MSPM0 ADC module introduction

—— **MSPM0 peripheral training series**

Presented by Yuhao Zhao

TEXAS INSTRUMENTS

MCU level overview

——MSPM0Lxx series

MSPM0L13x3/4/5/6

1.62 - 3.6V
-40 to 125 C

CPU
ARM Cortex-M0+
32 MHz

NVIC / 3-ch DMA

On-chip Memory
8, 16, 32 or 64 kB flash
2 or 4 kB SRAM

Data Integrity & Security
CRC accelerator (16 and 32 bit)

Programming & Debug
ARM SWD interface
ROM UART & I2C BSL

Power & Clocking
POR / BOR / SVS
Internal LF 32kHz (5%)
Internal HF 4-32MHz (1%)

Communication
UART w/ LIN (1)
UART (1)
SPI (1)
I2C (2) w/ FastMode+

IO
Up to 28 GPIO
Up to 2 low Ib OPA inputs

Precision Analog
12-bit SAR ADC 1Msps (1)
ULP/HS Comparator (1)
8-bit reference DAC (1)
Zero-drift chopper op-amps (2)
General purpose amp (1)
Internal ADC reference (2.5%)
Temperature sensor

Timers
General purpose 16-bit 2 CC (4)
Windowed watchdog

Leaded packages: SOT-16, VSSOP-20/28
No-lead packages: WQFN-16, VQFN-24/32

32 MHz MCU with up to 64kB flash, 32 pins, 12-bit ADC, dual zero-drift OPA/PGA, COMP

——MSPM0Gxx series

MSPM0G350x/310x/150x/110x

1.62 - 3.6V
-40 to 125 C

CPU
Arm Cortex-M0+
80 MHz

NVIC / MPU / 7-ch DMA

Accelerators
Math (DIV, SQRT, TRIG, MAC)

On-chip Memory
32, 64, or 128 kB flash [ECC]
16 or 32 kB SRAM [ECC]

Data Integrity & Security
CRC accelerator (16 and 32 bit)
AES256 accelerator + TRNG

Programming & Debug
ARM SWD interface
UART & I2C bootloader

Power & Clocking
POR / BOR / SVS
External LF 32kHz XTAL
External HF 4-48MHz XTAL
Internal LF 32kHz (3%)
Internal HF 4-32MHz (1%)
PLL (up to 80 MHz)

Communication
UART w/ LIN (1)
UART (3)
SPI (2)
I2C (2) w/ FastMode+
CAN-FD (1)

IO
Up to 60 GPIO

Precision Analog
12-bit ADC 4Msps (9-ch)
12-bit ADC 4Msps (8-ch)
Comparators w/ 8-bit DACs (3)
12-bit 1Msps buffered DAC (1)
Zero-drift chopper op-amps (2)
Internal reference (1.5%)
General purpose amp (1)
Temperature sensor

Timers
Advanced control 16-bit 4 CC (1)
Advanced control 16-bit 2 CC (1)
General purpose 32-bit 2 CC (1)
General purpose 16-bit 2 CC (2)
Low power 16-bit 2 CC (2)
Windowed watchdog (2)
Real-time clock (1)

Leaded packages: VSSOP-20/28, LQFP-48/64
No-lead packages: VQFN-24/32/48, nFBGA-64, WCSP-28

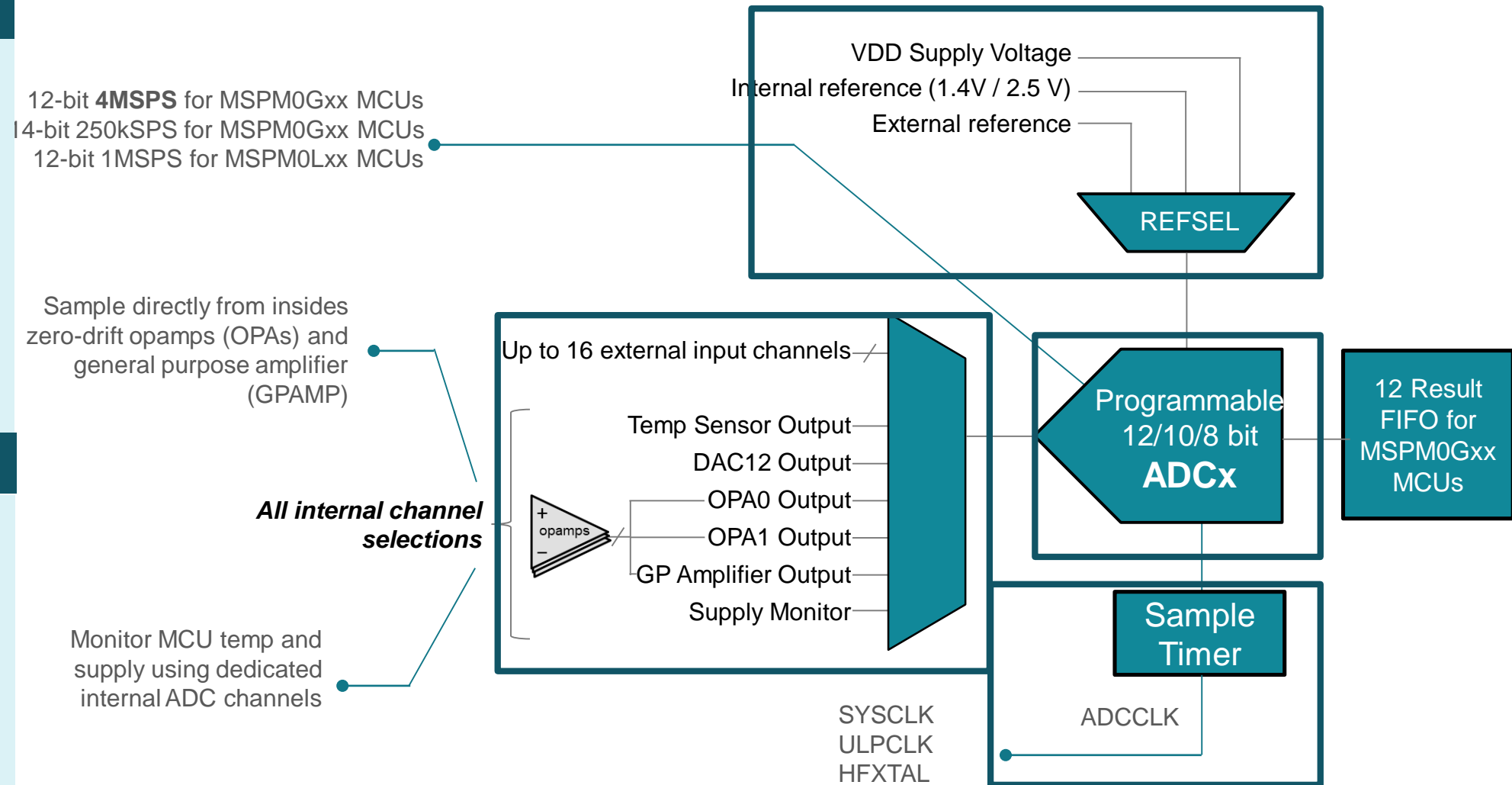*80 MHz MCU with up to 128kB flash, 64 pins, advanced analog, AES/TRNG, CAN-FD*

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MSPM0 ADC module introduction

Key Features

- **12-bit** resolution ADC
- 14-bit 250ksps with **H/W oversampling**
- **DMA support** with interrupt
- Operates in RUN, SLEEP and STOP **low-power modes**
- Full scale operating range: **1.62V – 3.6V**
- **11.2-bit** ENOB

Key Differences between G and L MCUs

- MSPM0G350x MCUs have **2 simultaneous ADC modules and** MSPM0L30x MCUs have one ADC module
- **Dedicated 80MHz** oscillator is equipped to enhance ADC conversion rate on MSPM0G350x MCUs; Up to 32MHz ADCLK is used on MSPM0L30x MCUs.
- 12-bit **4MSPS** conversion rate on MSPM0G350x MCUs
- 12 ADC **result FIFO** is equipped on MSPM0G350x MCUs

12-bit **4MSPS** for MSPM0Gxx MCUs
14-bit 250kSPS for MSPM0Gxx MCUs
12-bit 1MSPS for MSPM0Lxx MCUs

Sample directly from insides zero-drift opamps (OPAs) and general purpose amplifier (GPAMP)

All internal channel selections

Monitor MCU temp and supply using dedicated internal ADC channels

Up to 16 external input channels

Temp Sensor Output
DAC12 Output
OPA0 Output
OPA1 Output
GP Amplifier Output
Supply Monitor

+ opamps −

VDD Supply Voltage
Internal reference (1.4V / 2.5 V)
External reference

REFSEL

Programmable 12/10/8 bit ADCx

12 Result FIFO for MSPM0Gxx MCUs

Sample Timer

SYSCLK
ULPCLK
HFXTAL

ADCCLK

TEXAS INSTRUMENTS

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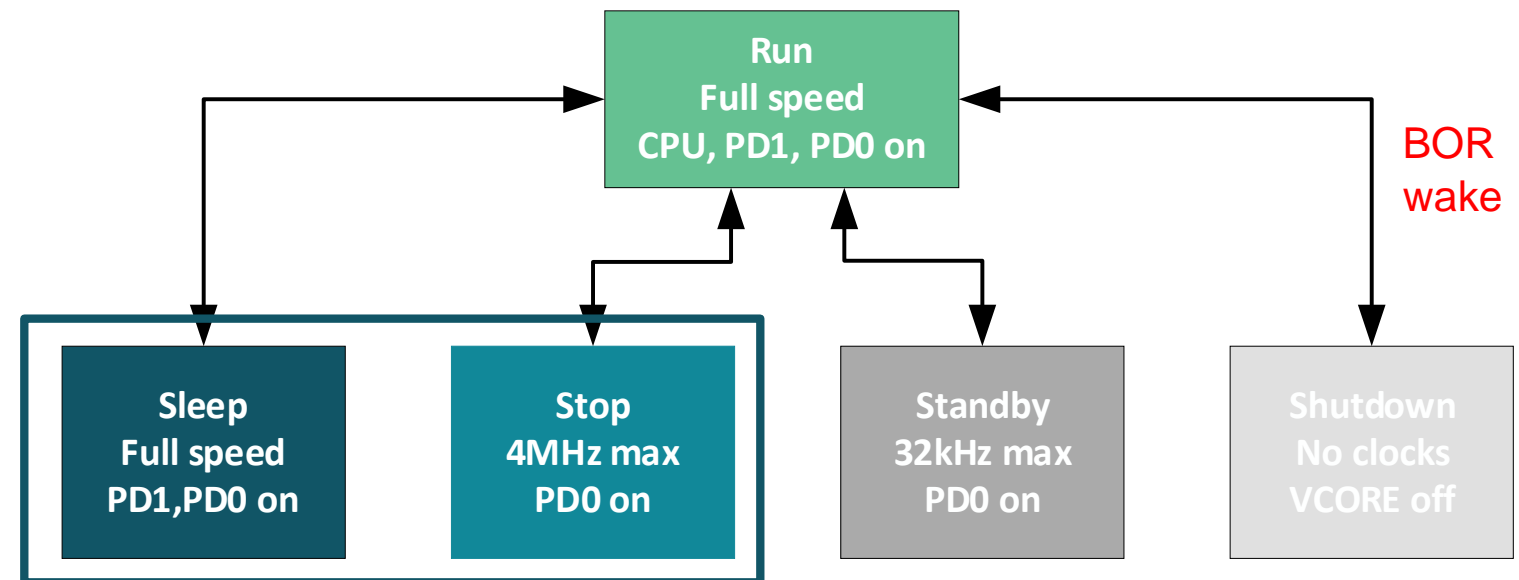- **11.2-bit** ENOB

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| Operating Mode | RUN | | | SLEEP | | | STOP | | | STANDBY | | | SHUTDOWN |
	RUN0	RUN1	RUN2	SLEEP0	SLEEP1	SLEEP2	STOP0	STOP1	STOP2	STANDBY0	STANDBY1	STANDBY2	
ADC	OPT									NS			OFF
DAC12	OPT									NS			OFF

OPT: The function is optional in the specified mode, and remains enabled if configured to be enabled.
NS: The function is not automatically disabled in the specified mode, but its use is not supported.


Run
Full speed
CPU, PD1, PD0 on

BOR wake

Sleep
Full speed
PD1,PD0 on

Stop
4MHz max
PD0 on

Standby
32kHz max
PD0 on

Shutdown
No clocks
VCORE off

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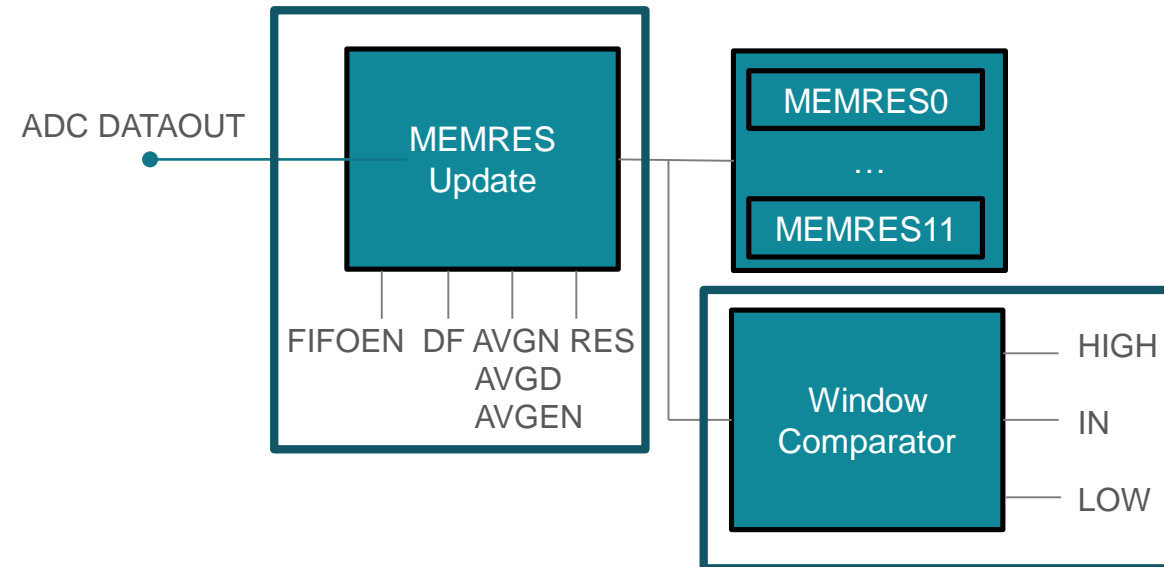
Bit Field Value	AVGN Settings (number of samples accumulated)	AVGD Settings (number of bits to right shift)
0x0	0	0
0x1	2	1
0x2	4	2
0x3	8	3
0x4	16	4
0x5	32	5
0x6	64	6
0x7	128	7

ADC module quick start

ADC introduction lab

Driverlib Examples

MSPM0G350x:

- adc12_14bit_resolution_250ksps
- adc12_max_freq_dma
- adc12_max_freq_dma_8bit
- adc12_monitor_supply
- adc12_simultaneous_trigger_event
- adc12_simultaneous_trigger_event_stop
- adc12_single_conversion
- adc12_single_conversion_vref_external
- adc12_single_conversion_vref_internal
- adc12_triggered_by_timer_event
- adc12_triggered_by_timer_event_stop
- adc12_window_comparator

MSPM0L13xx:

- adc12_max_freq_dma
- adc12_max_freq_dma_8bit
- adc12_monitor_supply
- adc12_single_conversion
- adc12_single_conversion_vref_external
- adc12_single_conversion_vref_internal
- adc12_triggered_by_timer_event
- adc12_triggered_by_timer_event_stop
- adc12_window_comparator

Related Links

MSPM0 online resource
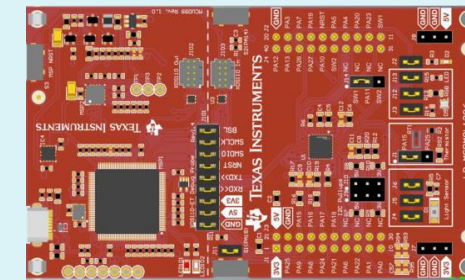MSPM0 quick start guide
MSPM0 Sysconfig user's guide

MSPM0G350x datasheet
MSPM0L13xx datasheet
MSPM0Gxx technical reference manual
MSPM0Lxx technical reference manual

Launchpad
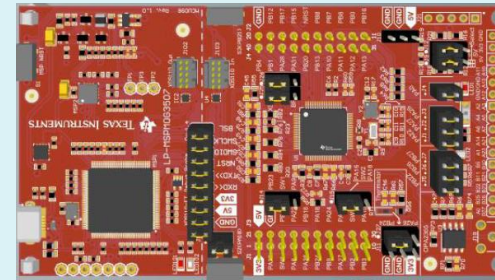
LP-MSPM0G3507   LP-MSPM0L1306

Sysconfig Entrance for ADC Setting

Step1:

Step2:

To find more MSPM0 training series, please visit:

- TI.com.cn
- WeChat (德州仪器公众号)
- Bilibili
- 21IC

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