MSPM0 timer module introduction

—— MSPM0 peripheral training series

Presented by Johnson He

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

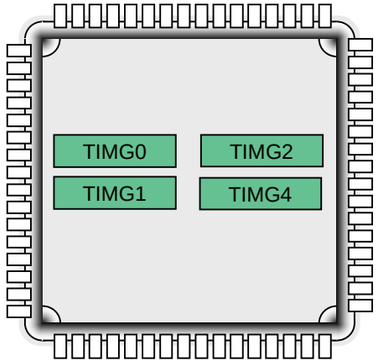
Leaded packages: SOT-16, VSSOP-20/28
No-lead packages: WQFN-16, VQFN-24/32

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

Up to 8 CH PWM

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

MSPM0L Series MCU
Up to 4*TIMG



MCU level overview
——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)

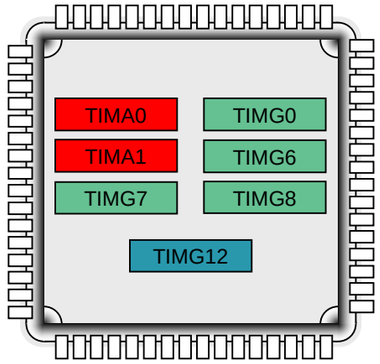
Leaded packages: VSSOP-20/28, LQFP-48/64
No-lead packages: VQFN-24/32/48, nFBGA-64, WCSP-28

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

Up to 22 CH PWM

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

MSPM0G Series MCU
Up to 2*TIMA, 5*TIMG



MSPM0 timer module introduction

Flexible power domain

Larger period

Complementary PWM output

Fault Handler

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	-	-	-

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:

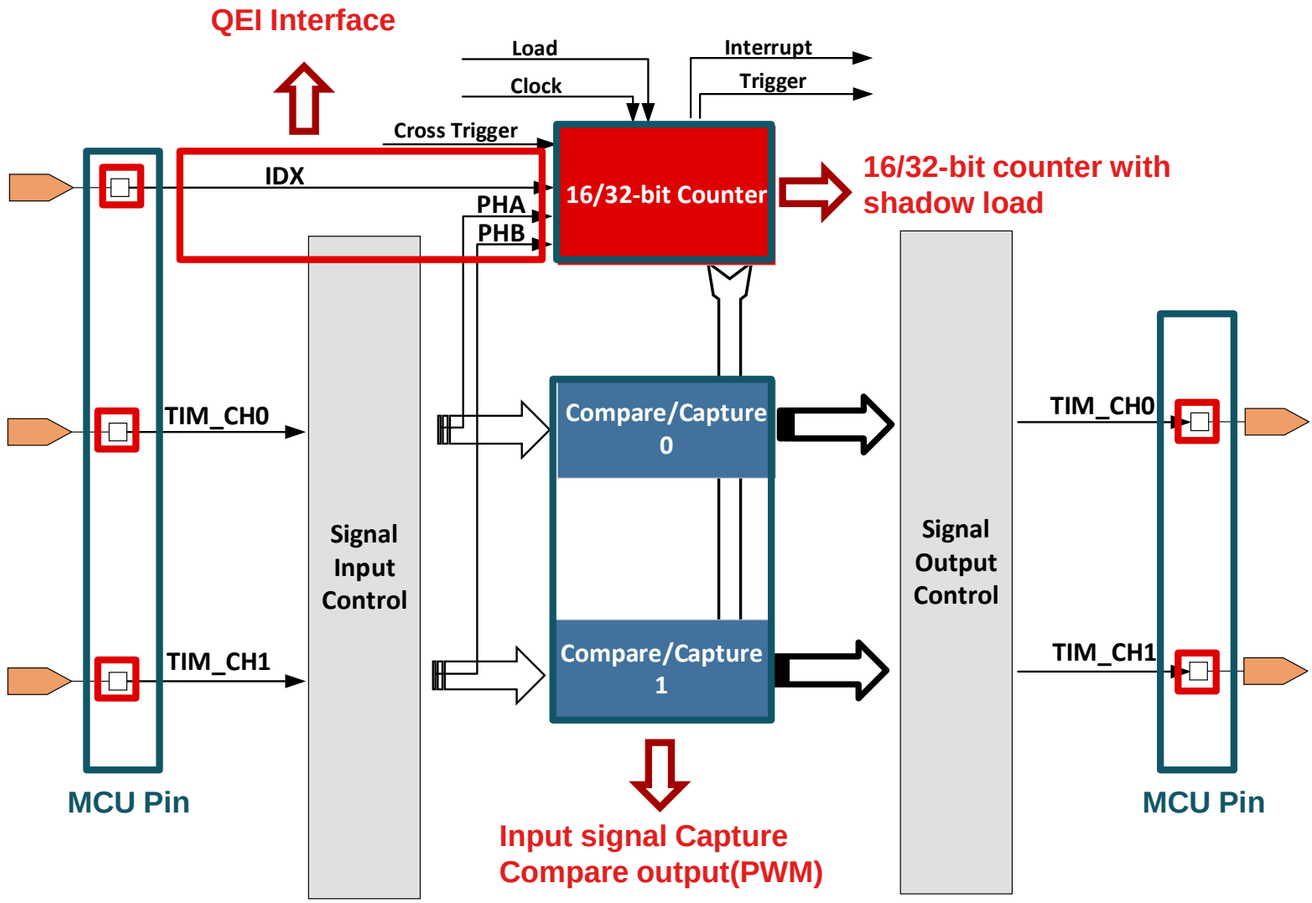
- Up to two independent channels for
  - Output compare
  - Input capture
  - PWM output
  - One-shot mode
- Pipelined compare mode for CC register

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:

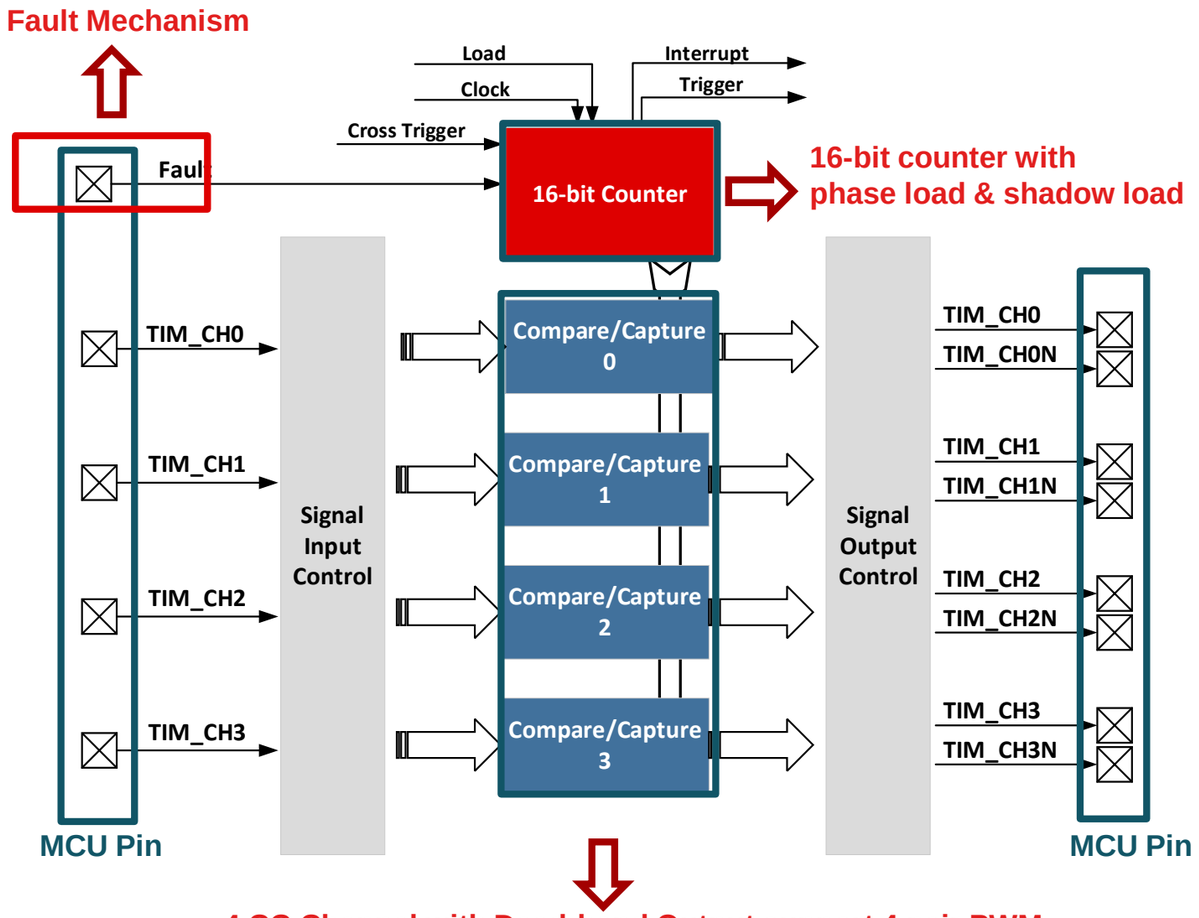
- Up to four independent channels for
  - Output compare
  - Input capture
  - PWM output
  - One-shot mode
- Pipelined compare mode for CC register
- **Complementary PWM output with dead-band**

Others:

- **Fault handling mechanism**

Application

- General Purpose
- Motor Control
- Power Inverter, PFC



Implemented in MSPM0G Series MCU

Timer module quick start

Academy

Timer introduction lab

Driverlib Examples

MSPM0G350x:

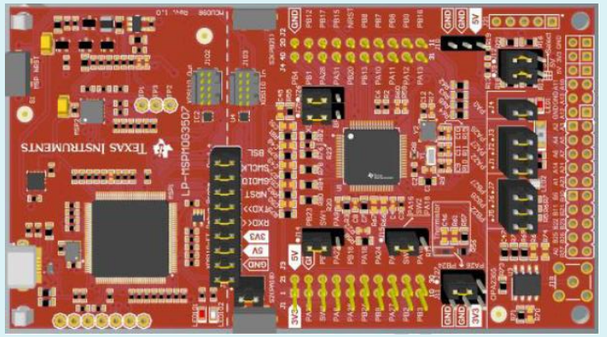
- tima_timer_mode_periodic_repeat_count
- tima_timer_mode_pwm_dead_band
- tima_timer_mode_pwm_edge_sleep_shadow_load
- tima_trigger_fail_mechanism
- timg_qei_mode
- timh_timer_mode_capture_edge_capture
- timh_timer_mode_compare_edge_count
- timh_timer_mode_one_shot_sleep
- timh_timer_mode_pwm_center_sleep
- 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

MSPM0L130x:

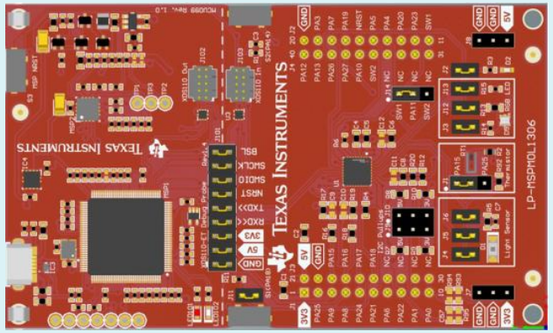
- timx_timer_mode_capture_duty_and_period
- timx_timer_mode_capture_edge_capture
- timx_timer_mode_compare_edge_count
- timx_timer_mode_one_shot_standby
- timx_timer_mode_periodic_sleep
- timx_timer_mode_periodic_standby
- timx_timer_mode_periodic_stop
- timx_timer_mode_pwm_center_stop
- timx_timer_mode_pwm_edge_sleep

Launchpad

LP-MSPM0G3507



LP-MSPM0L1306



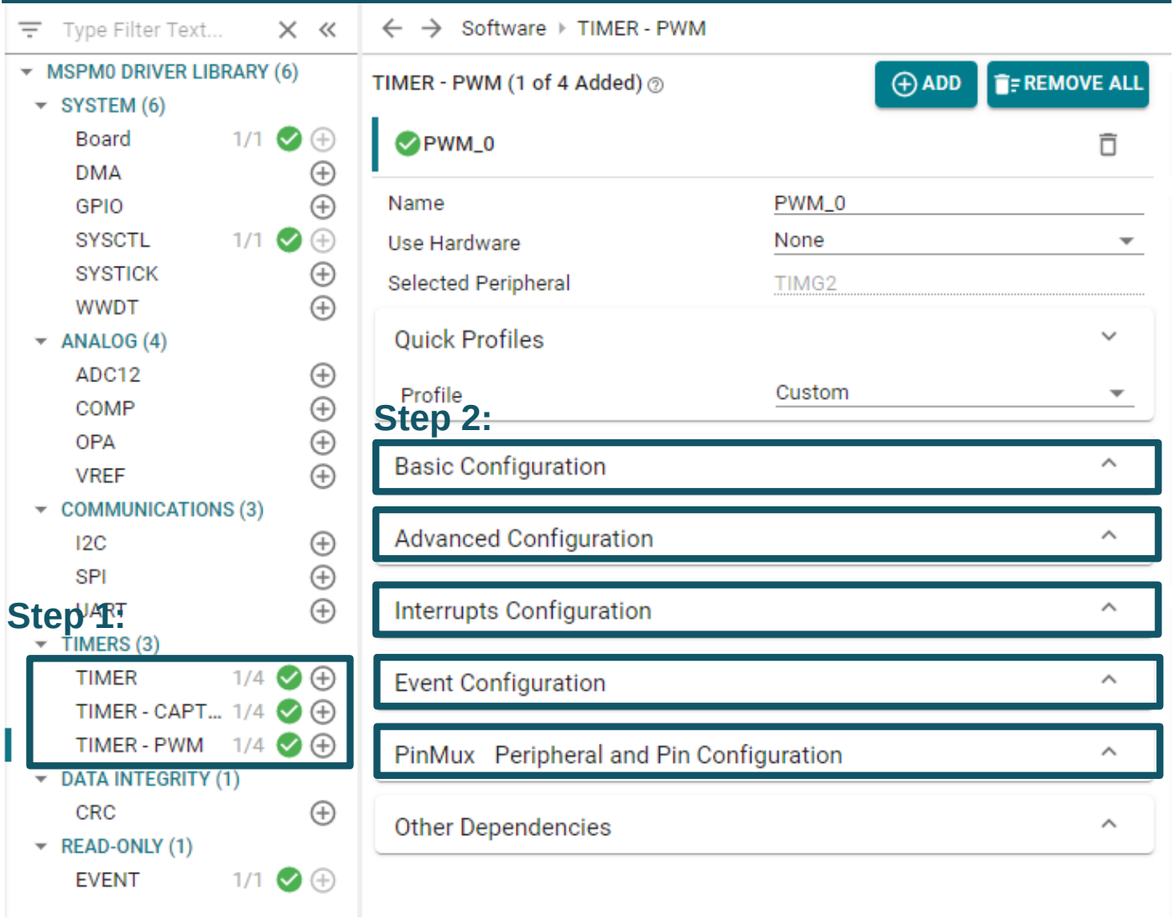
Related Links

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

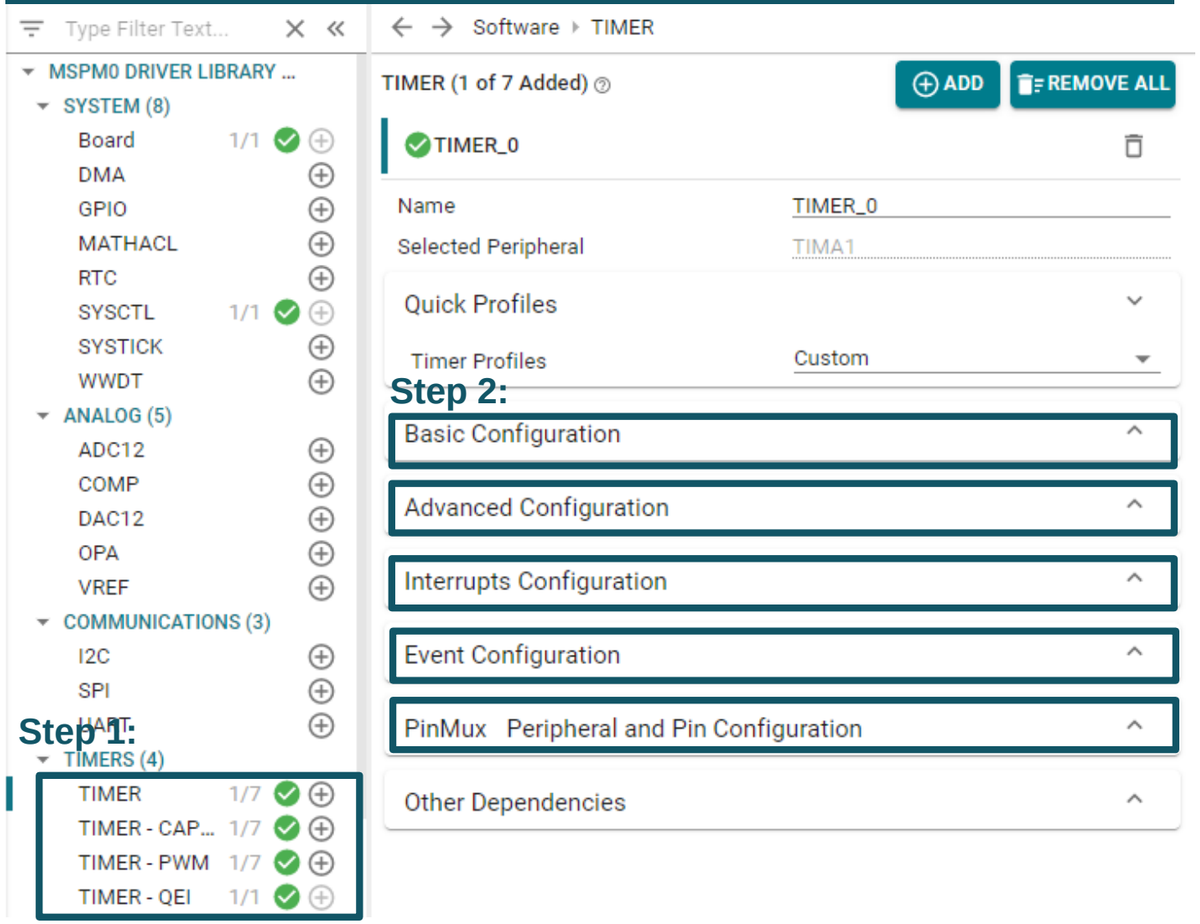
MSPM0G350x datasheet
MSPM0L13xx datasheet
MSPM0Gxx technical reference manual
MSPM0Lxx technical reference manual

Timer module quick start

Sysconfig Entrance for Timer Setting – MSPM0L Series



Sysconfig Entrance for Timer Setting – MSPM0G Series



To find more MSPM0 training series, please visit:

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