
Generating PWM signals using STM8 Nucleo-64 boards

Introduction

The NUCLEO-8S208RB (built around the STM8S208RBT6 device) and the NUCLEO-8L152R8 (built around the STM8L152R8T6 device) are boards that allow the evaluation of the main features of all the STM8S Series and STM8L Series microcontrollers.

This application note provides a short description on how to use the TIM peripheral to generate three PWM signals.

Table 1. Applicable products

Type	Part number
Evaluation boards	NUCLEO-8S208RB
	NUCLEO-8L152R8

Reference documents

- *STM8 Nucleo-64 boards* data brief (DB3591)
- *STM8L152R8T6 Nucleo-64 board* user manual (UM2351)
- *STM8S208RBT6 Nucleo-64 board* user manual (UM2364)

1 Application description

This section describes the hardware requirements, the application's schematics and the application's principle to use the TIM peripheral to generate three PWM signals on the NUCLEO-8S208RB or the NUCLEO-8L152R8 boards.

1.1 Hardware requirements

No additional hardware is required on the NUCLEO-8S208RB or the NUCLEO-8L152R8 boards.
An oscilloscope is needed as an external resource.

1.2 Application schematics

The application schematics of both boards are illustrated in the figures below.

Figure 1. STM8S Series application schematic

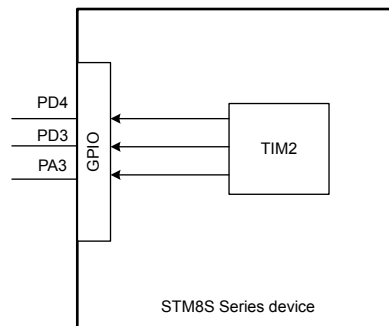
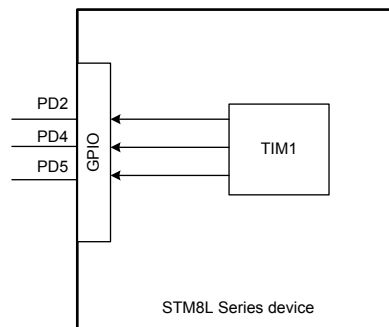


Figure 2. STM8L Series application schematic



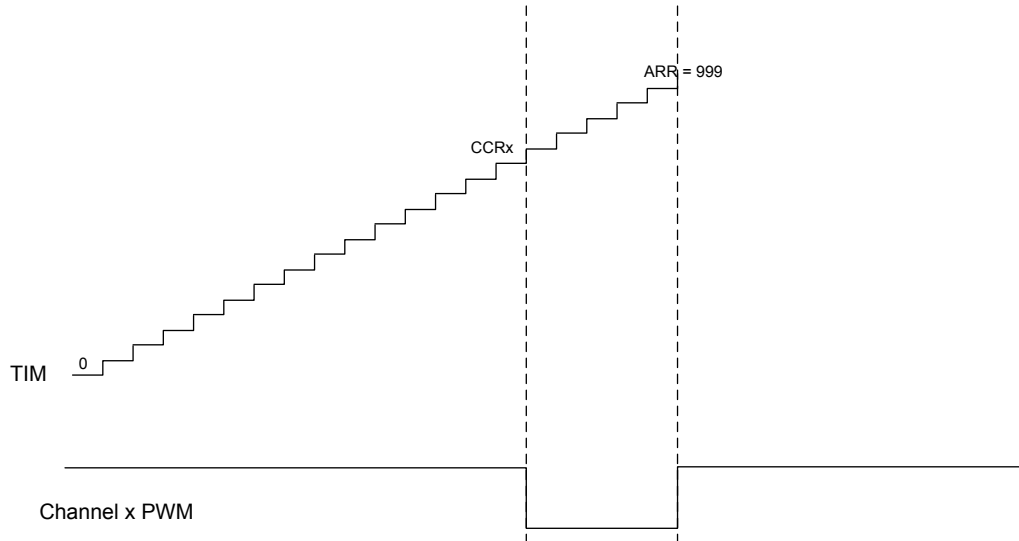
1.3 Application principle

This application is based on the use of the TIM in PWM (pulse width modulation) mode to generate three PWM signals.

- TIM2 for STM8S Series devices
- TIM1 for STM8L Series devices

The generation process is presented in the figure below.

Figure 3. PWM generation principle



TIM counts up from 0 to the auto-reload register value (TIM_ARR) according to the timer counter clock.

- When the counter value equals the compare/capture register (TIM_CCRx) value, channel x signal is set to 0.
- When the counter value reaches the TIM_ARR value the counter is reset and channel x signal is set to 1.

By configuring the TIMx_CCRx and TIMx_ARR registers the user can easily modify the duty cycle and the frequency of the PWM signals generated (see [Section 2 Software description](#)). By default the application provides the three PWM signals as specified in the table below.

Note: is possible to configure the AFR option byte to get channel 3 also on PD2.

Table 2. Default PWM signals

Signal	Duty cycle	Frequency	STM8S Series		STM8L Series	
			I/O pin	Header connector	I/O pin	Header connector
Channel 1 PWM	50%	2 KHz	PD4	CN5.6	PD2	CN5.24
Channel 2 PWM	25%		PD3	CN5.21 /CN6.1	PD4	CN5.6
Channel 3 PWM	75%		PA3	CN4.27	PD5	CN5.4

2 Software description

This example uses the STM8S Series and STM8L Series standard firmware libraries to control the general purpose functions.

To generate the PWM signals the TIMx peripheral must be configured as follows:

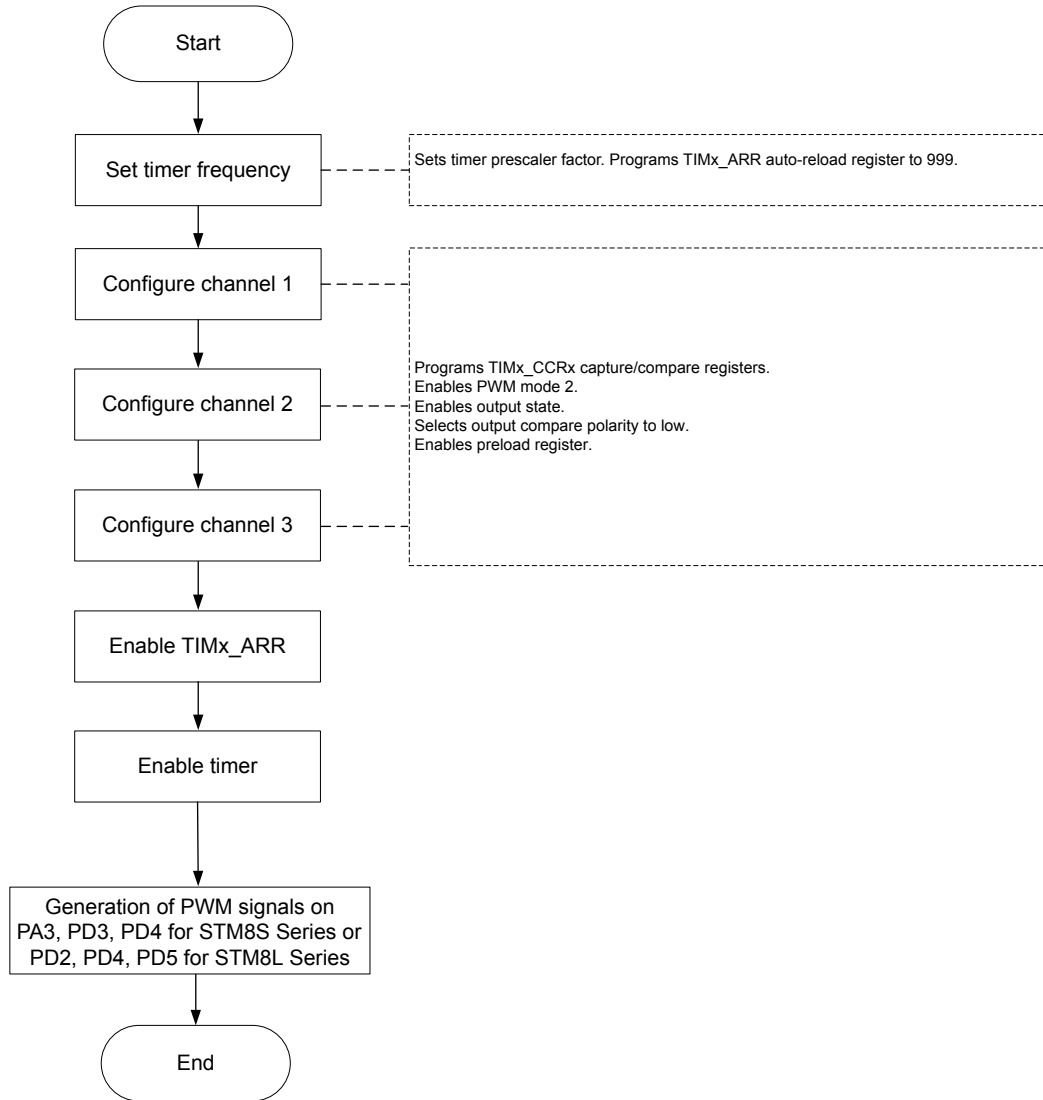
- Output state enabled for each channel
- Output compare active low for each channel
- Preload register enabled for each channel
- PWM output signal frequency = 2 KHz:
 - The timer source clock frequency is 2 MHz (f_{CPU} by default) and the prescaler is set to 1 to obtain a TIMx counter clock of 2 MHz.
 - PWM output signal frequency can be set according to the following equation:
PWM output signal frequency = TIMx counter clock / (TIMx_ARR + 1)
(in our case TIMx_ARR = 999, so PWM output signal frequency is 2 KHz)
- PWM mode for each channel. To obtain a different PWM duty cycle value on each channel the TIMx_CCRx register must be set according to this equation:
Channel x duty cycle = [TIMx_CCRx / (TIMx_ARR + 1)] x 100

By default we have:

- Channel 1: TIMx_CCR1x register value is 500, so channel 1 of TIMx generates a PWM signal with a frequency of 2 KHz and a duty cycle of 50%.
- Channel 2: TIMx_CCR2x register value is 750, so channel 2 of TIMx generates a PWM signal with a frequency of 2 KHz and a duty cycle of 75%.
- Channel 3: TIMx_CCR3x register value is 250, so channel 3 of TIMx generates a PWM signal with a frequency of 2 KHz and a duty cycle of 25%.

Note: TIMx = TIM2 for STM8S Series devices and TIM1 for STM8L Series devices

2.1 Application software flowchart

2.1.1 Main loop flowchart
Figure 4. Main loop flowchart


Revision history

Table 3. Document revision history

Date	Version	Changes
29-Jun-2018	1	Initial release.

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