

# Webinar

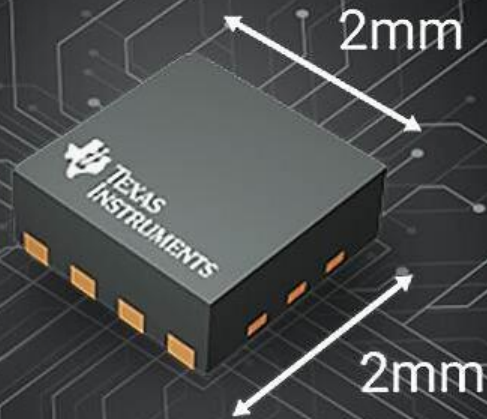
The smallest package TI MSPM0 MCU enables room to do more in your design

**Samantha Pozzi**

MSP Product Marketing Engineer

**Dennis Lehman**

MSP Applications Engineer



# Agenda

- TI's ARM Cortex-M0+ MCU portfolio overview
- MSPM0C Subsystem Designs
- Example applications with MSPM0C MCUs
- Getting started with MSPM0C MCUs

# MSPM0 MCUs | reducing your system cost

## Cost optimization

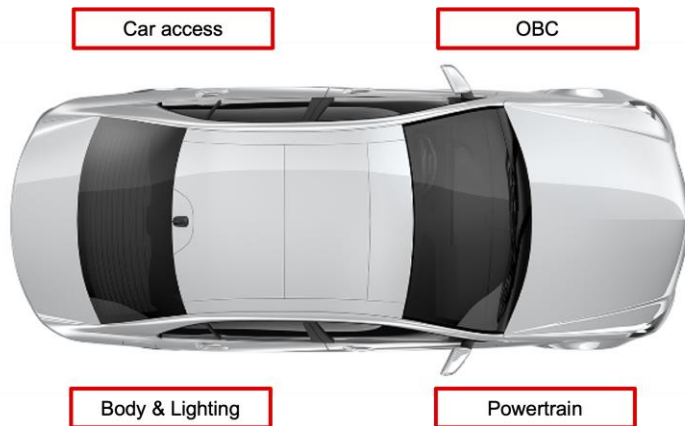
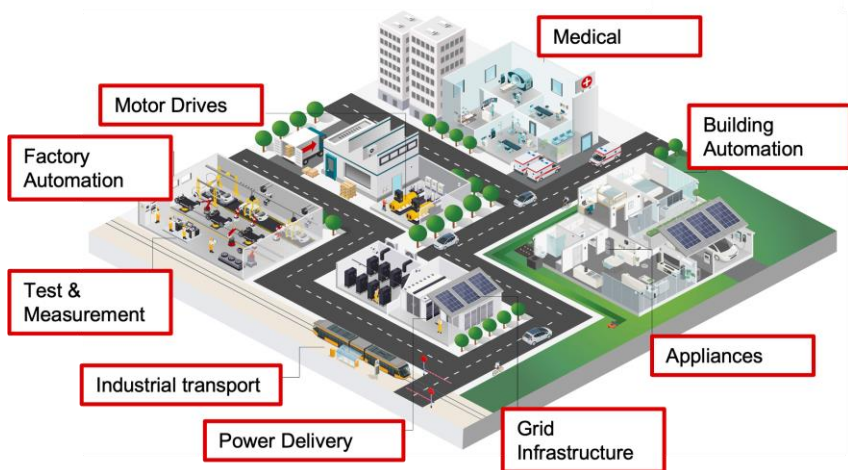
Best cost structure for microcontrollers with mix of digital, analog & memory

## 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



Pick a device optimized for your solution from a broad, pin-2-pin portfolio

# MSPM0 MCUs | scalable portfolio

Up to 125C Ta  
1.62-3.6V



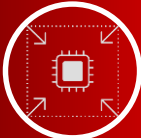
**M0G**  
*Best compute*

- 80MHz CPU
- CAN-FD options
- Fast 4MSPS sim-sam ADCs
- Math accelerator



**M0L**  
*Lowest power*

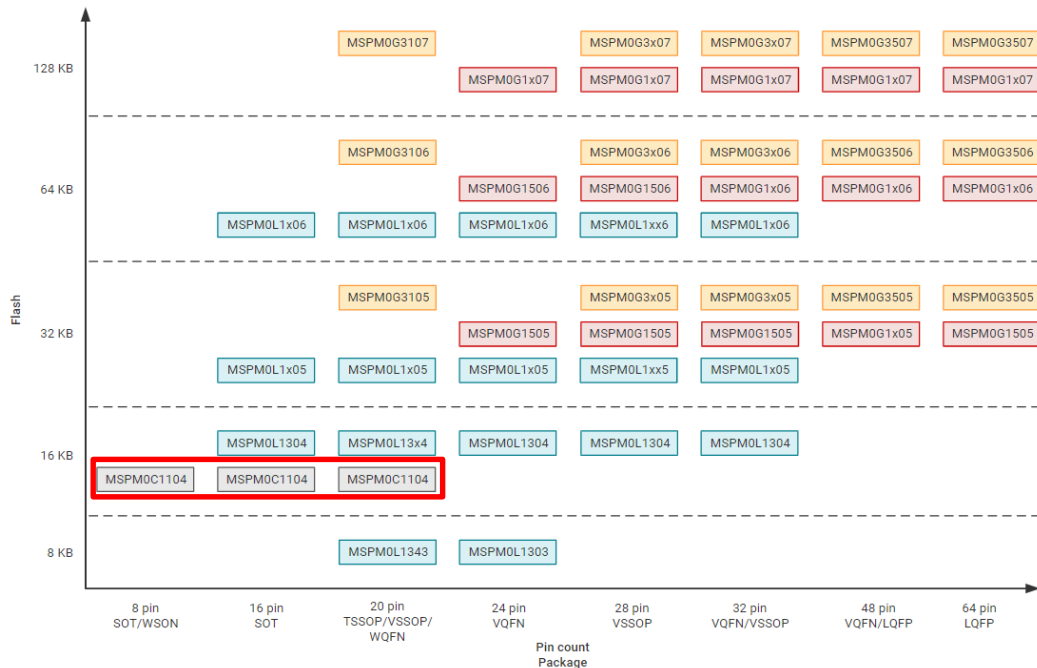
- 32MHz CPU
- 71µA/MHz (CoreMark run)
- 6µA-max standby at 85 °C
- 1µA-typ standby at 25 °C



**M0C**  
*Lowest cost*

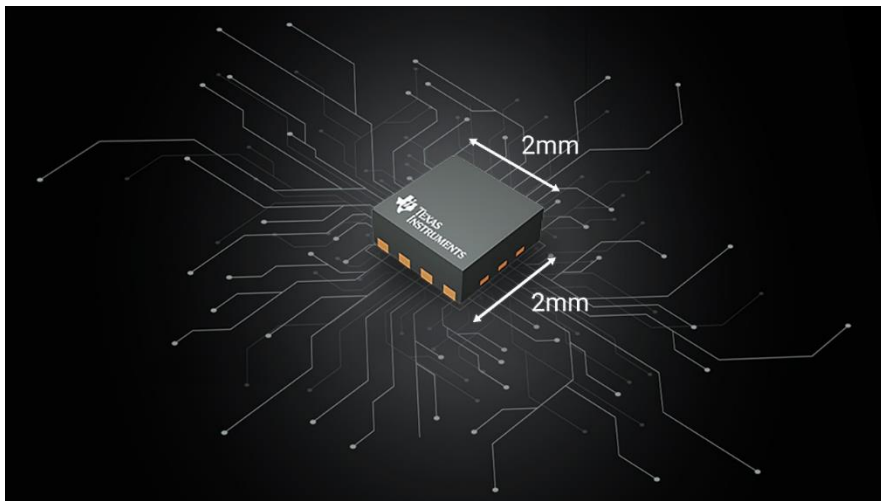
- 24MHz CPU
- Smallest QFN package (2x2)
- 0.5/0.65mm pitch packages
- Pin-compatible with industry

Unified software development kit & tools  
Pin-to-pin compatible in 10+ packages  
TI 65nm flash multi-sourced manufacturing





# MSPM0C MCUs | Room to do more



## 6 GPIOs

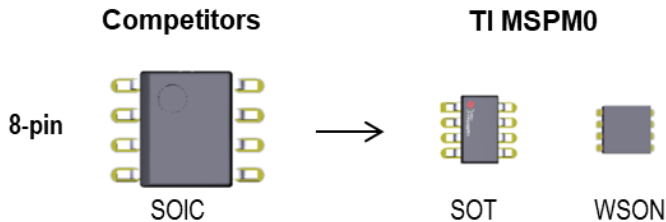
available with 8-pin WSON-DGS package

## 2x2 mm<sup>2</sup>

TI's smallest M0+ MCU package

## 7.35x Smaller

compared to common 8-pin SOIC



# MSPM0 software and tools ecosystem

*Rapidly develop with low-cost MSPM0 microcontrollers*



## MSPM0 SDK

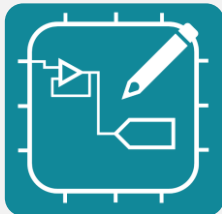
*Software, tools, and documentation to accelerate product development*



## MSPM0 LaunchPad

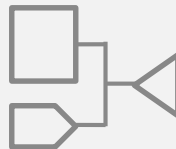
*An unconstrained prototyping platform*

**LP-MSPM0C1104** LaunchPads as low as **\$5.99**



## SysConfig & Analog Configurator

*Intuitive graphical configuration and code generation*



## TI MSPM0 Subsystems

*Subsystem design and software examples for common use-cases*

# MSPM0 C-Series MCUs | Broad applications

24 MHz low-cost MCU with up to 16kB flash, 20 pins, 12-bit ADC

## BUILDING & FACTORY AUTOMATION



Smoke detector



Gas detector



PIR sensor



Garage sensor



Field transmitter

## APPLIANCE



Coffee machine



Power tool



Vacuum cleaner



Dish washer

## PERSONAL ELECTRONIC



TWS



Stylus



E-toothbrush



Shaver



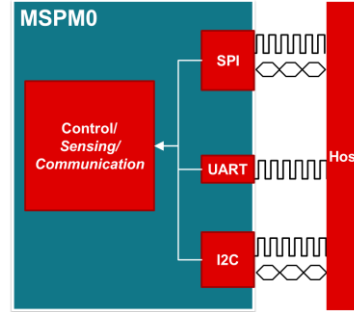
Printer



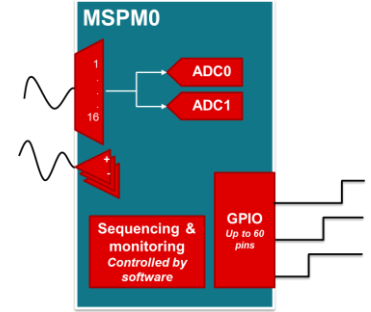
Wireless charger

## SUBSYSTEM

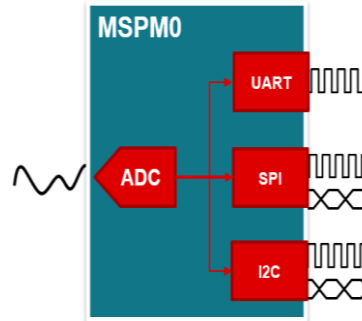
### > IO Expander



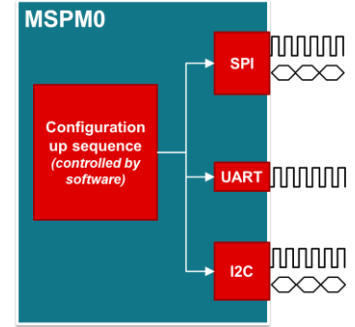
### > Power Sequencer/Voltage Supervisor



### > ADC to Comms Interface



### > System startup/configuration controller





# Subsystem Designs with MSPM0C MCUs

**Dennis Lehman**

MSP Applications Engineer

# Low cost ADC to SPI, I2C, UART

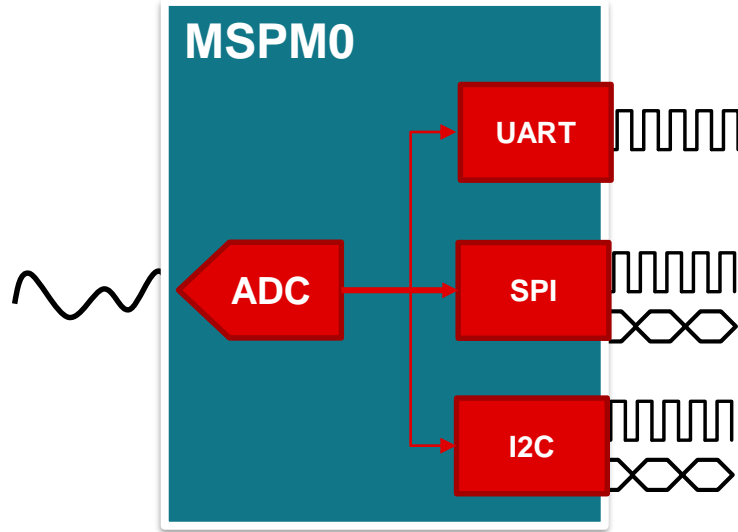
## Using low cost MSPM0 MCUs

### 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
  - [ADC to UART](#)
  - [ADC to I2C](#)
  - [ADC to SPI](#)
- Devices
  - [MSPM0G](#)
  - [MSPM0L](#)
  - [MSPM0C](#)

# I2C IO Expander

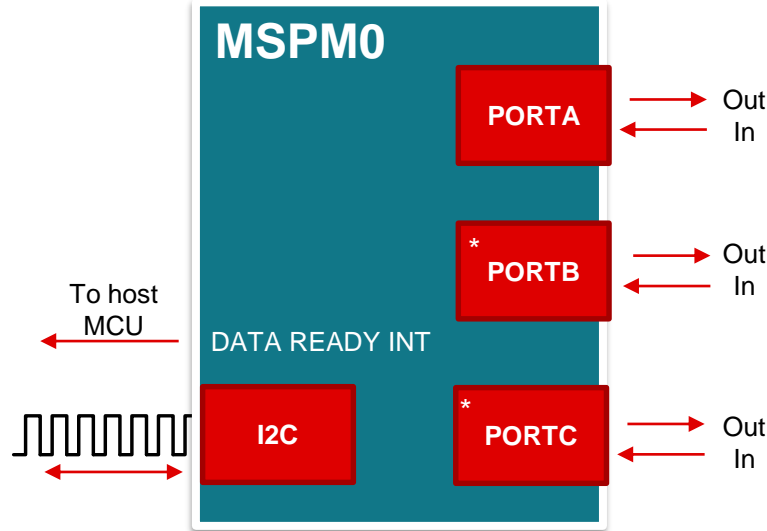
## Using low cost MSPM0 MCUs

### Functions

- GPIO Output – Pin addressable Set, Clear and Toggle
- GPIO Input – up to 32-bits
- Data ready interrupt to host MCU
- External input interrupts

### Advantages

- Extend host MCU GPIO functionality
- Effortless configuration using Sysconfig
- Supports any combination of IO pin configurations
- Leverage MSPM0 IO pin features
- Simple protocol



### Key questions

- Does your system need more GPIO?
- Present MCU not scalable?

### Key technicals

- I2C FM (400kHz), FM+ (1 Mbit/s)
- Number of available IO Ports is device dependent
- Low power operation

### Learn more

- Devices
  - [MSPM0G](#)
  - [MSPM0L](#)
  - [MSPM0C](#)

# Power sequencer and voltage supervisor

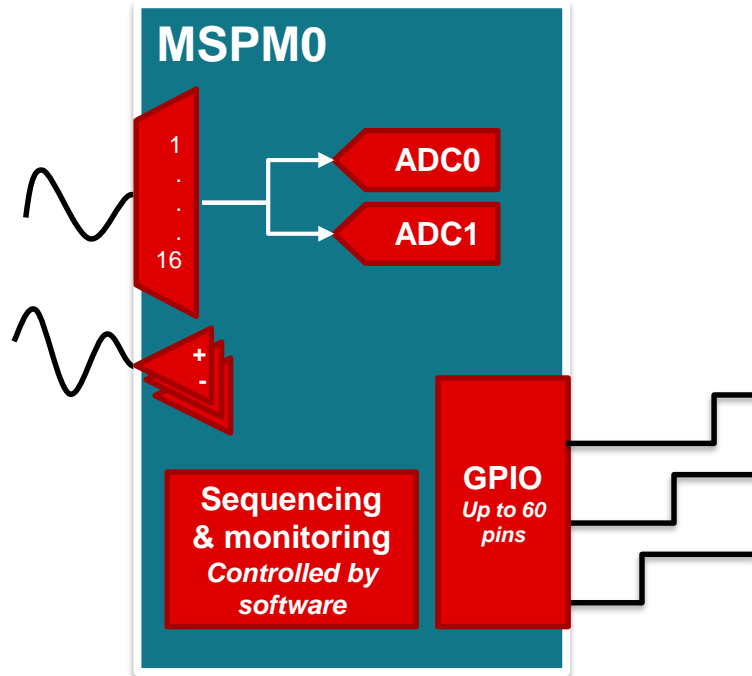
## Using low cost MSPM0 MCUs

### Functions

- Sequences power enables to correctly start system from power down.
- Acts as voltage supervisor to ensure proper system operation

### Advantages

- 200us cold boot time gets system started quickly
- Precise, cycle-by-cycle control of GPIO timing
- Up to 16 ADC input channels for voltage monitoring
- 3x comparators for high speed fault detection and reaction



### Key questions

- Does your system require power rail coordination?
- Does your system require voltage supervision?
- Is your system using a dedicated power rail sequencing device?

### Learn more

- SDK
  - [Power Sequencing](#)
- Devices
  - [MSPM0G](#)
  - [MSPM0L](#)
  - [MSPM0C](#)

# System startup/configuration controller

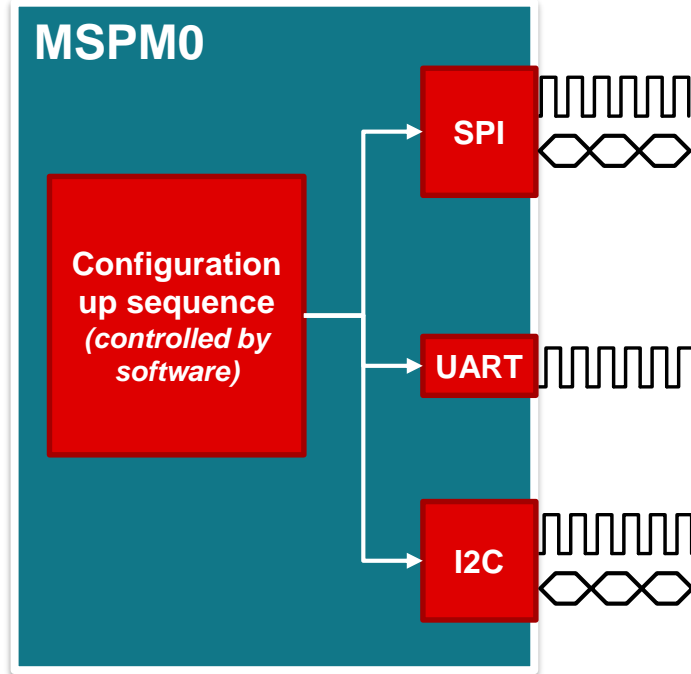
## Using low cost MSPM0 MCUs

### Functions

- MCU will do startup configuration of system via I2C, UART, and/or SPI

### Advantages

- 200us cold boot time gets system started quickly
- Fast data rates, multiple instances minimize system boot up time
  - 2x SPI up to 32MHz
  - 4x UART up to 10MHz
  - 2x I2C Fast-mode plus (1MHz)
- After configuration is finished MCU can perform other system tasks, or
- MCU can enter SHUTDOWN mode (50nA) to reduce system power.



### Key questions

- Does your system have a complex start up sequence?
- Does your system need to perform any initialization tasks on power up?
- Does your system use a start/configuration FPGA?

### Learn more

- Devices
  - [MSPM0G](#)
  - [MSPM0L](#)
  - [MSPM0C](#)

# Examples applications with MSPM0C MCUs

**Dennis Lehman**

MSP Applications Engineer

# Automotive lighting module

## Using low cost MSPM0C MCUs

### System information

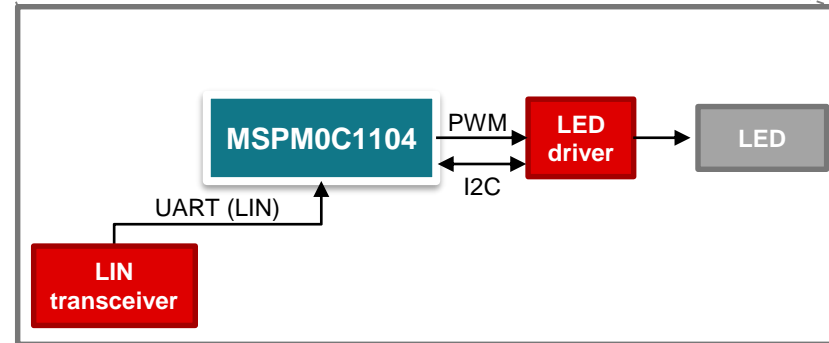
- Reliable communication interface for high-speed and off-board communication
- High-accuracy dimming functionality
- Optimized thermal performance in a small form factor

### MSPM0C features

- UART with LIN support
- Integrated ADC
- I2C and SPI communication interfaces
- Small packages



Color Code	
MSPM0C Component	
Analog Device	
User Interface	



# Shaver

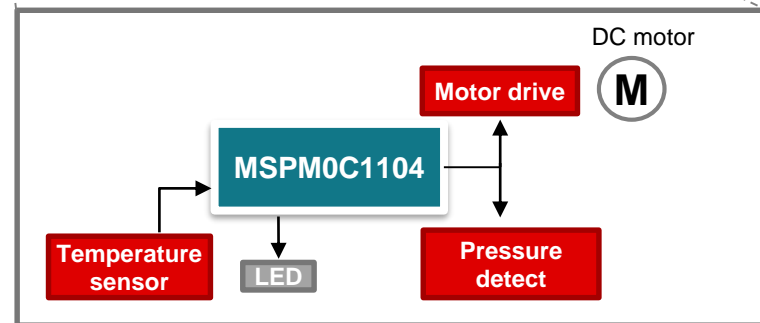
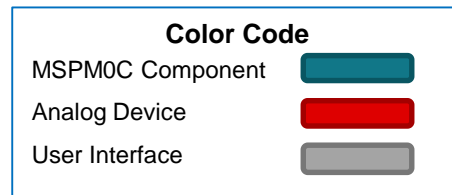
## Using low cost MSPM0C MCUs

### System information

- PWMs needed
- A few UART needed
- Motor voltage and current measurement
- NTC temperature measurement
- Buttons and LEDs

### MSPM0C features

- 16-bit Advanced timer for dead zone and fault detection
- 3-input Hall sensor mode for position sensing and speed computation
- Up to 10 channel ADC for voltage and current sensing
- DMA controller to boost ADC or other peripheral throughput
- Small packages





# Automotive window module

## Using low cost MSPM0C MCUs

### System information




- Control of powerful mechanism with sensitive anti-pinch detection
- Low-power dissipation while driving high-current loads
- Minimal conducted and radiated emissions
- Integrity of position information during brief battery supply transients

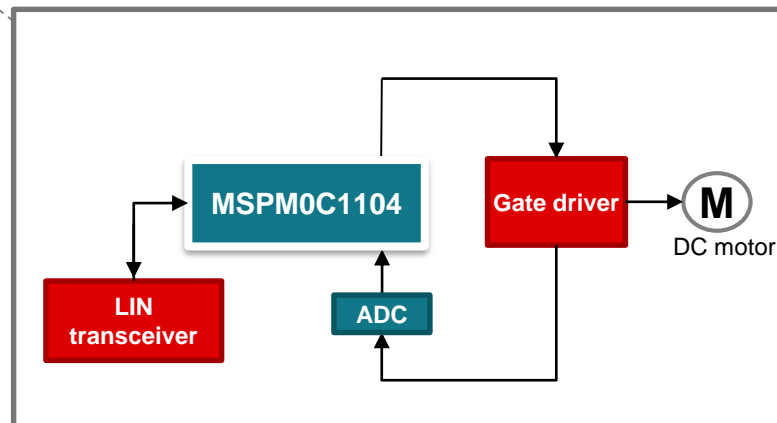
### MSPM0C features

- UART with LIN support
- Integrated ADC
- I2C and SPI communication interfaces
- Integrated temperature sensor
- Small packages



### Color Code

MSPM0C Component	
Analog Device	
User Interface	



# Getting started with MSPM0C MCUs

Tools & resources

*Live demo*

# Getting started

You can start evaluating this device leveraging the following:

Content type	Content title	Link to content or more details
Product information	MSPM0C1104 Product Page	<a href="#">MSPM0C Product Page</a>
Development tool or evaluation kit	MSPM0C1104 LaunchPad™ development kit	<a href="#">LaunchPad development kit</a>
Software	MSPM0 software development kit (SDK)	<a href="#">MSPM0-SDK</a>
Tool Page	Arm® Cortex ®-M0+ MCUs subsystems	<a href="#">MSPM0 Subsystem Tool Page</a>
Technical blog content or white paper	MSPM0Cx- Toothbrush and Shaver	<a href="#">App Brief</a>
Technical blog content or white paper	MSPM0 - Advanced Control Timer Helps for Better Control and Better Digital Output	<a href="#">App Note</a>
Tool Page	Simplified code migration	<a href="#">Tool Page</a>
Webinar Registration	Simplify your software efforts with MSPM0 MCU subsystems	<a href="#">Webinar on Tuesday, June 18<sup>th</sup>, 2024 Register Now!</a>



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