

# MSPM0 Timer Module Introduction

— MSPM0 peripheral training series

Presented by Brandon Fisher

# MCU level overview

## —MSPM0Lxx series

### MSPM0L13x3/4/5/6

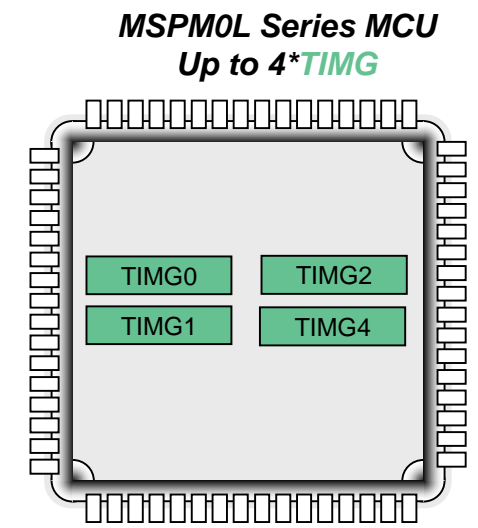
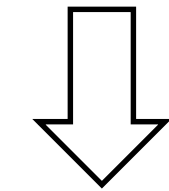
<b>CPU</b> <b>ARM Cortex-M0+</b> <b>32 MHz</b>  NVIC / 3-ch DMA	<b>Power &amp; Clocking</b> POR / BOR / SVS Internal LF 32kHz (5%) Internal HF 4-32MHz (1%)	<b>Precision Analog</b> 12-bit SAR ADC 1Msps (1) ULP/HS Comparator (1) 8-bit reference DAC (1) Zero-drift chopper op-amps (2) General purpose amp (1) Internal ADC reference (2.5%) Temperature sensor
<b>On-chip Memory</b> 8, 16, 32 or 64 kB flash 2 or 4 kB SRAM	<b>Communication</b> UART w/ LIN (1) UART (1) SPI (1) I2C (2) w/ FastMode+	<b>Timers</b> General purpose 16-bit 2 CC (4) Windowed watchdog
<b>Data Integrity &amp; Security</b> CRC accelerator (16 and 32 bit)	<b>IO</b> Up to 28 GPIO Up to 2 low Ib OPA inputs	
<b>Programming &amp; Debug</b> ARM SWD interface ROM UART & I2C BSL		

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

1.62 - 3.6V  
-40 to 125 C

Up to 8 CH PWM

**Timer Module**  
 General purpose 16-bit 2CC (4)



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

# MCU level overview

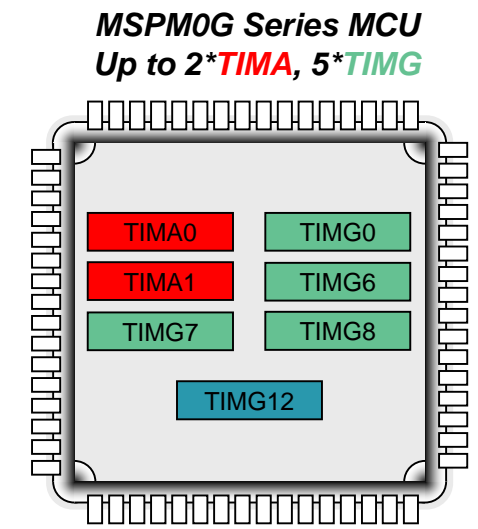
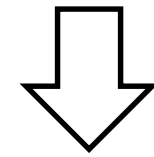
## MSPM0Gxx series

MSPM0G350x/310x/150x/110x <span style="float: right;">1.62 - 3.6V -40 to 125 C</span>		
<b>CPU</b> Arm Cortex-M0+ 80 MHz	<b>Power &amp; Clocking</b>	<b>Precision Analog</b>
NVIC / MPU / 7-ch DMA	POR / BOR / SVS	12-bit ADC 4Msps (9-ch)
<b>Accelerators</b>	External LF 32kHz XTAL	12-bit ADC 4Msps (8-ch)
Math (DIV, SQRT, TRIG, MAC)	External HF 4-48MHz XTAL	Comparators w/ 8-bit DACs (3)
<b>On-chip Memory</b>	Internal LF 32kHz (3%)	12-bit 1Msps buffered DAC (1)
32, 64, or 128 kB flash [ECC]	Internal HF 4-32MHz (1%)	Zero-drift chopper op-amps (2)
16 or 32 kB SRAM [ECC]	PLL (up to 80 MHz)	Internal reference (1.5%)
<b>Data Integrity &amp; Security</b>	<b>Communication</b>	General purpose amp (1)
CRC accelerator (16 and 32 bit)	UART w/ LIN (1)	Temperature sensor
AES256 accelerator + TRNG	UART (3)	<b>Timers</b>
<b>Programming &amp; Debug</b>	SPI (2)	Advanced control 16-bit 4 CC (1)
ARM SWD interface	I2C (2) w/ FastMode+	Advanced control 16-bit 2 CC (1)
UART & I2C bootloader	CAN-FD (1)	General purpose 32-bit 2 CC (1)
<b>IO</b>	<b>IO</b>	General purpose 16-bit 2 CC (2)
Up to 60 GPIO	Up to 60 GPIO	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

Up to 22 CH PWM

Timer Module	
Advanced control	16-bit 4CC (1)
Advanced control	16-bit 2CC (1)
General purpose	16-bit 2CC (2)
Low power	16-bit 2CC(2)
General purpose	32-bit 2CC (1)



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

# MSPM0 timer module introduction

Instance	Power Domain	Counter Resolution	Prescaler	Repeat Counter	CCP Channels	External PWM	Phase Load	Shadow Load	Shadow CC	Dead band	Fault Handler	QEI
TIMA0	PD1	16-bit	8-bit	8-bit	4	8	Yes	Yes	Yes	Yes	Yes	-
TIMA1	PD1	16-bit	8-bit	-	2	4	Yes	Yes	Yes	Yes	Yes	-
TIMG0	PD0	16-bit	8-bit	-	2	2	-	-	-	-	-	-
TIMG1	PD0	16-bit	8-bit	-	2	2	-	-	-	-	-	-
TIMG2	PD0	16-bit	8-bit	-	2	2	-	-	-	-	-	-
TIMG3	PD0	16-bit	8-bit	-	2	2	-	-	-	-	-	-
TIMG4	PD0	16-bit	8-bit	-	2	2	-	Yes	Yes	-	-	-
TIMG5	PD0	16-bit	8-bit	-	2	2	-	Yes	Yes	-	-	-
TIMG6	PD1	16-bit	8-bit	-	2	2	-	Yes	Yes	-	-	-
TIMG7	PD1	16-bit	8-bit	-	2	2	-	Yes	Yes	-	-	-
TIMG8	PD0	16-bit	8-bit	-	2	2	-	-	-	-	-	Yes
TIMG9	PD0	16-bit	8-bit	-	2	2	-	-	-	-	-	Yes
TIMG10	PD1	16-bit	8-bit	-	2	2	-	-	-	-	-	Yes
TIMG11	PD1	16-bit	8-bit	-	2	2	-	-	-	-	-	Yes
TIMG12	PD1	32-bit	-	-	2	2	-	-	Yes	-	-	-
TIMG13	PD0	32-bit	-	-	2	2	-	-	Yes	-	-	-

Flexible power domain

Larger period

Complementary PWM output

Fault Handler

High resolution

Event to trigger load

QEI  
Hall/Encoder

# General purpose timer module introduction

## Key Features

### Counter:

- 16/32-bit up, down or up-down counter, with repeat-reload mode
- Shadow register mode for load register
- Synchronization and cross trigger among different TIM instances
- Interrupt trigger generation and cross peripherals trigger capability

### Compare/Capture:

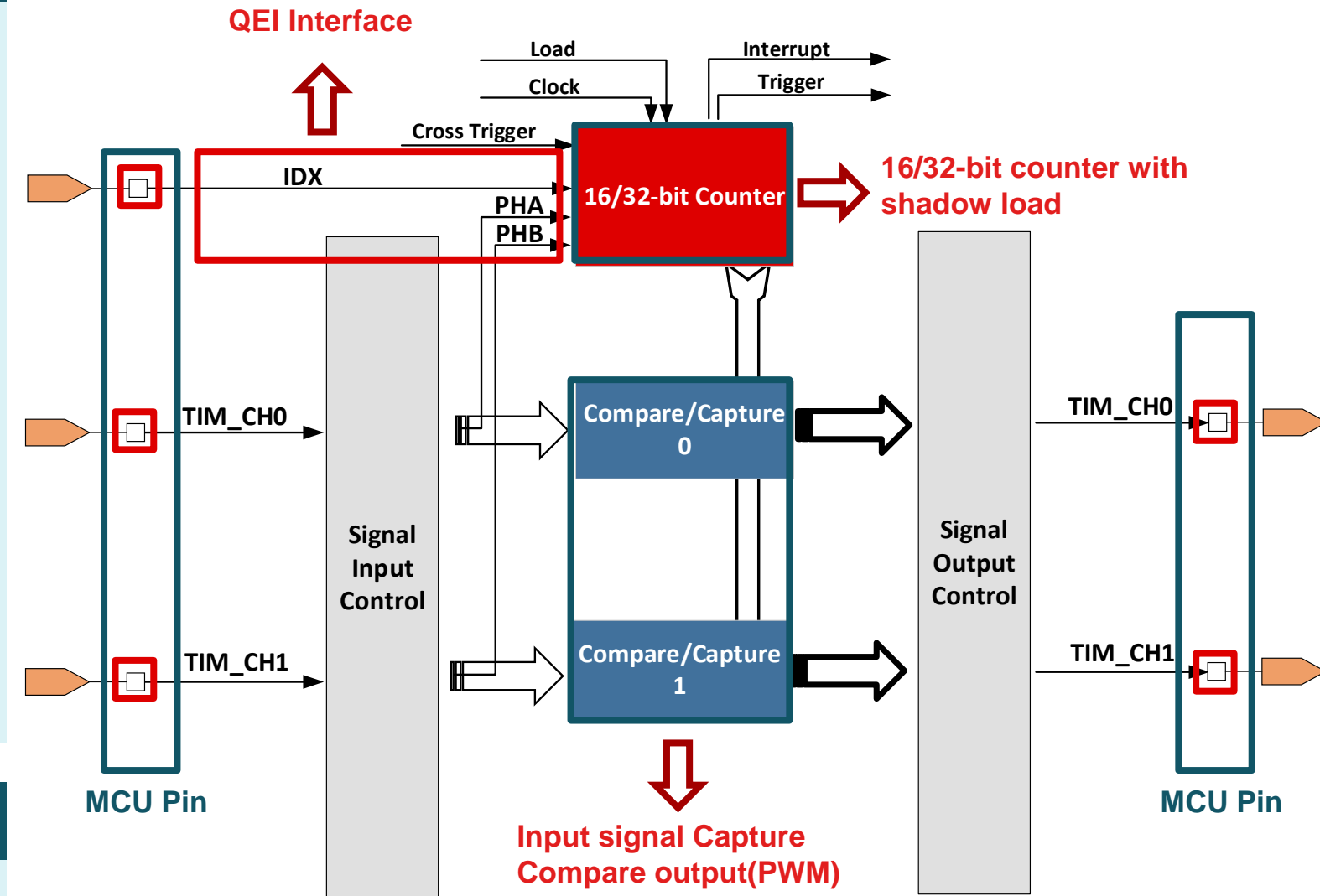
- Up to two independent channels for
  - Output compare
  - Input capture
  - PWM output
  - One-shot mode
- Pipelined compare mode for CC register

### Others:

- **Quadrature encoder/Hall interface** (TIMG8 – TIMG11)
- **32bit Counter**(TIMG12-TIMG13)

## Application

- General Purpose
- Motor Control
- Encoder, Position Sensing



Implemented in MSPM0G & MSPM0L Series MCU

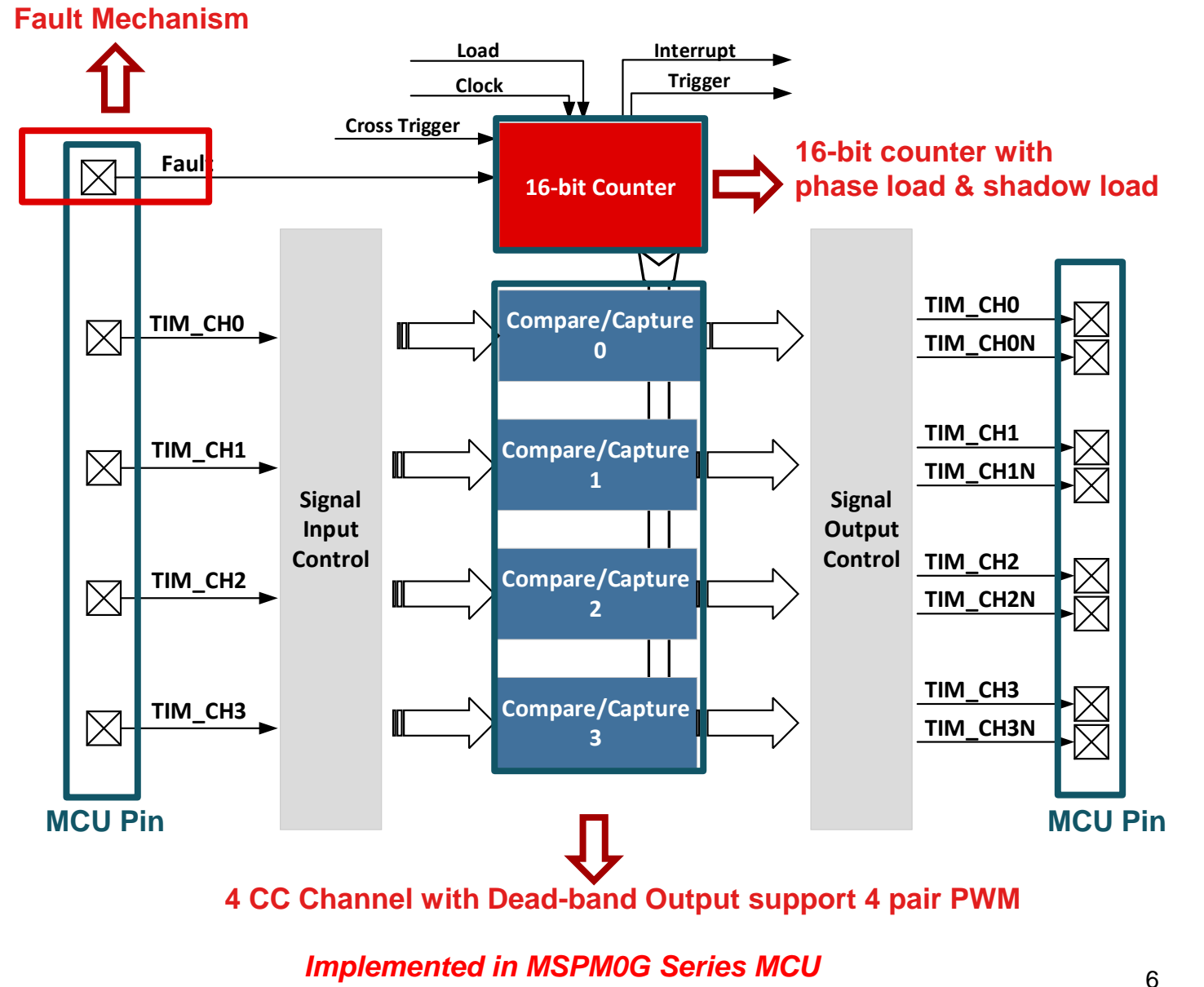
# Advanced control timer module introduction

## Key Features

- Counter:**
- 16-bit up, down or up-down counter, with repeat-reload mode
  - Shadow register mode for load register
  - Synchronization and cross trigger among different TIM instances
  - Interrupt trigger generation and cross peripherals trigger capability
- Compare/Capture:**
- Up to four independent channels for
    - Output compare
    - Input capture
    - PWM output
    - One-shot mode
  - Pipelined compare mode for CC register
  - **Complementary PWM output with dead-band**
- Others:**
- **Fault handling mechanism**

## Application

- General Purpose
- Motor Control
- Power Inverter, PFC



# Timer module quick start

## Academy

[Timer introduction lab](#)

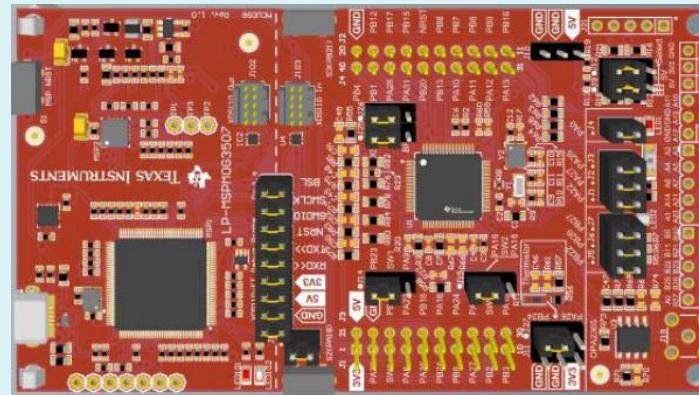
## [Driverlib](#) Examples

### MSPM0G350x:

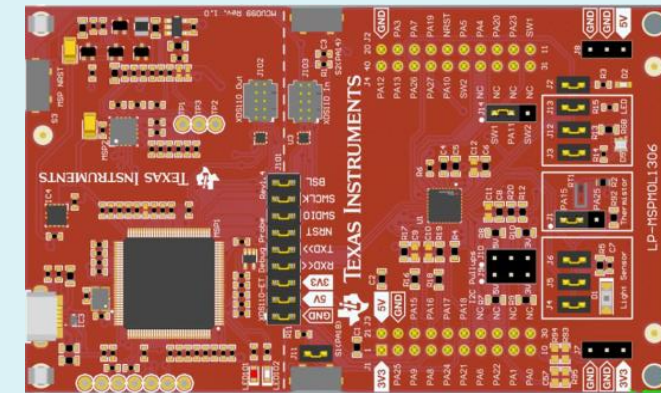
- ▶ `tima_timer_mode_periodic_repeat_count`
- ▶ `tima_timer_mode_pwm_dead_band`
- ▶ `tima_timer_mode_pwm_edge_sleep_shadow_load`
- ▶ `tima_trigger_fail_mechanism`
- ▶ `timg_qei_mode`
- ▶ `timh_timer_mode_capture_edge_capture`
- ▶ `timh_timer_mode_compare_edge_count`
- ▶ `timh_timer_mode_one_shot_sleep`
- ▶ `timh_timer_mode_pwm_center_sleep`
- ▶ `timh_timer_mode_pwm_edge_sleep_shadow_load`
- ▶ `timx_timer_mode_capture_duty_and_period`
- ▶ `timx_timer_mode_capture_edge_capture`
- ▶ `timx_timer_mode_compare_edge_count`
- ▶ `timx_timer_mode_one_shot_standby`
- ▶ `timx_timer_mode_periodic_sleep`
- ▶ `timx_timer_mode_periodic_standby`
- ▶ `timx_timer_mode_periodic_stop`
- ▶ `timx_timer_mode_pwm_center_stop`
- ▶ `timx_timer_mode_pwm_cross_trigger_stop_restore`
- ▶ `timx_timer_mode_pwm_edge_sleep`

## Launchpad

### [LP-MSPM0G3507](#)



### [LP-MSPM0L1306](#)



### MSPM0L130x:

- ▶ `timx_timer_mode_capture_duty_and_period`
- ▶ `timx_timer_mode_capture_edge_capture`
- ▶ `timx_timer_mode_compare_edge_count`
- ▶ `timx_timer_mode_one_shot_standby`
- ▶ `timx_timer_mode_periodic_sleep`
- ▶ `timx_timer_mode_periodic_standby`
- ▶ `timx_timer_mode_periodic_stop`
- ▶ `timx_timer_mode_pwm_center_stop`
- ▶ `timx_timer_mode_pwm_edge_sleep`

## Related Links

- ▶ [MSPM0 in Resource Explorer](#)
- ▶ [MSPM0 Quick start guide](#)
- ▶ [MSPM0 Sysconfig user's guide](#)

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

# Timer module quick start

## Sysconfig Entrance for Timer Setting – MSPM0L Series

The screenshot shows the Sysconfig interface for the MSPM0L Series. The left sidebar lists various driver libraries, with the 'TIMERS (3)' section highlighted. 'TIMER - PWM' is selected and highlighted with a red box, labeled 'Step 1:'. The main panel shows 'TIMER - PWM (1 of 4 Added)' with a 'PWM\_0' profile selected. Below this, a list of configuration sections is shown, with 'Basic Configuration', 'Advanced Configuration', 'Interrupts Configuration', 'Event Configuration', and 'PinMux Peripheral and Pin Configuration' highlighted with red boxes, labeled 'Step 2:'. The 'Name' field is set to 'PWM\_0', 'Use Hardware' is 'None', and 'Selected Peripheral' is 'TIMG2'. The 'Profile' is set to 'Custom'.

## Sysconfig Entrance for Timer Setting – MSPM0G Series

The screenshot shows the Sysconfig interface for the MSPM0G Series. The left sidebar lists various driver libraries, with the 'TIMERS (4)' section highlighted. 'TIMER - PWM' is selected and highlighted with a red box, labeled 'Step 1:'. The main panel shows 'TIMER (1 of 7 Added)' with a 'TIMER\_0' profile selected. Below this, a list of configuration sections is shown, with 'Basic Configuration', 'Advanced Configuration', 'Interrupts Configuration', 'Event Configuration', and 'PinMux Peripheral and Pin Configuration' highlighted with red boxes, labeled 'Step 2:'. The 'Name' field is set to 'TIMER\_0', 'Selected Peripheral' is 'TIMA1', and the 'Profile' is set to 'Custom'.



# To learn more about MSPM0, please visit:

- [MSPM0 MCUs](#)
- [MSPM0 SDK](#)
- [MSPM0 Academies](#)