

MSPM0 amplifier module introduction

— MSPM0 peripheral training series

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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	Power & Clocking POR / BOR / SVS Internal LF 32kHz (5%) Internal HF 4-32MHz (1%)	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)	Amplifiers Zero-drift chopper op-amps (OPA) General purpose amp (GPAMP)
On-chip Memory 8, 16, 32 or 64 kB flash 2 or 4 kB SRAM	Communication UART w/ LIN (1) UART (1) SPI (1) I2C (2) w/ FastMode+	Internal ADC reference (2.5%) Temperature sensor	
Data Integrity & Security CRC accelerator (16 and 32 bit)	IO Up to 28 GPIO Up to 2 low Ib OPA inputs	Timers General purpose 16-bit 2 CC (4) Windowed watchdog	
Programming & Debug ARM SWD interface ROM UART & I2C BSL			

Ledged 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

MSPM0 OPA overview

Key Features

High flexibility:

- Configurable amplifier modes
- Rich selection of external/internal input options
- Output to ADC, OPA and comparator
- Programmable gain amplifier (PGA) up to 32x
- Burnout current source to detect sensor status

High performance:

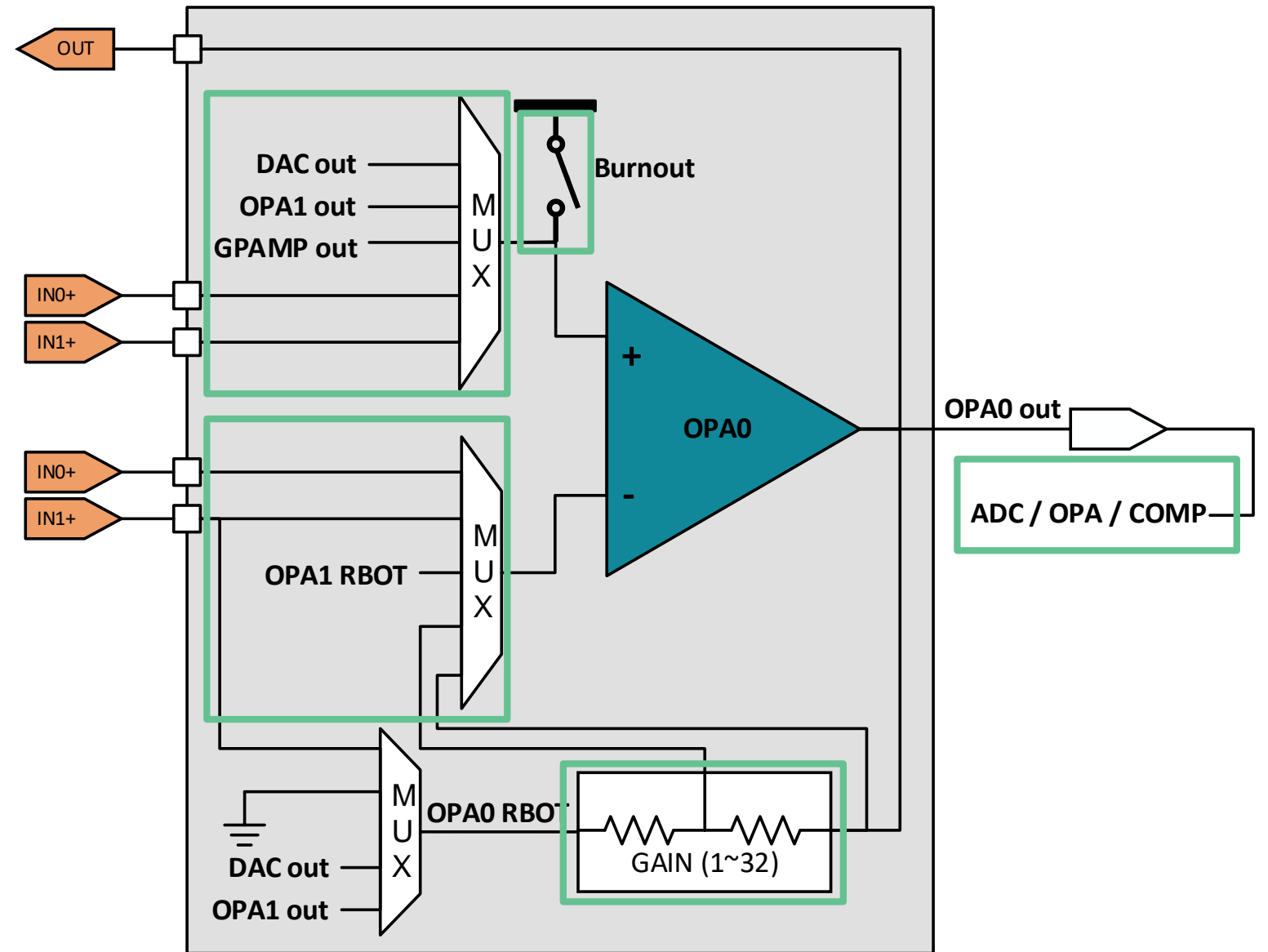
- **Chopper stabilization** to reduce offset, drift, and 1/f noise, **0.1 mV Vos**, **1- μ V/°C Vos drift** with chopping
- Rail-to-rail input & output
- **6MHz GBW**
- Lower to **100 μ A** quiescent current

Some Use Cases

- Use internal OPAs to replace external OPAs
- Switch between IOs to use one OPA to realize two OPA functions
- Dynamic change OPA settings to calibrate voltage offset and internal Gain with ADC and DAC

Differences between G and L MCUs

- MSPM0L134x has dedicated IN- pin to reach **10pA** bias current for TIA(Transimpedance amplifier) application

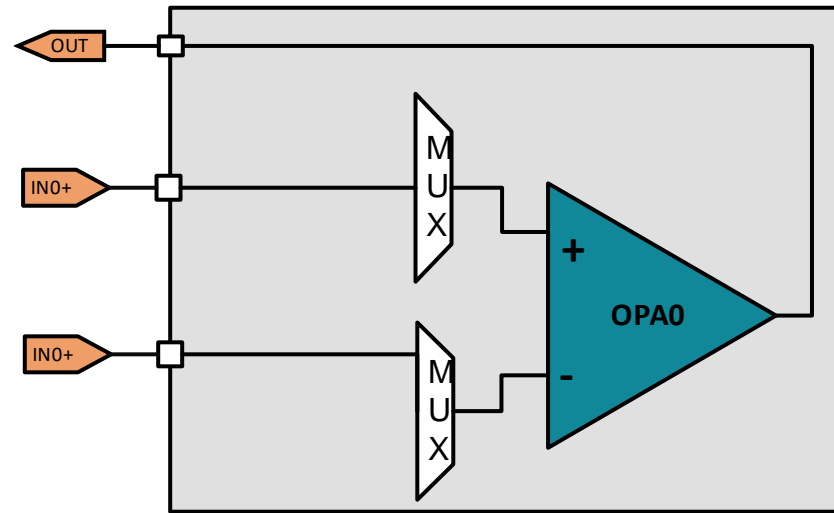


OPA key parameters summery

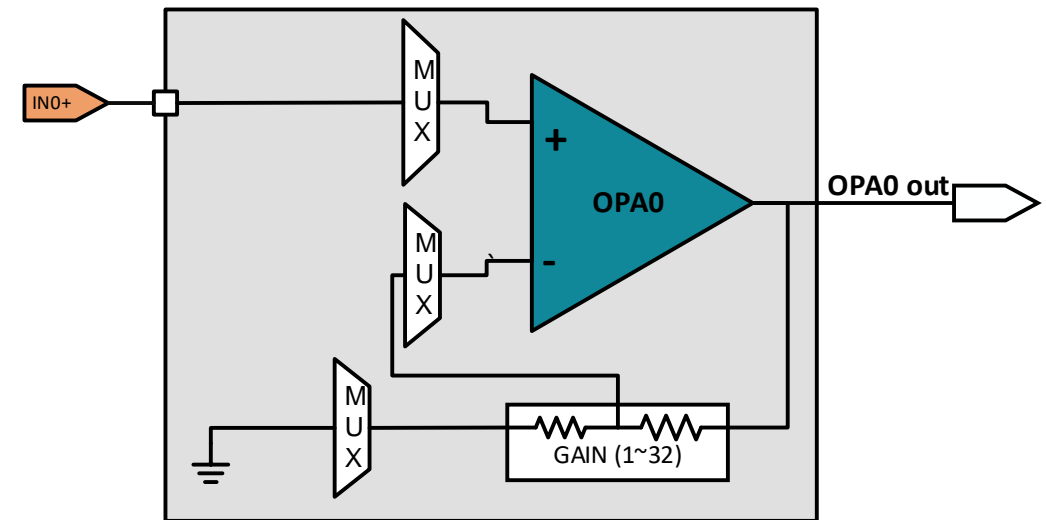
Parameters	Value without chopper	Value without chopper	Unit
Rail-to-rail	60 ~ VDD-60		mV
GBW (typ)	6	~0.125/Gain	MHz
Slew rate (typ)	4		V/ μ s
Vos (25°C max)	± 2	± 0.3	mV
Offset drift (typ)	± 5.2	± 0.5	μ V/ $^{\circ}$ C
Vn at 1 kHz (typ)	240	NA	nV \sqrt Hz
Input bias current (25°C typ)	150 (Shared OPA pin) 10 (Dedicated OPA pin)	1000 (Shared OPA pin) 800 (Dedicated OPA pin)	pA
CMRR (typ)	89	95	dB
Iout (typ)	1		mA
Iq per channel (typ)	0.1		mA
Internal Gain	0~32		V/V

OPA flexibility

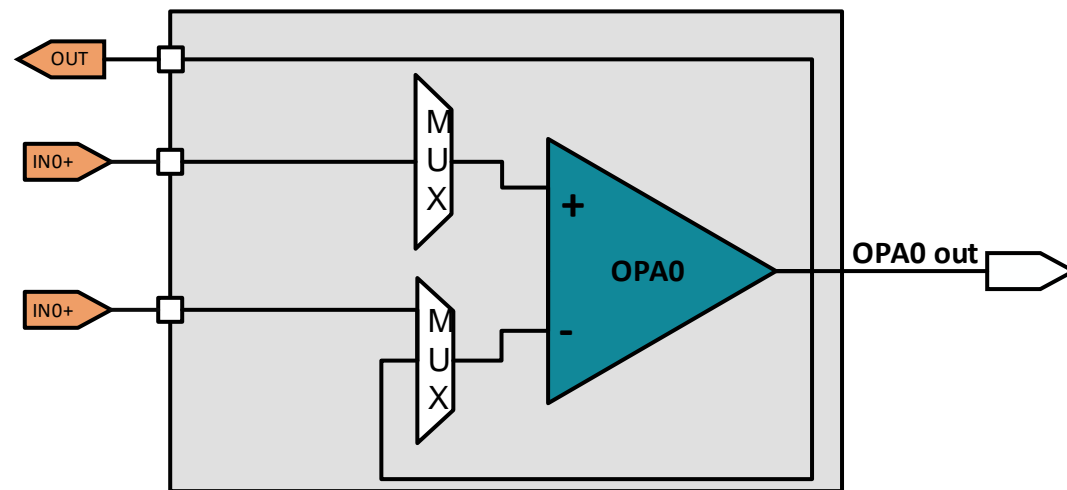
General-Purpose Mode:



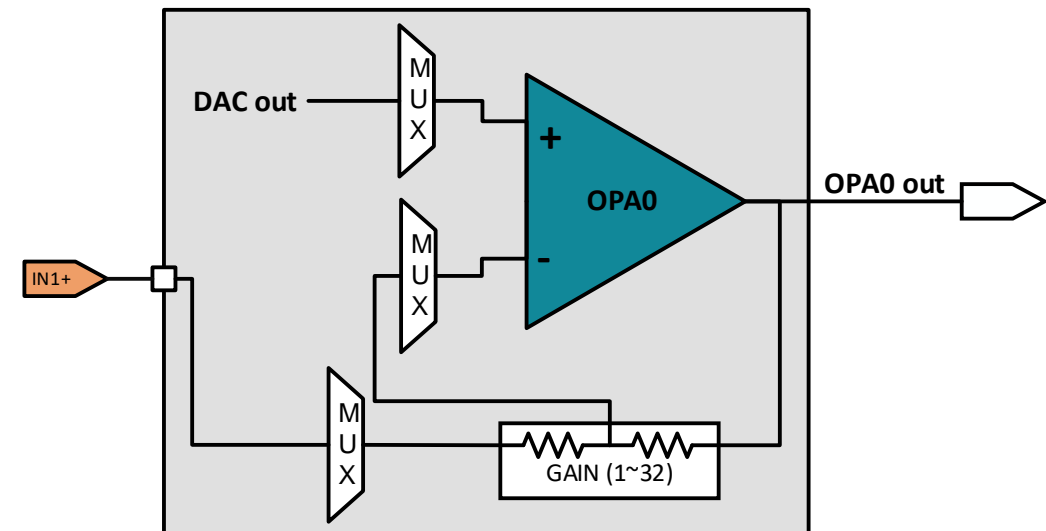
Non-inverting PGA Mode:



Buffer Mode:

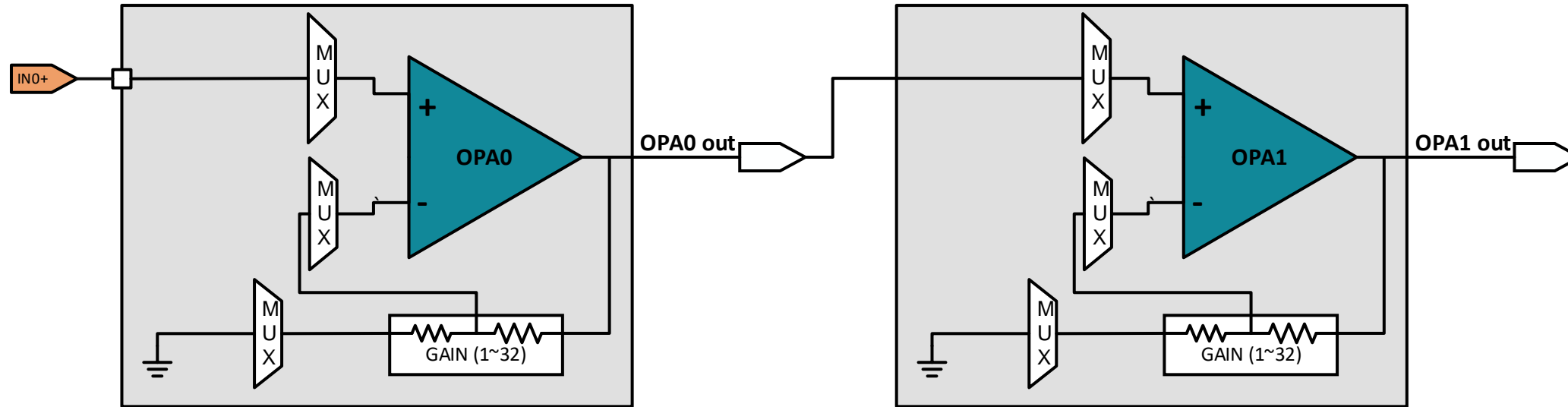


Inverting PGA Mode:

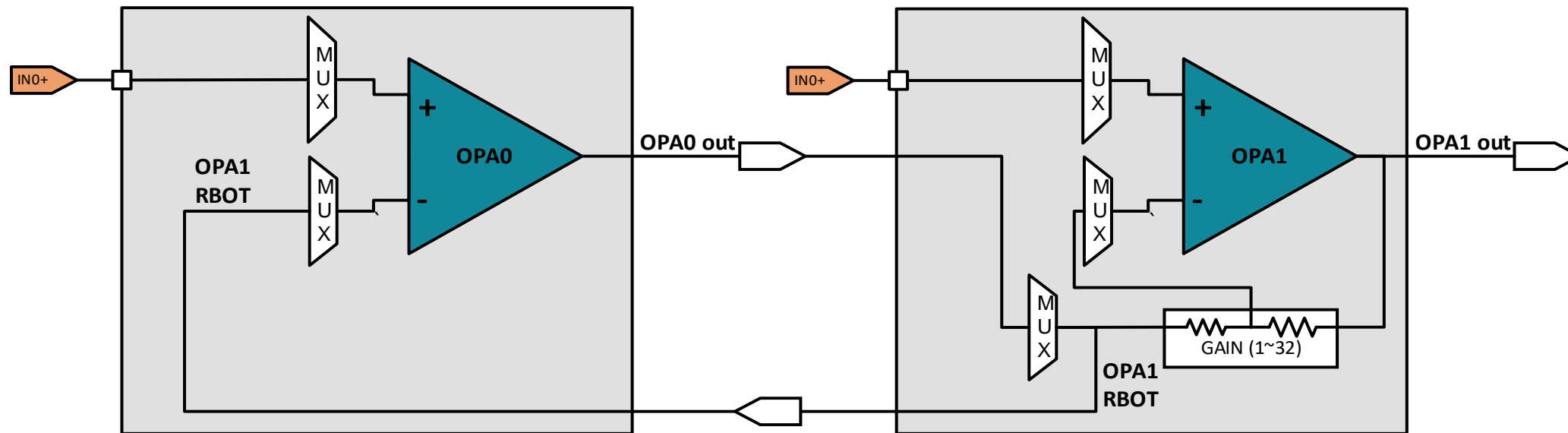


OPA flexibility

Cascade Amplifier Mode:



Differential Amplifier Mode:



MSPM0 GPAMP overview

Key Features

Flexibility:

- Output to ADC and OPA
- Programmable internal unity gain feedback loop

Performance:

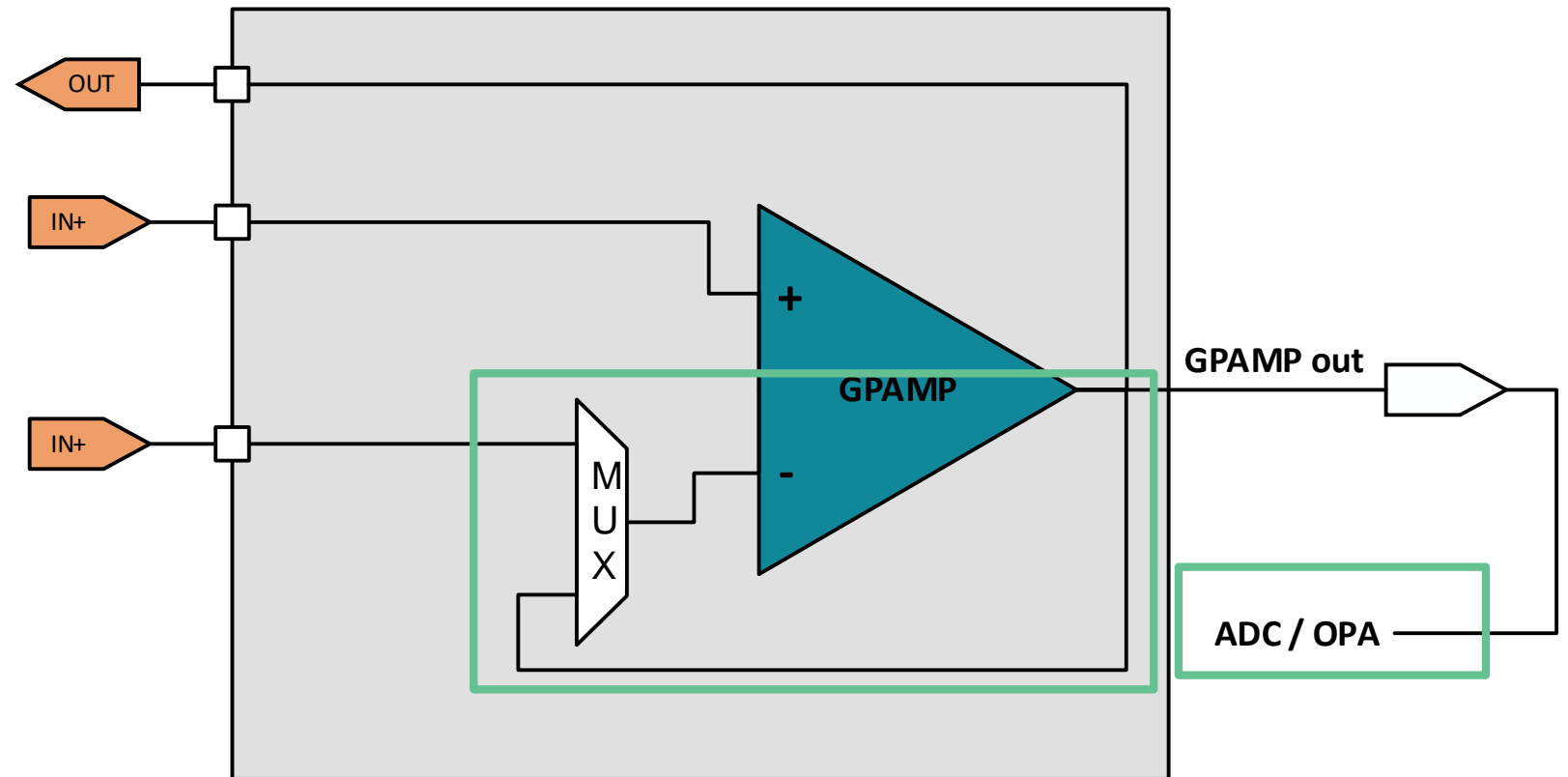
- **Chopper stabilization** to reduce offset, drift, and 1/f noise
- Rail-to-rail input & output
- 350KHz GBW

Some Use Cases

- General purpose amplifier
- Signal buffer

OPA vs GPAMP

	Parameter	OPA	GPAMP
Flexibility	Input MUX	External/ADC/DAC/REF/OPA/GPAMP	External/ GPAMP
	PGA	1~32	1
	burnout current source	Support	NA
Performance	GBW	6MHz	350KHz
	Quiescent current	100uA	100uA
	Vos with chopper	<0.3mV	<0.39mV
	Ios no chopper	150pA	16pA



OPA module quick start

Academy

[OPA introduction lab](#)

Driverlib Examples

MSPM0G350x:

- opa_dac8_output_buffer
- opa_general_purpose_rri
- opa_inverting_pga_with_dac
- opa_non_inverting_pga
- opa_signal_chain_to_adc

MSPM0L13xx:

- opa_dac8_output_buffer
- opa_general_purpose_rri
- opa_non_inverting_pga

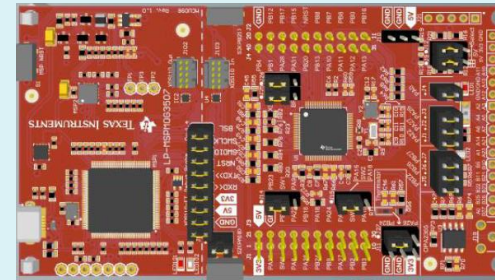
Related Links

- [MSPM0 online resource](#)
- [MSPM0 quick start guide](#)
- [MSPM0 Sysconfig user's guide](#)

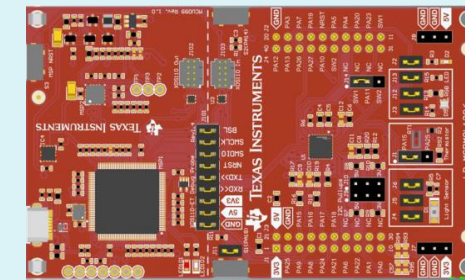
- [MSPM0G350x datasheet](#)
- [MSPM0L13xx datasheet](#)
- [MSPM0Gxx technical reference manual](#)
- [MSPM0Lxx technical reference manual](#)

Launchpad

[LP-MSPM0G3507](#)



[LP-MSPM0L1306](#)



Sysconfig Entrance for OPA Setting

The screenshot shows the Sysconfig tool interface. On the left, a tree view lists various peripheral categories: ANALOG (5), COMMUNICATIONS (5), and TIMERS (5). Under ANALOG, the 'OPA' item is selected and highlighted with a red box, labeled 'Step 1:'. The right pane shows the configuration for 'OPA (1 of 2 Added)'. It includes a 'Name' field set to 'OPA_0' and a 'Selected Peripheral' field set to 'OPA0'. A red box highlights the '+ ADD' button, labeled 'Step 2:'. Below these fields, there are sections for 'Quick Profiles' and 'OPA Pre-Set Configuration'. The configuration options are: Non-Inverting Channel (PSEL) set to 'Open', Inverting Channel (NSEL) set to 'Open', Input MUX (MSEL) set to 'Open', and Gain set to 'Non-Inverting: 1x / Inverting: Invalid'.

To find more MSPM0 training series, please visit:

- [Ti.com.cn](http://ti.com.cn)
- [WeChat \(德州仪器公众号\)](#)
- [Bilibili](#)
- [21IC](#)