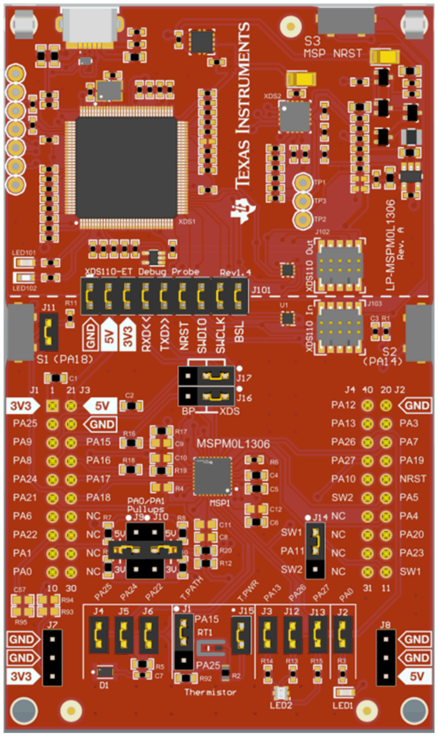
User's Guide

MSPM0L1306 LaunchPad Development Kit (LP-MSPM0L1306)

ABSTRACT

The MSPM0L1306 LaunchPad™ Development Kit is an easy-to-use evaluation module for the MSPM0L1306 microcontroller (MCU). The kit contains everything needed to start developing on the MSPM0L1xx microcontroller platform, including onboard debug probe for programming, debugging, and energy measurements. The board also features onboard buttons and LEDs for quick integration of a simple user interface, an onboard thermistor, light sensor, and RGB LED.

The following figure shows the LP-MSPM0L1306 LaunchPad development kit.



LP-MSPM0L1306 LaunchPad Development Kit

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1 Getting Started

1.1 Introduction

The MSPM0L1306 is an Arm® 32-bit Cortex®-M0+ CPU with frequency up to 32MHz. The device features 64KB of embedded flash memory combined with 4KB of on-chip RAM. The integrated high-performance analog peripherals like 12-bit 1-Msps SAR ADC, zero-drift and zero-crossover chopper op-amps (OPA), and a general-purpose amplifier (GPAMP) help users design their system.

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

Free software development tools are also available such as TI's Code Composer Studio™ IDE, IAR Embedded Workbench™ IDE, and Keil® µVision® IDE. Code Composer Studio IDE supports EnergyTrace™ technology when paired with the MSPM0L1306 LaunchPad development kit. More information about the LaunchPad development kit, the supported BoosterPack plug-in modules, and the available resources can be found at the TI LaunchPad™ development kit portal. To get started quickly and find available resources in the MSPM0 software development kit (SDK), visit the TI Cloud Developer Zone. MSPM0 MCUs are also supported by extensive online collateral, training with MSP Academy, and online support through the TI E2E™ support forums.

1.2 Key Features

- Onboard XDS110 debug probe with external programming option
- EnergyTrace technology available for ultra-low-power debugging
- 2 buttons, 1 LED and 1 RGB LED for user interaction
- Thermistor circuit
- Light sensor circuit
- RC filter for ADC input (unpopulated by default)
- Supports BSL invoke with GPIO and XDS110
- Backchannel UART through USB to PC

1.3 What's Included

1.3.1 Kit Contents

1. MSPM0L1306 LaunchPad Development Kit
2. 1 Micro USB cable
3. 1 Quick Start Guide

1.3.2 Software Examples

- Out-of-Box Software Example
- Sysconfig Compatibility
- SDK Examples

1.4 First Step Out-of-Box Experience

An easy way to get started with the EVM is by using the preprogrammed out-of-box code. This code demonstrates some key features of the EVM and is meant to be used with the LP-MSPM0L1306 out-of-box demo GUI.

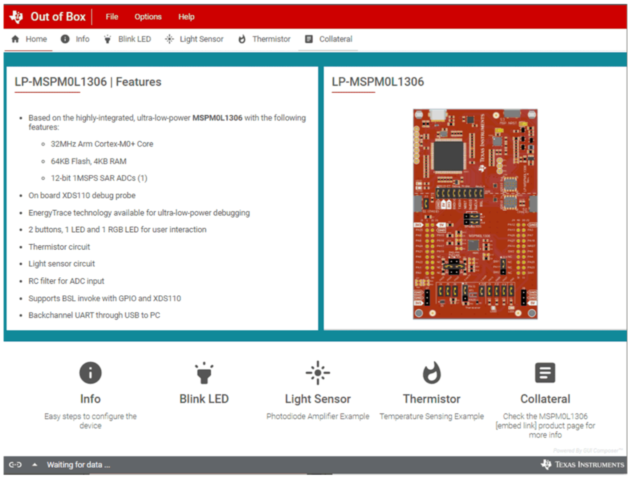
1.4.1 Connecting to the Computer

Connect the LaunchPad development kit using the included USB cable to a computer. A green power LED illuminates. For proper operation, drivers are needed. TI recommends that you get the drivers by installing an IDE such as the TI Code Composer Studio IDE or IAR Embedded Workbench IDE.

1.4.2 Running the Out-of-Box Experience

Access the GUI Composer powered GUI for the Out-of-Box Experience (OoBE) through the TI Cloud Gallery. Alternatively, the GUI is provided with the MSPM0 SDK as well for offline operation. Figure X below shows the welcome screen for the GUI. The GUI runs through three main examples:

- Blink LED – Change rate of LED blink
- Light Sensor – Read light sensor and plot results, while also modulate RGB brightness
- Thermistor – Read thermistor voltage and plot converted temperature over time. RGB LED changes colors to signify differences of temperature measured.



LP-MSPM0L1306 | Features

- Based on the highly-integrated, ultra-low-power **MSPM0L1306** with the following features:
  - 32MHz Arm Cortex-M0+ Core
  - 64KB Flash, 4KB RAM
  - 12-bit 1MSPS SAR ADCs (1)
- On board XDS110 debug probe
- EnergyTrace technology available for ultra-low-power debugging
- 2 buttons, 1 LED and 1 RGB LED for user interaction
- Thermistor circuit
- Light sensor circuit
- RC filter for ADC input
- Supports BSL invoke with GPIO and XDS110
- Backchannel UART through USB to PC

Info: Easy steps to configure the device

Light Sensor: Photodiode Amplifier Example

Thermistor: Temperature Sensing Example

Collateral: Check the MSPM0L1306 [embed link] product page for more info

Figure 1-1. LP-MSPM0L1306 OoBE GUI

1.5 Next Steps: Looking Into the Provided Code

After the EVM features have been explored, the fun can begin. It's time to open an integrated development environment and start editing the code examples. See Section 4 for available IDEs and where to download them.

Code examples are provided in the MSPM0 SDK. Code is licensed under BSD, and TI encourages reuse and modifications to fit specific needs. See MSPM0 SDK User Guide for more details about code examples available.

The quickest way to get started using the LaunchPad development kit is to use TI's cloud development tools. The cloud-based Resource Explorer provides access to all of the examples and resources in MSPM0 SDK. Code Composer Studio Cloud is a simple Cloud-based IDE that enables developing and running applications on the LaunchPad development kit. SysConfig for MSPM0 is another graphical tool that can be utilized to easily and quickly setup your MSPM0L1306 device, pins, and peripherals to fit your development needs. SysConfig is strongly encouraged to be used when starting any new project.

With the XDS110 debug probe, debugging and downloading new code is simple. A connection between the EVM and a PC through the provided USB cable is all that is needed.

2 Hardware

Figure 2-1 shows an overview of the LP-MSPM01306 hardware.

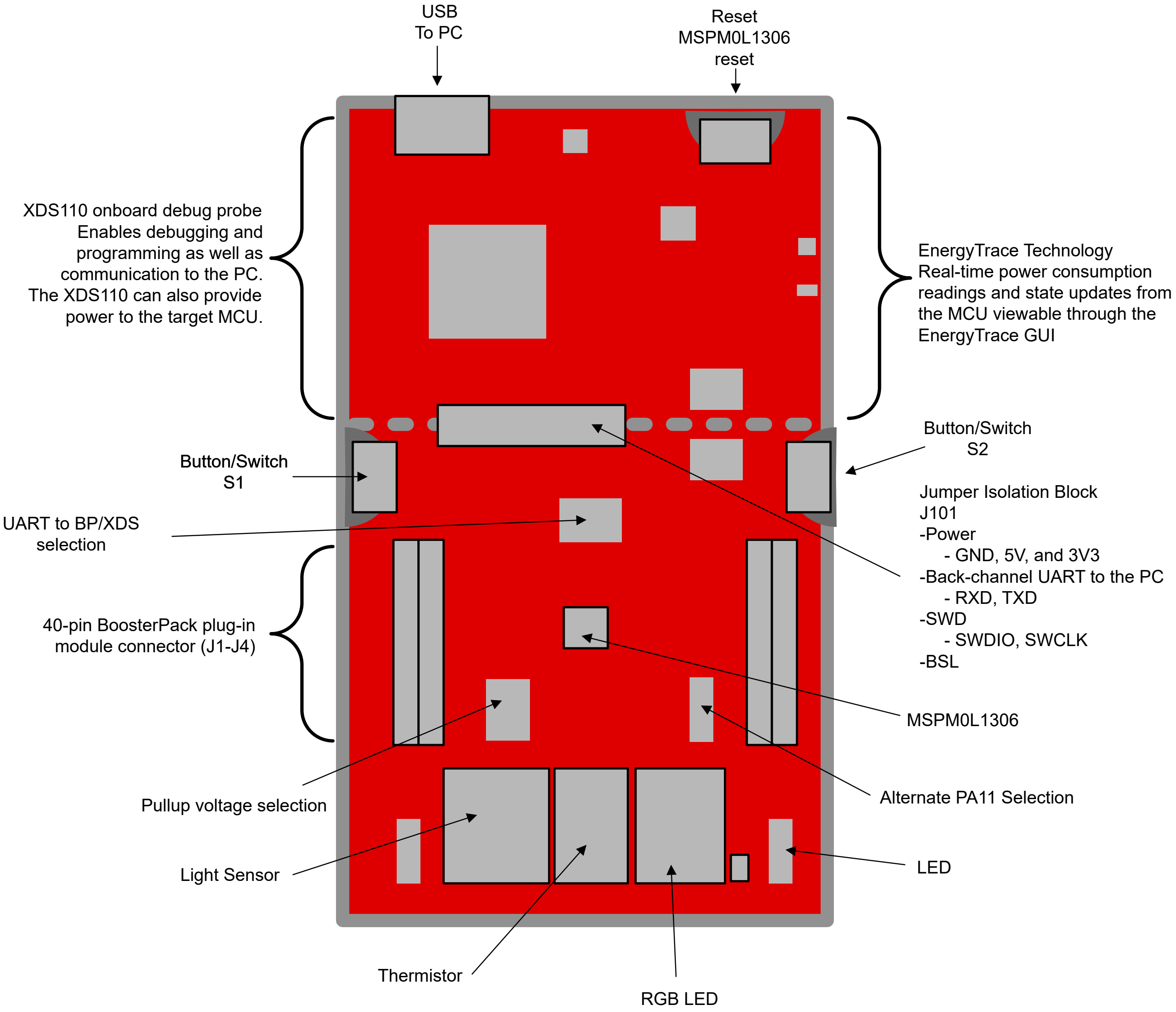


Figure 2-1. LP-MSPM0L1306 Overview

2.1 Jumper Map

Table 2-1. LaunchPad Kit Jumpers Shunt Installation

Jumper	Description	Default setting	Connected Pin or Signal	Low Power Measurement Recommendation
J101	XDS110-ET isolation block	Installed	GND, 5 V, 3V3, RXD, TXD, NRST, SWDIO, SWCLK, BSL	OFF to disconnect from XDS-110 circuitry
J102	XDS110-ET Program Out	NA	GND, 3V3, SWDIO, SWCLK, NRST	No external connection
J103	XDS110-ET Program In	NA	GND, 3V3, SWDIO, SWCLK	No external connection
J1	Thermistor signal selection	(1) short to (2)	PA15 (ADC0_9)	OFF to disconnect from thermistor circuit
J2	Red LED D2	Installed	PA0	OFF to disconnect pin from LED
J3	RGB LED D1 – Green Channel	Installed	PA13 (TIMG0_C1)	OFF to disconnect pin from RGB LED
J4	Light Sensor	Installed	PA25 (OPA0_IN+)	OFF to disconnect from photodiode circuit
J5	Light Sensor	Installed	PA24 (OPA0_IN-)	OFF to disconnect from photodiode circuit
J6	Light Sensor	Installed	PA22 (OPA0_OUT)	OFF to disconnect from photodiode circuit
J7	External 3.3V	NA	3V3, GND	No connect to external circuits
J8	External 5V	NA	5V, GND	No connect to external circuits
J9	Open-drain IO PA0 voltage pullup selection	(2) open	NA	OFF if pin initialized as output low or input with pullup or pulldown
J10	Open-drain IO PA1 voltage pullup selection	(2) open	NA	OFF if pin initialized as output low or input with pullup or pulldown
J11	Button S1 connection	Installed	PA18	OFF to avoid current from external pulldown depending on pin configuration
J12	RGB LED D1 – Red Channel	Installed	PA26 (TIMG1_C0)	OFF to disconnect pin from RGB LED
J13	RGB LED D1 – Blue Channel	Installed	PA27 (TIMG1_C1)	OFF to disconnect pin from RGB LED
J14	Alternate PA11 BoosterPack Connection	(1) short to (2)	PA11 – SW1	Don't care if not used in BoosterPack connector
J15	Thermistor Power	Installed	3V3	OFF to remove power to thermistor circuitry
J16	UART Path Selection – BP – UART TX- XDS	(1) short to (2)	PA8 – XDS	OFF to disconnect pin
J17	UART Path Selection – BP – UART RX- XDS	(1) short to (2)	PA9 – XDS	OFF to disconnect pin

2.2 Block Diagram

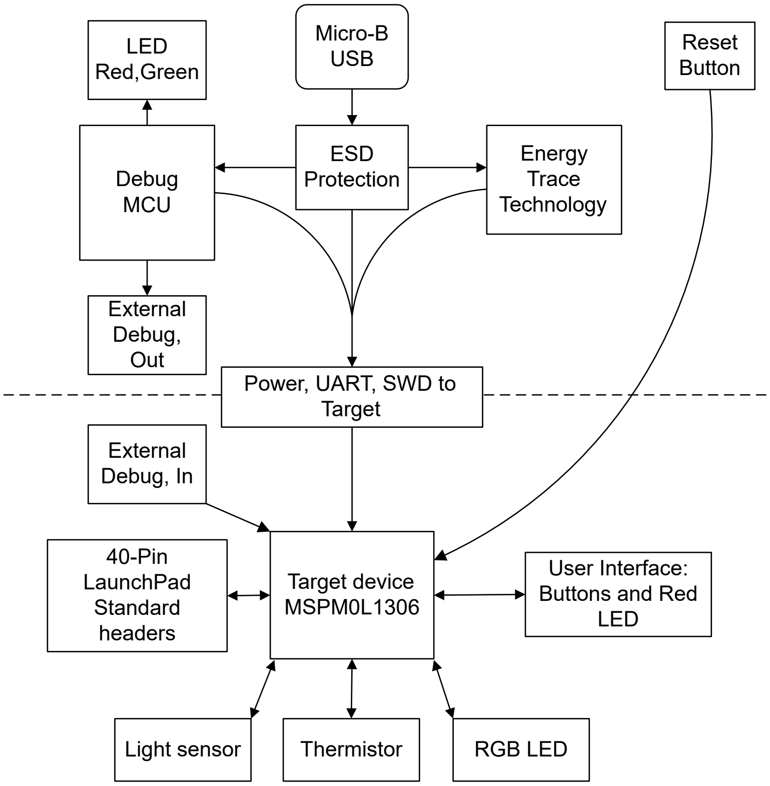


Figure 2-2. Block Diagram

2.3 Hardware Features

2.3.1 MSPM0L1306 MCU

The MSPM0L1306 device provides up to 64KB embedded flash program memory with up to 4KB SRAM. The devices incorporate a high speed on-chip oscillator with an accuracy of ±1%, eliminating the need for an external crystal. Additional features include a 3-channel DMA, 16 and 32-bit CRC accelerator, and a variety of high-performance analog peripherals such as one 12-bit 1-Msps ADC with configurable internal voltage reference, one high-speed comparator with built-in reference DAC, two zero-drift zero-crossover op-amps with programmable gain, one general-purpose amplifier, and an on-chip temperature sensor. These devices also offer intelligent digital peripherals such as four 16-bit general purpose timers, one windowed watchdog timer, and a variety of communication peripherals including two UARTs, one SPI, and two I2Cs. These communication peripherals offer protocol support for LIN, IrDA, DALI, Manchester, Smart Card, SMBus, and PMBus. Device feature include:

- 1.62V to 3.6V operation
- Arm 32-bit Cortex-M0+, up to 32MHz
- 64KB of flash and 4KB SRAM
- 12-bit 1-Msps ADC
- Two zero-drift, zero-crossover chopper op-amps
- Four 16-bit general purpose timers
- Internal 4 to 32MHz oscillator with ±1% accuracy (SYSOSC)
- 28 GPIOs

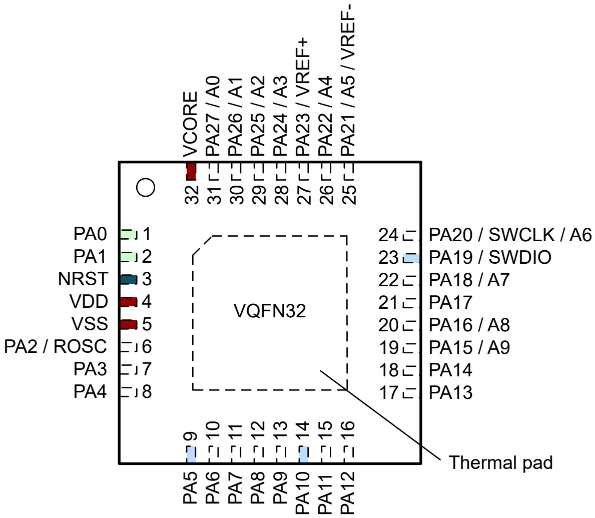


Figure 2-3. 32-Pin RHB (VQFN) (Top View)

2.3.2 XDS110-ET Onboard Debug Probe With EnergyTrace Technology

To keep development easy and cost effective, the TI LaunchPad development kits integrate an onboard debug probe, which eliminates the need for expensive programmers. The MSPM0L1306 has the XDS110 debug probe (see Figure 2-4), which is a simple and low-cost debugger that supports all MSPM0 device derivatives.

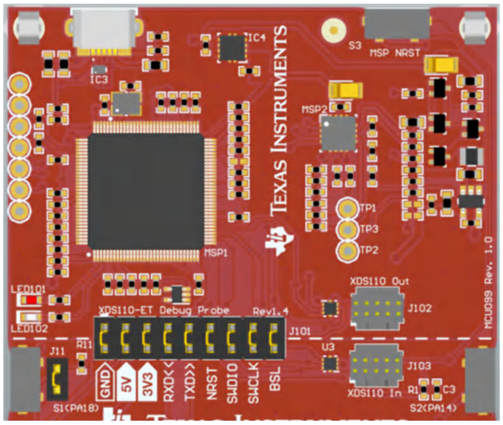


Figure 2-4. LP-MSPM0L1306 Debugger

The XDS110-ET provides a "backchannel" UART-over-USB connection with the host, which can be very useful during debugging and for easy communication with a PC. More details can be found in Section 2.3.4.

The XDS110-ET also includes EnergyTrace Technology that allows a user to quickly estimate the power consumption of their application. Accurate EnergyTrace measurements can only be taken if the XDS110-ET is the sole provider of power to the target device. Measurements include all power drawn from the portion of the board below the isolation block. See Section 2.6 for more information around current measurements.

2.3.3 Debug Probe Connection: Isolation Jumper Block

The isolation jumper block at jumper J101 allows the user to connect or disconnect signals that cross from the XDS110-ET domain into the MSPM0L1306 target domain. This includes XDS110-ET SWD signals, application UART signals, and 3.3V and 5V power.

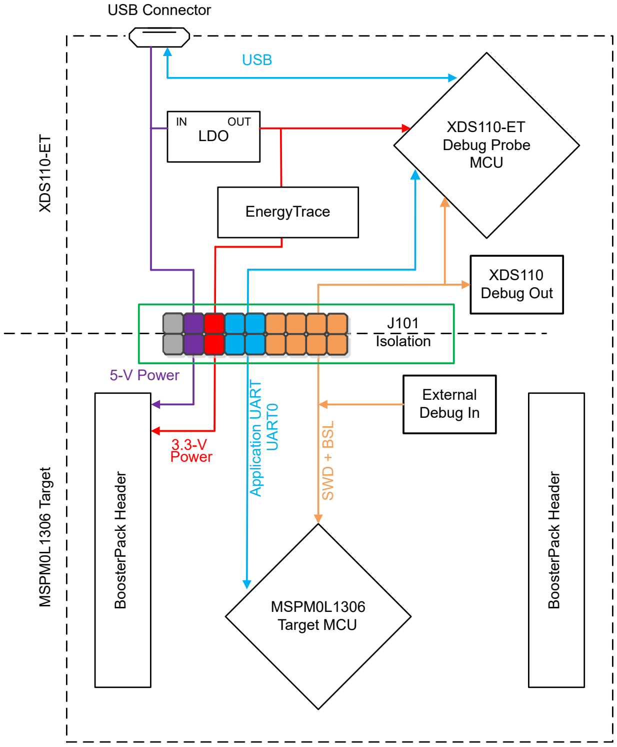


Figure 2-5. Debug Probe Connection

Table 2-2. Isolation Block Jumpers

Jumper	Description
GND	Ground
5 V	5V VBUS from USB
3V3	3.3V rail, derived from VBUS in the XDS110-ET domain
RXD<<	Backchannel UART: The target MSPM0L1306 receives data through this signal. The arrows indicate the direction of the signal.
TXD>>	Backchannel UART: The target MSPM0L1306 sends data through this signal. The arrows indicate the direction of the signal.
NRST	RST signal
SWDIO	Serial wire debug: SWDIO data signal.
SWCLK	Serial wire debug: SWDCLK clock signal
BSL	Bootstrap loader signal

Reasons to open these connections:

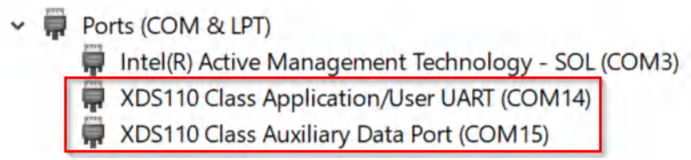
- To remove any and all influence from the XDS110-ET debug probe for high accuracy target power measurements
- To control 3V and 5V power flow between the XDS110-ET and target domains
- To expose the target MCU pins for other use than onboard debugging and application UART communication
- To expose the programming and UART interface of the XDS110-ET to be used for devices other than the onboard MCU.

2.3.4 Application (or *Backchannel*) UART

The backchannel UART allows communication with the USB host that is not part of the target application's main functionality. This 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.

Figure 2-6 shows the pathway of the backchannel UART. The backchannel UART is connected to UART0 (PA8, PA9) deepening on the jumper settings on headers J16 and J17.

On the host side, a virtual COM port for the application backchannel UART is generated when the LaunchPad development kit enumerates on the host. You 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. You need to identify the COM port for the backchannel. On Windows PCs, Device Manager can assist.



Ports (COM & LPT)
Intel(R) Active Management Technology - SOL (COM3)
XDS110 Class Application/User UART (COM14)
XDS110 Class Auxiliary Data Port (COM15)

Figure 2-6. Application Backchannel UART in Device Manager

The backchannel UART is the *XDS110 Class Application/User UART* port. In this case, Figure 2-6 shows COM14, but this port can vary from one host PC to the next. After identifying the correct COM port, configure in the host application according to documentation. The user can then open the port and begin communication from the host.

On the target MSPM0L1306 side, the backchannel is connected to the UART0 module. The XDS110-ET has a configurable baud rate; therefore, the PC application configuring the baud rate to be the same as what is configured on the UART0 is important.

2.3.5 Using an External Debug Probe Instead of the Onboard XDS110-ET

Many users have a specific external debug probe that is preferred to use, and want to bypass the XDS110-ET debug probe to program the MSPM0 target MCU. This is enabled by jumpers on isolation block J101, and the connector J103. Using an external debug probe is simple, and full JTAG access is provided through J103.

1. Remove jumpers on the JTAG signals on the J101 isolation block, including NRST, SWDIO and SWCLK.
2. Plug any Arm debug probe into J103
3. J103 follows the Arm Cortex Debug Connector standard outlined in Cortex-M Debug Connectors.
4. Plug USB power into the LaunchPad development kit, or power externally.
5. Make sure that the jumpers across 3V3 and GND are connected if using USB power.
6. External debug probes do not provide power, the VCC pin is a power sense pin.
7. For more details on powering the LaunchPad development kit, see Section 2.4.

2.3.6 Using the XDS110-ET Debug Probe With a Different Target

The XDS110-ET debug probe on the LaunchPad development kit can interface to most Arm Cortex-M devices, not just the onboard target MSPM0L1306 device. This functionality is enabled by the J102 10-pin Cortex-M JTAG connector and a 10-pin cable. Header J102 follows the Cortex-M Arm standard, however, pin 1 is not a voltage sense pin. The XDS110-ET outputs only 3.3V JTAG signals. If another voltage level is needed, the user must provide level shifters to translate the JTAG signal voltages. Additionally, 3.3V of output power can be sourced from the XDS110-ET when jumper J102 is connected. This allows the XDS110-ET to power the external target at 3.3V through pin 1. EnergyTrace technology is not supported on this interface.

1. Remove jumpers on the JTAG signals on the J101 isolation block, including RST, TMS, TCK, TDO, and TDI.
2. Plug the 10-pin cable into J102, and connect to an external target. a. J102 follows the Arm Cortex Debug Connector standard outlined in Cortex-M Debug Connectors.
3. Plug USB power into the LaunchPad development kit, or power externally. JTAG levels are 3.3V only.

2.3.7 Special Features

2.3.7.1 Thermistor

The LaunchPad kit includes a 10k linear thermistor (PTC) – TMP6131. Figure 2-7 shows the circuit. The PTC is in a low-side configuration with a 10kΩ 10ppm pullup resistor. Default position of jumper in header indicated (1-2 position) connects this circuit directly to the ADC. In this mode, the output voltage is approximately 1.6V at room temperature. See Section 3 for code examples. See Table 2-1 for device-specific module connections.

The jumper can also be set to the 2-3 position to allow an OPA connection to the thermistor. The OPA output can be connected internally, using software, to the negative OPA terminal. This allows the OPA to be used as a buffer for the thermistor with an internal connection to an ADC channel for sampling. If an external connection or additional biasing or filtering is wanted, then the passives identified in Figure 2-7 need to be populated.

Note

The capacitor and resistor network associated with OPA is not populated by default. This allows the user to populate with their own passive values to fit their application needs.

Note

When using OPA and the passive network, be sure to check for conflicts with other pins on the LaunchPad EVM as pins are multiplexed with several functions.

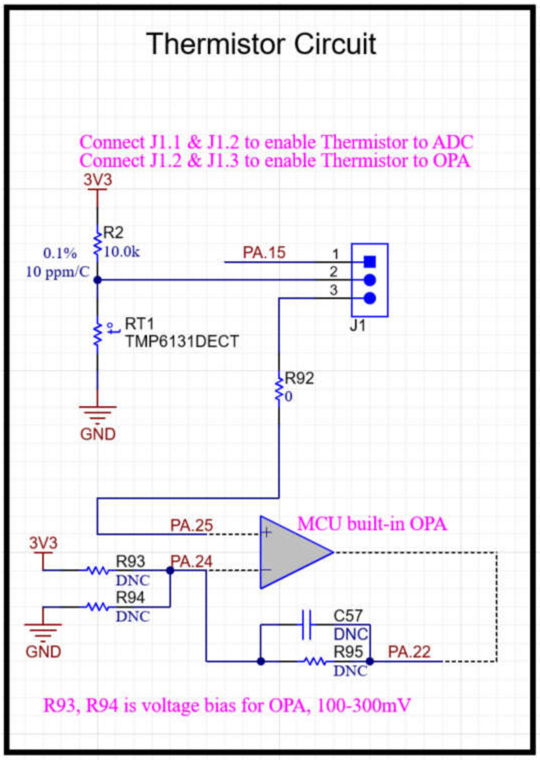

Thermistor Circuit
Connect J1.1 & J1.2 to enable Thermistor to ADC
Connect J1.2 & J1.3 to enable Thermistor to OPA
3V3
R2
10.0k
0.1%
10 ppm/C
PA.15
1
2
3
J1
RT1
TMP6131DECT
R92
0
GND
PA.25
MCU built-in OPA
+
-
3V3
R93
DNC
PA.24
R94
DNC
GND
C57
DNC
R95
DNC
PA.22
R93, R94 is voltage bias for OPA, 100-300mV

Figure 2-7. Thermistor Circuit

2.3.7.2 Light Sensor

A light sensor circuit is provided on the EVM by using the photodiode in configuration shown in Figure 2-8. The jumper connections between this circuit and the MSPM0 are populated by default so the photodiode is in circuit. The jumpers can be removed to place the photodiode out of circuit so the MSPM0 connections can be used for other evaluation purposes.

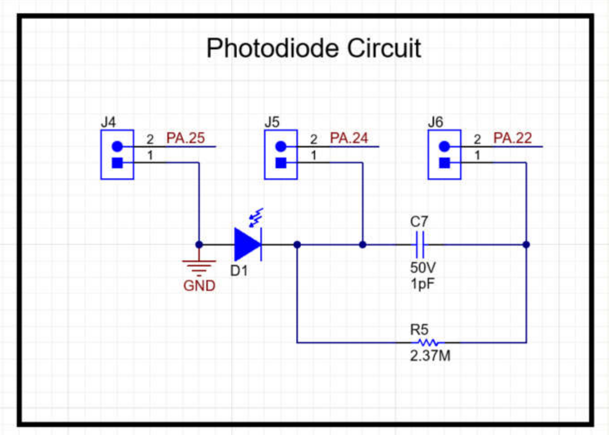


Figure 2-8. Light Sensor Circuit

This circuit is intended to be used with the internal OPA of the MSPM0 in an transimpedance configuration to drive the circuit. The OPA output is internally set to an ADC channel for sampling. See Table 2-1 for device-specific module connections and Section 3 for example code.

2.4 Power

The board accommodates various powering methods, including through the onboard XDS110-ET as well as external or BoosterPack plug-in module power.

2.4.1 XDS110-ET USB Power

The most common power-supply scenario is from USB through the XDS110-ET debugger. This provides 5V power from the USB and also regulates this power rail to 3.3V for XDS110-ET operation and 3.3V to the target side of the LaunchPad development kit. Power from the XDS110-ET is controlled by jumper J101. For 3.3V, make sure that a jumper is connected across the J101 3V3 terminal.

2.5 External Power Supply and BoosterPack Plug-in Module

Header J7 is present on the board to supply external power directly. To comply with the device voltage operation specifications when supplying external power is important. The MSPM0L1306 has an operating range of 1.62 V to 3.6 V. More information can be found in the MSPM0L1306 data sheet.

2.6 Measure Current Draw of the MSPM0 MCU

To measure the current draw of the MSPM0L1306 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:

1. Remove the 3V3 jumper in the J101 isolation block, and attach an ammeter across this jumper.
2. Consider the effect that the backchannel UART and any circuitry attached to the MSPM0L1306 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.
3. Make sure there are no floating inputs/outputs (I/Os) on the MSPM0L1306. This causes unnecessary extra current draw. Every I/O either be driven out or, if the I/O is an input, needs to be pulled or driven to a high or low level.
4. Begin target execution.

5. For the most accurate current measurements, place the device in “Free Run” mode and disconnect programming signals between the MSPM0L1306 and the debug portion of the board (header J101).
6. Measure the current. Keep in mind that if the current levels are fluctuating, then getting a stable measurement can be difficult. Measuring quiescent states is easier.
7. Note that the thermistor circuitry on revision E1 of this board cannot be completely unpowered, and provides additional current to the measurements unless the thermistor is unpopulated.

EnergyTrace technology can also be used to compare various current profiles and better optimize your energy performance.

2.7 Clocking

The internal SYSOSC is 32MHz as default at the accuracy of 2.5%. To achieve higher accuracy, a 0.1% 100kΩ resistor is connected to the ROSC pin, PA2. If higher accuracy is not needed, then resistor R6 can be depopulated, and pin PA2 used for the other functions. 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. For more clock tree details see Section 2.3 *Clock Module (CKM)* of the *MSPM0 L-Series 32MHz Microcontrollers Technical Reference Manual*.

2.8 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 LaunchPad development kits and BoosterPack plug-in modules across the TI ecosystem.

While most BoosterPack plug-in modules are compliant with the standard, some are not. The MSPM0L1306 LaunchPad development kit is not compatible with all 40-pin BoosterPack plug-in modules due to the fact that the MSPM0L1306 device does not have enough pins to fill the standard. If the reseller or owner of the BoosterPack plug-in module does not explicitly indicate compatibility with the MSPM0L1306 LaunchPad development kit, then compare the schematic of the candidate BoosterPack plug-in module with the LaunchPad development kit to verify compatibility. Keep in mind that sometimes conflicts can be resolved by changing the MSPM0L1306 device pin function configuration in software.

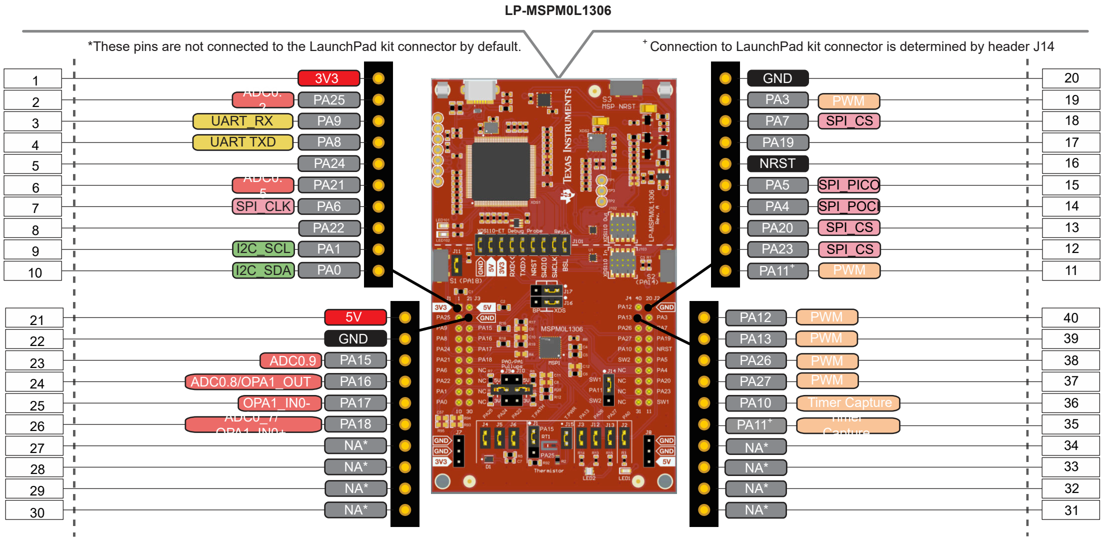


Figure 2-9. LaunchPad Development Kit to BoosterPack Plug-in Module Connector Pinout

3 Software Examples

See the MSPM0 SDK documentation for more details about available software.

4 Resources

4.1 Integrated Development Environments

Although the source files can be viewed with any text editor, more can be done with the projects if the projects opened with a development environment like Code Composer Studio IDE (CCS), IAR Embedded Workbench IDE, or KIEL IDE.

4.1.1 TI Cloud Development Tools

TI's Cloud-based software development tools provide instant access to MSPM0 SDK content and a web-based IDE.

4.1.2 TI Resource Explorer Cloud

TI Resource Explorer Cloud provides a web interface for browsing examples, libraries, and documentation found in MSPM0SDK without having to download files to your local drive. Visit TI Resource Explorer Cloud at dev.ti.com.

4.1.3 Code Composer Studio Cloud

Code Composer Studio Cloud (CCS Cloud) is a web-based IDE that enables you to quickly create, edit, build, and debug applications for your LaunchPad development kit. No need to download and install large software packages, simply connect your LaunchPad development kit and begin. You can choose to select from a large variety of examples in MSPM0SDK software or develop your own application. CCS Cloud supports debug features such as execution control, breakpoints, and viewing variables.

For more information, see the full comparison between CCS Cloud and CCS Desktop.

Visit Code Composer Studio Cloud at dev.ti.com

4.1.4 Code Composer Studio IDE

Code Composer Studio Desktop is a professional integrated development environment that supports the TI Microcontroller and Embedded Processors portfolio. Code Composer Studio comprises a suite of tools used to develop and debug embedded applications. Code Composer Studio includes an optimizing C/C++ compiler, source code editor, project build environment, debugger, profiler, and many other features.

Learn more about CCS and download at http://www.ti.com/tool/ccstudio. Access the MSPM0 SDK and MSPM0L1306 code examples by using TI Resource Explorer within CCS.

4.2 MSPM0 SDK and TI Resource Explorer

TI Resource Explorer is a tool integrated into CCS that allows the user to browse through available design resources. TI Resource Explorer helps the user quickly find what is needed inside packages. TI Resource Explorer is well organized to find everything that is needed quickly, and the user can import software projects into the workspace in one click.

TI Resource Explorer Cloud is one of the TI Cloud Development tools, and is tightly integrated with CCS Cloud to deliver the best cloud based IDE experience.

4.3 MSPM0L1306 MCU

4.3.1 Device Documentation

More information about the MSPM0L1306 device is available. For every MSP device, the documentation is organized as shown in Table 4-1.

Table 4-1. Device Documentation

Document	For MSPM0L1306	Description
Device family TRM	*MSPM0 L-Series 32MHz Microcontrollers Technical Reference Manual*	Architectural information about the device, including all modules and peripherals such as clocks, timers, ADC, and so on
Device-specific data sheet	*MSPM0L134x, MSPM0L130x Mixed-Signal Microcontrollers* *MSPM0L110x Mixed-Signal Microcontrollers*	Device-specific information and all parametric information for this device

4.3.2 MSPM0L1306 Code Examples

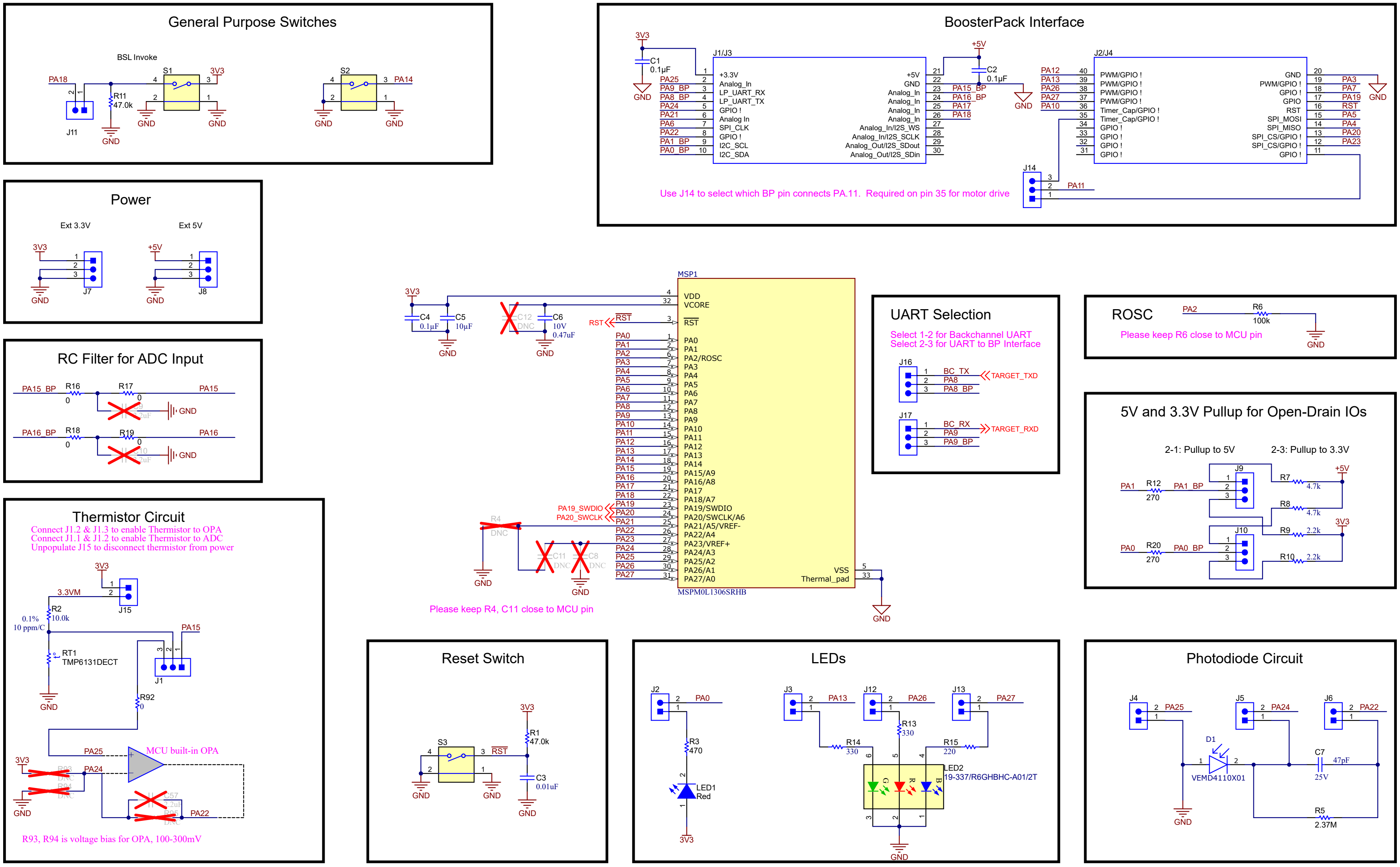
MSPM0_SDK has a set of simple C examples that demonstrate how to use the entire set of peripherals on the MSPM0L1306 MCU. Every MSP derivative has a set of these code examples. When starting a new project or adding a new peripheral, these examples serve as a great starting point.

4.4 Community Resources

4.4.1 TI E2E Forums

Search the forums at e2e.ti.com. If you cannot find your answer, post your question to the community!

5 Schematics



Use J14 to select which BP pin connects PA.11. Required on pin 35 for motor drive

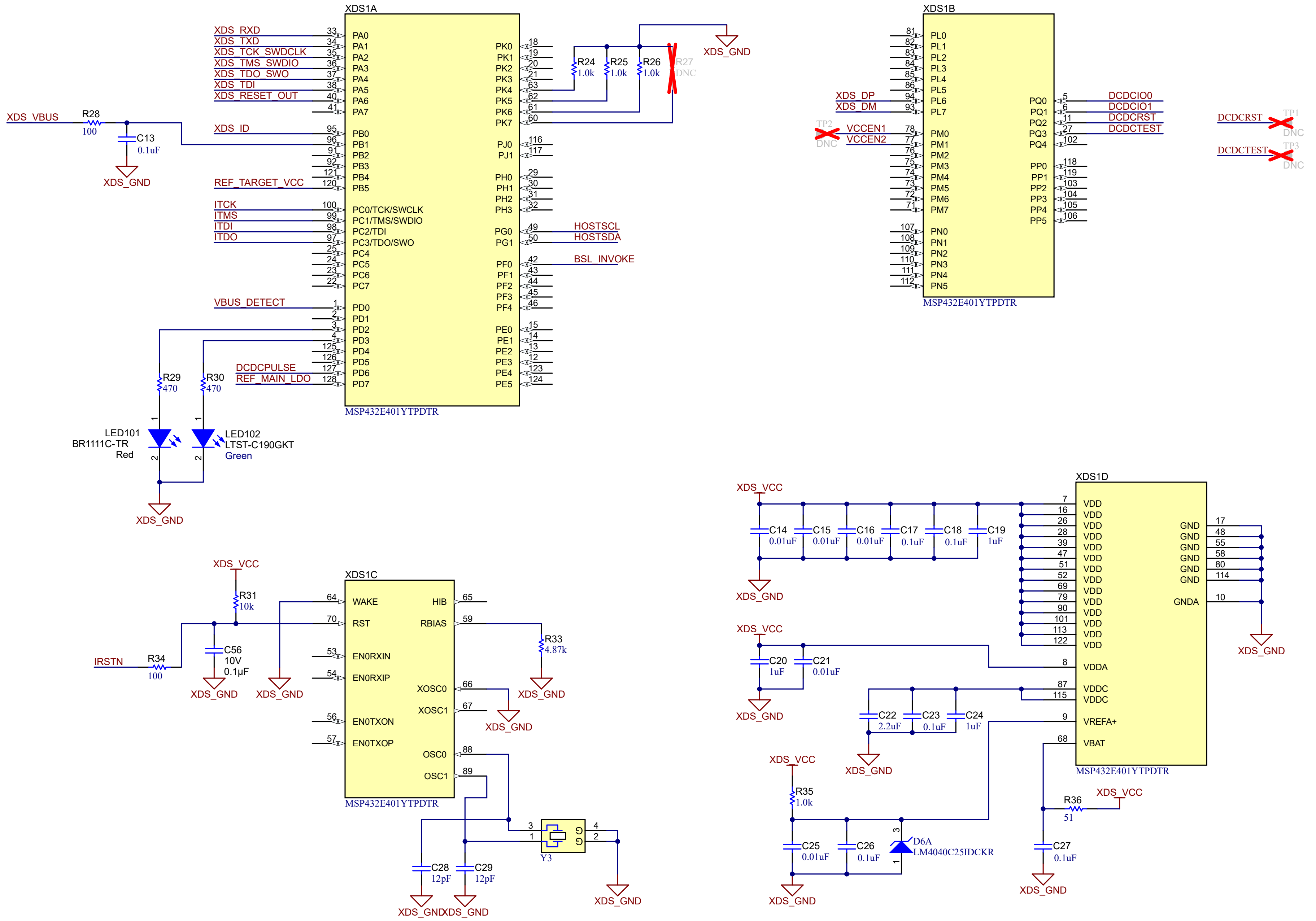
Please keep R4, C11 close to MCU pin

Select 1-2 for Backchannel UART
Select 2-3 for UART to BP Interface

Please keep R6 close to MCU pin

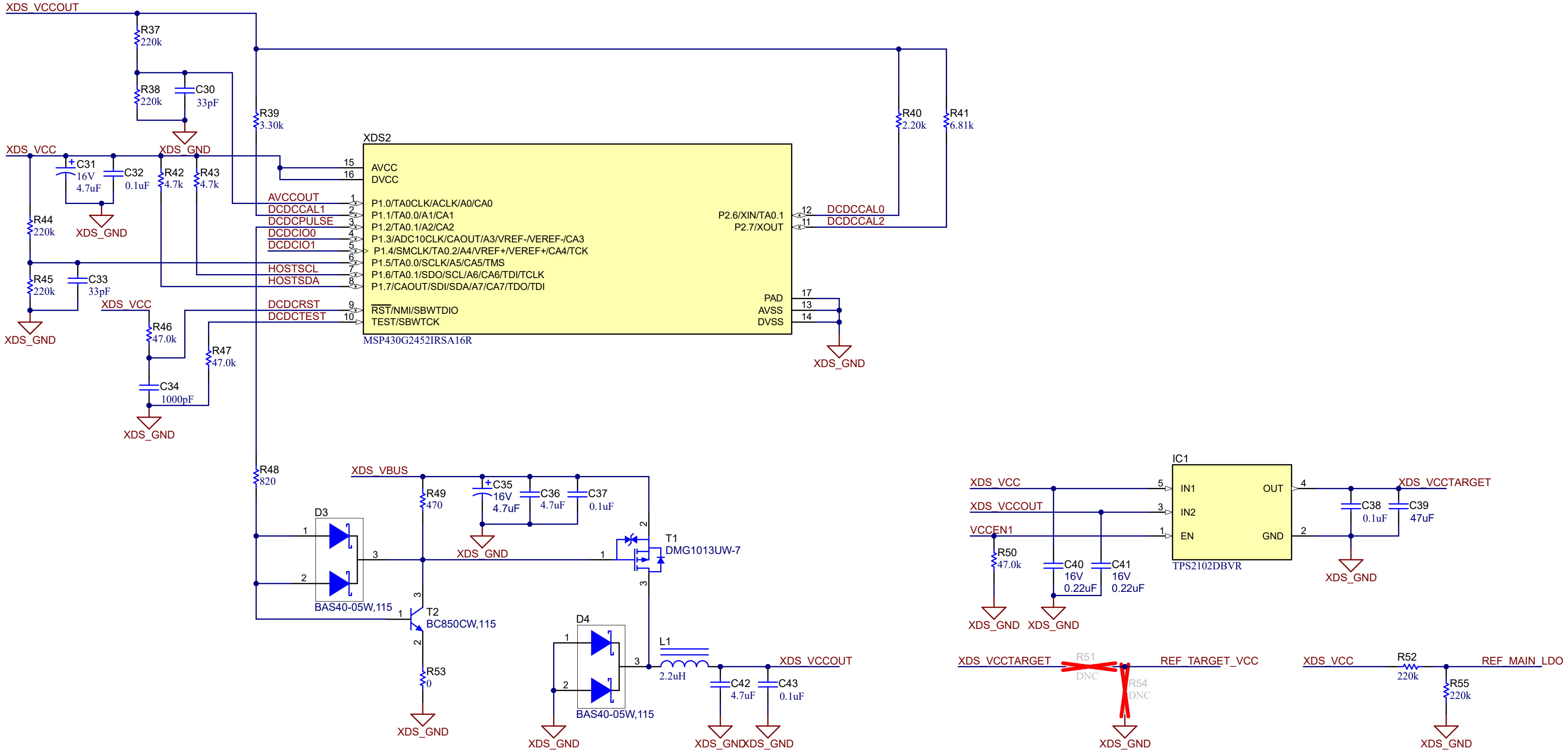
Connect J1.2 & J1.3 to enable Thermistor to OPA
Connect J1.1 & J1.2 to enable Thermistor to ADC
Unpopulate J15 to disconnect thermistor from power

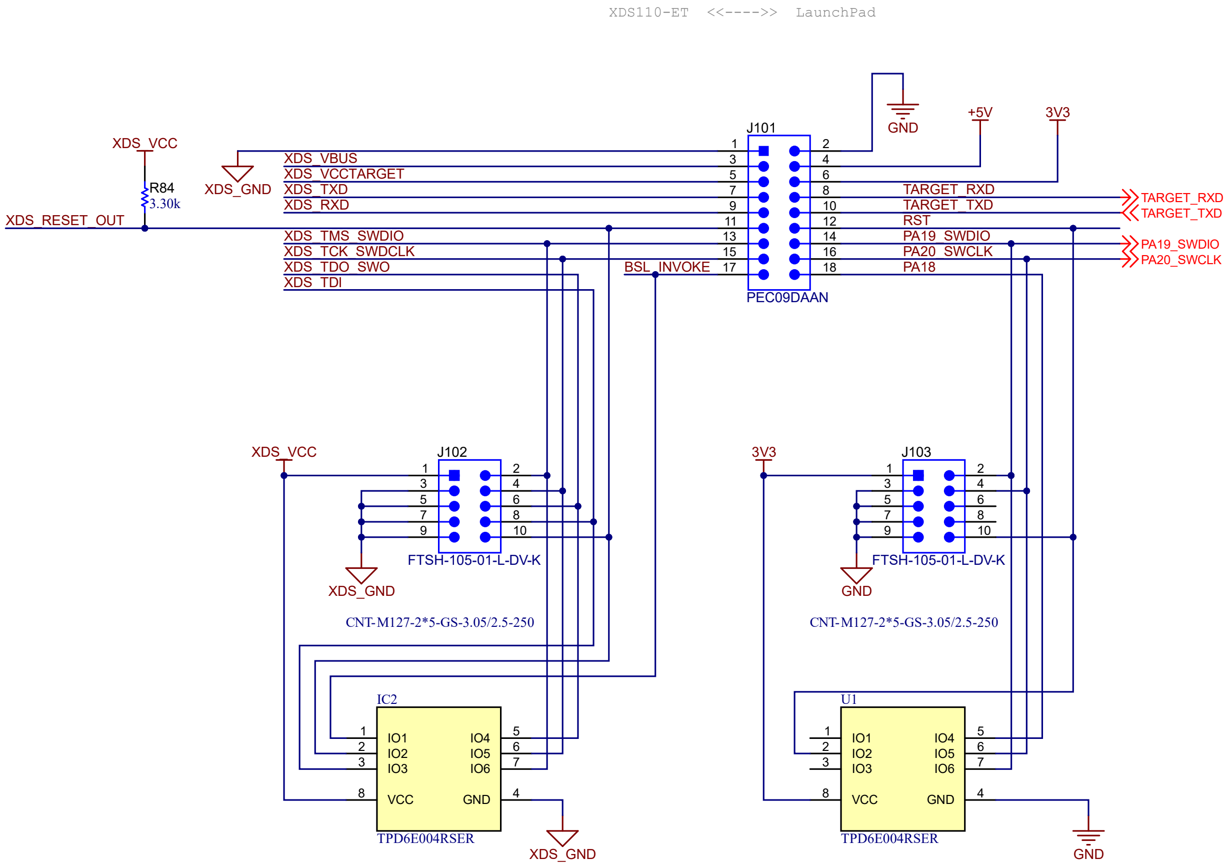
R93, R94 is voltage bias for OPA, 100-300mV

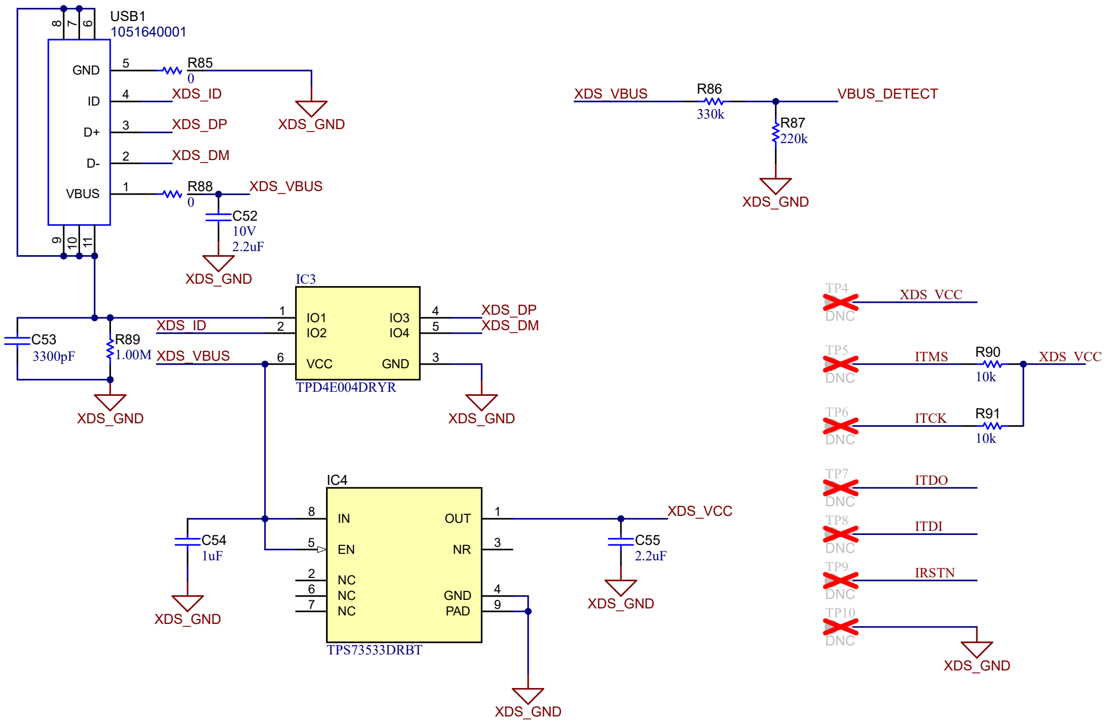

XDS1A
XDS_RXD
XDS_TXD
XDS_TCK_SWDCLK
XDS_TMS_SWDIO
XDS_TDO_SWO
XDS_TDI
XDS_RESET_OUT
PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
XDS_VBUS
R28
100
C13
0.1uF
XDS_GND
XDS_ID
PB0
PB1
PB2
PB3
PB4
PB5
REF_TARGET_VCC
ITCK
ITMS
ITDI
ITDO
PC0/TCK/SWCLK
PC1/TMS/SWDIO
PC2/TDI
PC3/TDO/SWO
PC4
PC5
PC6
PC7
VBUS_DETECT
PD0
PD1
PD2
PD3
PD4
PD5
PD6
PD7
DCDCPULSE
REF_MAIN_LDO
R29
470
R30
470
LED101
BR1111C-TR
Red
LED102
LTST-C190GKT
Green
XDS_GND
PK0
PK1
PK2
PK3
PK4
PK5
PK6
PK7
R24
1.0k
R25
1.0k
R26
1.0k
R27
DNC
XDS_GND
PJ0
PJ1
PH0
PH1
PH2
PH3
PG0
PG1
HOSTSCL
HOSTSDA
PF0
PF1
PF2
PF3
PF4
BSL_INVOKE
PE0
PE1
PE2
PE3
PE4
PE5
MSP432E401YTPDTR
XDS1B
PL0
PL1
PL2
PL3
PL4
PL5
PL6
PL7
XDS_DP
XDS_DM
TP2
DNC
VCCEN1
VCCEN2
PM0
PM1
PM2
PM3
PM4
PM5
PM6
PM7
PN0
PN1
PN2
PN3
PN4
PN5
PQ0
PQ1
PQ2
PQ3
PQ4
DCDCIO0
DCDCIO1
DCDCRST
DCDCTEST
PP0
PP1
PP2
PP3
PP4
PP5
MSP432E401YTPDTR
DCDCRST
TP1
DNC
DCDCTEST
TP3
DNC
XDS1C
XDS_VCC
R31
10k
IRSTN
R34
100
C56
10V
0.1µF
XDS_GND
XDS_GND
WAKE
RST
EN0RXIN
EN0RXIP
EN0TXON
EN0TXOP
HIB
RBIAS
XOSC0
XOSC1
OSC0
OSC1
R33
4.87k
XDS_GND
XDS_GND
MSP432E401YTPDTR
Y3
C28
12pF
C29
12pF
XDS_GND
XDS_GND
XDS_GND
XDS1D
XDS_VCC
C14
0.01uF
C15
0.01uF
C16
0.01uF
C17
0.1uF
C18
0.1uF
C19
1uF
XDS_GND
VDD
GND
GNDA
XDS_GND
XDS_VCC
C20
1uF
C21
0.01uF
XDS_GND
VDDA
VDDC
C22
2.2uF
C23
0.1uF
C24
1uF
XDS_GND
VREFA+
VBAT
MSP432E401YTPDTR
XDS_VCC
R35
1.0k
C25
0.01uF
C26
0.1uF
D6A
LM4040C25IDCKR
XDS_GND
R36
51
XDS_VCC
C27
0.1uF
XDS_GND

Software-controlled DCDC converter

Energy measurement method protected under U.S. Patent Application 13/329,073 and subsequent patent applications




XDS110-ET <<---->> LaunchPad
J101
PEC09DAAN
GND
+5V
3V3
XDS_VCC
R84
3.30k
XDS_GND
XDS_RESET_OUT
XDS_VBUS
XDS_VCCTARGET
XDS_TXD
XDS_RXD
XDS_TMS_SWDIO
XDS_TCK_SWDCLK
XDS_TDO_SWO
XDS_TDI
BSL_INVOKE
TARGET_RXD
TARGET_TXD
RST
PA19_SWDIO
PA20_SWCLK
PA18
TARGET_RXD
TARGET_TXD
PA19_SWDIO
PA20_SWCLK
XDS_VCC
J102
FTSH-105-01-L-DV-K
XDS_GND
CNT-M127-2*5-GS-3.05/2.5-250
3V3
J103
FTSH-105-01-L-DV-K
GND
CNT-M127-2*5-GS-3.05/2.5-250
IC2
IO1
IO2
IO3
IO4
IO5
IO6
VCC
GND
TPD6E004RSER
XDS_GND
U1
IO1
IO2
IO3
IO4
IO5
IO6
VCC
GND
TPD6E004RSER
GND


USB1
1051640001
8
7
6
GND
ID
D+
D-
VBUS
9
10
11
5
4
3
2
1
R85
0
XDS_GND
XDS_ID
XDS_DP
XDS_DM
R88
0
XDS_VBUS
C52
10V
2.2uF
XDS_GND
XDS_VBUS
R86
330k
VBUS_DETECT
R87
220k
XDS_GND
IC3
1
2
IO1
IO2
IO3
IO4
4
5
XDS_DP
XDS_DM
XDS_ID
C53
3300pF
R89
1.00M
XDS_VBUS
6
VCC
GND
3
TPD4E004DRYR
XDS_GND
XDS_GND
IC4
8
IN
OUT
1
XDS_VCC
5
EN
NR
3
C54
1uF
C55
2.2uF
2
6
7
NC
NC
NC
GND
PAD
4
9
TPS73533DRBT
XDS_GND
XDS_GND
XDS_GND
TP4
DNC
XDS_VCC
TP5
DNC
ITMS
R90
10k
XDS_VCC
TP6
DNC
ITCK
R91
10k
TP7
DNC
ITDO
TP8
DNC
ITDI
TP9
DNC
IRSTN
TP10
DNC
XDS_GND

6 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision D (November 2023) to Revision E (January 2024)	Page
• Updated all images in Section 5 *Schematics*	16

Changes from Revision C (March 2023) to Revision D (November 2023)	Page
• Deleted *Design Files*	5

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