**TIMERS**

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**TIMER Generic features**

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The Timer features include:

* 16-bit up, down, up/down auto-reload counter.
* 16-bit programmable prescaler allowing dividing (also on the fly) the counter clock frequency either by any factor between 1 and 65536.
* Up to 4 independent channels for: Input Capture, Output Compare, PWM generation (Edge and Center-aligned Mode), One-pulse mode output
* Synchronization circuit to control the timer with external signals and to interconnect several timers together.
* Supports incremental encoder for positioning purposes

**HOW TO USE THIS DRIVER**

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Initialize the TIM low level resources by implementing the following functions depending on the selected feature:

* Time Base : **HAL\_TIM\_Base\_MspInit()**
* Input Capture : **HAL\_TIM\_IC\_MspInit()**
* Output Compare : **HAL\_TIM\_OC\_MspInit()**
* PWM generation : **HAL\_TIM\_PWM\_MspInit()**
* One-pulse mode output : **HAL\_TIM\_OnePulse\_MspInit()**
* Encoder mode output : **HAL\_TIM\_Encoder\_MspInit()**

Initialize the TIM low level resources :

Enable the TIM interface clock using **\_\_HAL\_RCC\_TIMx\_CLK\_ENABLE();**

TIM pins configuration

1. Enable the clock for the TIM GPIOs using the following function: **\_\_HAL\_RCC\_GPIOx\_CLK\_ENABLE();**
2. Configure these TIM pins in Alternate function mode using **HAL\_GPIO\_Init();**

The external Clock can be configured, if needed (the default clock is the internal clock from the APBx), using the following function: **HAL\_TIM\_ConfigClockSource**, the clock configuration should be done beforeany start function.

Configure the TIM in the desired functioning mode using one of the Initialization function of this driver:

* **HAL\_TIM\_Base\_Init**: to use the Timer to generate a simple time base
* **HAL\_TIM\_OC\_Init** and **HAL\_TIM\_OC\_ConfigChannel**: to use the Timer to generate an Output Compare signal.
* HAL\_TIM\_PWM\_Init and HAL\_TIM\_PWM\_ConfigChannel: to use the Timer to generate a PWM signal.
* **HAL\_TIM\_IC\_Init** and **HAL\_TIM\_IC\_ConfigChannel**: to use the Timer to measure an signal.
* HAL\_TIM\_OnePulse\_Init and HAL\_TIM\_OnePulse\_ConfigChannel: to use the Timer in One Pulse Mode.
* HAL\_TIM\_Encoder\_Init: to use the Timer Encoder Interface.

Activate the TIM peripheral using one of the start functions depending from the feature used:

1. Time Base : HAL\_TIM\_Base\_Start(), HAL\_TIM\_Base\_Start\_DMA(), HAL\_TIM\_Base\_Start\_IT()
2. Input Capture : HAL\_TIM\_IC\_Start(), HAL\_TIM\_IC\_Start\_DMA(), HAL\_TIM\_IC\_Start\_IT()
3. Output Compare : HAL\_TIM\_OC\_Start(), HAL\_TIM\_OC\_Start\_DMA(), HAL\_TIM\_OC\_Start\_IT()
4. PWM generation : HAL\_TIM\_PWM\_Start(), HAL\_TIM\_PWM\_Start\_DMA(), HAL\_TIM\_PWM\_Start\_IT()
5. One-pulse mode output : HAL\_TIM\_OnePulse\_Start(), HAL\_TIM\_OnePulse\_Start\_IT()
6. Encoder mode output : HAL\_TIM\_Encoder\_Start(), HAL\_TIM\_Encoder\_Start\_DMA(), HAL\_TIM\_Encoder\_Start\_IT().

The DMA Burst is managed with the two following functions:

* HAL\_TIM\_DMABurst\_WriteStart()
* HAL\_TIM\_DMABurst\_ReadStart()