Webinar

Software made simple with MSPM0 MCU subsystems

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Agenda

- TI’s ARM Cortex-M0+ MCU portfolio overview
- MSPM0 MCU software development kit overview
- MSPM0 MCU subsystem examples and demonstration
- Getting started with MSPM0 MCU subsystems page

MSPM0 MCUs | Reducing your system cost

Cost optimization

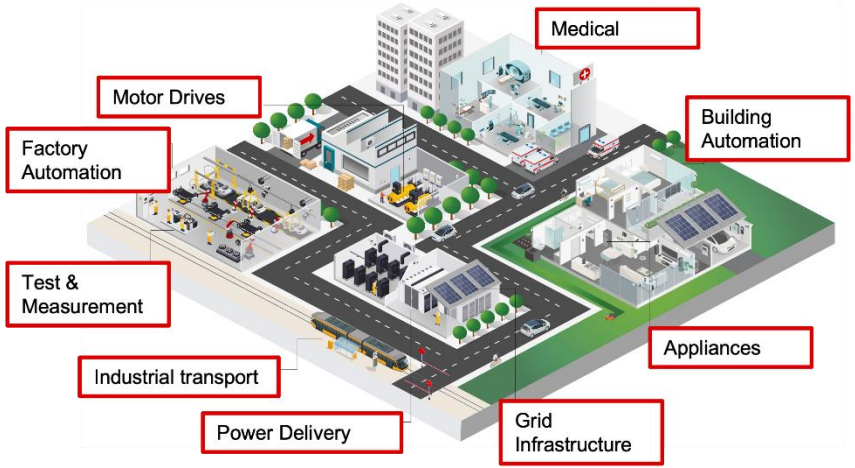
Best cost structure for microcontrollers with mix of digital, analog & memory

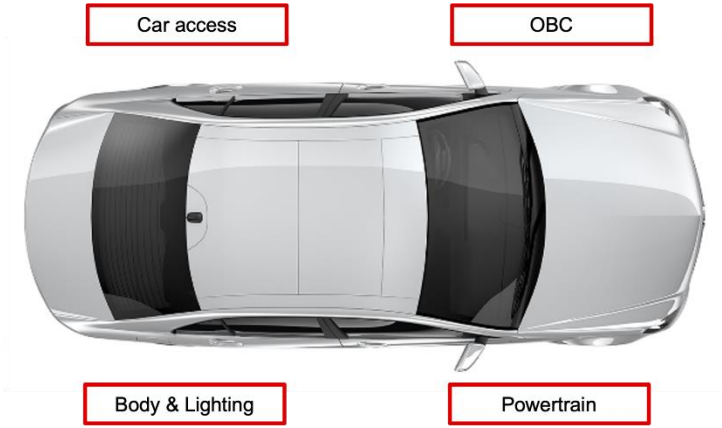
Smallest packages

Leverage the cost benefit of packages that are used by high volume analog

Advanced analog integration

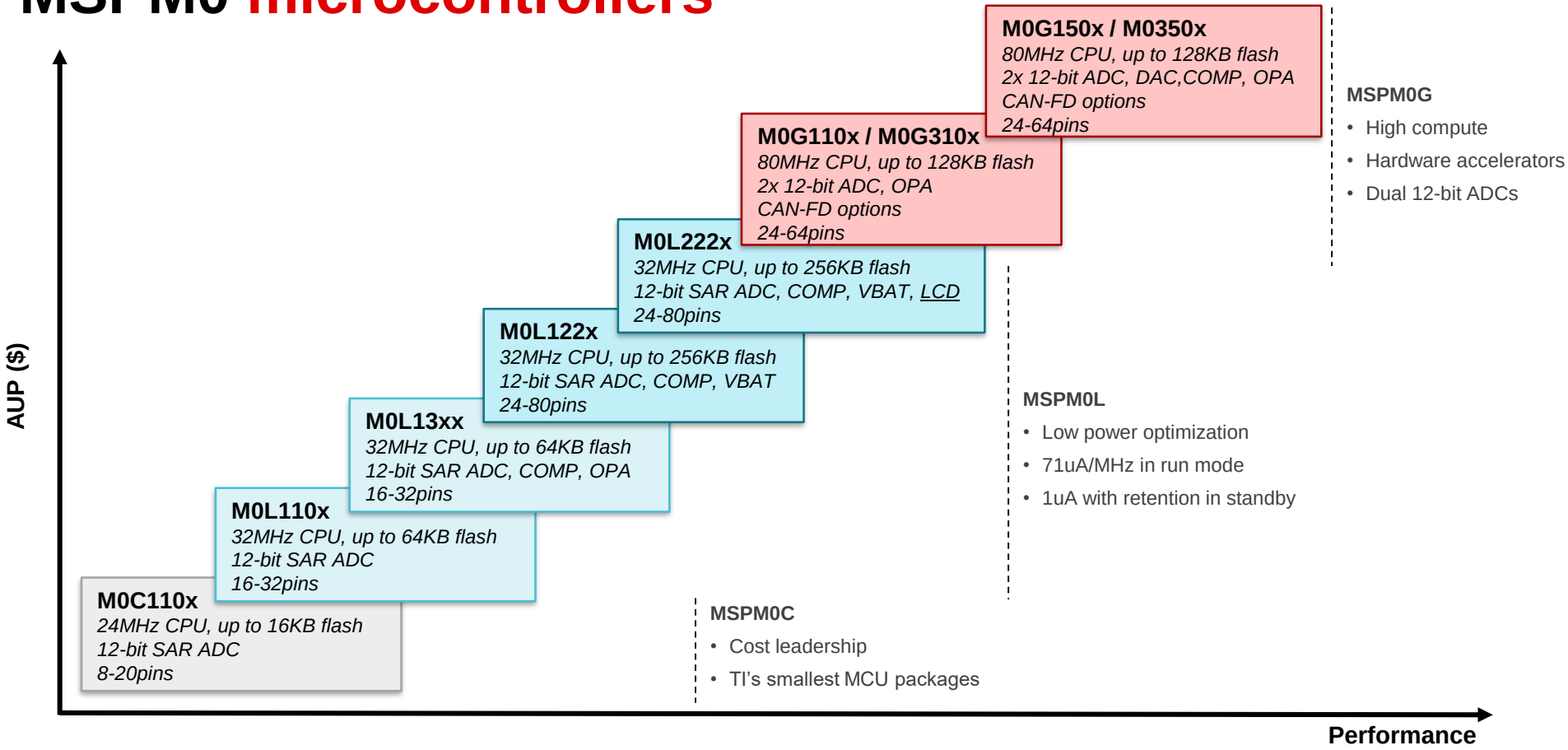
Save components, board space and simplify supply chain with integrated advanced analog





Devices optimized for broad range of industrial and automotive applications

MSPM0 microcontrollers



MSPM0 SDK | All the SW you need in one place

Customer application

Libraries, middleware, and stacks

- Control
- Sensing
- Communication
- Display
- Logging and memory
- DSP and math
- Logic
- Security
- Functional safety

Multiple code examples

- Peripheral code examples
- MSP subsystems

Real time operating systems

- Zephyr RTOS
- FreeRTOS

Drivers

- TI Drivers (high level abstraction)
- DriverLib (low level abstraction)

Device boot features

- Boot loaders
- Secure boot

Hardware

Automotive

- 3P CAN and LIN stacks
- MCAL

Tools

- IDEs
- Compilers
- Debuggers
- Programmers
- Configuration

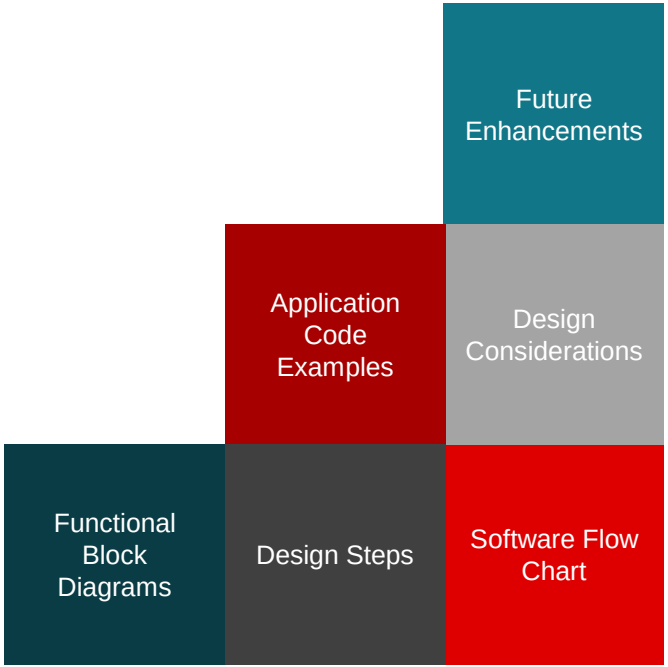
Within MSPM0 SDK

Outside of MSPM0 SDK

External tools

What are subsystems?

Building blocks for common MCU design challenges



Subsystem Design

Dynamic Programmable Gain Amplifier

TEXAS INSTRUMENTS

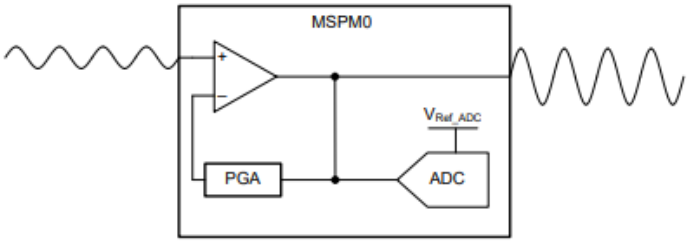


Figure 1-1. Subsystem Functional Block Diagram

```
#include "ti_msp_dl_config.h"

#define HIGHMARGIN 3890 // 4095*0.75 = 75% of max ADC value
#define LOWMARGIN  1638 // 4095*0.25 = 25% of max ADC value
#define MAXGAIN  DL_OPA_GAIN_N7_P8 // Maximum GAIN level of OPA wanted
#define MINGAIN  DL_OPA_GAIN_N1_P2 // Minimum GAIN level of OPA wanted.
//For non-inverting PGA mode this is an OPA GAIN of 2x. See advisory in TRM for MIN GAIN.

int main(void)
{
    SYSCFG_DL_init();

    //Set ADC Window Compare thresholds
    DL_ADC12_disableConversions(ADC12_0_INST);
    DL_ADC12_configWinCompHighThld(ADC12_0_INST, HIGHMARGIN);
    DL_ADC12_configWinCompLowThld(ADC12_0_INST, LOWMARGIN);
```

Faster development time | Save on software resources

MSPM0 MCU subsystem availability

General functionality

Subsystem	M0G	M0L	M0C
Digital mux	✓	✓	✓
Task scheduler	✓	✓	✓
Diode matrix	✓	✓	✓
Power sequencer	✓	✓	✓
LED driver with PWM	✓	✓	✓
FIR (digital filters)	✓		
IIR (digital filters)	✓		
RTC scheduler	✓	✓	✓
Interfacing with 5V	✓	✓	✓

Communication bridges

Subsystem	M0G	M0L	M0C
UART to I2C	✓	✓	✓
CAN to UART	✓		
CAN to SPI	✓		
CAN to I2C	✓		
I2C to UART	✓	✓	✓
UART to SPI	✓	✓	✓

Analog functions

Subsystem	M0G	M0L	M0C
ADC to PWM	✓	✓	✓
PWM DAC	✓	✓	✓
ADC with DMA ping pong	✓	✓	
ADC with SPI interface	✓	✓	✓
ADC with I2C interface	✓	✓	✓
ADC with UART	✓	✓	✓
Data sensor aggregator	✓	✓	✓
PGA	✓	✓	
Transimpedance amplifier	✓	✓	

LED Drivers with PWM

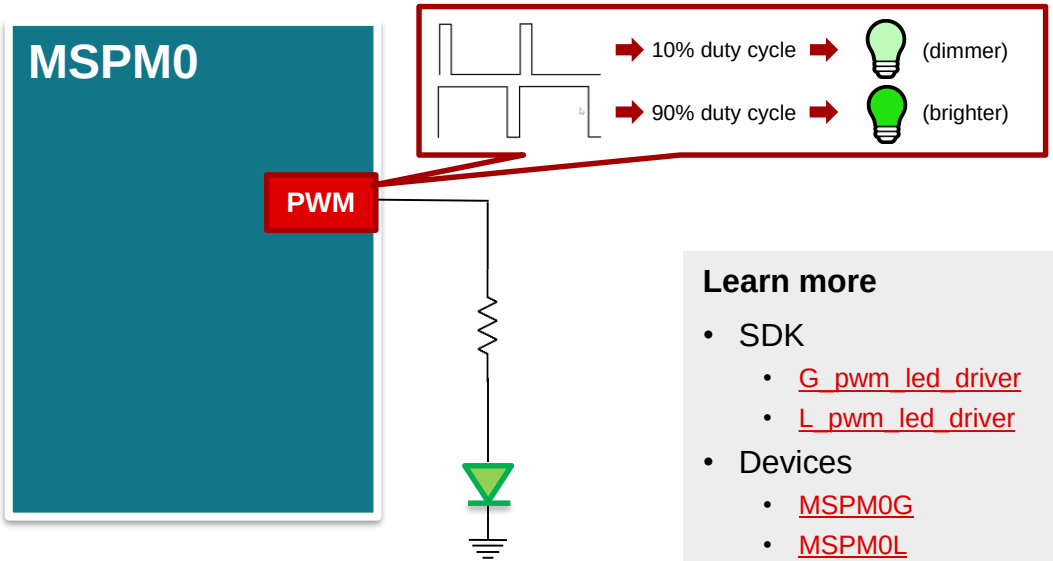
Using MSPM0 to drive LEDs

Functions

- Drive LEDs on M0 devices using PWMs
- Control rate of dimming using general purpose timer

Advantages

- Four general purpose timers with two capture compare registers each → 8 total PWM channels to drive LEDs (drive multiple LEDs with one timer)
- Can drive up to 20 mA on both M0G and M0L devices
- Pipelined compare feature that allows you to hold the update timer counter values until a certain event
- 5V tolerant open-drain IOs
- HD IOs available on M0G device

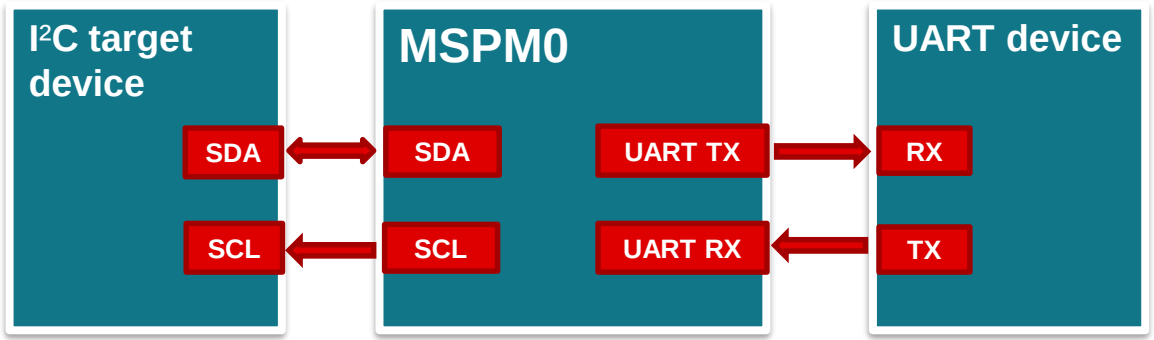


Learn more

- SDK
  - G_pwm_led_driver
  - L_pwm_led_driver
- Devices
  - MSPM0G
  - MSPM0L
  - MSPM0C

UART-to-I2C Bridge

Using low cost MSPM0



Functions

- Write UART input data to target device via I2C communication
- Read data from I2C target device to controller and output on UART

Advantages

- Support for both UART and I2C on one device
- Easily convert between UART to I2C protocols
- Send packet of UART data to multiple peripheral devices via I2C
- Allow hardware devices that only support UART to access I2C protocol for data transmission and exchange

Learn more

- M0 MySecure repository
  - Request access to mysecure
- Devices
  - MSPM0G
  - MSPM0L

Key questions

- Do you need to communicate UART data to multiple peripheral devices or read from multiple peripheral devices and output via UART?
- Does your system only support UART?

Low cost ADC to SPI, I2C, UART

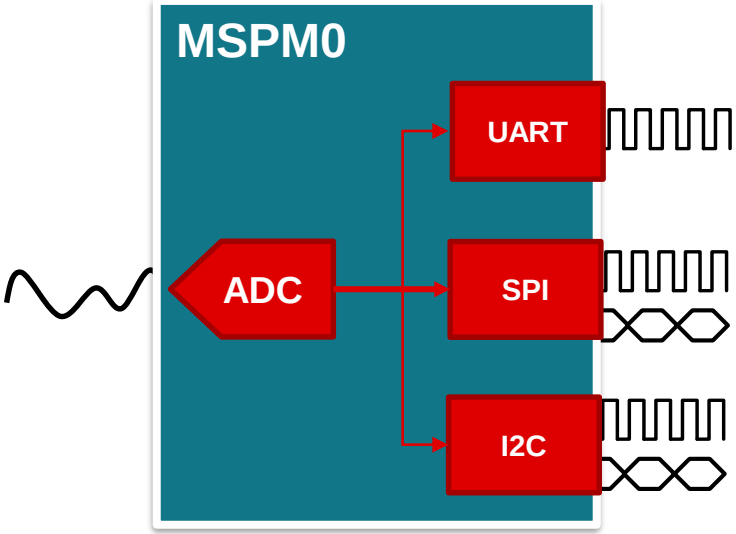
Using low cost MSPM0

Functions

- Samples analog signals with ADC
- Sends ADC result through desired communication interface (SPI, I2C, UART)

Advantages

- Reduce size of your PCB by using the MSPM0's internal ADC and send through SPI, I2C and/or UART.
- Can pre-process the ADC data before sending to another device.
- Can send through any included communication interface for flexibility



Key questions

- Does your system need an analog signal read?
- Does your system require SPI, I2C, or UART communication?
- Do you have limited PCB space?

Learn more

- SDK
  - G_adc_to_uart
  - G_adc_to_i2c_target
  - G_adc_to_spi_peripheral
  - L_adc_to_uart
  - L_adc_to_i2c_target
  - L_adc_to_spi_peripheral
- Devices
  - MSPM0G
  - MSPM0L
  - MSPM0C

Dynamic Programmable Gain Amplifier

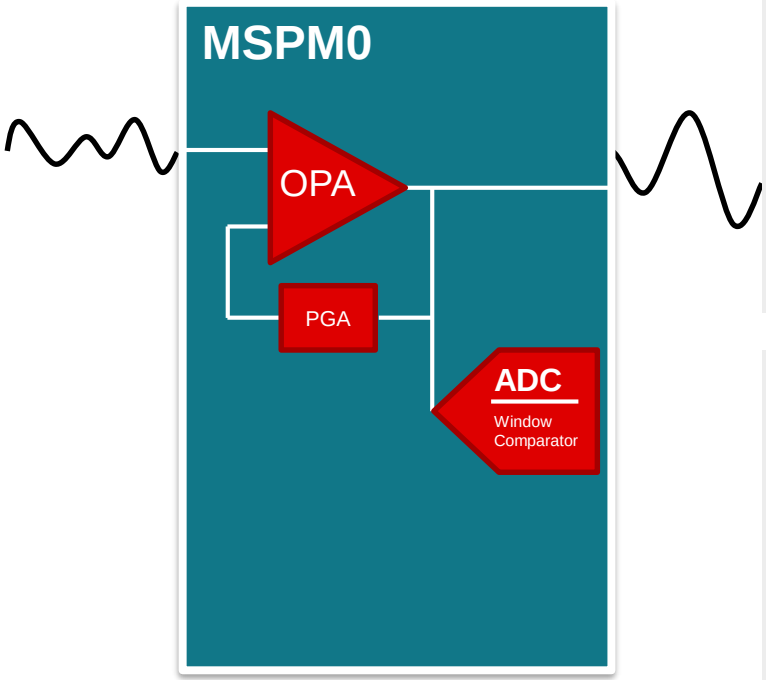
Using low cost MSPM0

Functions

- Automatically adjust signal gain to keep output at defined voltage ranges
- Optionally output signal or sample with ADC

Advantages

- OPA Gain adjusts without signal interruption
- Increases signal acquisition dynamic range
- Reduce hardware components and board space
- Shutdown Amp capability to save power



Key questions

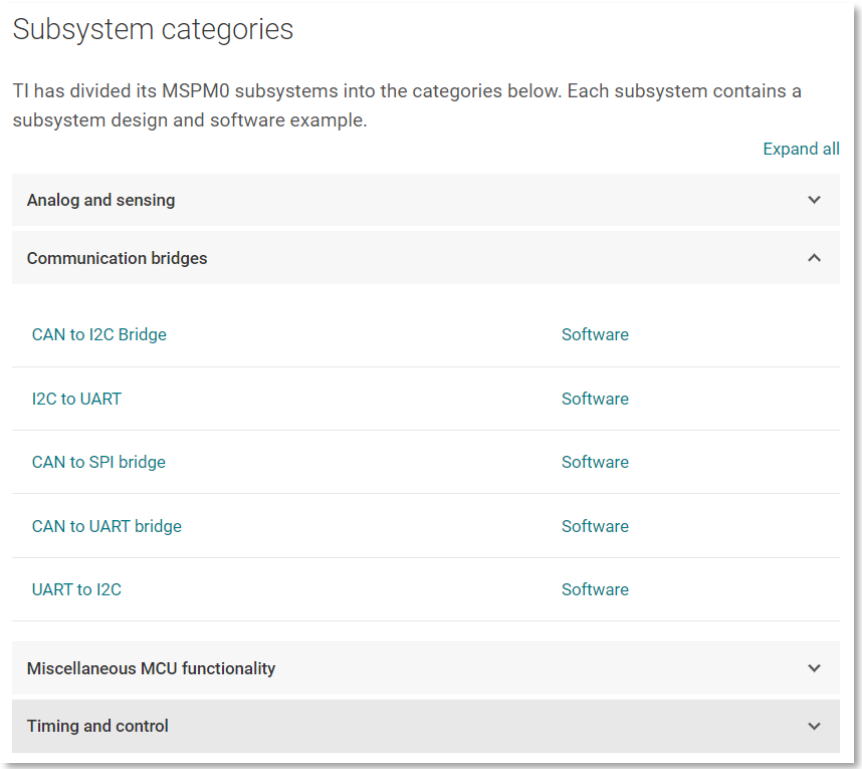
- Do you need to a high dynamic range of signal acquisition?
- Does your system have multiple gain stages for the same signal for different situations?
- Do you need Shutdown Amp capabilities?

Learn more

- SDK
  - L_programmable_gain_amplifier_1
  - L_programmable_gain_amplifier_2
- Devices
  - MSPM0G
  - MSPM0L
  - MSPM0C

Getting started

Arm Cortex –M0+ MCU subsystems page



MSPM0 SDK
https://www.ti.com/tool/MSPM0-SDK

MSPM0C Launchpad
https://www.ti.com/tool/LP-MSPM0C1104

MSPM0L Launchpad
https://www.ti.com/tool/LP-MSPM0L1306

MSPM0G Launchpad
https://www.ti.com/tool/LP-MSPM0G3507

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