

MSPM0 MCUs: More Options, Unlimited Possibilities



Selecting the Right Microcontroller Does Not Have to be Complicated

Whether you are selecting an MCU to solve a new design challenge, determining the best scalable MCU family to use across a new product platform, or just re-designing an existing system to improve supply continuity and reduce costs, TI's [MSPM0 portfolio of Arm® Cortex®-M0+ MCUs](#) is built for you. MSPM0 is about more than just the microcontroller. MSPM0 is about delivering more system cost optimization, more code re-use, and enabling faster development- even when you are not an MCU expert. MSPM0 enables you to focus on what's really important: differentiating your own product and your end user experience.

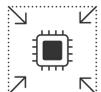
Designed with more than two decades of expertise in bringing the best analog and low power performance to more than 500 MCU products, TI's MSPM0 portfolio simplifies the hard work of cost optimization, future proofing, and platform porting to let you focus on the differentiating features of your products, and not on understanding your MCUs.

Take advantage of more options with 330+ cost optimized devices in a broadly scalable portfolio with the most comprehensive analog options in the industry and discover the unlimited possibilities for what you can quickly create with MSPM0 MCUs. Built with a multi-sourced 300mm wafer fabrication strategy that leverages TI's industry-leading investments in low power embedded flash internal manufacturing capacity, together with the smallest leaded packages in the industry, there is no reason to look elsewhere for your next MCU.



Broadly Scalable

- Three software compatible compute performance levels (24MHz, 32MHz and 80MHz)
- Pin-to-pin compatible across eight leaded and no-lead package options
- Scalable analog from basic ADCs up to dual ADCs with op amps, comparators, and DAC



Cost Optimized

- Built with TI's internal 65nm process technology for the lowest cost and power
- Smallest leaded 16-, 20-, and 28-pin packages in the industry (double the pin count in half the space)
- Zero-drift chopper-stabilized integrated op amps reduce bill of materials



Simple to use

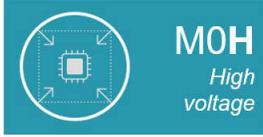
- Fully graphical configuration of peripherals, clocking, analog modules, pin MUX, and security
- Most optimized software driver library in the industry with more than 200 code examples
- Libraries addressing diagnostics, motor control, secure boot, wired communication, and more



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



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



- 32MHz CPU
- 4.5-5.5V supply voltage
- 0.5/0.65mm pitch packages
- Pin-compatible with industry



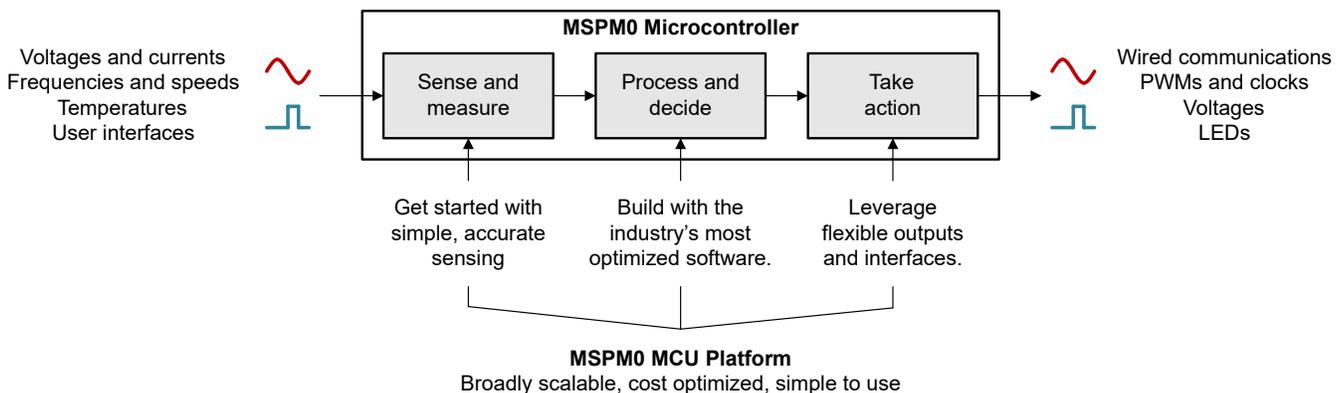
- 24MHz CPU
- Smallest package (1.38mm²)
- 0.5/0.65mm pitch packages
- Pin-compatible with industry

Platform features

- Powerful Arm Cortex-M0+ 32-bit processor
- Automotive Q100 enabled
- Broad 1.62- to 3.6V supply (1.8 or 3.6V with 10% tolerance), or 4.5- to 5.5V supply
- All 5V I/Os in 5V MSPM0H family
- Up to -40 to 125°C operating temperature range
- Flexible 1µA 32kHz standby mode with full SRAM retention
- Ultra-low power segmented LCD controller supporting up to 8×51 and 4×55 LCD displays
- Up to 1% accurate on-chip high frequency oscillator
- Available 5V-tolerant open-drain and 20mA high-drive I/O in 3.3V variants
- 32MHz fast clock wake from standby in less than 4.5µs
- 11.2 effective number of bits from SAR ADCs
- First zero-drift chopper stabilized op amps in an MCU on the industry
- Available ECC on flash memory and SRAM
- Secure boot capable with flexible device security modes

MCU Fundamentals: Done Better, at the Lowest Cost

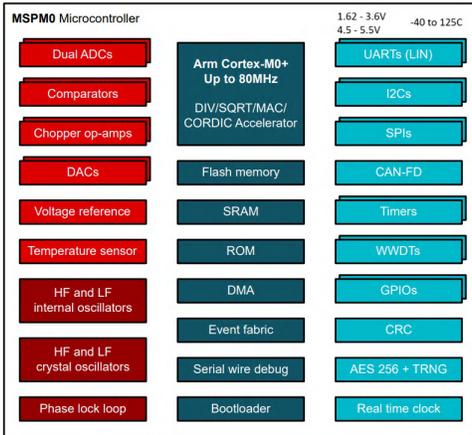
In an embedded system, MCUs have three core responsibilities: the MCUs must accurately and reliably measure the real world, process measurement data to make critical decisions, and act on the decisions with output modules or communication interfaces. This combination of critical functions in one integrated circuit makes device selection challenging. Choosing an MCU that does all three aspects well often brings negative trade-offs in scalability, cost, or ease-of-use. TI's [Broadly Scalable](#), [Cost Optimized](#), and [Simple to Use](#) portfolio of MSPM0 MCUs is all about doing all three core responsibilities of an MCU better without compromises, enabling unlimited possibilities.



MCU application requirements also evolve over time. New projects often require changes to support cost reduction, the addition of a new feature, or improved supply continuity. The broad scalability of the MSPM0 takes engineers from the starting point all the way to the destination with hardware and software re-use, whether the destination requires a lower cost device or a higher performance device. Developed from the ground up for both pin-to-pin compatibility and software compatibility, MSPM0 enables designers to not only scale across flash memory options but also across the broadest range of analog peripherals, digital peripherals, and compute performance.

More options.

Unlimited possibilities.



Appliances: Implement everything from simple sensor and user interface modules up to FOC motor drives

Building automation: Leverage on-chip analog and low-power architecture to enable more accurate building security and fire safety systems

Factory automation: Design with the smallest package sizes and support for 125°C ambient temperature with scalable memory options

Grid infrastructure: Industry-leading cold start-up time for circuit monitoring applications, pairable with TI metrology front-end for energy metering and monitoring

Lighting: Add support for the DALI protocol, build with FreeRTOS, and leverage up to 100,000 flash program-erase cycles for data storage

Medical: Reduce bill of materials in health monitoring applications with integrated chopper amplifiers

Motor drives: Implement trapezoidal and FOC algorithms with more CPU performance to process data from faster and more accurate ADCs

Power delivery: Integrate low-side current sensing for programmable charging and gauging applications

Wired communication: Bridge CAN-FD, LIN, DALI, Smart card, Manchester, IrDA, SM-BUS, 1-wire, and more

Start your next MCU design with MSPM0 MCUs and get to market faster and at the lowest cost, while building on top of the most optimized software and largest investment in low-cost MCU manufacturing capacity in the industry.

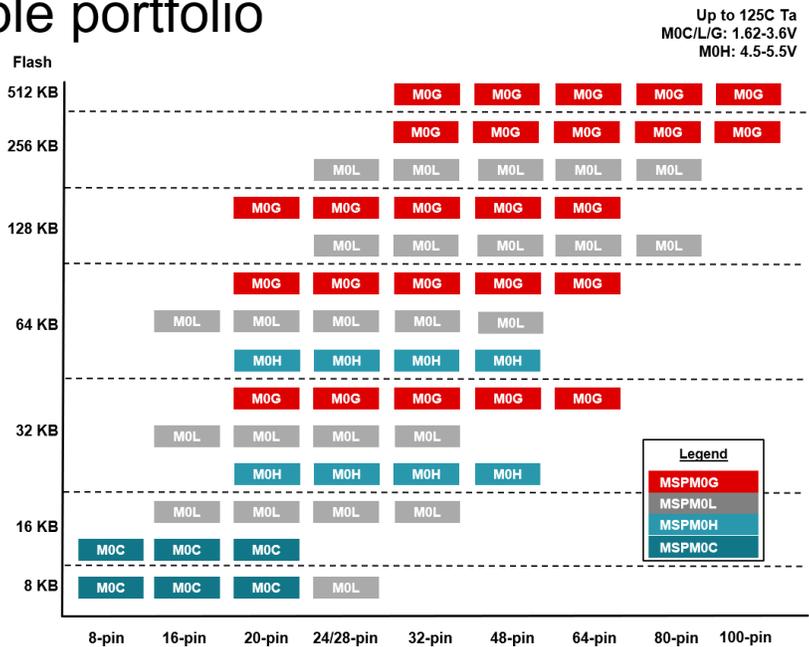
Broadly Scalable

Get the most out of your hardware and software investments with pin-to-pin compatibility and software compatibility. From basic, low pin count 24MHz MSPM0C MCUs to more integrated MSPM0L13xx 32MHz MCUs and MSPM0G350x 80MHz MCUs with CAN-FD and the best analog, MSPM0 has a feature set optimized for every application.

MSPM0 MCUs | Scalable portfolio

- 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
- M0H High voltage**
 - 32MHz CPU
 - 4.5-5.5V supply voltage
 - 0.5/0.65mm pitch packages
 - Pin-compatible with industry
- M0C Lowest cost**
 - 24MHz CPU
 - Smallest package (1.38mm²)
 - 0.5/0.65mm pitch packages
 - Pin-compatible with industry

Unified software development kit & tools
Pin-to-pin compatible in 15+ packages
TI 65nm flash multi-sourced manufacturing



Future-proofed for increased compute	<ul style="list-style-type: none"> • Scale from 24MHz up to 80MHz when applications require more performance • Available acceleration for divide, square root, multiply-accumulate, and trigonometric functions • Execute from flash memory at 80MHz with just two wait states, enabling a > 20% compute performance increase compared with competing designs limited to two wait states at just 64MHz
Broad memory and package options More information	<ul style="list-style-type: none"> • Start from just 8KB and scale up to 128KB of on-chip flash, with up to 32KB of single-cycle, low-power SRAM • MSPM0 G-series MCUs enable CAN-FD with 128KB flash in the industry's smallest 20-pin leaded package • 16-pin leaded SOT package provides twice the number of pins in half the PCB area of competing SOIC-8 MCUs
Industry leading analog in three scalable levels More information	<ul style="list-style-type: none"> • For basic applications, MSPM0 enables simple, accurate sensing with fast and accurate 12-bit SAR ADCs featuring convenient functions including a window comparator and hardware averaging (up to 14-bit result) • The MSPM0L13xx family adds a comparator and the first zero-drift, chopper-stabilized op amps in an MCU in the industry, enabling designers to eliminate more PCB components without compromising on accuracy • MSPM0G150x and MSPM0G350x families provide dual, simultaneous sampling SAR ADCs, three fast comparators, two zero-drift chopper-stabilized op amps, and a 12-bit voltage DAC

Cost Optimized

With MSPM0 MCUs, designers can reduce costs at both the component level and system level without compromising on performance and flexibility.

Internal manufacturing More information	<ul style="list-style-type: none"> • The MSPM0 platform leverages TI's internal 65-nm low power flash process technology to enable the lowest cost MCUs with more chips per wafer than competing MCUs • Wafer fabrication is multi-sourced with both TI internal fab and external foundry capacity for supply continuity • Highly optimized, TI internal final assembly and test facilities and techniques enable reduced cost
Reduced package and PCB costs More information	<ul style="list-style-type: none"> • Optimized silicon enables the use of smaller, cost effective packages not previously possible for MCUs, including small-outline transistor (SOT-23-THN) and very-thin shrink small outline package (VSSOP) • SOT-23-THN packages provide double the number of pins in less than half of the PCB area of competing small-outline integrated circuit (SOIC) packaging, enabling smaller, lower cost PCB assemblies
Affordable analog performance More information	<ul style="list-style-type: none"> • With the industry's first chopper-stabilized op amps integrated into an MCU, it's now possible to simplify designs by bringing the analog signal chain into the MCU, without compromising on performance • MSPM0 chopper-stabilized op amps provide $\leq \pm 0.5\text{mV}$ of input offset drift across the -40 to 125°C operating range, significantly reducing measurement error in high gain applications; with a flexible on-chip analog interconnect, it's possible to create a wide variety of analog circuits, including inverting/non-inverting amplifiers, buffers, PGAs (from 1X to 32X gain), and differential or cascaded amplifier topologies • MSPM0G MCU families offer dual, simultaneous-sampling 4Msps 12-bit SAR ADCs with internal hardware averaging to enable 14-bit 250-ksps sampling for applications requiring higher precision monitoring of voltages and currents, often eliminating the need for a discrete ADC

Delivering Geopolitically Dependable Supply

Our investments in new 300mm wafer fabs provide scale, efficiency and quality for devices like our MSPM0 MCUs, helping support our customers for decades to come. Learn more at ti.com/manufacturing.



Cost Optimized, Small Leaded Packages

With optimized SOT-23-THN and VSSOP packages, designers get double the pins in half the PCB area of competing designs, saving package cost, and PCB space.



Simple to Use

Time to market can be just as important as device cost when building embedded systems for cost constrained products. MSPM0 MCUs are supported by a comprehensive development ecosystem including TI developed and third-party software and tools to make releasing a product a snap. Go from [idea to product rapidly](#) with MSPM0 MCUs.

MSPM0 Development Ecosystem

Graphical configuration
[More information](#)

- TI SysConfig graphical configuration environment enables simple configuration of MSPM0 devices, including:
 - Pin multiplexing with real-time conflict management and code generation
 - Configuration of all MSPM0 peripheral modules with driver initialization code generation
 - Visual clock system configuration to resolve clock dependencies
- TI Analog Configurator for rapidly setting up analog signal chains inside MSPM0 MCUs and visualizing measurement results in real time

Optimized software development kit (SDK)

- Comprehensive, unified software development kit supporting all MSPM0 MCUs with a common framework
- Support for bare metal, peripheral driver abstraction, and RTOS development models
- Most optimized peripheral drivers in the industry (one-third the code size of competing low level drivers on average) enables use of MSPM0 driver library even with small flash memory devices or in performance constrained applications
- Comprehensive middleware libraries and tools for a variety of applications:
 - Motor control libraries (FOC-based BLDC, sensored trapezoidal, brushed DC, and stepper motors)
 - Energy metering and monitoring library (including metrology computation and ADC interfacing)
 - Comprehensive safety diagnostics library (IEC 60730 Class-B)
 - Optimized secure boot library (public key cryptography with optimized SHA256)
 - Wired communication examples for LIN, SMBus, DALI, 1-Wire, and more
- Built-in support for FreeRTOS real-time operating system
- More than 200 code examples for quickly getting started with peripherals

Rapid prototyping	<ul style="list-style-type: none"> • MSPM0 C-series 24MHz 16KB flash LaunchPad hardware development kit (LP-MSPM0C1104) • MSPM0 C-series 32MHz 64KB flash LaunchPad hardware development kit (LP-MSPM0C1106) • MSPM0 L-series 32MHz 64KB flash, OPA, COMP, LaunchPad hardware development kit (LP-MSPM0L1306) • MSPM0 H-series 32MHz 5V, 64KB flash LaunchPad hardware development kit (LP-MSPM0H3216) • MSPM0 G-series 80MHz 128KB flash LaunchPad hardware development kit (LP-MSPM0G3507) • MSPM0 G-series 80MHz 512KB flash LaunchPad hardware development kit (LP-MSPM0G3519) • MSPM0 L-series 32MHz 256KB flash, LCD, LaunchPad hardware development kit (LP-MSPM0L2228) • MSPM0 L-series 32MHz 128KB flash LaunchPad hardware development kit (LP-MSPM0L1117)
Reference designs & subsystems	<ul style="list-style-type: none"> • TI application reference designs for power delivery, grid infrastructure, factory automation, medical, appliances, and more • Simple MSPM0 subsystem references covering broad use-cases including: ADC+DMA, amplifier topologies, 5V logic interfacing, PWM LED driver, PWM DAC, serial protocol conversion, system supervision, and more
Broad IDE & tool support	<ul style="list-style-type: none"> • Supported by TI's Code Composer Studio (CCS) integrated development environment • Full third party support available for IAR Embedded Workbench (EW) for Arm and Keil MDK environments • Supported by the TI XDS-110, Segger J-Link and Elprotronic C-GANG programming tools • Host-side framework for interfacing to MSPM0 bootstrap loader (BSL) for device programming
Comprehensive training	<ul style="list-style-type: none"> • TI MSPM0 Academy modules provide step-by-step training on how to get the most out of each MSPM0 peripheral for your application • TI Precision Labs modules provide in-depth training on microcontroller applications and technology • Master hardware development with hardware design guides for MSPM0 G-series, L-series, C-series • Extracting the maximum battery life using low power optimization guides for MSPM0 G-series and L-series • Understand cybersecurity features of MSPM0 MCUs with cybersecurity feature guide
Migration guides	<ul style="list-style-type: none"> • Migrate applications from STM32 to MSPM0 with a simple migration guide • Pin to Pin Migrate applications from STM8S003 to MSPS003 with a simple migration guide

With the MSPM0 development ecosystem, you do not need to be an MCU expert or an analog design expert to get the most out of your MCU. Get started today with a MSPM0 LaunchPad evaluation kit from [MSPM0 product page](#) and discover the unlimited possibilities for what you can rapidly prototype and create with MSPM0 MCUs from Texas Instruments.

Explore the MSPM0 MCU portfolio online today at [TI.com](#).

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