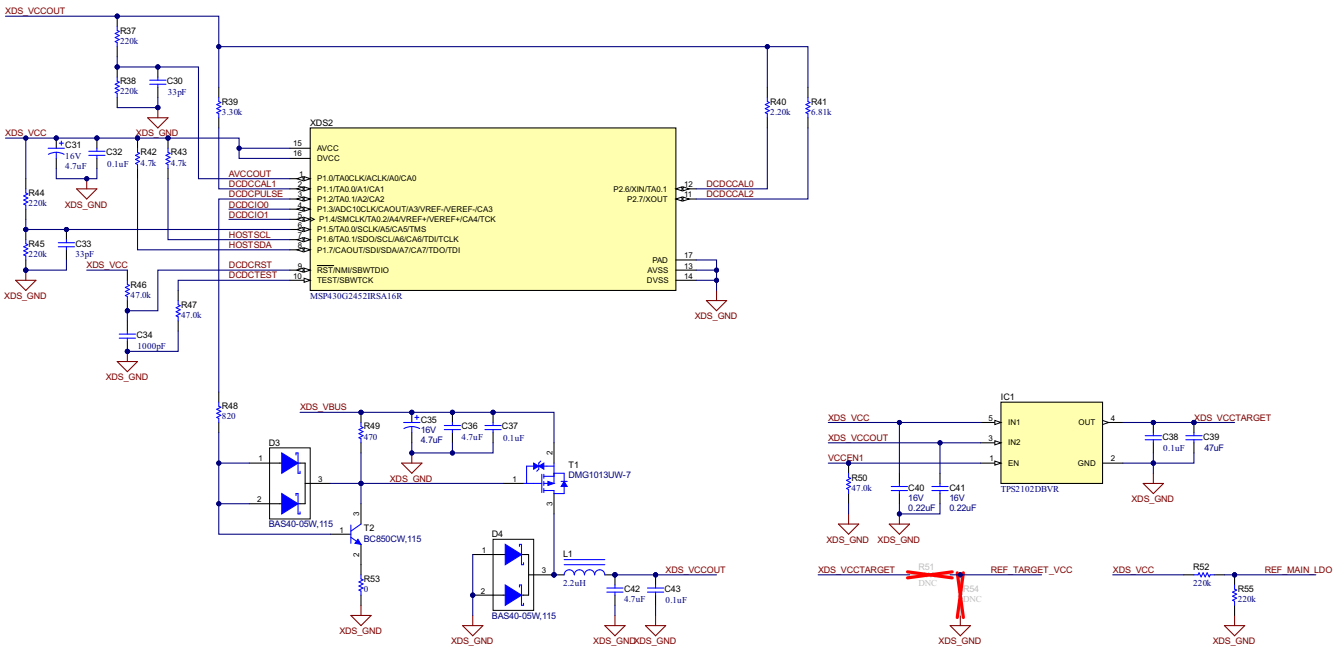


图 4-3. LP-MSPM0C1106 目标器件原理图

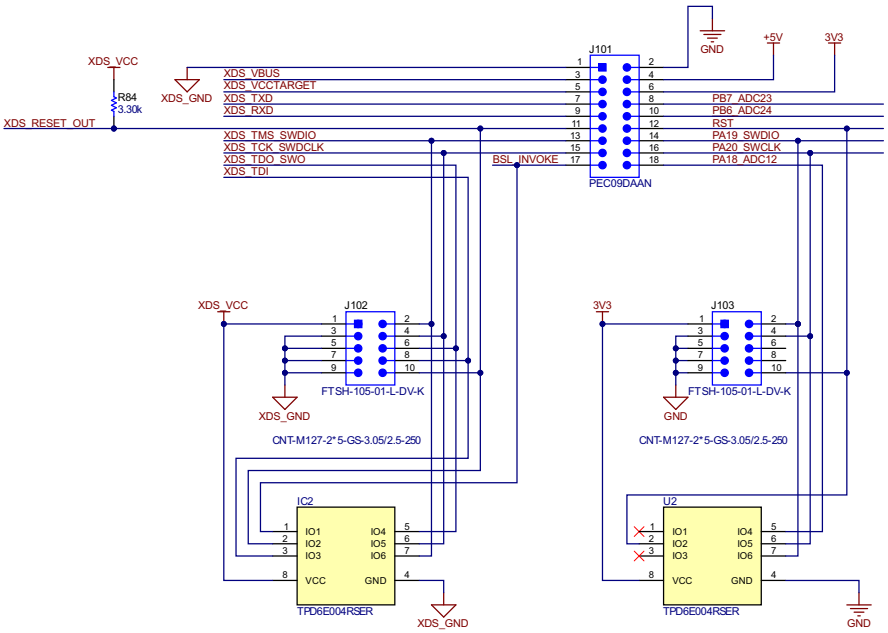


图 4-4. LP-MSPM0C1106 目标器件原理图

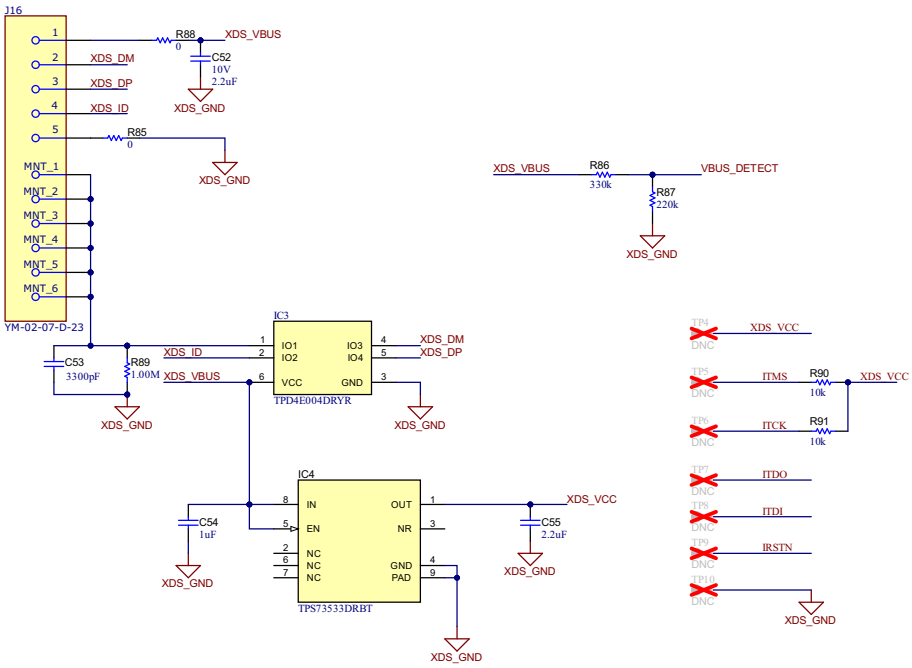


图 4-5. LP-MSPM0C1106 目标器件原理图

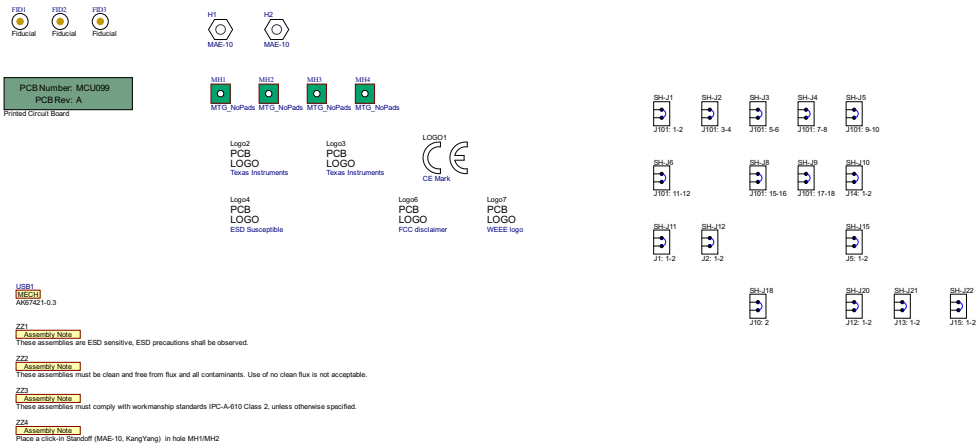


图 4-6. LP-MSPM0C1106 目标器件原理图

4.2 PCB 布局

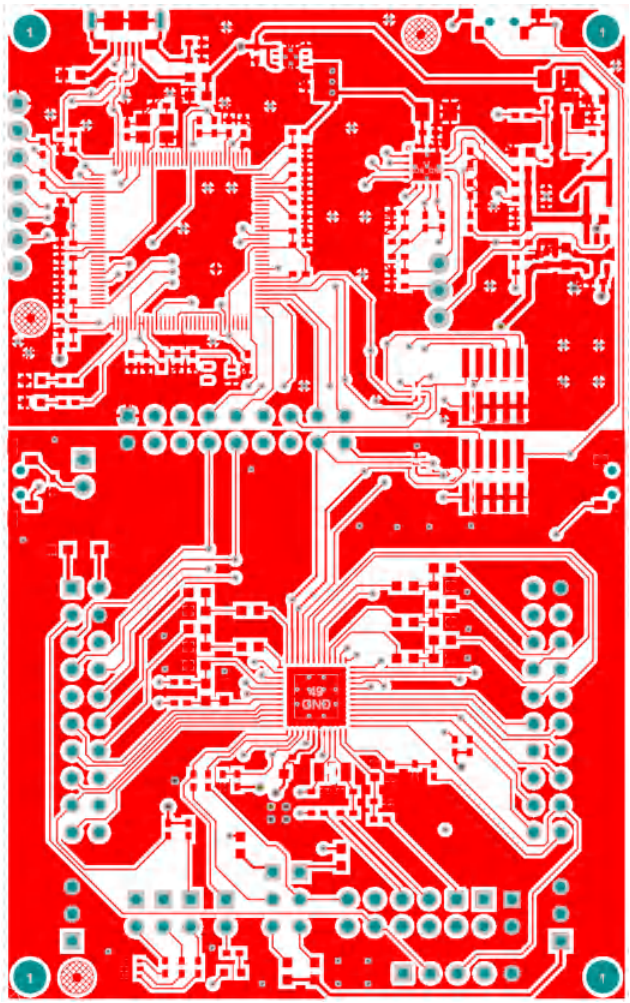


图 4-7. 第 1 层：信号和电源（顶视图）

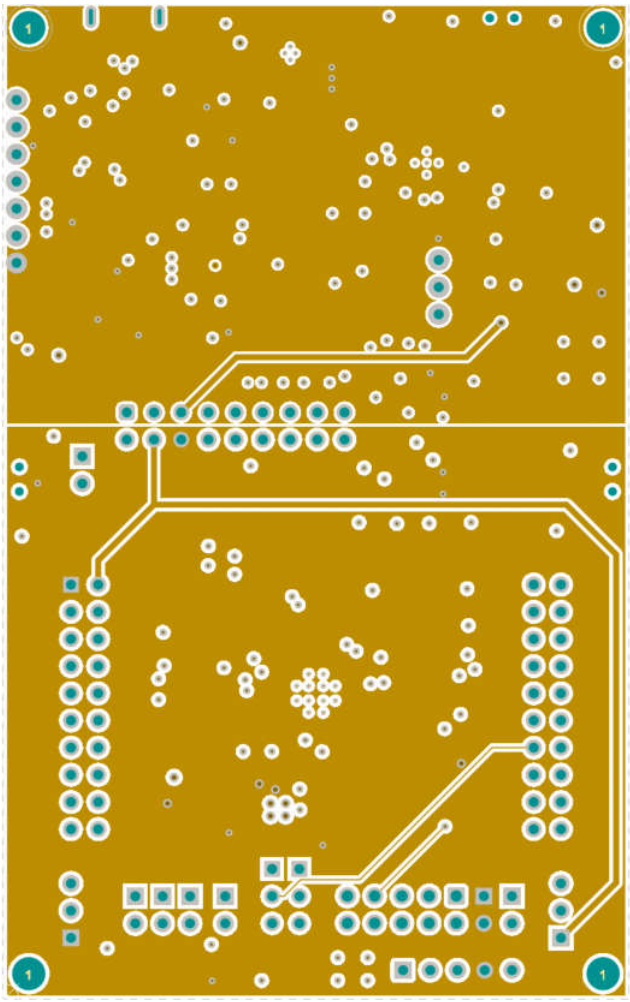


图 4-8. 第 2 层：VDD

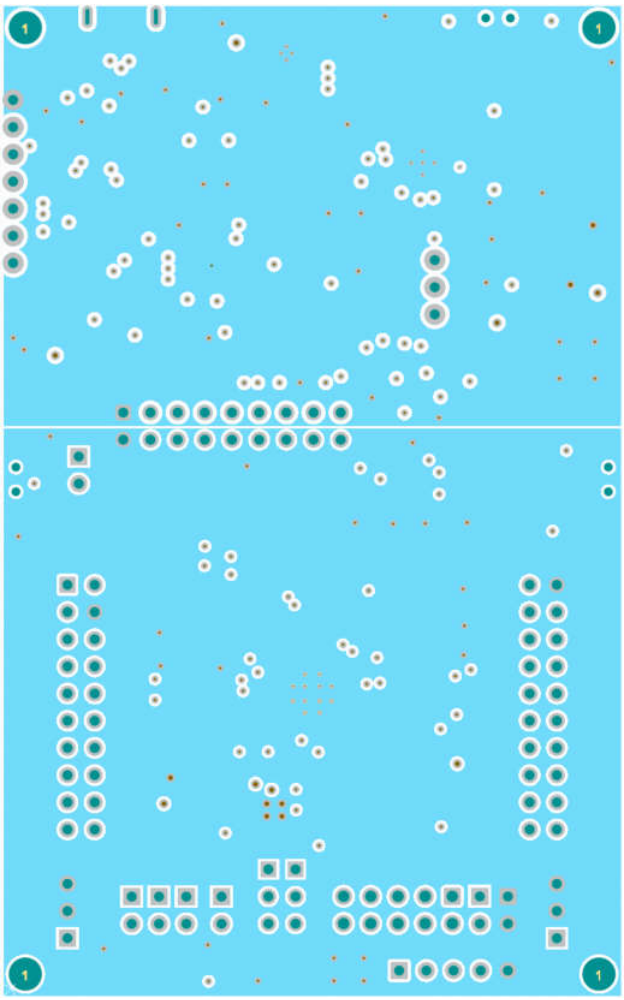


图 4-9. 第 3 层：GND

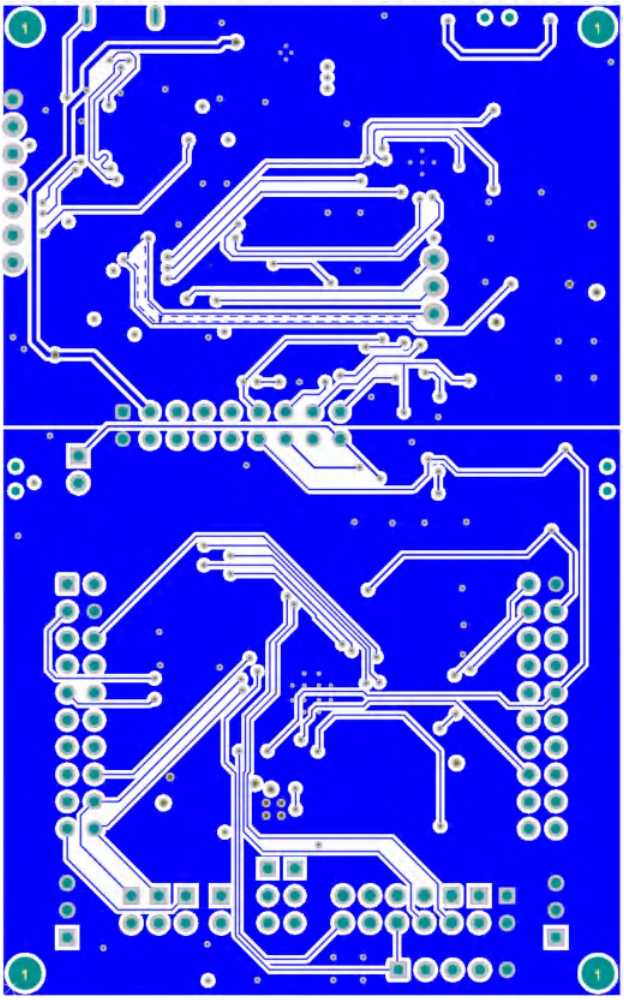


图 4-10. 第 4 层：信号 (底视图)

4.3 物料清单 (BOM)

表 4-1. 物料清单

位号	数量	值	说明	器件型号	封装参考	制造商
SH-J1、SH-J2、SH-J3、SH-J4、SH-J5、SH-J6、SH-J8、SH-J9、SH-J10、SH-J11、SH-J12、SH-J15、SH-J18、SH-J20、SH-J21、SH-J22	16	J101：1-2，J101：3-4，J101：5-6，J101：7-8，J101：9-10，J101：11-12，J101：15-16，J101：17-18，J14：1-2，J1：1-2，J2：1-2，J5：1-2，J10：2，J12：1-2，J13：1-2，J15：1-2	分流器，100mil，镀金，黑色	2228CG	SNT-100-BK-G	Nextron
R19、R20、R21、R22、R53、R57、R58、R59、R60、R64、R65、R85、R88	13	0	电阻，0，5%，0.1W，0603	RC0603JR-070RL	0603	Yageo
C13、C17、C18、C23、C26、C27、C32、C37、C38、C43	10	0.1uF	电容，陶瓷，0.1uF，10V，+/-10%，X5R，0402	CC0402KRX5R6BB104	0402	Yageo
J3、J4、J7、J8、J9	5		接头，100mil，2x1，锡，TH	NS-201-SH0386-201S-1*2P(F)	CONN_90120-0122	NS-TECH
C14、C15、C16、C21、C25	5	0.01uF	电容，陶瓷，0.01μF，25V，+/- 10%，X7R，0402	CC0402KRX7R8BB103	0402	Yageo
R37、R38、R44、R45、R87	5	220k	电阻，220k，1%，0.0625W，0402	RC0402FR-07220KL	0402	Yageo America
C19、C20、C24、C54	4	1uF	电容，陶瓷，1uF，25V，+/-10%，X5R，0402	CC0402KRX5R8BB105	0402	Yageo
R24、R25、R26、R35	4	1.0k	电阻，1.0k，5%，0.063W，0402	AC0402JR-071KL	0402	Yageo
R4、R29、R30、R49	4	470	电阻，470，5%，0.063W，0402	AC0402JR-07470RL	0402	Yageo
S1、S2、S3	3		开关，SPST，0.05A，12VDC，SMD	THBM02-LAB	SW_1188E	HONGJU
R31、R90、R91	3	10k	电阻，10k，5%，0.063W，0402	AC0402JR-0710KL	0402	Yageo
FID1、FID2、FID3	3		基准标记。没有需要购买或安装的元件。	基准	Fiducial10-30	不适用
R46、R47、R50	3	47.0k	电阻，47.0k，1%，0.0625W，0402	RC0402FR-0747KL	0402	Yageo America

表 4-1. 物料清单（续）

位号	数量	值	说明	器件型号	封装参考	制造商
D3、D4	2	40V	二极管，肖特基，40V，0.12A，AEC-Q101，SOT-323	BAS40-05W,115	SOT-323	Nexperia
LED1、LED101	2	红色	LED，红色，SMD	LTST-C190KRKT	1111C_Red	LITE-ON
C9、C11	2	15pF	电容，陶瓷，15pF，50V，+/-5%，C0G/NP0，0402	CC0402JRNPO9BN150	0402	Yageo America
C1, C2	2	0.1uF	电容，陶瓷，0.1µF，25V，+/-10%，X5R，0603	CC0603KRX5R8BB104	0603	Yageo
R42、R43	2	4.7k	电阻，4.7k，5%，0.063W，0402	AC0402JR-074K7L	0402	Yageo
R1、R6	2	47k	电阻，47k，5%，0.063W，0402	AC0402JR-0747KL	0402	Yageo
R28、R34	2	100	电阻，0，5%，0.063W，AEC-Q200 0 级，0402，电阻，100，5%，0.063W，0402	AC0402JR-07100RL	0402	Yageo
R52、R55	2	220k	电阻，220k，5%，0.063W，AEC-Q200 0 级，0402	AC0402JR-07220KL	0402	Yageo
R32、R62	2	270	电阻，270，5%，0.063W，0402	AC0402JR-07270RL	0402	Yageo
R9、R10	2	330	电阻，330，5%，0.063W，0402	AC0402JR-07330RL	0402	Yageo
R39、R84	2	3.30k	电阻，3.30k，1%，0.1W，AEC-Q200 0 级，0402	AC0402FR-073K3L	0402	Yageo
J102、J103	2		接头（有罩），1.27mm，5x2，金，SMT	GTEC201-0502A001R1BF	Samtec_FTSH-105-01-x-DV-K	Greenconn
C22、C55	2	2.2µF	电容，陶瓷，2.2uF，6.3V，+/-10%，X5R，0402	CC0402KRX5R5BB225	0402	Yageo
C40、C41	2	0.22uF	电容，陶瓷，0.22uF，16V，+/-10%，X7R，0402	CC0402KRX7R7BB224	0402	Yageo
C36、C42	2	4.7µF	电容，陶瓷，4.7uF，16V，+/-10%，X5R，0603	CC0603KRX5R7BB475	0603	Yageo

表 4-1. 物料清单（续）

位号	数量	值	说明	器件型号	封装参考	制造商
C28、C29	2	12pF	电容，陶瓷，12pF，50V，+/-5%，C0G/NP0，0402	CC0402JRNPO9BN120	0402	Yageo
C10、C12	2	15pF	电容，陶瓷，15pF，50V，+/-5%，C0G/NP0，0402	CC0402JRNPO9BN150	0402	Yageo
C30、C33	2	33pF	电容，陶瓷，33pF，50V，+/-5%，C0G/NP0，0402	CC0402JRNPO9BN330	0402	Yageo
H1、H2	2		垫片支架，尼龙 66	MAE-10	KY_MAE-10	Kang Yang
J10、J15	2		接头，100mil，3x1，锡，TH	NS-201-SH0385-201S-1*3P(F)	CONN_PEC03SAAN	NS-TECH
R17、R18	2	0	电阻，0，5%，0.063W，0402	RC0402JR-070RL	0402	Yageo America
R61、R63	2	2.2k	电阻，2.2k，5%，0.1W，0603	RC0603JR-072K2L	0603	Yageo
R23、R56	2	4.7k	电阻，4.7k，5%，0.1W，0603	RC0603JR-074K7L	0603	Yageo
C31、C35	2	4.7µF	电容，钽，4.7µF，16V，+/-10%，4Ω，SMD	TAJA475K016RNJ	3216-18	AVX
IC2、U2	2		用于高速数据接口的低电容 +/-15kV ESD 保护阵列，6 通道，-40°C 至 85°C，8 引脚 UQFN (RSE)，绿色环保（符合 RoHS 标准，无锑/溴）	TPD6E004RSER	RSE0008A	德州仪器 (TI)
LED2	1	Rgb	LED，RGB，SMD	19-337/R6GHBHC-A01/2T	19-337_RGB	Everlight
USB1	1		电缆，USB-A 至微型 USB-B，0.3m	A006ZX051		ZanXin
T2	1	45V	晶体管，NPN，45V，0.1A，SOT-323	BC850CW,115	SOT-323	NXP Semiconductor
C56	1	0.1uF	电容，陶瓷，0.1µF，10V，+/-10%，X7R，0402	CC0402KRX7R6BB104	0402	Yageo
C52	1	2.2 µ F	电容，陶瓷，2.2uF，10V，+/-10%，X5R，0603	CC0603KRX5R6BB225	0603	Yageo

表 4-1. 物料清单（续）

位号	数量	值	说明	器件型号	封装参考	制造商
L1	1	2.2 µ H	电感，绕线型，陶瓷，2.2uH，0.89A，0.13 Ω，SMD	CBC2518T2R2M	CBC2518	Taiyo Yuden
R89	1	1.00Meg	电阻，1.00M，1%，0.063W，0402	AC0402FR-071ML	0402	Yageo
R40	1	2.20k	电阻，2.20k，1%，0.063W，0402	RMCF0402FT2K20	0402	Stackpole
R33	1	4.87k	电阻，4.87k，1%，0.063W，AEC-Q200 0 级，0402	AC0402FR-074K87L	0402	Yageo
R41	1	6.81k	电阻，6.81k，1%，0.063W，0402	AC0402FR-076K81L	0402	Yageo
R36	1	51	电阻，51，5%，0.063W，AEC-Q200 0 级，0402	AC0402JR-0751RL	0402	Yageo
R7	1	220	电阻，220，5%，0.063W，0402	AC0402JR-07220RL	0402	Yageo
T1	1	-20V	MOSFET，P 沟道，-20V，-0.82A，SOT-323	DMG1013UW-7	SOT-323	Diodes Inc.
C34	1	1000pF	电容，陶瓷，1000pF，6.3V，+/-10%，X5R，0402	CC0402KRX7R7BB102	0402	Yageo
C6	1	0.01uF	电容，陶瓷，0.01uF，16V，+/-10%，X5R，0402	CC0402KRX7R7BB103	0402	Yageo
C4	1	0.1uF	电容，陶瓷，0.1 µ F，50V，+/-20%，X5R，0402	CC0402KRX5R9BB104	0402	Yageo
C53	1	3300pF	电容，陶瓷，3300pF，50V，+/-10%，X7R，0402	CC0402KRX7R9BB332	0402	Yageo
C3	1	10uF	电容，陶瓷，10µF，6.3V，+/-20%，X5R，0603	CC0603MRX5R5BB106	0603	Yageo
C39	1	47uF	电容器，陶瓷，47µF，6.3V，+/-20%，X5R，0603	CL10A476MQ8QRNC	0603	Samsung

表 4-1. 物料清单（续）

位号	数量	值	说明	器件型号	封装参考	制造商
D6	1		精密微功耗并联电压基准、0.2% 精度、2.5V、15ppm/°C、15mA、-40°C 至 85°C、5 引脚 SC70 (DCK)、绿色环保（RoHS，无锑/溴）	LM4040B25IDCKR	DCK0005A_N	德州仪器 (TI)
LED102	1	绿色	LED，绿色，SMD	LTST-C190GKT	LED_LTST-C190	Lite-On
XDS2	1		MSP430G2x52、MSP430G2x12 混合信号微控制器，RSA0016B (VQFN-16)	MSP430G2452IRSA16R	RSA0016B	德州仪器 (TI)
XDS1	1		MSP432E401YTPDT、PDT0128A (TQFP-128)	MSP432E401YTPDTR	PDT0128A	德州仪器 (TI)
U1	1		混合信号微控制器	MSPM0C1106SRGZ	RGZ0048B-MFG	德州仪器 (TI)
Y3	1		晶振，16MHz，8pF，SMD	5YAA16000082TF80Q3	NDK_NX3225GA	INTERQUIP
J5	1		接头，100mil，3x1，锡，TH	NS-201-SH0385-201S-1*3P(F)	PEC03SAAN_Launchpad_3V3	NS-TECH
J6	1		接头，100mil，3x1，锡，TH	NS-201-SH0385-201S-1*3P(F)	PEC03SAAN_Launchpad_5V0	NS-TECH
J101	1		接头，2.54mm，9x2，锡，TH	NS-201-SH0384-201S-2*9P(F)	Sullins_PxC09DAAN	NS-TECH
!PCB1	1		印刷电路板	印刷电路板		不限
Y2	1		晶振，32MHz，10pF，SMD	Q22FA1280009200	XTAL_FA-128	Epson
R86	1	330k	电阻，330k，1%，0.0625W，0402	RC0402FR-07330KL	0402	Yageo America
R48	1	820	电阻，820，1%，0.063W，0402	RC0402FR-07820RL	0402	Yageo America
J1	1		插座，2.54mm，10x2，锡，TH	NS-203-SH0135-203S-Y-2*10P(F)	BoosterPack_40pin_J1J3	NS-TECH
J2	1		插座，2.54mm，10x2，锡，TH	NS-203-SH0135-203S-Y-2*10P(F)	BoosterPack_40pin_J2J4	NS-TECH
IC3	1		用于高速数据接口的 ESD 保护阵列，4 通道，-40 至 +85°C，6 引脚 SON (DRY)，环保（符合 RoHS 标准，无锑/溴）	TPD4E004DRYR	DRY0006A	德州仪器 (TI)

表 4-1. 物料清单（续）

位号	数量	值	说明	器件型号	封装参考	制造商
IC1	1		2.7V-4V 双路输入/单路输出 MOSFET，0.5A 主输入/0.1A 辅助输入，低电平有效使能端，通信温度，DBV0005A (SOT-23-5)	TPS2102DBVR	DBV0005A_N	德州仪器 (TI)
IC4	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)	TPS73533DRBT	DRB0008A	德州仪器 (TI)
Y1	1		晶振，32.768KHz，12.5pF，SMD	9CAA32768122TF70QT	Epson_FC-135	INTERQUIP
J16	1		Micro USB 5F B 型 Smt	YM-02-07-D-23	FP-YM-02-07-D-23_CONN_USB_8MM10_5MM88-MFG	Yang Ming

5 其他信息

5.1 商标

LaunchPad™, EnergyTrace™, BoosterPack™, Code Composer Studio™, and SimpleLink™ are trademarks of Texas Instruments.
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6 相关文档

6.1 补充内容

以下各项是开始使用 MSPM0 的重要学习材料：

- MSPM0 Academy
- MSPM0-SDK 代码示例
- TI 高精度实验室

7 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 (July 2025) to Revision B (July 2026)	Page
• 更新了 *LP-MSPM0C1106* 图像	1

Changes from Revision * (April 2025) to Revision A (July 2025)	Page
• 更新了*特性* 部分	1
• 更新了 *LP-MSPM0C1106 目标器件原理图*	8
• 添加了 *PCB 布局*部分	11
• 更新了 BOM	15

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

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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.

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