Application Note

M0L or M0G: How to Pick the Right MSP Microcontroller for Your Application

ABSTRACT

One of the main features of the MSPM0 platform is its scalability. Every device with the MSPM0 prefix that has the same package and pin-count is pin-to-pin compatible for drop-in replacements. This provides a high level of flexibility, as when you begin designing with a particular MCU, you can always swap it out if your MCU requirements change further on in the design phase without having to make any changes to the board. Additionally, if the next generation of your product requires more features in the MCU, you can upgrade it and just drop it on to your new board.

Now, this scalability presents a considerable amount of options. How do you pick the right one for your application? Let's start with some basic MCU features. The main difference between MSPM0L and MSPM0G is the CPU speed:

- M0L devices have a max frequency of 32 MHz
- M0G devices have a max frequency of 80 MHz

If your application requires the MCU to be faster than 32 MHz, then an M0G device is where you want to start. The following figure and table provide a quick comparison of some of the different offerings.

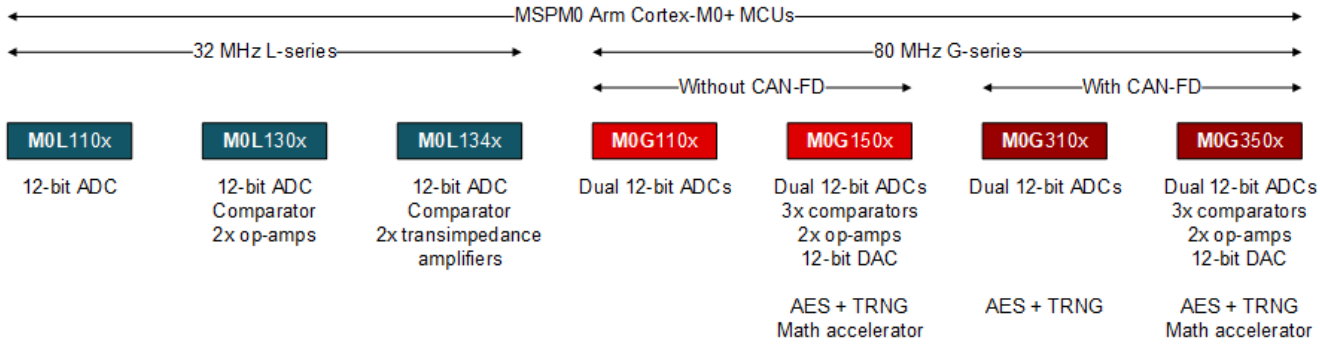

Figure 1-1. MSPM0 Microcontrollers

Device	CPU Speed [MHz]	Flash [KB]	SRAM [KB]	Analog Level	Special Features
MSPM0L110x	32	32, 64	4	Low	
MSPM0L130x(1)	32	8, 16, 32, 64	2, 4	Low	Zero-drift op-amps
MSPM0L134x	32	8, 16, 32, 64	2, 4	Medium	Dual transimpedance amplifiers, zero-drift op-amps
MSPM0G110x	80	32, 64, 128	16, 32	Low	
MSPM0G150x	80	32, 64, 128	16, 32	High	Zero-drift op-amps
MSPM0G310x(1)	80	32, 64, 128	16, 32	Low	CAN-FD, zero-drift op-amps
MSPM0G350x(1)	80	32, 64, 128	16, 32	High	CAN-FD, zero-drift op-amps

(1) Includes AEC-Q100 qualified options

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1 MSPM0L

Let's say 32 MHz is fast enough for your application. Now, how much memory do you need? M0L devices typically have less memory than M0G devices. M0L devices with expanded memory are planned, but for now the nonvolatile memory ranges from 8KB to 64KB of flash and 2KB to 4KB of SRAM. If this is within your requirements then we're still in good shape with M0L.

Another basic specification is the GPIO count, which is driven by the pin-count of the MCU. For now, the maximum pin count for an M0L MCU is 32 pins, which allows for up to 28 GPIOs.

With the basic requirements out of the way, let's take a look at some other features the M0L has to offer. For now, we can break this down into two subfamilies: MSPM0L110x and MSPM0L13xx. The following figure and table provide a legend for reading the complete device name in the M0L110x subfamily.

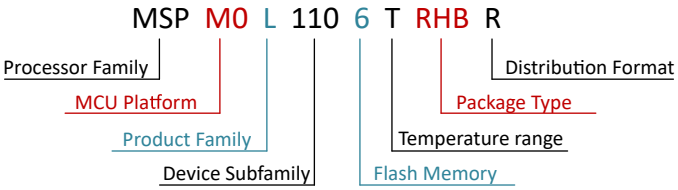

Figure 1-1. Device Nomenclature

Processor Family	MSP = Mixed-signal processor
MCU Platform	M0 = Arm® based 32-bit M0+
Product Family	L = 32-MHz frequency
Device Subfamily	110 = ADC
Flash Memory	5 = 32KB 6 = 64KB
Temperature Range	T = –40°C to 105°C S = –40°C to 125°C
Package Type	DYY = SOT-16 DGS20 = VSSOP-20 RGE = VQFN-24 DGS28 = VSSOP-28 RHB = VQFN-32
Distribution Format	T = Small reel R = Large reel No marking = Tube or tray

Do you need a general purpose MCU for low- to mid-end applications? MSPM0L1105 has:

- 32KB flash (4KB SRAM)
- 1 12-bit, 1-MSPS SAR ADC
- 2 UART (1 with LIN)
- 1 SPI
- 1 I2C

Need more memory? MSPM0L1106 is the exact same except with 64KB flash.

Now let's take a look at MSPM0L13xx. The following figure and table provide a legend for reading the complete device name in the M0L13xx subfamily.

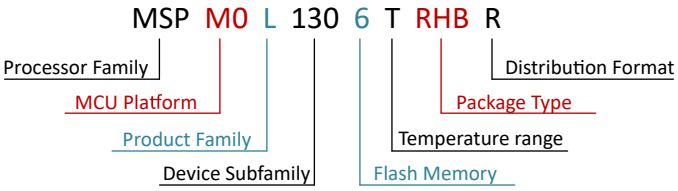

Figure 1-2. Device Nomenclature

Processor Family	MSP = Mixed-signal processor
MCU Platform	M0 = Arm® based 32-bit M0+
Product Family	L = 32-MHz frequency
Device Subfamily	130 = ADC, 2x OPA, COMP 134 = ADC, 2x OPA (10-pA input bias current), COMP
Flash Memory	3 = 8KB 4 = 16KB 5 = 32KB 6 = 64KB
Temperature Range	T = –40°C to 105°C S = –40°C to 125°C Q =–40°C to 125°C, AEC-Q100 qualified
Package Type	DYY = SOT-16 DGS20 = VSSOP-20 RGE = VQFN-24 DGS28 = VSSOP-28 RHB = VQFN-32
Distribution Format	T = Small reel R = Large reel No marking = Tube or tray

This subfamily presents more analog integration, an increased temperature range, AEC-Q100 automotive qualified options, and more memory options. Let's say your application needs some precision analog components for sensing. MSPM0L1306 provides:

- 64KB flash (4KB SRAM)
- 1 12-bit, 1-Msps SAR ADC
- 2 UART (1 with LIN)
- 1 SPI
- 2 I2C
- 2 zero-drift chopper op-amps
- 1 8-bit reference DAC
- 1 comparator

MSPM0L1346 provides the same as above, but also offers support for transimpedance amplifier configurations.

The main differences between MSPM0L110x and MSPM0L13xx is that MSPM0L13xx has more integrated analog, while MSPM0L110x is more of a general-purpose MCU. However, these MCUs share a lot of the same packages and pin-counts and are pin-to-pin compatible with each other. You can begin a design with one, and then just drop in a different one later on if needed.

2 MSPM0G

Now, let's restart the MCU selection process, and say your application requires an MCU with a frequency faster than 32 MHz. In this case, you will need something from the M0G family. The M0G family was designed for applications that require a lot of computation, so it boasts higher frequency, higher memory, more advanced analog integration, and higher pin counts than the M0L family. It also has advanced timers and a math accelerator for motor control applications, and a real time clock (RTC).

It will be expanded in the future, but for now the nonvolatile memory ranges from 32 to 128KB flash, and SRAM is 16 to 32KB. For GPIOs, the pin count is up to 64 pins for now, which allows for up to 60 GPIO.

We can break M0G further down into subfamilies to take a look at some other features it has to offer: MSPM0Gx10x, and MSPM0Gx50x. The following figure and table provide a legend for reading the complete device name in the M0Gx10x subfamily:

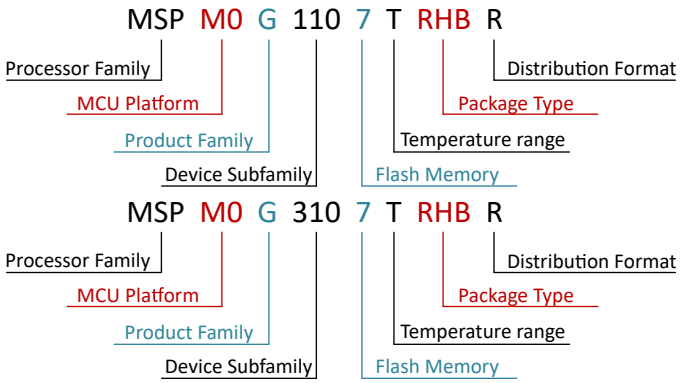

Figure 2-1. Device Nomenclature

Processor Family	MSP = Mixed-signal processor
MCU Platform	M0 = Arm® based 32-bit M0+
Product Family	G = 80-MHz frequency
Device Subfamily	110 = 2x ADC 310 = 2x ADC, CAN-FD
Flash Memory	5 = 32KB 6 = 64KB 7 = 128KB
Temperature Range	T = –40°C to 105°C S = –40°C to 125°C Q =–40°C to 125°C, AEC-Q100 qualified
Package Type	RGE = VQFN-24 DGS28 = VSSOP-28 RHB = VQFN-32 PT = LQFP-48 PM = LQFP-64
Distribution Format	T = Small reel R = Large reel No marking = Tube or tray

Do you need a general purpose MCU with a lot of memory? MSPM0G1107 has:

- 128KB flash (32KB SRAM)
- 2 12-bit, 4-MSPS SAR ADC
- 4 UART (1 with LIN)
- 2 SPI
- 2 I2C

- 3 16-bit advanced timers
- 1 24-bit high resolution timer
- RTC
- Math accelerator

MSPM0G3107 has the exact same features, but with an addition of CAN-FD and automotive AEC-Q100 qualified options.

Do you need a similar MCU but with more integrated analog? A device in the M0Gx50x subfamily may fit your needs. The following figure and table provide a legend for reading the complete device name in the M0Gx50x subfamily:

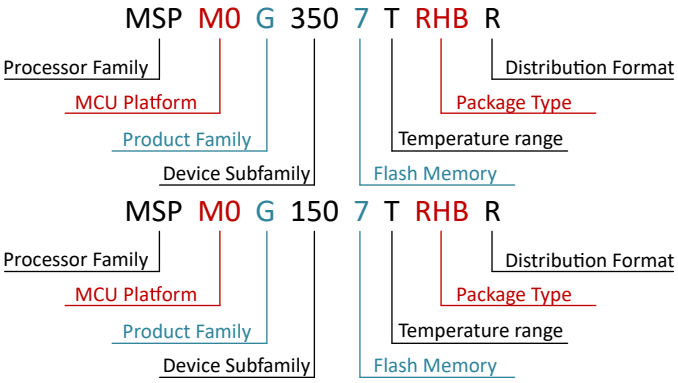

Figure 2-2. Device Nomenclature

Processor Family	MSP = Mixed-signal processor
MCU Platform	M0 = Arm® based 32-bit M0+
Product Family	G = 80-MHz frequency
Device Subfamily	150 = 2x ADC, 2x OPA, 3x COMP 350 = 2x ADC, 2x OPA, 3x COMP, CAN-FD
Flash Memory	5 = 32KB 6 = 64KB 7 = 128KB
Temperature Range	T = –40°C to 105°C S = –40°C to 125°C Q =–40°C to 125°C, AEC-Q100 qualified
Package Type	RGE = VQFN-24 DGS28 = VSSOP-28 RHB = VQFN-32 PT = LQFP-48 PM = LQFP-64
Distribution Format	T = Small reel R = Large reel No marking = Tube or tray

MSPM0G1507 has similar features of MSPM0G1107, but with the addition of advanced, integrated, precision analog:

- 3 comparators
- 1 12-bit 1-MSPS buffered DAC
- 3 8-bit reference DACs
- 2 zero-drift chopper op-amps

MSPM0G3507 is the same as MSPM0G1507, except it includes CAN-FD and AEC-Q100 automotive qualified options.

MSPM0G3507 has:

- 128KB flash (32KB SRAM)
- 2 12-bit 4-Msps SAR ADC
- 4 UART (1 with LIN)
- 2 SPI
- 2 I2C
- 3 16-bit advanced timers
- 1 24-bit high resolution timer
- RTC
- Math accelerator
- 1 CAN-FD
- 3 comparators
- 1 12-bit 1-MSPS buffered DAC
- 3 8-bit reference DACs
- 2 zero-drift chopper op-amps

The main differences between MSPM0Gx10x and MSPM0Gx50x is that MSPM0Gx50x has more integrated analog, while MSPM0Gx10x is more of a general-purpose MCU. However, both families have variants that support CAN-FD and have automotive AEC-Q100 qualified options. These MCUs share a lot of the same packages and pin-counts and are pin-to-pin compatible with each other as well. You can begin a design with one, and then just drop in a different one later on if needed.

3 Summary

To summarize the differences, if you need a low memory, low pin count, general purpose MCU with options for integrated analog, then an MCU from the M0L family would best fit your needs. If you need something with higher memory, higher pin count, advanced analog, and more computation, then you can consider an MCU from the M0G family. However, regardless of family and subfamily, MCUs with the same package and pin count are pin-to-pin compatible. So, if you ever change your mind about your selection and need more or less features out of your MCU, you can always swap it out without having to make any hardware or software changes.

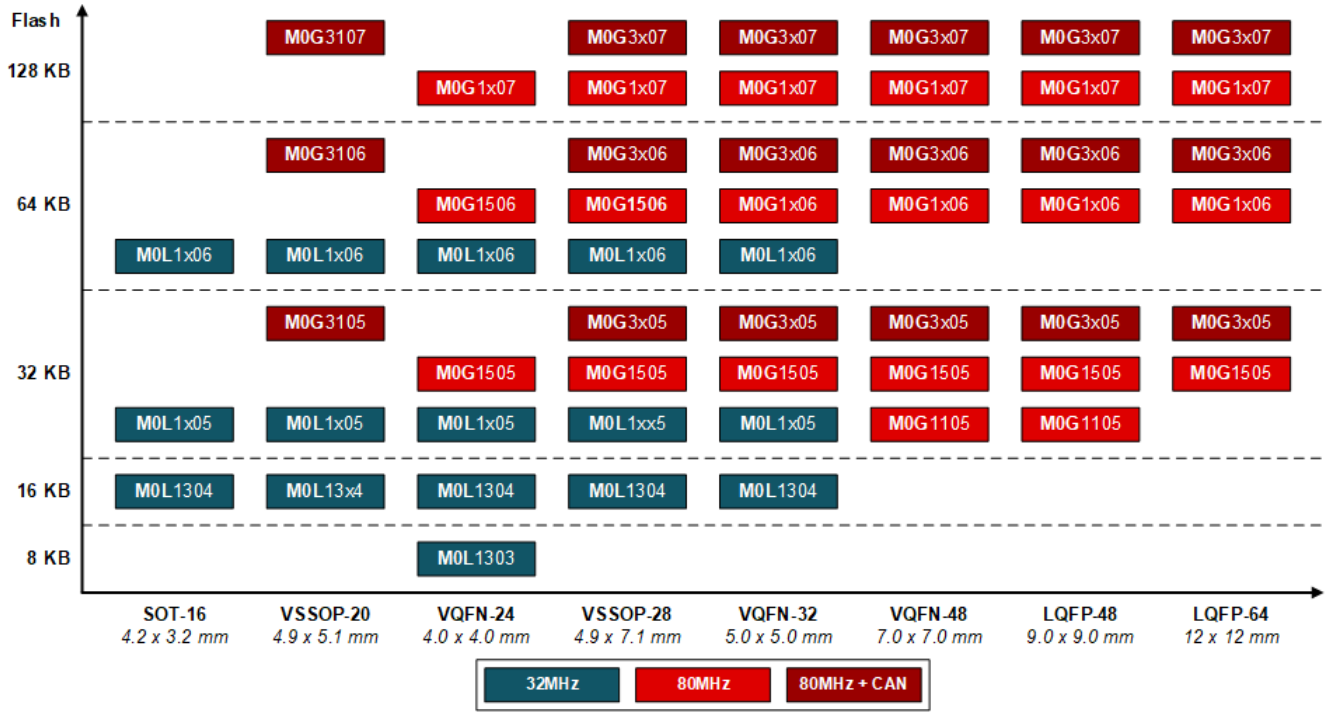

Figure 3-1. Device Selection

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