User's Guide

MSP-LITO-L1306 Evaluation Module

ABSTRACT

The MSP-LITO-L1306 Evaluation Module is an easy-to use evaluation module for the MSPM0L1306 microcontroller (MCU). The EVM is a small, complete, and breadboard-friendly board which contains the basic components needed for a complete MSPM0L1306-based system. Different from the LP-MSPM0L1306, this EVM is a minimum MSPM0L1306 system board because this EVM doesn't contain special function module such as the onboard debug probe, thermistor and light sensor. However, this EVM contains an onboard button and LED for quick integration of a simple user interface.

The following figure shows the MSP-LITO-L1306 Evaluation Module.

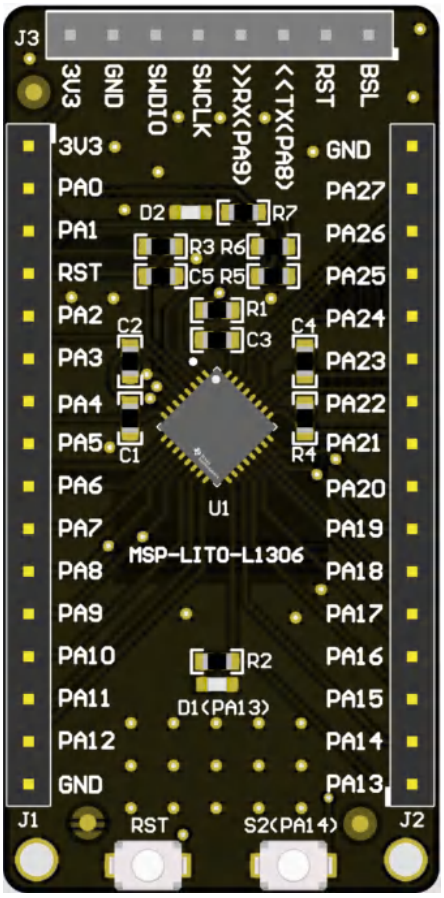

Figure 1-1. MSP-LITO-L1306 Evaluation Module

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Trademarks

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 the system.

This EVM has the 32-pin headers. Rapid prototyping is simplified by connecting other modules which is needed by customer through the 32-pin headers and Dupont lines. And this minimum system EVM can be plugged into breadboard directly to set up a completed & customized application system easily.

Free software development tools are also available such as TI's Code Composer Studio™ IDE, IAR Embedded Workbench™ IDE, and Keil® µVision® IDE. 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

- Minimum and simple system board which is breadboard-friendly and easy to set up a customized system
- Two buttons including one for MCU reset, one LED for user interaction and one LED to indicate that power supply is normal
- Supports BSL invoke through GPIO directly and XDS110
- Combines with another minimum debugger XDS110-ETP for use

1.3 What's included

Kit Contents

- MSP-LITO-L1306 Evaluation

Software Examples

- Sysconfig Compatibility
- SDK examples

1.4 Starting Steps

MSP-LITO-L1306-EVM needs to be used combining with one debugger, such as XDS110-ETP, LP-XDS110, LP-XDS110ET, etc., because there is no onboard debugger.

First step: Connection with debugger and computer

For example, we combine MSP-LITO-L1306 and XDS110-ETP to use. Connect the Evaluation Module with XDS110-ETP through the J3, then connect the XDS110-ETP with a computer through the USB plug. And another way is to use the onboard debugger on LP-MSPM0L1306, etc. and connect the debugger to a computer through the USB cable.

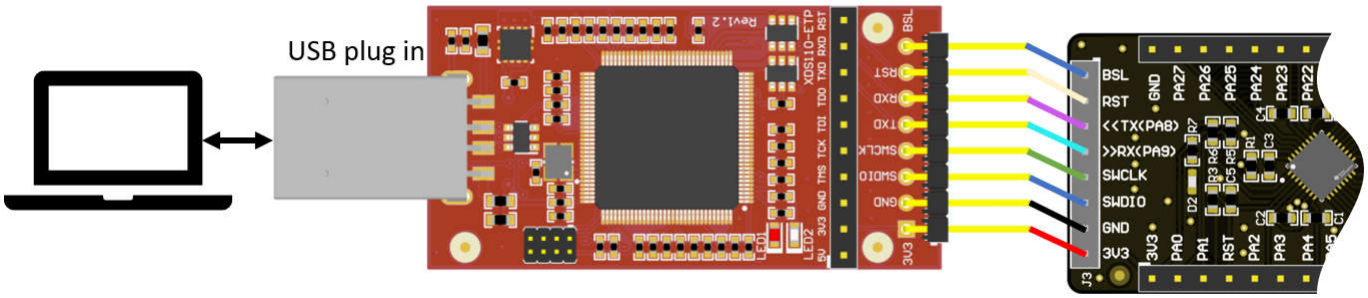


Figure 1-1. Connection with XDS110-ETP and computer

Next steps: Looking into the Provided Code

After the EVM hardware connection is already, 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 EVM 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 EVM. 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.

2 Hardware

Figure 2-1 shows an overview of the MSP-LITO-L1306-EVM hardware.

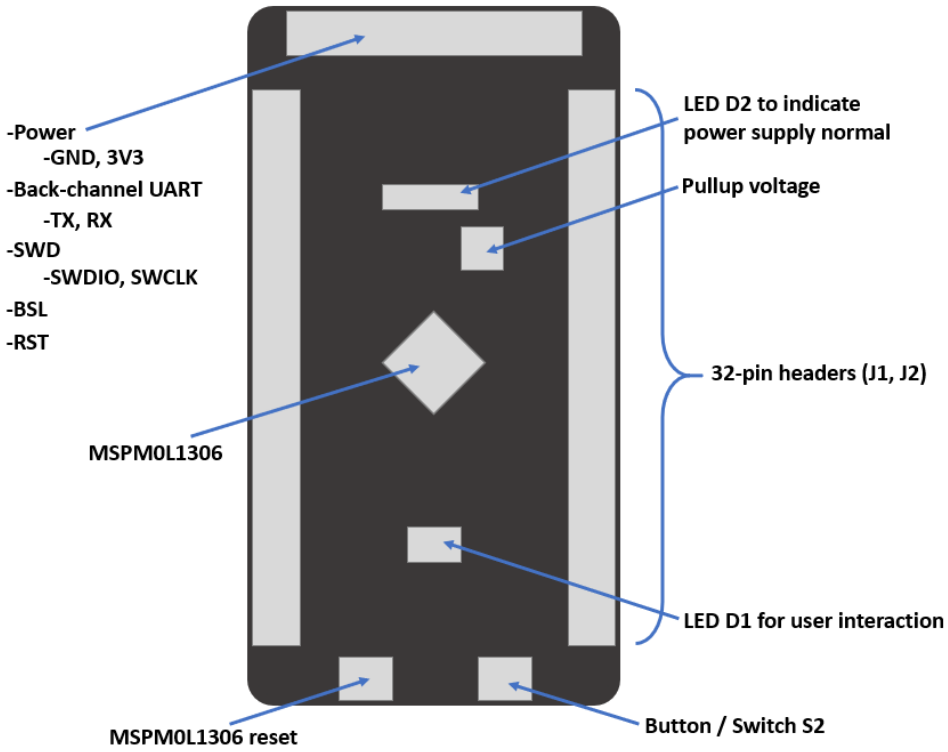


Figure 2-1. MSP-LITO-L1306-EVM Overview

Block Diagram

Figure 2-2 shows the simple block diagram of MSP-LITO-L1306-EVM.

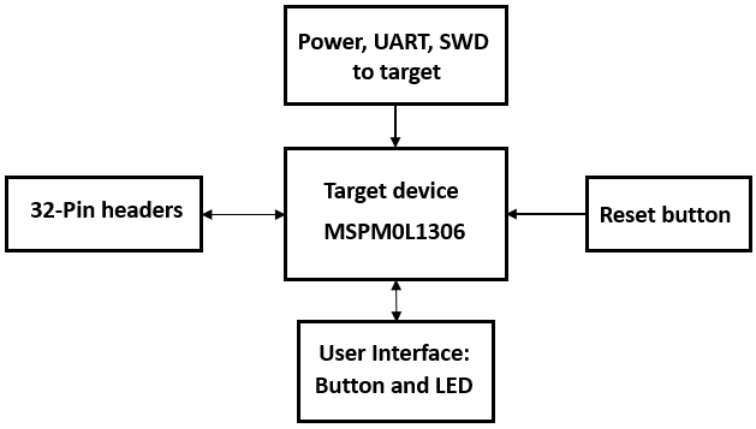


Figure 2-2. Block Diagram

2.1 Hardware Features

2.1.1 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

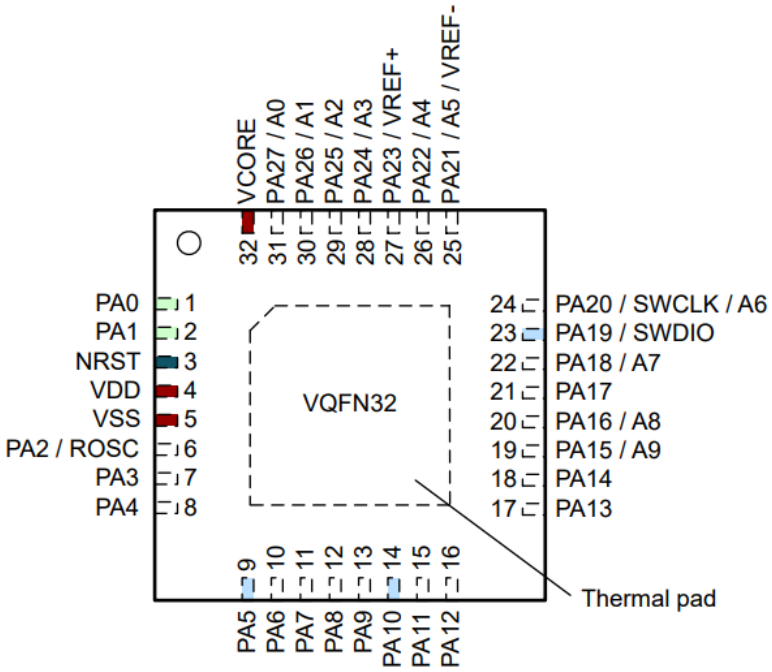


Figure 2-3. 32-Pin RHB (VQFN) (Top View)

2.1.2 Application (or Backchannel) UART

After connecting MSP-LITO-L1306-EVM with one debugger which has a UART channel (such as XDS110-ETP, LP-XDS110, etc) or UART-USB transfer equipment, 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 MSP-LITO-L1306.

On the target MSPM0L1306 side, the backchannel is connected to the UART0 module (PA8 and PA9).

2.1.3 Using an External Debug Probe

MSP-LITO-L1306-EVM doesn't have onboard debugger so this EVM needs to use an external debug probe connecting through J3 such as XDS110-ETP-EVM (the mini XDS110 debugger), LP-XDS110, or LP-XDS110-ET, etc.

2.2 Power

The EVM board accommodates various powering methods, including through the external debugger, and 3V3 header (on J1) power directly.

The most common power-supply scenario is from USB through the external debugger. External debugger regulates the power from USB to 3.3V for debugger operation and 3.3V to the MSP-LITO-L1306 side. Power from the external debugger is controlled by J3.

The 3v3 header (on J1) is present on the board to supply external power directly. Complying with the device voltage operation specifications when supplying external power is important. The MSPM0L1306 has an operating range of 1.62V to 3.6V. More information can be found in the MSPM0L1306 data sheet.

2.3 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.

2.4 Pinout

This EVM has the 32-Pin headers which can help customer set up the application system rapidly through connecting with other modules. Figure 2-4 shows the MSP-LITO-L1306 headers Pinout. For the complete functionality of all pins, please refer to the MSPM0L130X Mixed-Signal Microcontrollers datas heet. Through the 32-Pin headers, this EVM can also be plugged into a breadboard and help customer set up a completed & customized system on the breadboard easily.

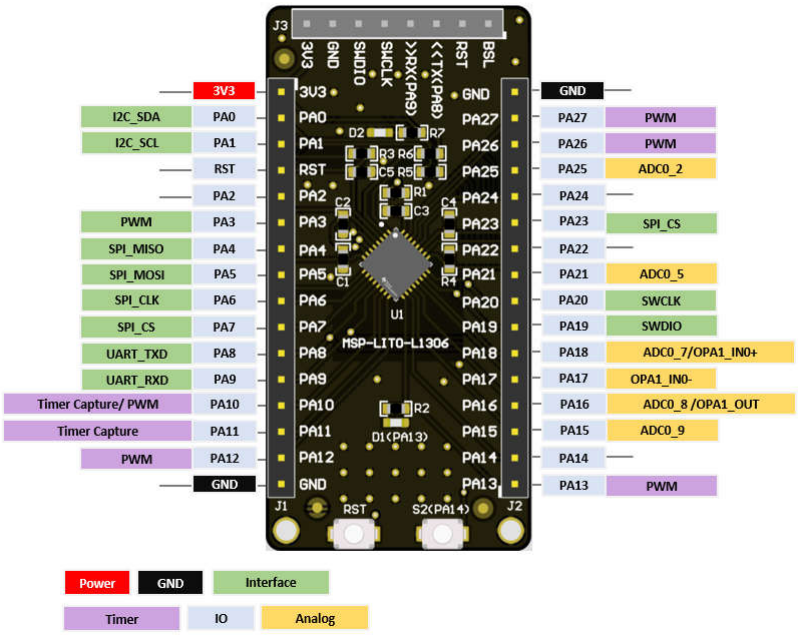


Figure 2-4. MSP-LITO-L1306 headers Pinout

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 application system. No need to download and install large software packages, simply connect your debugger & EVM 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

Table 4-1. Device Documentation (continued)

Document	For MSPM0L1306	Description
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

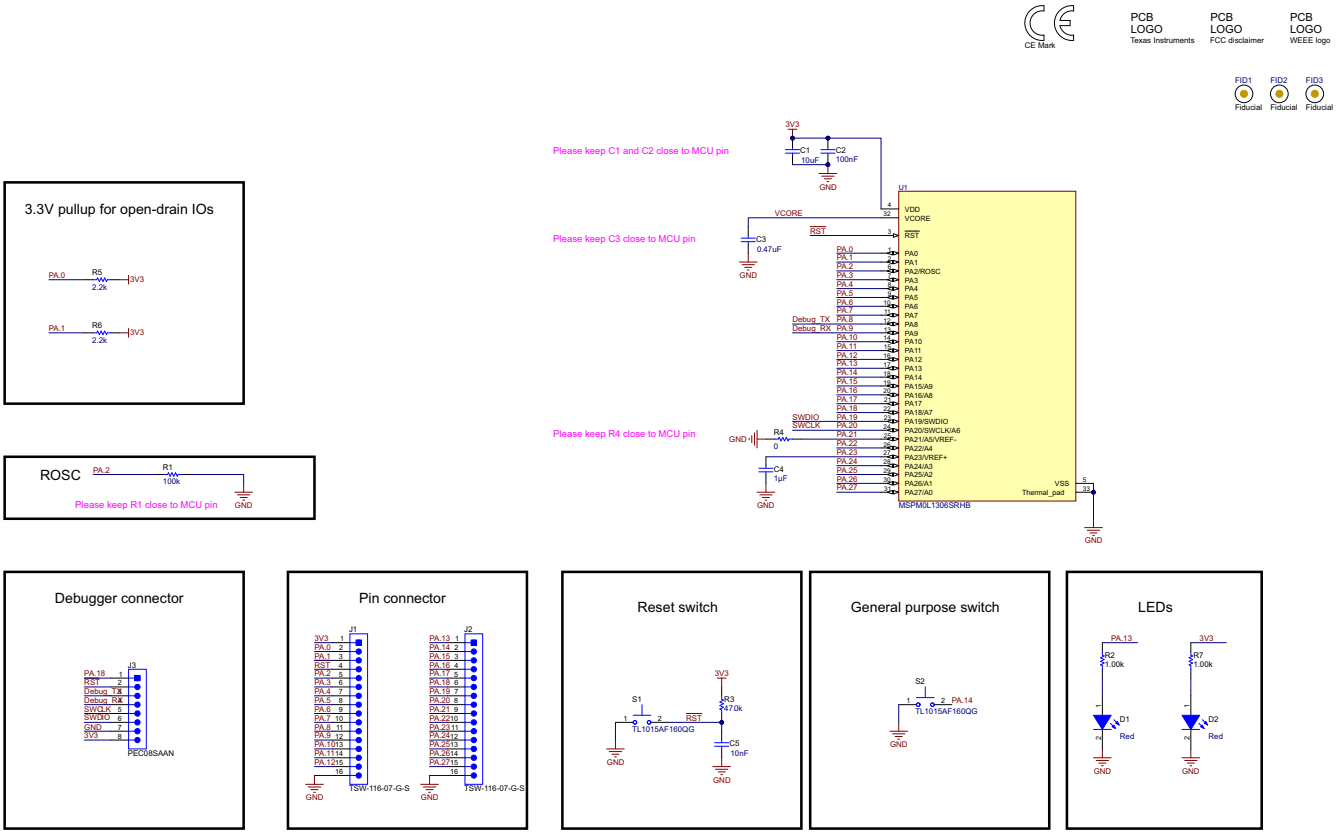
MSPM0_SDK has a set of simple C examples that demonstrate how to use the entire set of peripherals on the MSPM0L1306 MCU. Every MSP derivative has a set of these code examples. When starting a new project or adding a new peripheral, these examples serve as a great starting point.

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



6 Revision History

DATE	REVISION	NOTES
January 2024	*	Initial Release

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