EVM User's Guide: LP-MSPM0L2117

MSPM0L2117 Evaluation Module

Description

The LP-MSPM0L2117 LaunchPad™ development kit is an easy-to-use evaluation module for the MSPM0L2117 microcontroller (MCU). The LaunchPad kit contains everything needed to start developing on the MSPM0L211x and MSPM0L112x microcontroller platform, including an onboard debug probe for programming, debugging, and EnergyTrace™ technology. The board also features on-board buttons, LEDs, an RGB LED, and an LCD panel.

The MSPM0L2117 is a 32-bit Arm® Cortex® M0+ CPU with a frequency up to 32MHz. The device features 128KB of flash with 12KB of SRAM. The device also has internal analog, such as internal ADC, voltage reference, and comparator with 8-bit DAC. The MSPM0L2117 is the second MSPM0 device that features an LCD controller, which supports one to eight mux LCD panels.

Get Started

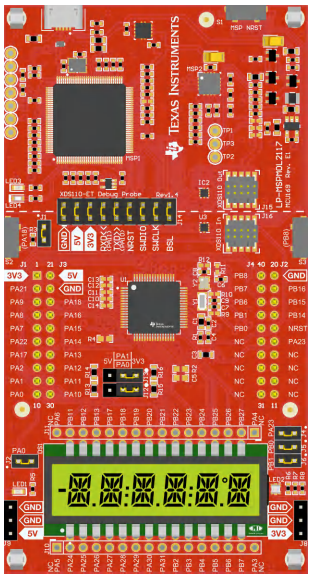
1. Order the LP-MSPM0L2117 from ti.com.
2. Navigate to dev.ti.com to browse for code examples.
3. Plug MSPM0L2117 into a PC with the provided USB cable.
4. Download code directly from the browser to the MSPM0L2117 with CCS Cloud.
5. Download CCS Theia for a desktop integrated development environment.
6. Download the MSPM0 SDK for desktop stored examples, demos, and software libraries.

Features

- Onboard XDS110 debug probe
- Backchannel UART through USB to PC
- USB powered
- 40-pin BoosterPack™ headers
- Hardware user interfaces
  - Two buttons: 1 LCD Panel, 1 RGB LED, 1 Red LED
- External clock crystals

Applications

- Grid infrastructure
- Factory automation
- Appliances
- Medical and healthcare
- Test and measurement



LP-MSPM0L2117

1 Evaluation Module Overview

1.1 Introduction

The MSPM0L2117 is a 32-bit Arm® Cortex® -M0+ CPU with an LCD controller and enhanced security features. The device can be used in a variety of tasks from a simple housekeeping MCU with the 64 pins to a full-application level with single-phase e-metering. The easiest way to get started with MSPM0L2117 is with the LP-MSPM0L2117 LaunchPad™ . The LaunchPad has all the features to load code, debug, and prototype right out of the box.

Rapid prototyping is simplified by the 40-pin BoosterPack™ plug-in module headers, which support a wide range of available BoosterPack plug-in modules. Users can quickly add features like wireless connectivity, graphical displays, environmental sensing, and much more. Users can design their own BoosterPack plug-in module or choose among many already available from TI and third-party developers.

To make prototyping easier, TI provides the MSPM0 software development kit (SDK) which has a variety of code examples to demonstrate how to use the internal peripherals.

Free software development tools are also available, such as TI's Code Composer Studio™ IDE. We also support third-party IDEs such as IAR Embedded Workbench® IDE and Arm® Kiel® µVision® IDE. The Code Composer Studio IDE supports EnergyTrace™ technology with the LP-MSPM0L2117 LaunchPad development kit. More information about the LaunchPad development kit, the supported BoosterPack plug-in modules, and the available resources can be found at TI's LaunchPad™ development kit portal. To get started quickly and find available resources in the MSPM0 software development kit (SDK), visit the TI Developer Zone. The MSPM0 MCUs are also supported by extensive online collateral, training with MSPM0 Academy and online support through the TI E2E™ support forums.

1.2 Kit Contents

- LP-MSPM0L2117 LaunchPad™ development kit
- USB cable
- Quickstart guide

1.3 Specification

LP-MSPM0L2117 is designed to be used in conjunction with a PC, Mac® , or Linux® workstation running the Code Composer Studio™ (CCS). The CCS can run as a stand-alone version on a workstation or be accessed through the web (CCS Cloud) without the need for a software installation. Alternatively, LP-MSPM0L2117 ships with an example loaded, which can be controlled by a GUI. See the out-of-box description below.

The device can be powered from a power supply other than the build-in USB power supply. This feature allows the user to forgo the PC connection. Power can be applied either directly or to the 3.3V rail. When using an external power supply, do not exceed 3.3V. Programming can be done externally with a separate XDS110 external debugger utilizing the on-board Arm® 10-pin connector.

1.4 Device Information

LP-MSPM0L2117 uses the following devices from Texas Instruments.

Table 1-1. Device Information

Device Name	Description	Purpose
MSP432E401YTPDT	SimpleLink™ 32-bit Arm® Cortex® -M4F MCU with Ethernet™ , CAN, 1MB Flash and 256kB RAM	XDS110 Host Device
MSPM0L2117SPNAR	Mixed-signal microcontroller with 32MHz Arm® Cortex® 32-bit-M0+ CPU, 128kB flash, and 12kB SRAM	Evaluation device
MSP430G2452IRSA16R	Mixed-signal microcontroller with 16-bit RISC CPU, 8kB Flash, and 256B SRAM	DC/DC controller for EnergyTrace™ Technology
TPD4E004RSER	ESD-protection array for high-speed data interfaces, 4 channels	Protect MSPM0L2117 from ESD damage through USB connector
TPS73533DRBT	500mA, adjustable, low quiescent current, low-noise, high-PSRR, single-output LDO regulator	3.3V power XDS110 and MSPM0L2117
TPS2102DBVR	2.7V to 4V power MUX, dual-input, single-output power switch	Switches XDS110 power

2 Hardware

2.1 Hardware Overview

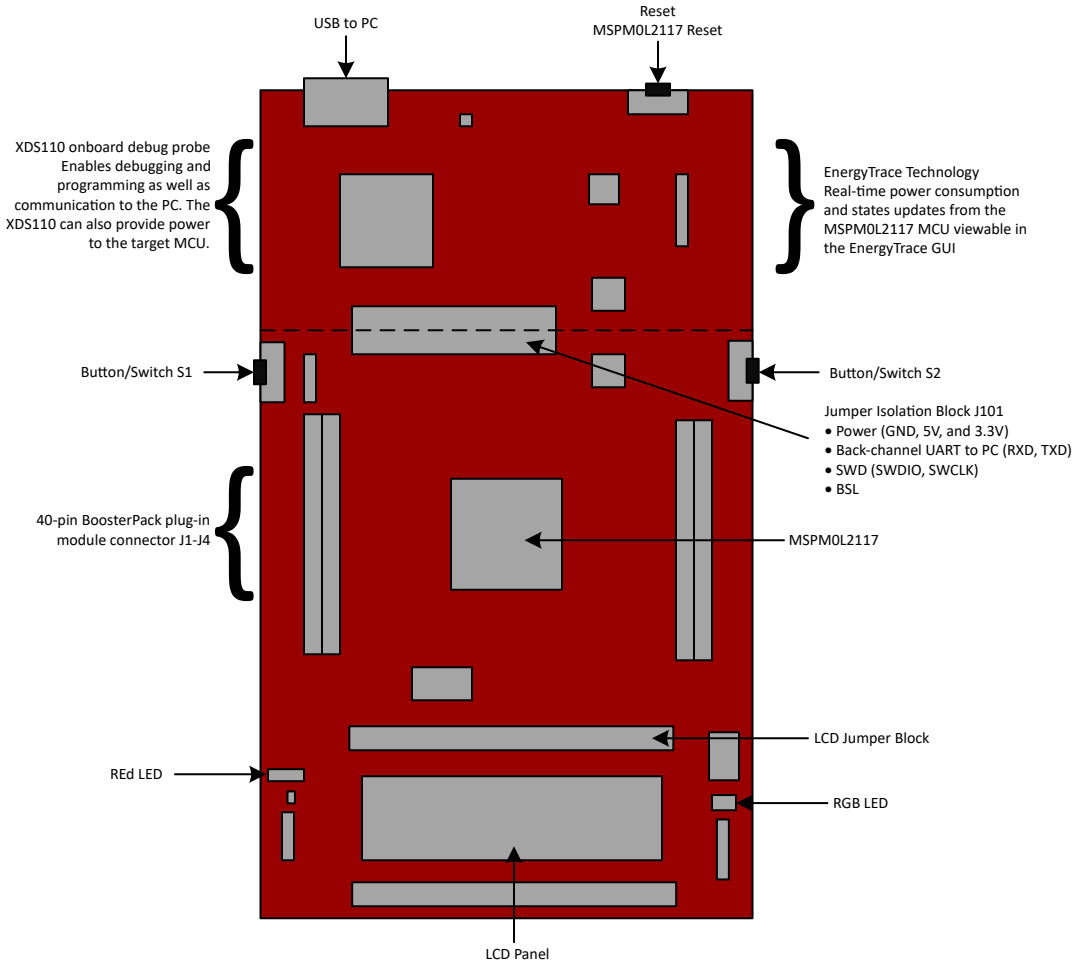


Figure 2-1. Diagram of LP-MSPM0L2117 Jumpers and Connectors

LP-MSPM0L2117 has many hardware features, which allow the user full access to the MSPM0L2117 pins, while still providing onboard connectivity for easy use. Shunt connections provide a way for the user to easily change the LaunchPad™ configuration. The location of these shunts is shown in Figure 2-1. The connection of each shunt is described in Table 2-1.

Table 2-1. Jumper Information

Jumper	Description	Default Setting	Connected Signal
J12	Open drain I/O pullups	Right and center connection	PA0: 4.7k pullup resistor to 5V, or 2.2k pullup resistor to 3.3V depending on setting
J13	Open drain I/O pullups	Right and center connection	PA1: 4.7kΩ pullup resistor to 5V, or 2.2kΩ pullup resistor to 3.3V depending on setting
J2	Red LED connection (LED3)	Populated	3.3V through LED and 470Ω resistor to PA0
J4	RGB blue connection	Populated	PA23 through 220Ω resistor and LED to ground
J5	RGB red connection	Populated	PB10 through 220Ω resistor and LED to ground
J6	RGB green connection	Populated	PB9 through 220Ω resistor and LED to ground
J1	BSL button	Populated	PA18: 47kΩ pulldown resistor, switch pulls up to 3.3V

2.2 Power Requirements

The LP-MSPM0L2117 only needs the USB plugged in and the debugger jumper block populated to power the device. With the on-board LDO, the 5V USB supply is converted to 3.3V with a supply of 500mA. The LaunchPad™ can also be powered using the 3.3V or 5V headers through an external supply. Do not exceed 3.3V on the 3.3V rail or 5V on the 5V rail.

Figure 2-2 shows the power connections on the LP-MSPM0L2117.

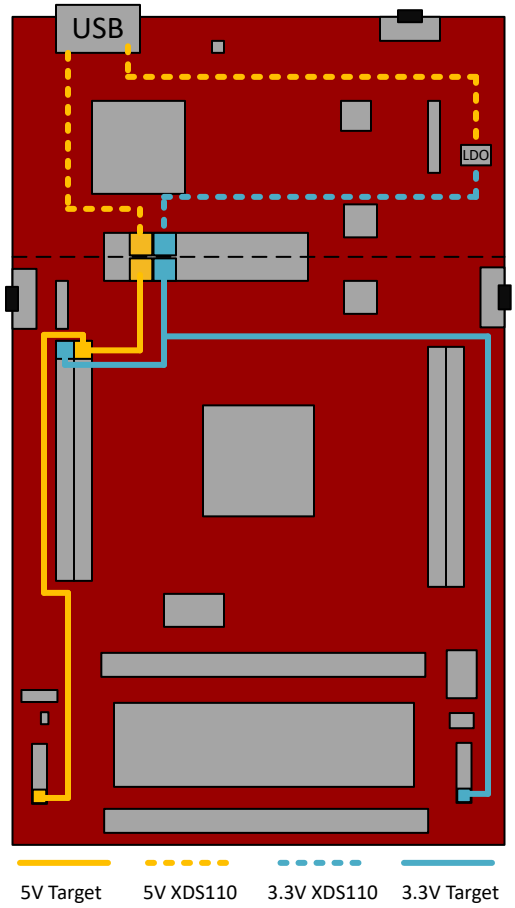


Figure 2-2. LP-MSPM0L2117 Power Connections

2.3 XDS110 Debug Probe

LP-MSPM0L2117 features an onboard debug probe to streamline prototyping. The debugger used on this LaunchPad™ is the XDS110 variant, which supports all MSPM0 device derivatives. The integrated XDS110 debug probe is separated from the rest of the MSPM0L2117 circuitry, which is shown by the dashed silkscreen on the LaunchPad. The XDS110 is only connected through signals that pass through J101, in addition to a common ground.

2.3.1 Isolation Jumper Block

The isolation jumper block J14 allows the user to connect or disconnect signals that cross from the XDS110 domain into the MSPM0L2117 target domain. This includes the XDS110 SWD signals, application UART signals, 3.3V and 5.5V power, reset, and a BSL invoke.

Table 2-2. Isolation Jumper Block

Jumper	Description
5V	5V rail from the USB
3V3	3.3V rail from the LDO
RXD<<	Backchannel UART: The target MSPM0L2117 receives data through this signal. The arrows indicate the direction of the signal.
TXD>>	Backchannel UART: The target MSPM0L2117 sends data through this signal. The arrows indicate the direction of the signal.
NRST	Reset signal
SWDIO	Serial wire debug: SWDIO data signal
SWCLK	Serial wire debug: SWCLK clock signal
BSL	Invoke pin for bootstrap loader. Allows the XDS110 to invoke BSL.

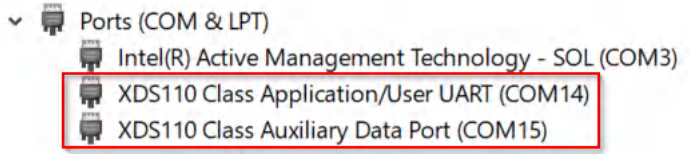
During normal prototyping most shunts are populated. However, there are some scenarios where a user needs to open these connections:

- To remove any and all influence from the XDS110 debug probe for high accuracy target power measurements
- To control 3.3V and 5V power flow between the XDS110 and target domains
- To expose the target MCU pins for other use than onboard debugging and application UART communication.
- To expose the programming and UART interface for the XDS110 so that the XDS110 can be used for devices other than the onboard MCU.

2.3.2 Application (Backchannel) UART

The backchannel UART allows communication with the USB host that is not part of the main function of the target application. This feature is very useful during development, and also provides a communication channel to the PC host side. This can be used to create graphical user interfaces (GUIs) and other programs on the PC that communicate with the LaunchPad™ development kit.

On the host side, a virtual COM port for the application backchannel UART is generated when the LaunchPad development kit enumerates on the host. Users can use any PC application that interfaces with COM ports, including terminal applications like HyperTerminal™ or Docklight™ , to open this port and communicate with the target application. Users need to identify the COM port for the backchannel. On Windows® PCs, *Device Manager* can assist.



A. Intel® is a trademark of Intel Corporation.

Figure 2-3. Application Backchannel UART in Device Manager

The backchannel UART is the *XDS110 Class Application/User UART* port. In this case, Figure 2-3 shows COM14, but this port can vary from one host PC to the next. After identifying the correct COM port, configure the port in the host application according to documentation. The user can then open the port and begin communication from the host.

On the target MSPM0L2117 side, the backchannel UART is connected to UART0 (PA10, PA11). The XDS110 has a configurable baud rate; therefore, the PC application configuring the baud rate needs to be the same baud rate.

2.4 Measure Current Draw of the MSPM0L2117

To measure the current draw of the MSPM0L2117 MCU using a multimeter, use the 3V3 jumper on the J101 jumper isolation block. The current measured includes the target device, LaunchPad™ circuits, and any current drawn through the BoosterPack™ plug-in module headers. To measure ultra-low power, follow these steps:

- Remove the 3V3 jumper in the J14 isolation block, and attach an ammeter across this jumper.
- Consider the effects that the backchannel UART and any circuitry attached to the MSPM0L2117 can have on the current draw. Consider disconnecting these at the isolation jumper block, or at least consider the current sinking and sourcing capability in the final measurement.
- Make sure there are no floating inputs/outputs (I/Os) on the MSPM0L2117. This causes unnecessary extra current draw. Every I/O is either driven or, if the I/O is an input, is pulled or driven to a high or low level.
- Begin target execution.
- For the most accurate current measurements, place the device in *free run* mode and disconnect programming signals between the MSPM0L2117 and the debug portion of the board (header J14).
- Measure the current. Keep in mind that if the current levels are fluctuating, then getting a stable measurement can be difficult. Measuring the quiescent states is easier.

2.5 Clocking

The internal SYSOSC is 32MHz as default at the accuracy of 2.5%. The MCLK is sourced by 32MHz SYSOSC at default. CPUCLK is sourced directly from MCLK in *run* mode and disabled in other modes. The low-power clock (ULPCLK) can be sourced by MCLK and active in *run* and *sleep* mode by configuration. The part also includes and internal 32kHz oscillator, LFOSC, which is the default low frequency source. Included on the LaunchPad™ are two clock crystal options, 1 high-frequency 32MHz crystal (HFXT) and 1 low-frequency 32.728kHz crystal (LFXT). The crystals can be selected during application programming as the clock source for the high-frequency and low-frequency clocks.

For more clock tree details see *Clock Module (CKM)* of the *MSPM0 L-Series Microcontrollers Technical Reference Manual*.

2.6 BoosterPack Plug-in Module Pinout

The LaunchPad™ development kit adheres to the 40-pin LaunchPad development kit pinout standard, where pins are available. A standard was created to aid compatibility between the LaunchPad development kits and the BoosterPack™ plug-in modules across the TI ecosystem.

While most BoosterPack plug-in modules are compliant with the standard, some are not. If the reseller or owner of the BoosterPack plug-in module does not explicitly indicate compatibility with the LP-MSPM0L2117 LaunchPad development kit, then compare the schematic of the candidate BoosterPack plug-in module with the LaunchPad development kit to verify compatibility. Conflicts can be resolved by changing the MSPM0L2117 device pin function configuration in software.

2.7 Liquid Crystal Display (LCD)

Included in the MSPM0L2117 is an on-board LCD. This LCD is driven by the internal LCD driver of the MSPM0L2117. The LaunchPad™ includes passive components to support both charge pump or internal resistor ladder configurations. Figure 2-4 shows the LCD segment layout and Table 2-3 shows the LCD segment mapping.

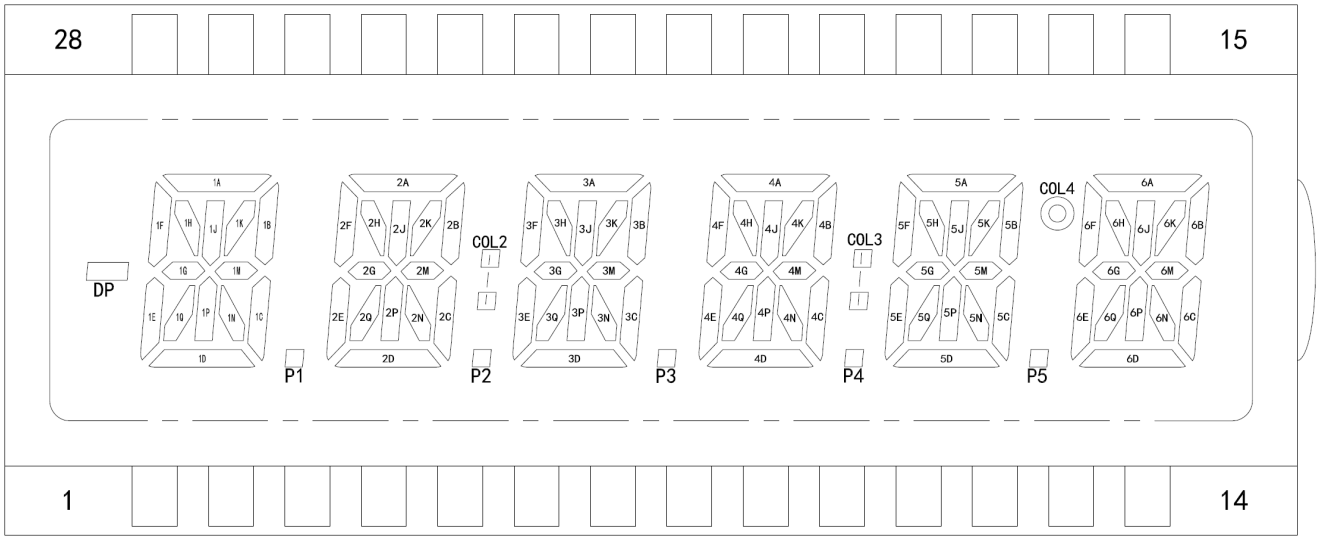


Figure 2-4. LCD Segment Layout

Table 2-3. LCD Segment Mapping

LP Pin	Pin Function	LCD Pin	COM1	COM2	COM3	COM4
PA24	LCD26	1	2D	2E	2F	-
PA25	LCD27	2	2Q	2G	2H	2A
PA26	LCD28	3	2N	2P	2J	2K
PA27	LCD29	4	P2	2C	2M	2B
PA28	LCD30	5	3D	3E	3F	COL2
PA29	LCD31	6	3Q	3G	3H	3A
PA30	LCD32	7	3N	3P	3J	3K
PA31	LCD45	8	P3	3C	3M	3B
PB2	LCD47	9	4D	4E	4F	-
PB3	LCD48	10	4Q	4G	4H	4A
PB4	LCD33	11	COM1	-	-	-
PB5	LCD34	12	-	COM2	-	-
PB9	LCD7	13	-	-	COM3	-
PB10	LCD35	14	-	-	-	COM4
PB27	LCD44	15	-	6C	6M	6B
PB26	LCD43	16	6N	6P	6J	6K
PB25	LCD42	17	6Q	6G	6H	6A
PB24	LCD24	18	6D	6E	6F	COL4
PB23	LCD41	19	P5	5C	5M	5B
PB22	LCD40	20	5N	5P	5J	5K
PB21	LCD39	21	5Q	5G	5H	5A
PB20	LCD23	22	5D	5E	5F	COL3
PB19	LCD20	23	P4	4C	4M	4B
PB18	LCD19	24	4N	4P	4J	4K
PB17	LCD18	25	P1	1C	1M	1B
PB13	LCD38	26	1N	1P	1J	1K
PB12	LCD37	27	1Q	1G	1H	1A
PB11	LCD36	28	1D	1E	1F	DP

3 Software

3.1 Software Development Options

There are multiple ways to prototype with LP-MSPM0L2117:

1. CCS Cloud – Choose this option to get started quickly with minimal installation.
2. CCS Theia – Choose this option to work offline and have full access to debug features. See the CCS Theia documentation to get started.

3.2 CCS Cloud

1. Navigate to dev.ti.com. Users are required to install the CCS Cloud Agent. If CCS Cloud Agent is not installed yet, then follow the steps to complete this installation.
2. Plug in LP-MSPM0L2117 using a micro-USB cable. TI Developer Zone automatically detects that LP-MSPM0L2117 has been plugged in.
3. Click *Browse software and examples*, which opens the MSPM0 SDK in a new window.
4. In the left bar, navigate to Arm-based microcontrollers > Embedded Software > MSPM0 SDK > Examples > Development Tools > DriverLib > gpio_toggle_output > No RTOS > TI Clang Compiler > gpio_toggle_output.
5. Click the *Import* button in the top right corner of the screen. This action imports the project into the CCS Cloud and opens in a new window.
6. In CCS Cloud, click the debug icon in the left bar to open the debug view.
7. Click the *play* button to deploy the code to the device and open a debug session. By default, the debugger pauses the first line of code.
8. Click the blue *play* button to start the application.
9. The RGB LED on LP-MSPM0L2117 needs to be blinking.

Now, the user is ready to begin prototyping by modifying the code or by importing a different example code.

4 Hardware Design Files

4.1 Schematics

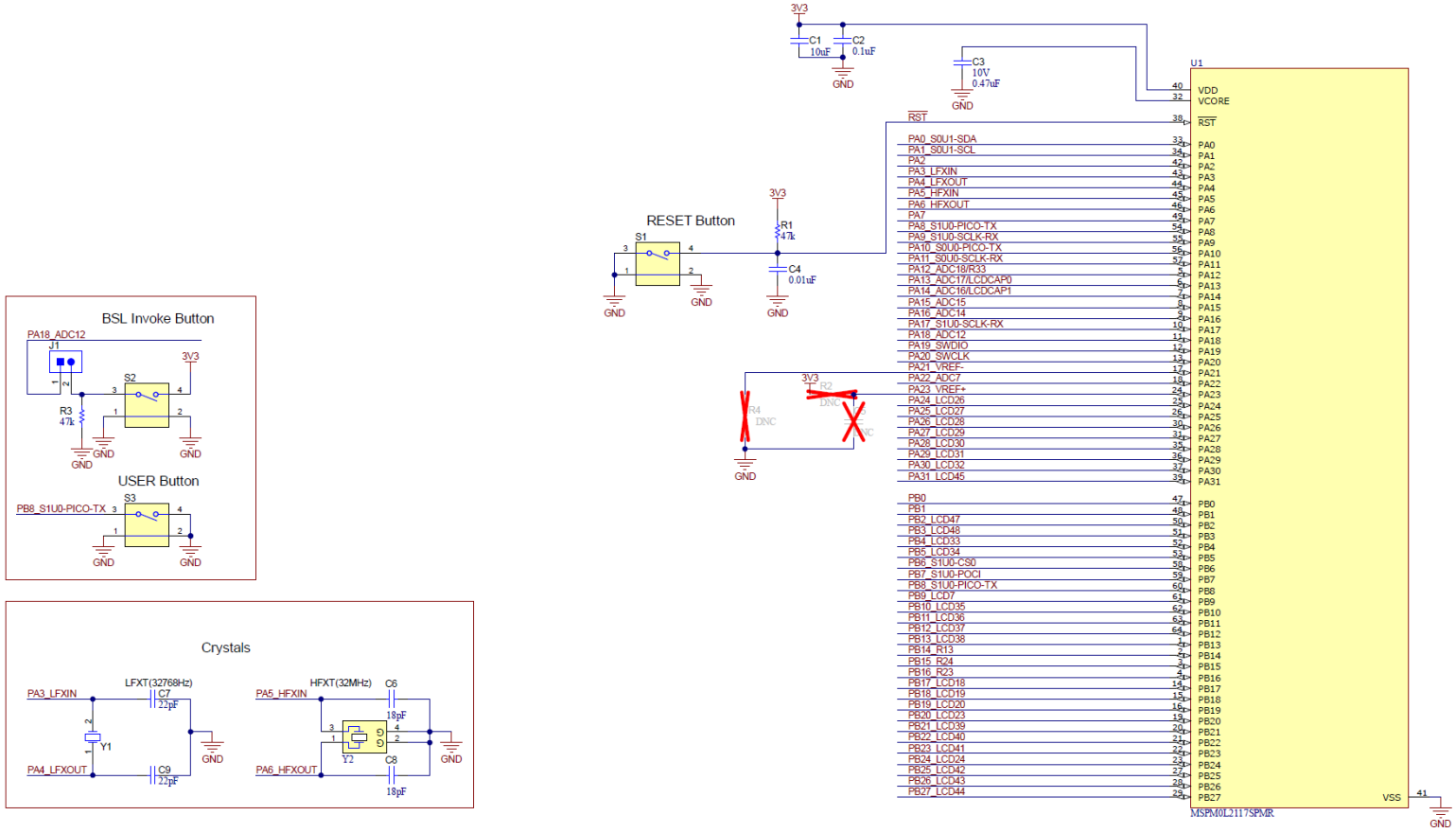


Figure 4-1. MSPM0L2117 Target Device Schematic

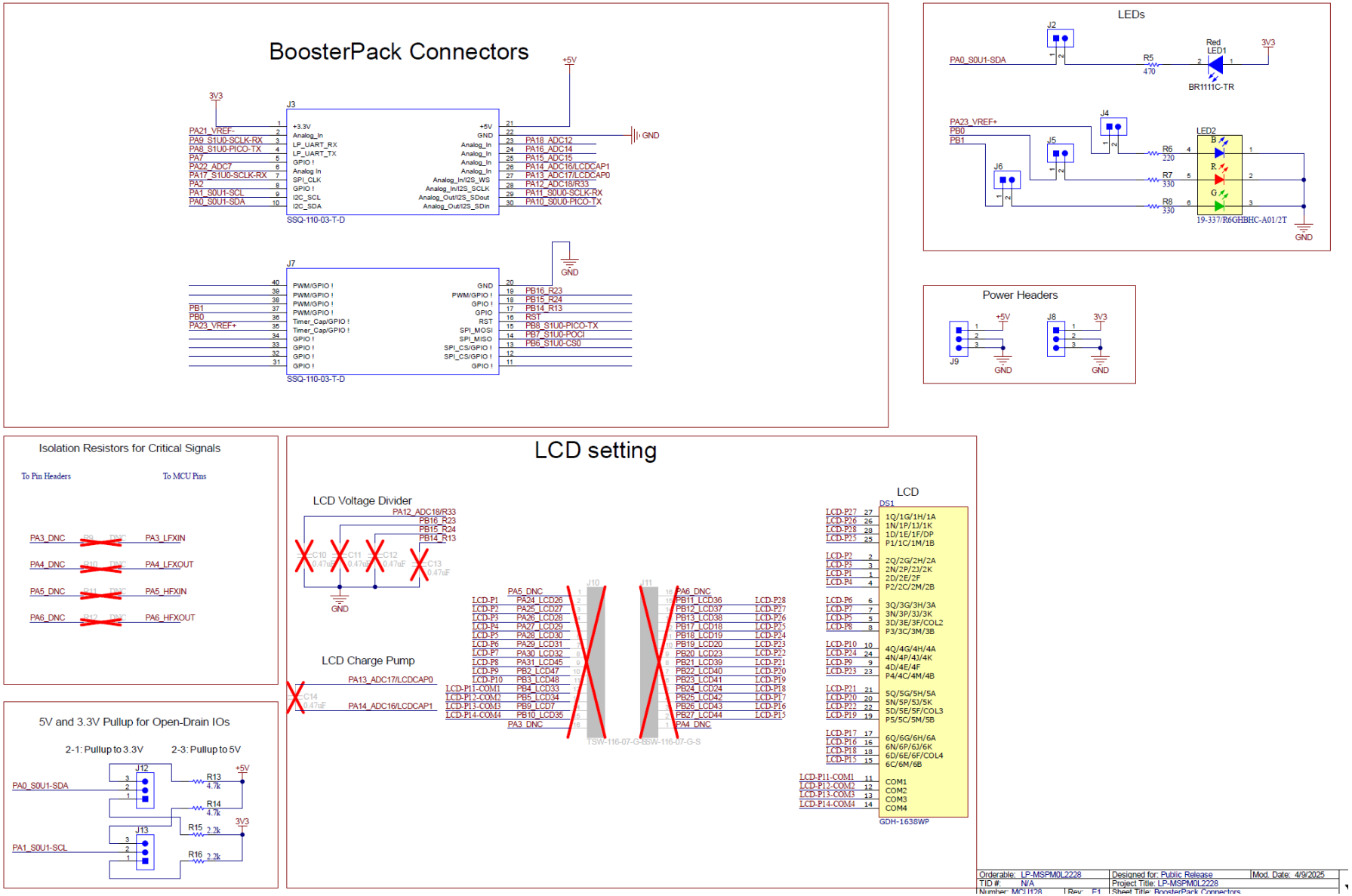


Figure 4-2. BoosterPack™ Connectors

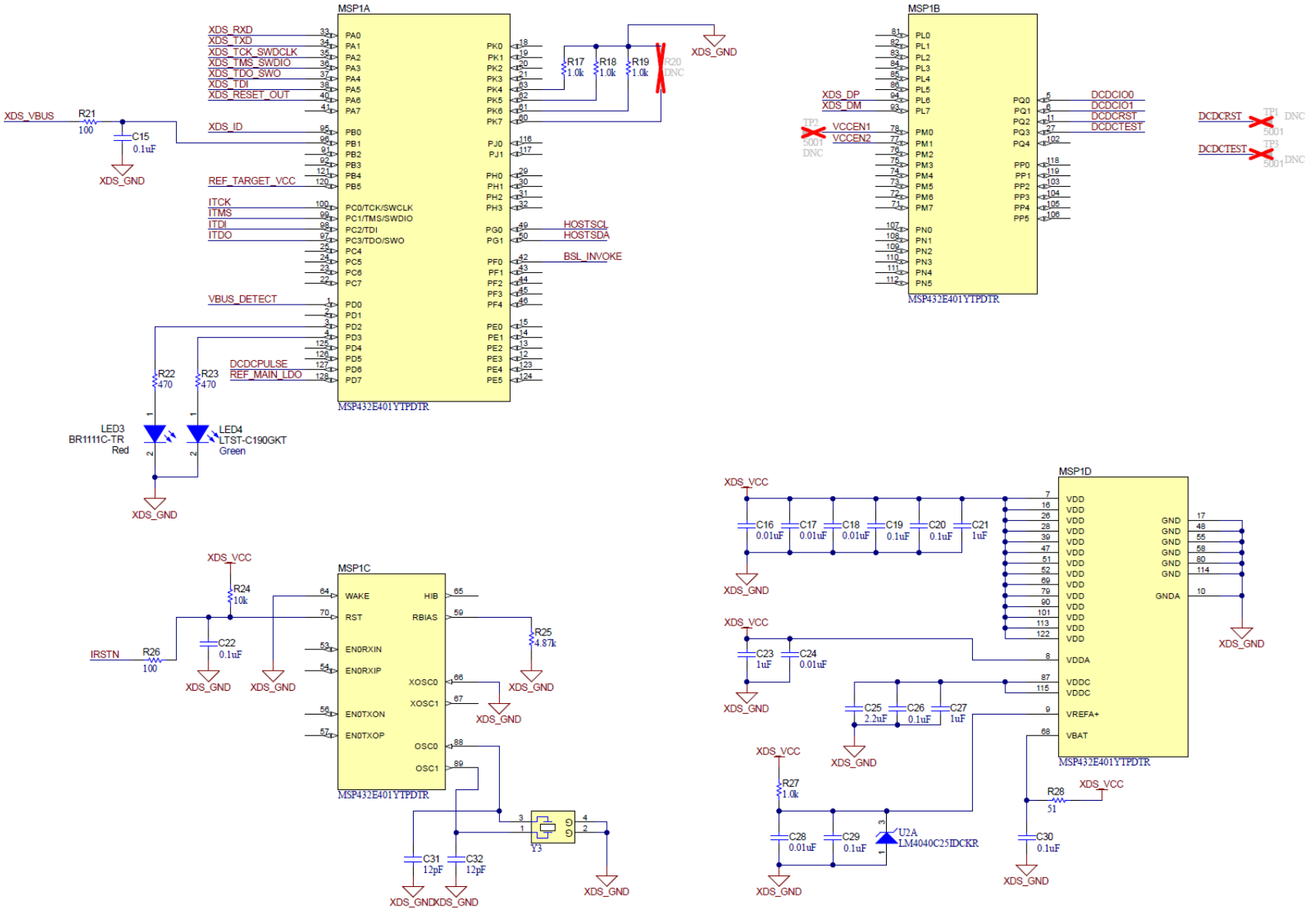


Figure 4-3. XDS110 Debug Probe Schematic

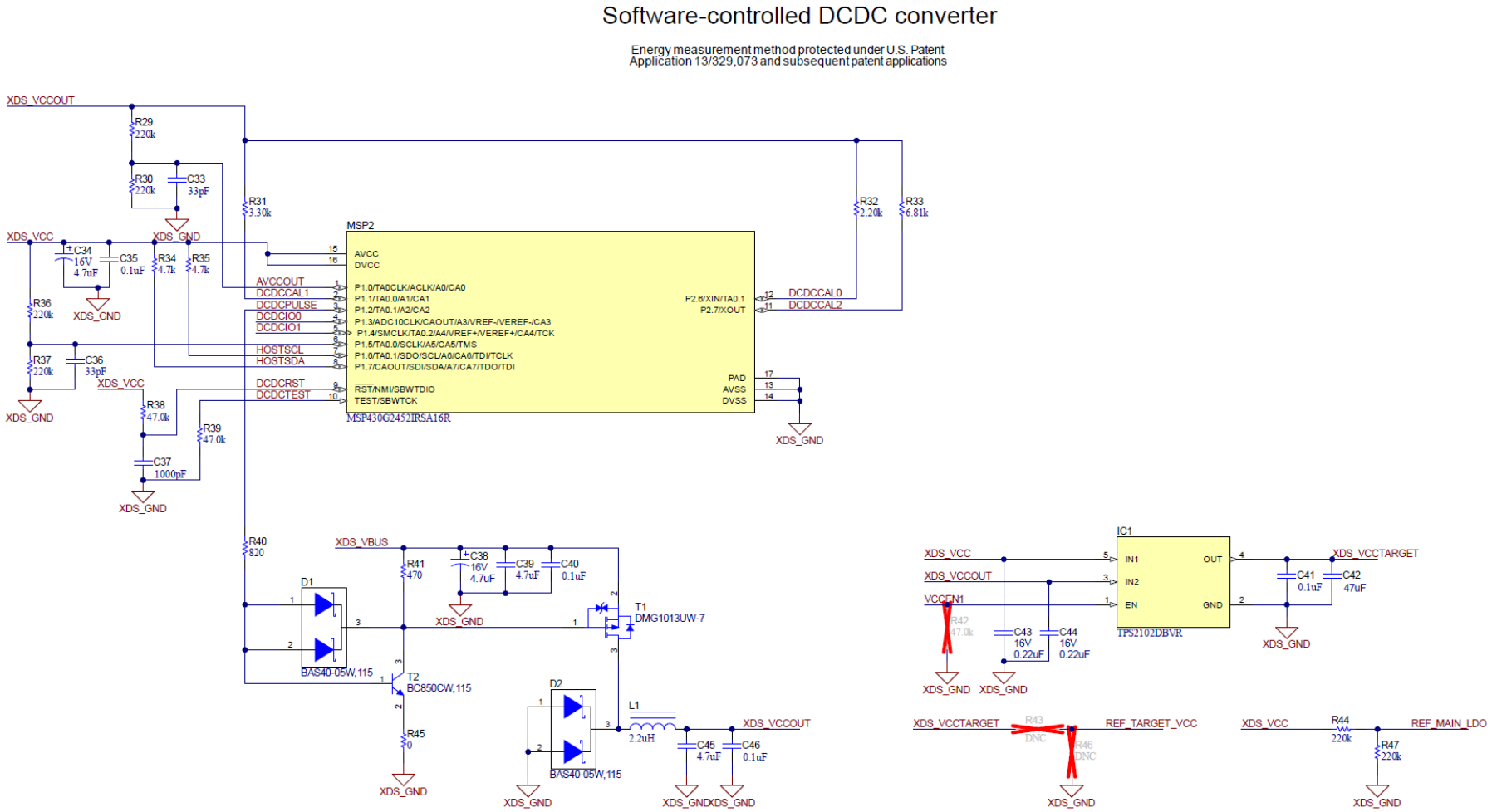


Figure 4-4. XDS110 EnergyTrace™ Schematic

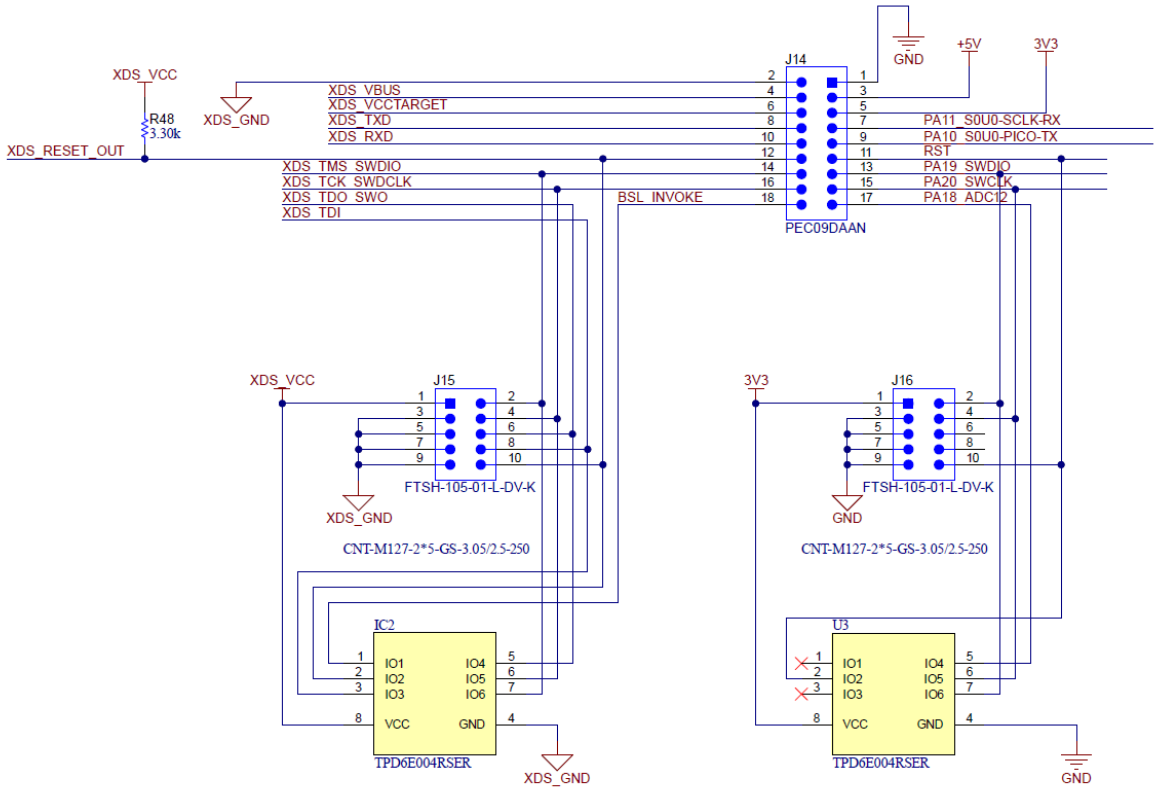


Figure 4-5. XDS110 Target Interface Schematic

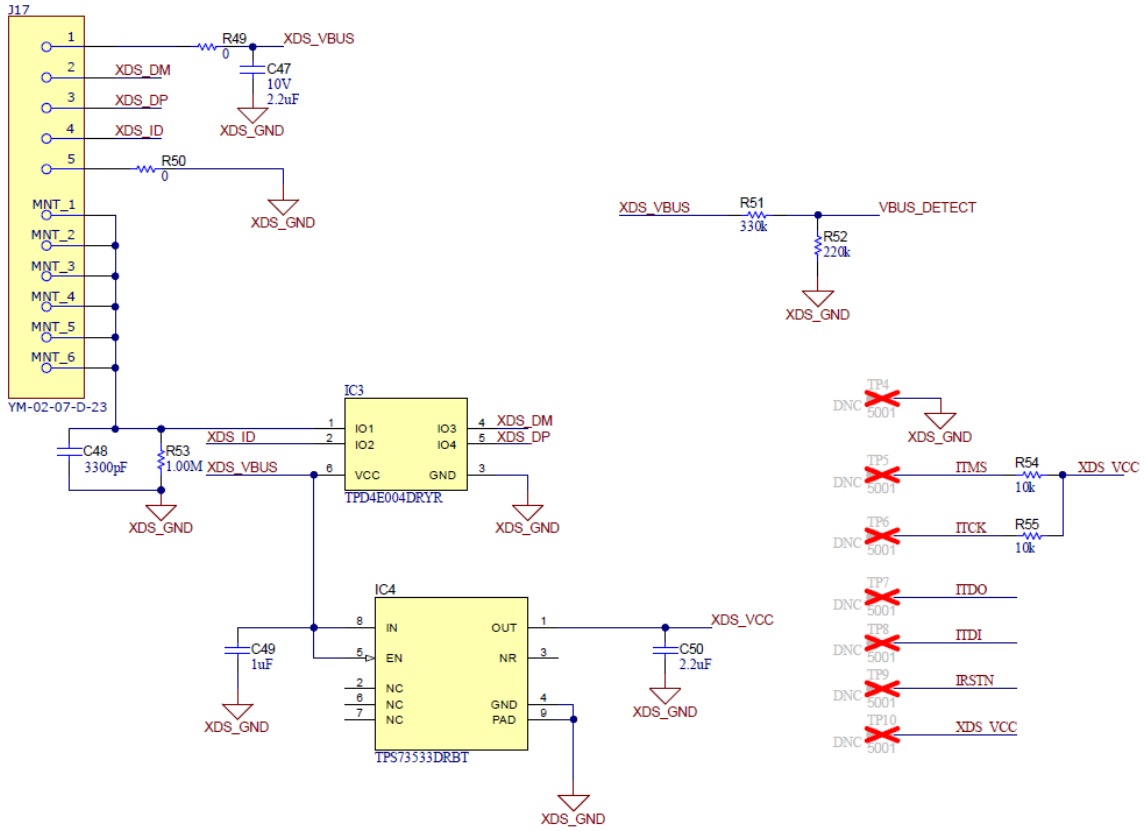


Figure 4-6. XDS110 USB Power Schematic

4.2 PCB Layers

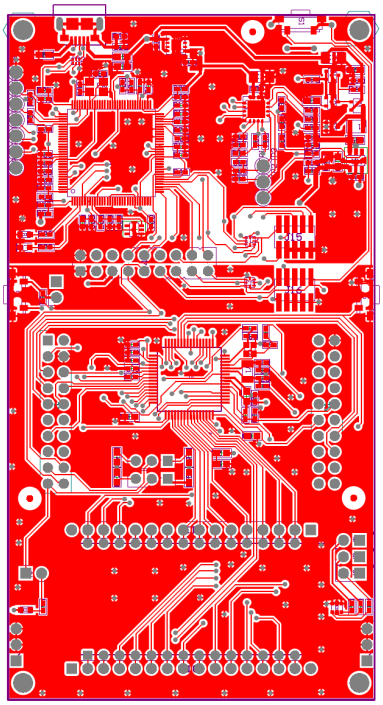


Figure 4-7. PCB Top Layer

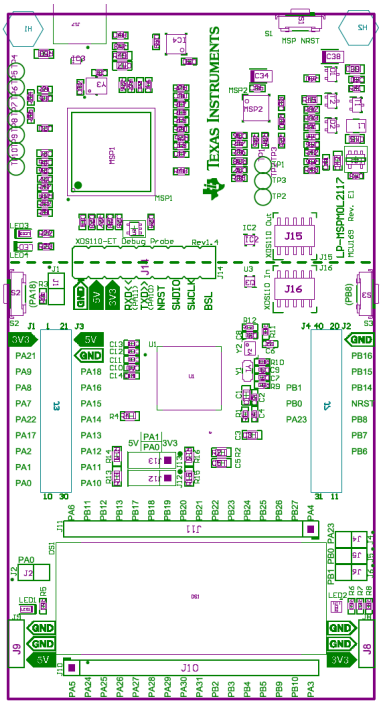


Figure 4-8. PCB Top Overlay

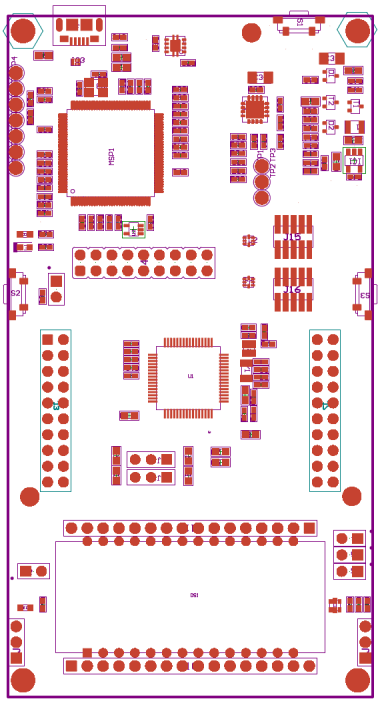


Figure 4-9. PCB Top Solder

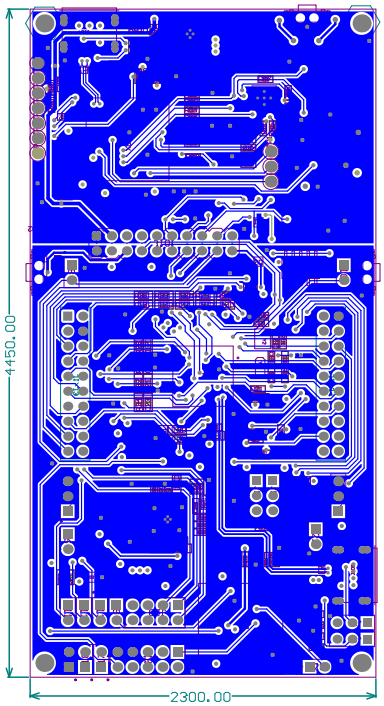


Figure 4-10. PCB Bottom Layer

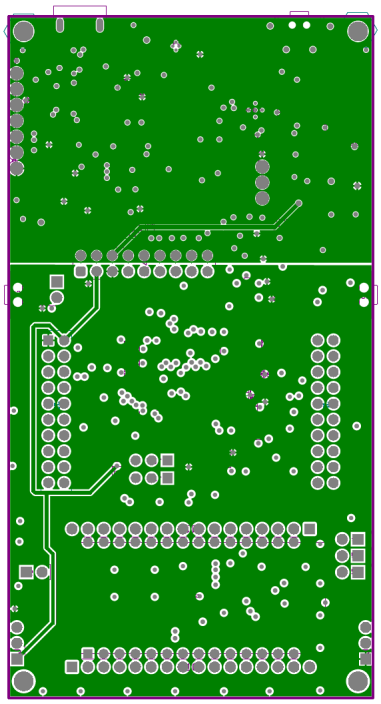


Figure 4-11. PCB VCC Plane

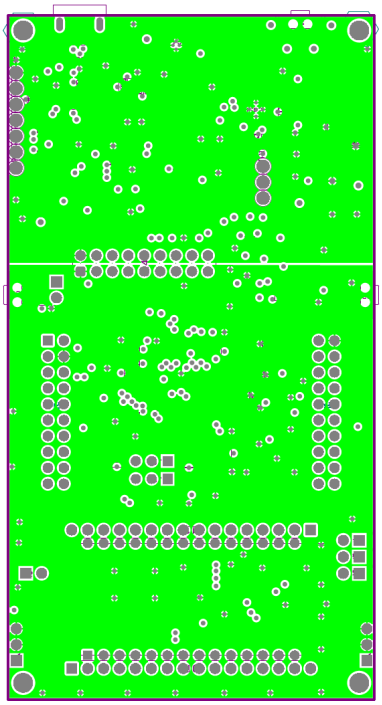


Figure 4-12. PCB GND Plane

4.3 Bill of Materials (BOM)

Table 4-1. Bill of Materials

Designator	Quantity	Value	Description	PartNumber	Manufacturer
!PCB1	1		Printed Circuit Board	MCU128	Any
C1	1	10µF	CAP, CERM, 10µF, 6.3V, ±20%, X5R, 0603	GRM188R60J106ME84	MuRata
C2	1	0.1µF	CAP, CERM, 0.1µF, 50V, ±20%, X5R, 0402	GRM155R61H104ME14D	MuRata
C3	1	0.47µF	CAP, CERM, 0.47µF, 10V, ±10%, X5R, 0603	C0603C474K8PACTU	Kemet
C4	1	0.01µF	CAP, CERM, 0.01µF, 16V, ±10%, X5R, 0402	GRM155R61C103KA01D	MuRata
C6	1	18pF	CAP, CERM, 18pF, 50V, ±5%, C0G/NP0, 0402	CL05C180JB5NNNC	Samsung Electro-Mechanics
C7	1	22pF	CAP, CERM, 22pF, 50V, ±5%, C0G/NP0, 0402	GRM1555C1H220JA01D	MuRata
C8	1	18pF	CAP, CERM, 18pF, 50V, ±5%, C0G/NP0, 0402	CL05C180JB5NNNC	Samsung Electro-Mechanics
C9	1	22pF	CAP, CERM, 22pF, 50V, ±5%, C0G/NP0, 0402	GRM1555C1H220JA01D	MuRata
C15	1	0.1µF	CAP, CERM, 0.1µF, 6.3V, ±10%, X7R, 0402	GRM155R70J104KA01D	MuRata
C16	1	0.01µF	CAP, CERM, 0.01µF, 25V, ±10%, X7R, 0402	GRM155R71E103KA01D	MuRata
C17	1	0.01µF	CAP, CERM, 0.01µF, 25V, ±10%, X7R, 0402	GRM155R71E103KA01D	MuRata
C18	1	0.01µF	CAP, CERM, 0.01µF, 25V, ±10%, X7R, 0402	GRM155R71E103KA01D	MuRata
C19	1	0.1µF	CAP, CERM, 0.1µF, 6.3V, ±10%, X7R, 0402	GRM155R70J104KA01D	MuRata
C20	1	0.1µF	CAP, CERM, 0.1uF, 6.3V, ±10%, X7R, 0402	GRM155R70J104KA01D	MuRata
C21	1	1µF	CAP, CERM, 1µF, 25V, ±10%, X5R, 0402	C1005X5R1E105K050BC	TDK
C22	1	0.1µF	CAP, CERM, 0.1µF, 6.3V, ±10%, X7R, 0402	GRM155R70J104KA01D	MuRata
C23	1	1µF	CAP, CERM, 1µF, 25V, ±10%, X5R, 0402	C1005X5R1E105K050BC	TDK
C24	1	0.01µF	CAP, CERM, 0.01µF, 25V, ±10%, X7R, 0402	GRM155R71E103KA01D	MuRata
C25	1	2.2µF	CAP, CERM, 2.2µF, 6.3V, ±10%, X5R, 0402	GRM155R60J225KE95D	MuRata
C26	1	0.1µF	CAP, CERM, 0.1µF, 6.3V, ±10%, X7R, 0402	GRM155R70J104KA01D	MuRata
C27	1	1µF	CAP, CERM, 1µF, 25V, ±10%, X5R, 0402	C1005X5R1E105K050BC	TDK
C28	1	0.01µF	CAP, CERM, 0.01µF, 25V, ±10%, X7R, 0402	GRM155R71E103KA01D	MuRata
C29	1	0.1µF	CAP, CERM, 0.1µF, 6.3V, ±10%, X7R, 0402	GRM155R70J104KA01D	MuRata
C30	1	0.1µF	CAP, CERM, 0.1µF, 6.3V, ±10%, X7R, 0402	GRM155R70J104KA01D	MuRata
C31	1	12pF	CAP, CERM, 12pF, 50V, ±5%, C0G/NP0, 0402	GRM1555C1H120JA01D	MuRata
C32	1	12pF	CAP, CERM, 12pF, 50V, ±5%, C0G/NP0, 0402	GRM1555C1H120JA01D	MuRata
C33	1	33pF	CAP, CERM, 33pF, 50V, ±5%, C0G/NP0, 0402	GRM1555C1H330JA01D	MuRata
C34	1	4.7µF	CAP, TA, 4.7µF, 16V, ±10%, 4Ω, SMD	TAJA475K016RNJ	AVX
C35	1	0.1µF	CAP, CERM, 0.1µF, 6.3V, ±10%, X7R, 0402	GRM155R70J104KA01D	MuRata
C36	1	33pF	CAP, CERM, 33pF, 50V, ±5%, C0G/NP0, 0402	GRM1555C1H330JA01D	MuRata

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	PartNumber	Manufacturer
C37	1	1000pF	CAP, CERM, 1000pF, 50V, ±10%, X7R, AEC-Q200 Grade 1, 0402	GCM155R71H102KA37D	MuRata
C38	1	4.7µF	CAP, TA, 4.7µF, 16V, ±10%, 4Ω, SMD	TAJA475K016RNJ	AVX
C39	1	4.7µF	CAP, CERM, 4.7uF, 16V, ±10%, X5R, 0603	GRM188R61C475KAAJ	MuRata
C40	1	0.1µF	CAP, CERM, 0.1µF, 6.3V, ±10%, X7R, 0402	GRM155R70J104KA01D	MuRata
C41	1	0.1µF	CAP, CERM, 0.1µF, 6.3V, ±10%, X7R, 0402	GRM155R70J104KA01D	MuRata
C42	1	47µF	CAP, CERM, 47µF, 6.3V, ±20%, X5R, 0603	GRM188R60J476ME15D	MuRata
C43	1	0.22µF	CAP, CERM, 0.22µF, 16V, ±10%, X7R, 0402	GRM155R71C224KA12D	MuRata
C44	1	0.22µF	CAP, CERM, 0.22µF, 16V, ±10%, X7R, 0402	GRM155R71C224KA12D	MuRata
C45	1	4.7µF	CAP, CERM, 4.7µF, 16V, ±10%, X5R, 0603	GRM188R61C475KAAJ	MuRata
C46	1	0.1µF	CAP, CERM, 0.1µF, 6.3V, ±10%, X7R, 0402	GRM155R70J104KA01D	MuRata
C47	1	2.2µF	CAP, CERM, 2.2µF, 10V, ±10%, X5R, 0603	C0603C225K8PACTU	Kemet
C48	1	3300pF	CAP, CERM, 3300pF, 50V, ±10%, X7R, 0402	GRM155R71H332KA01D	MuRata
C49	1	1µF	CAP, CERM, 1µF, 25V, ±10%, X5R, 0402	C1005X5R1E105K050BC	TDK
C50	1	2.2µF	CAP, CERM, 2.2µF, 6.3V, ±10%, X5R, 0402	GRM155R60J225KE95D	MuRata
D1	1	40V	Diode, Schottky, 40V, 0.12A, AEC-Q101, SOT-323	BAS40-05W,115	Nexperia
D2	1	40V	Diode, Schottky, 40V, 0.12A, AEC-Q101, SOT-323	BAS40-05W,115	Nexperia
DS1	1		GDH-1638WP	GDH-1638WP	Xiamen Ocular Optics
FID1	1		Fiducial mark. There is nothing to buy or mount.	N/A	N/A
FID2	1		Fiducial mark. There is nothing to buy or mount.	N/A	N/A
FID3	1		Fiducial mark. There is nothing to buy or mount.	N/A	N/A
H1	1		Spacer Support, Nylon 66	MAE-10	Kang Yang
H2	1		Spacer Support, Nylon 66	MAE-10	Kang Yang
IC1	1		2.7-4V Dual In/Single Out MOSFET, 0.5A Main/0.1A Aux Input, Act-Low Enable, Comm. Temp., DBV0005A (SOT-23-5)	TPS2102DBVR	Texas Instruments
IC2	1		Low-Capacitance ±15kV ESD Protection Array for High-Speed Data Interfaces, 6 Channels, -40 to +85°C, 8-pin UQFN (RSE), Green (RoHS and no Sb/Br)	TPD6E004RSER	Texas Instruments
IC3	1		ESD-Protection Array for High-Speed Data Interfaces, 4 Channels, -40 to +85°C, 6-pin SON (DRY), Green (RoHS and no Sb/Br)	TPD4E004DRYR	Texas Instruments
IC4	1		500mA, Adjustable, Low Quiescent Current, Low-Noise, High-PSRR, Single-Output LDO Regulator, DRB0008A (VSON-8)	TPS73533DRBT	Texas Instruments
J1	1		Header, 100mil, 2x1, Tin, TH	90120-0122	Molex

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	PartNumber	Manufacturer
J2	1		Header, 100mil, 2x1, Tin, TH	90120-0122	Molex
J3	1		Receptacle, 2.54mm, 10x2, Tin, TH	SSQ-110-03-T-D	Samtec
J4	1		Header, 100mil, 2x1, Tin, TH	90120-0122	Molex
J5	1		Header, 100mil, 2x1, Tin, TH	90120-0122	Molex
J6	1		Header, 100mil, 2x1, Tin, TH	90120-0122	Molex
J7	1		Receptacle, 2.54mm, 10x2, Tin, TH	SSQ-110-03-T-D	Samtec
J8	1		Header, 100mil, 3x1, Tin, TH	PEC03SAAN	Sullins Connector Solutions
J9	1		Header, 100mil, 3x1, Tin, TH	PEC03SAAN	Sullins Connector Solutions
J10	1		Header, 100mil, 16x1, Gold, TH	TSW-116-07-G-S	Samtec
J11	1		Header, 100mil, 16x1, Gold, TH	TSW-116-07-G-S	Samtec
J12	1		Header, 100mil, 3x1, Tin, TH	PEC03SAAN	Sullins Connector Solutions
J13	1		Header, 100mil, 3x1, Tin, TH	PEC03SAAN	Sullins Connector Solutions
J14	1		Header, 2.54mm, 9x2, Tin, TH	PEC09DAAN	Sullins Connector Solutions
J15	1		Header (Shrouded), 1.27mm, 5x2, Gold, SMT	FTSH-105-01-L-DV-K	Samtec
J16	1		Header (Shrouded), 1.27mm, 5x2, Gold, SMT	FTSH-105-01-L-DV-K	Samtec
J17	1		Micro USB 5F B Type Smt	YM-02-07-D-23	Yang Ming
L1	1	2.2µH	Inductor, Wirewound, Ceramic, 2.2uH, 0.89A, 0.13Ω, SMD	CBC2518T2R2M	Taiyo Yuden
LED1	1	Red	LED, Red, SMD	BR1111C-TR	Stanley Electric Co., LTD
LED2	1	RGB	LED, RGB, SMD	19-337/R6GHBHC-A01/2T	Everlight
LED3	1	Red	LED, Red, SMD	BR1111C-TR	Stanley Electric Co., LTD
LED4	1	Green	LED, Green, SMD	LTST-C190GKT	Lite-On
MSP1	1		MSP432E401YTPDT, PDT0128A (TQFP-128)	MSP432E401YTPDTR	Texas Instruments
MSP2	1		MSP430G2x52, MSP430G2x12 Mixed Signal Microcontroller, RSA0016B (VQFN-16)	MSP430G2452IRSA16R	Texas Instruments
R1	1	47k	RES, 47k, 5%, 0.063W, 0402	CRCW040247K0JNED	Vishay-Dale
R3	1	47k	RES, 47k, 5%, 0.063W, 0402	CRCW040247K0JNED	Vishay-Dale
R5	1	470	RES, 470, 5%, 0.063W, 0402	CRCW0402470RJNED	Vishay-Dale
R6	1	220	RES, 220, 5%, 0.063W, 0402	CRCW0402220RJNED	Vishay-Dale
R7	1	330	RES, 330, 5%, 0.063W, 0402	CRCW0402330RJNED	Vishay-Dale

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	PartNumber	Manufacturer
R8	1	330	RES, 330, 5%, 0.063W, 0402	CRCW0402330RJNED	Vishay-Dale
R13	1	4.7k	RES, 4.7k, 5%, 0.1W, 0603	RC0603JR-074K7L	Yageo
R14	1	4.7k	RES, 4.7k, 5%, 0.1W, 0603	RC0603JR-074K7L	Yageo
R15	1	2.2k	RES, 2.2k, 5%, 0.1W, 0603	RC0603JR-072K2L	Yageo
R16	1	2.2k	RES, 2.2k, 5%, 0.1W, 0603	RC0603JR-072K2L	Yageo
R17	1	1.0k	RES, 1.0k, 5%, 0.063W, 0402	CRCW04021K00JNED	Vishay-Dale
R18	1	1.0k	RES, 1.0k, 5%, 0.063W, 0402	CRCW04021K00JNED	Vishay-Dale
R19	1	1.0k	RES, 1.0k, 5%, 0.063W, 0402	CRCW04021K00JNED	Vishay-Dale
R21	1	100	RES, 100, 5%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW0402100RJNED	Vishay-Dale
R22	1	470	RES, 470, 5%, 0.063W, 0402	CRCW0402470RJNED	Vishay-Dale
R23	1	470	RES, 470, 5%, 0.063W, 0402	CRCW0402470RJNED	Vishay-Dale
R24	1	10k	RES, 10k, 5%, 0.063W, 0402	CRCW040210K0JNED	Vishay-Dale
R25	1	4.87k	RES, 4.87k, 1%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW04024K87FKED	Vishay-Dale
R26	1	100	RES, 100, 5%, 0.063W, 0402	CRCW0402100RJNED	Vishay-Dale
R27	1	1.0k	RES, 1.0k, 5%, 0.063W, 0402	CRCW04021K00JNED	Vishay-Dale
R28	1	51	RES, 51, 5%, 0.063W, AEC-Q200 Grade 0, 0402	CRCW040251R0JNED	Vishay-Dale
R29	1	220k	RES, 220k, 1%, 0.0625W, 0402	RC0402FR-07220KL	Yageo America
R30	1	220k	RES, 220k, 1%, 0.0625W, 0402	RC0402FR-07220KL	Yageo America
R31	1	3.30k	RES, 3.30k, 1%, 0.1W, AEC-Q200 Grade 0, 0402	ERJ-2RKF3301X	Panasonic
R32	1	2.20k	RES, 2.20k, 1%, 0.063W, 0402	CRCW04022K20FKED	Vishay-Dale
R33	1	6.81k	RES, 6.81k, 1%, 0.063W, 0402	CRCW04026K81FKED	Vishay-Dale
R34	1	4.7k	RES, 4.7k, 5%, 0.063W, 0402	CRCW04024K70JNED	Vishay-Dale
R35	1	4.7k	RES, 4.7k, 5%, 0.063W, 0402	CRCW04024K70JNED	Vishay-Dale
R36	1	220k	RES, 220k, 1%, 0.0625W, 0402	RC0402FR-07220KL	Yageo America
R37	1	220k	RES, 220k, 1%, 0.0625W, 0402	RC0402FR-07220KL	Yageo America
R38	1	47.0k	RES, 47.0k, 1%, 0.0625W, 0402	RC0402FR-0747KL	Yageo America
R39	1	47.0k	RES, 47.0k, 1%, 0.0625W, 0402	RC0402FR-0747KL	Yageo America
R40	1	820	RES, 820, 1%, 0.063W, 0402	RC0402FR-07820RL	Yageo America
R41	1	470	RES, 470, 5%, 0.063W, 0402	CRCW0402470RJNED	Vishay-Dale
R44	1	220k	RES, 220k, 1%, 0.0625W, 0402	RC0402FR-07220KL	Yageo America
R45	1	0	RES, 0, 5%, 0.1W, 0603	RC0603JR-070RL	Yageo
R47	1	220k	RES, 220k, 1%, 0.0625W, 0402	RC0402FR-07220KL	Yageo America
R48	1	3.30k	RES, 3.30k, 1%, 0.1W, AEC-Q200 Grade 0, 0402	ERJ-2RKF3301X	Panasonic
R49	1	0	RES, 0, 5%, 0.1W, 0603	RC0603JR-070RL	Yageo

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	PartNumber	Manufacturer
R50	1	0	RES, 0, 5%, 0.1W, 0603	RC0603JR-070RL	Yageo
R51	1	330k	RES, 330k, 1%, 0.0625W, 0402	RC0402FR-07330KL	Yageo America
R52	1	220k	RES, 220k, 1%, 0.0625W, 0402	RC0402FR-07220KL	Yageo America
R53	1	1.00Meg	RES, 1.00 M, 1%, 0.063W, 0402	CRCW04021M00FKED	Vishay-Dale
R54	1	10k	RES, 10k, 5%, 0.063W, 0402	CRCW040210K0JNED	Vishay-Dale
R55	1	10k	RES, 10k, 5%, 0.063W, 0402	CRCW040210K0JNED	Vishay-Dale
S1	1		Switch, SPST, 0.05A, 12 VDC, SMD	1188E-1K2-V-TR	Diptronics
S2	1		Switch, SPST, 0.05A, 12 VDC, SMD	1188E-1K2-V-TR	Diptronics
S3	1		Switch, SPST, 0.05A, 12 VDC, SMD	1188E-1K2-V-TR	Diptronics
SH-J1	1	J101: 1-2	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J2	1	J101: 3-4	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J3	1	J101: 5-6	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J4	1	J101: 7-8	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J5	1	J101: 9-10	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J6	1	J101: 11-12	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J7	1	J101: 12-13	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J8	1	J101: 15-16	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J9	1	J101: 17-18	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J10	1	J1: 1-2	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J11	1	J2: 1-2	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J12	1	J8: 1-2	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J13	1	J15: 1-2	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J14	1	J25: 1-2	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J15	1	J27: 1-2	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
SH-J16	1	J13: 1-2	Shunt, 100mil, Gold plated, Black	SNT-100-BK-G	Samtec
T1	1	-20V	MOSFET, P-CH, -20V, -0.82A, SOT-323	DMG1013UW-7	Diodes Inc.
T2	1	45V	Transistor, NPN, 45V, 0.1A, SOT-323	BC850CW,115	NXP Semiconductor
U1	1		MSPM0L2117SPMR	MSPM0L2117SPMR	Texas Instruments
U2	1		Precision Micropower Shunt Voltage Reference, 0.5% accuracy, 2.5V, 15ppm/°C, 15mA, -40 to 85°C, 5-pin SC70 (DCK), Green (RoHS and no Sb/Br)	LM4040C25IDCKR	Texas Instruments
U3	1		Low-Capacitance ±15kV ESD Protection Array for High-Speed Data Interfaces, 6 Channels, -40 to +85°C, 8-pin UQFN (RSE), Green (RoHS and no Sb/Br)	TPD6E004RSER	Texas Instruments

Table 4-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	PartNumber	Manufacturer
USB1	1		Cable, USB-A to micro USB-B, 0.3m	AK67421-0.3	Assman WSW
Y1	1		Crystal, 32.768KHz, 12.5pF, SMD	X1A0001410014	Epson
Y2	1		Crystal, 32MHz, 10pF, SMD	Q22FA1280009200	Epson
Y3	1		Crystal, 16MHz, 8pF, SMD	NX3225GA-16.000M-STD-CRG-1	NDK

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6 Related Documentation

6.1 Supplemental Content

The following items are important learning materials to get started with MSPM0.

- MSPM0 Academies
- MSPM0-SDK Code examples
- TI Precision Labs

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