TLE9893_2QKW62S_CCU7_PWM

About this document

Scope and purpose

The aim of this guide is to present the scope, the implementation, the algorithm and a demonstration of the **TLE9893_2QKW62S_CCU7_PWM** example code for the TLE989x Infineon Embedded Power ICs based on Arm® Cortex® M3. This example code can be found in the Keil µVision Pack Installer.

The full functionalities and characteristics of the embedded power devices are described in the datasheets and user's manual. Please refer to these documents for more detailed information. Furthermore, a low level (line-by-line) description of the code is not the aim of this document, although occasionally some codeblocks might be reported if necessary to the comprehension.

Note: *The following information is given as a hint for the implementation of the system only and shall not be regarded as a description or warranty of a certain functionality, condition or quality of the referred devices or presented software example.*

Intended audience

Design engineers, system engineers, embedded power designers

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1 Introduction

In the TLE9893_2QKW62S_CCU7_PWM example, three signals are modulated and output via the GPIO pins P1.2, P1.0 and P0.9. Three respectively inverted signals are modulated and output via the GPIO pins P0.3, P1.1 and P0.8. The timer T12 is configured with a period time of 50µs. The choosen operation mode is edge-aligned.

Table 1 shows the configured channels and their corresponding output pins. The channel 2 is only applicable on 64-pin devices.

Channel	DC	CC7x	COUT7x
Ch0	50%	P1.2	P0.3
Ch1	25%	P1.0	P1.1
Ch2	80%	P0.9	P0.8

Table 1 Overview about the configured channel

Figure 1 shows the configured CCU7 signals and their expected output flow for a 50µs time period.

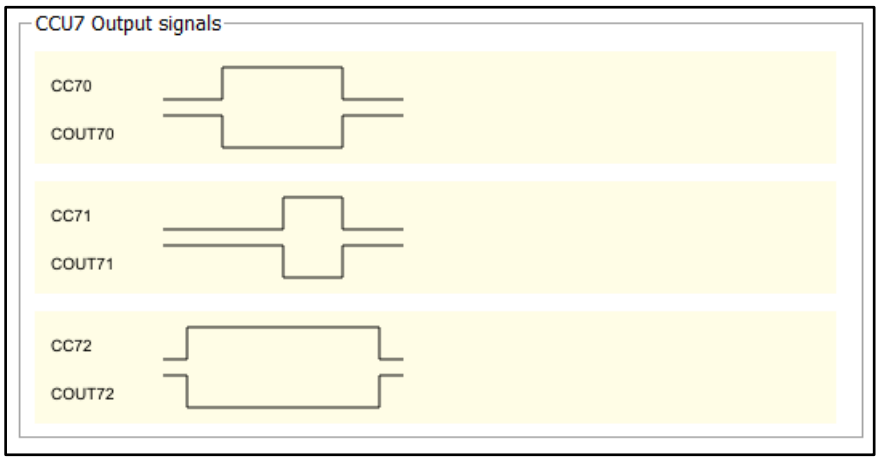

Figure 1 Overview of all output signals from Config Wizard

The channel 0 is configured with two compare values CC70A, for a duty cycle of 25%, and C70B, for a duty cycle of 75%.

Figure 2 shows the expected output for the channel 0:

- The blue line represents the signal with the compare values defined above at the pin P1.2: the signal starts with low level until 25% of the 50µs time period (= 12.5µs) and stays high until the duty cycle of 75% (= 37.5µs) is reached.
- The yellow line represents the corresponding inverted signal at the pin P0.3.

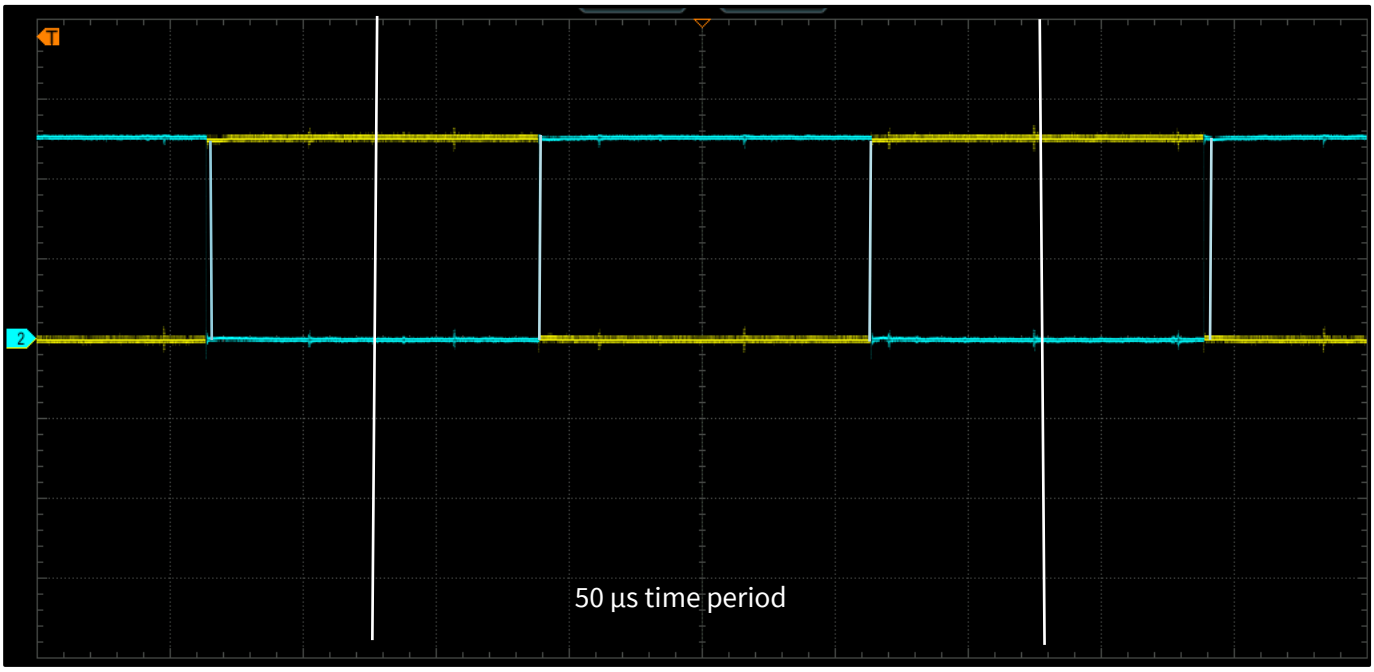

Figure 2 Capture of signal on pin P1.2 and its corresponding inverted signal on pin P0.3

The channel 1 is configured with two compare values CC71A, for a duty cycle of 50%, and C71B, for a duty cycle of 75%.

Figure 3 shows the expected output for the channel 1:

- The blue line represents the signal with the compare values defined above at the pin P1.0: the signal starts with low level until 50% of the 50µs time period (= 25µs) and stays high until the duty cycle of 75% (= 37.5µs) is reached.
- The yellow line represents the corresponding inverted signal at the pin P1.1.

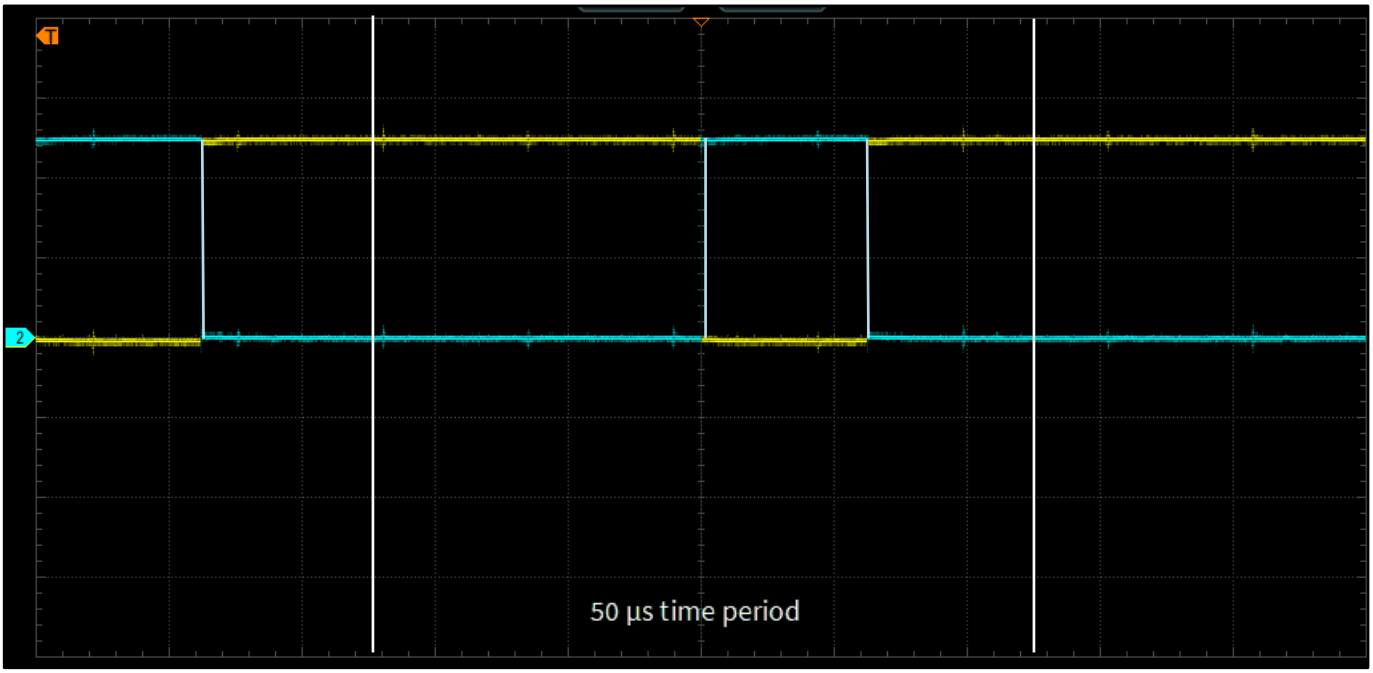

Figure 3 Capture of signal on pin P1.0 and its corresponding inverted signal on pin P1.1

The channel 2 is configured with two compare values CC72A, for a duty cycle of 10%, and C72B, for a duty cycle of 90%.

Figure 4 shows the expected output for the channel 2:

- The blue line represents the signal with the compare values defined above at the pin P0.9: the signal starts with low level until 10% of the 50µs time period (= 5µs) and stays high until the duty cycle of 90% (= 45µs) is reached.
- The yellow line represents the corresponding inverted signal at the pin P0.8.

This signal is shown for the 64-pin devices only.

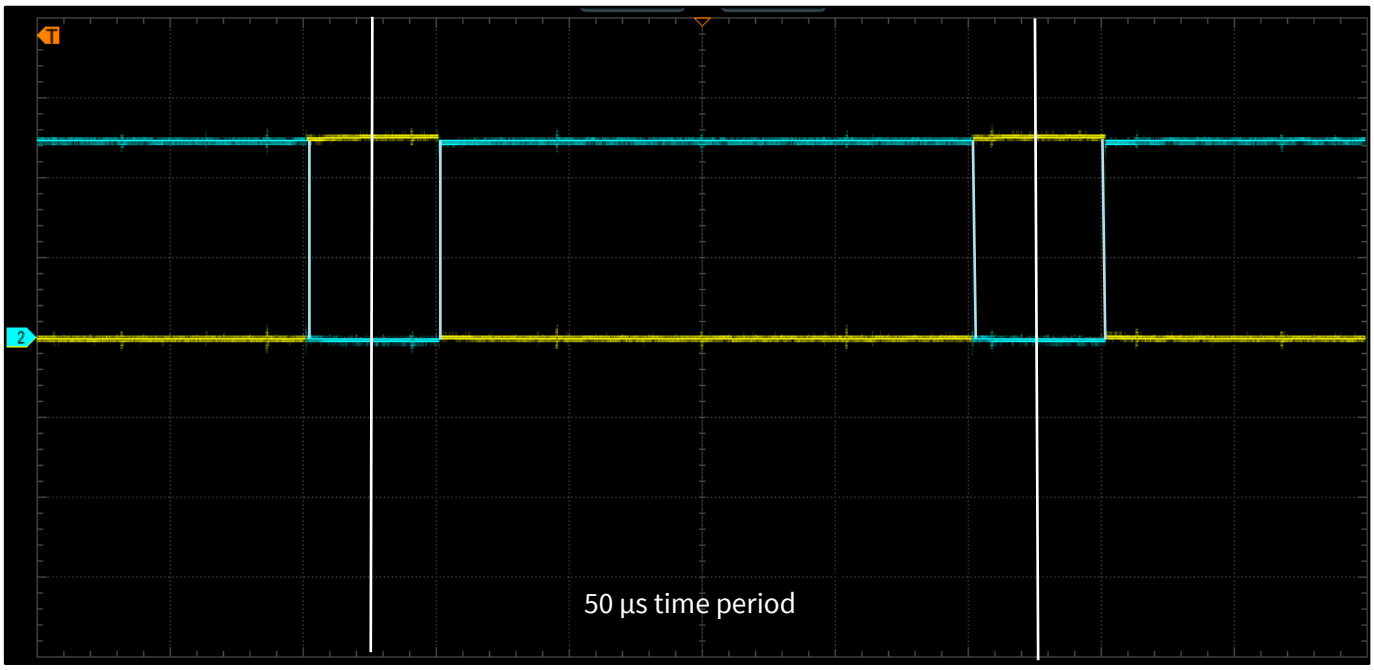

Figure 4 Capture of signal on pin P0.9 and its corresponding inverted signal on pin P0.8

2 Hardware

This chapter shows how to run the TLE989X_2QKW62S_CCU7_PWM example with the TLE988X/TLE989x evaluation board. For this the project must be opened and compiled.

Figure 5 shows the TLE988X/TLE989X evaluation board. The application code must be loaded via a debugger (e.g. ULINK or J-Link) to the board. The board must be powered with 12V (red and black connections).

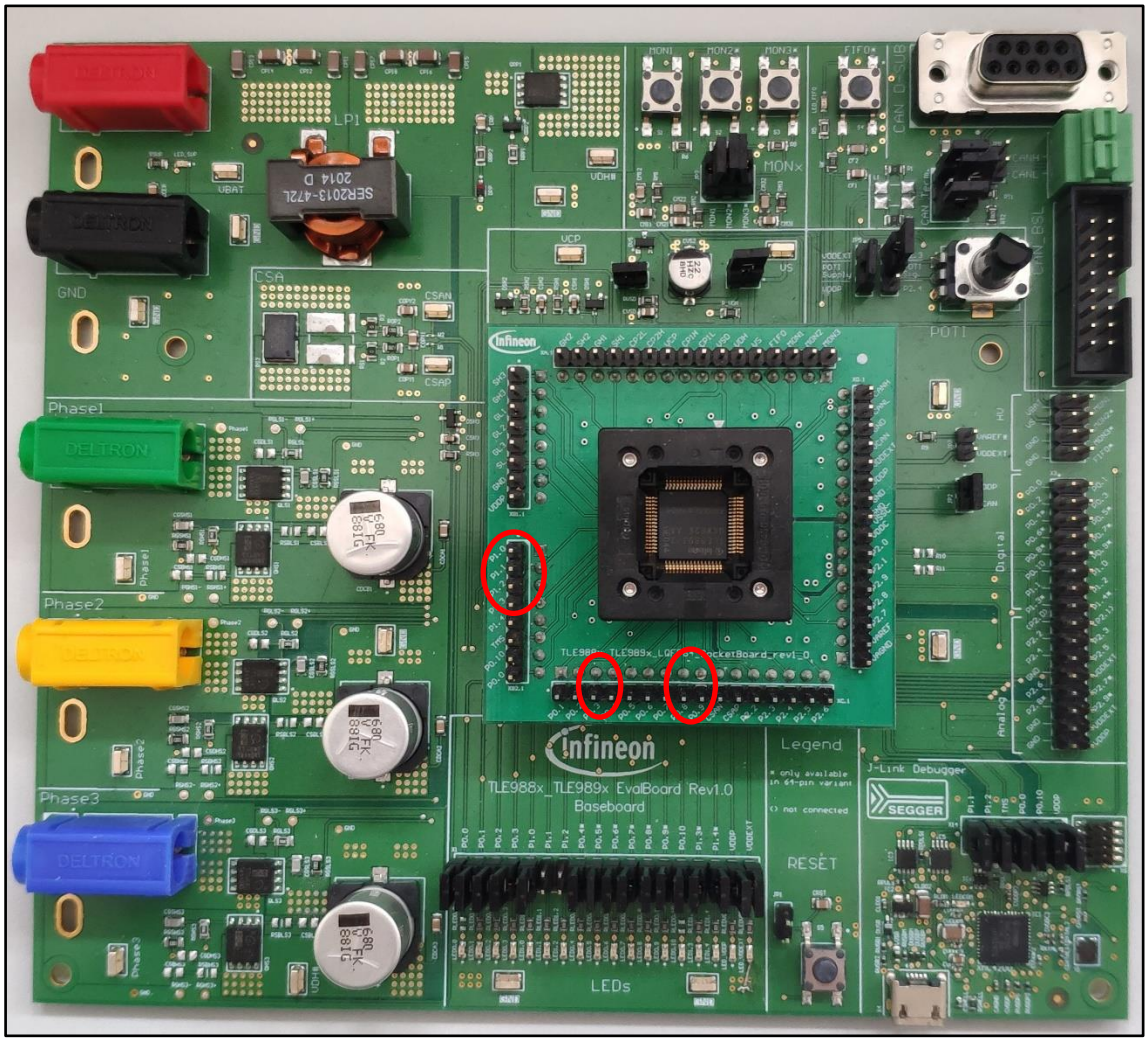

Figure 5 TLE988X/TLE989X evaluation board

The modulated output signals can be tapped on the GPIO pins P1.2, P1.0 and P0.9.

The modulated corresponding inverted signals can be tapped on the GPIO pins P0.3, P1.1 and P0.8.

3 Implementation

This chapter shows the process to follow to get a working TLE9893_2QKW62S_CCU7_PWM example.

3.1 Get the example via the Pack Installer for Keil

Open the Pack Installer within the Keil IDE. See Figure 6 below.

Choose the appropriate device (here TLE9893_2QKW62S) on the left-hand side. On the right-hand side, select the tab Examples, where you can access the TLE9893_2QKW62S_CCU7_PWM example.

Clicking on “Copy” will copy the example on your computer and open it.

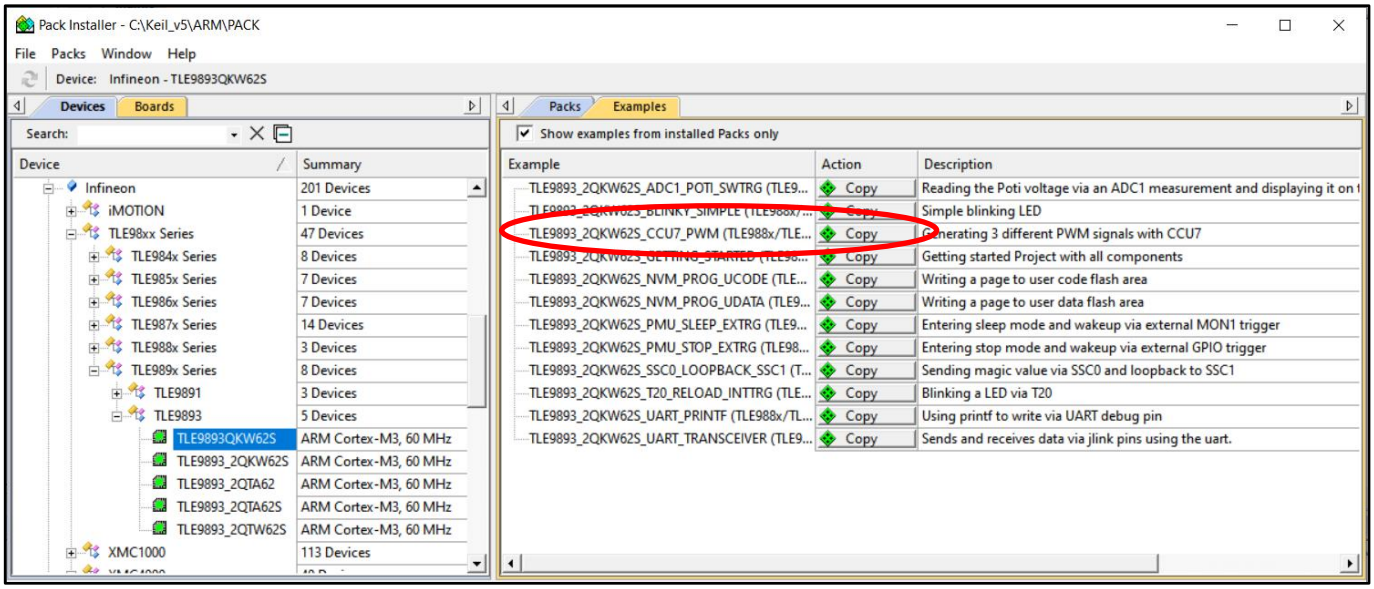

Figure 6 Keil Pack Installer

3.2 Configuration

In order to see the configured pins, start the tool Config Wizard. It is available within the Keil IDE through a shortcut in the Tools menu.

The Config Wizard opens and shows an overall status of the current pin configuration. In Figure 7 the pins P1.2, P1.0 and P0.9 are configured to output the modulated signals.

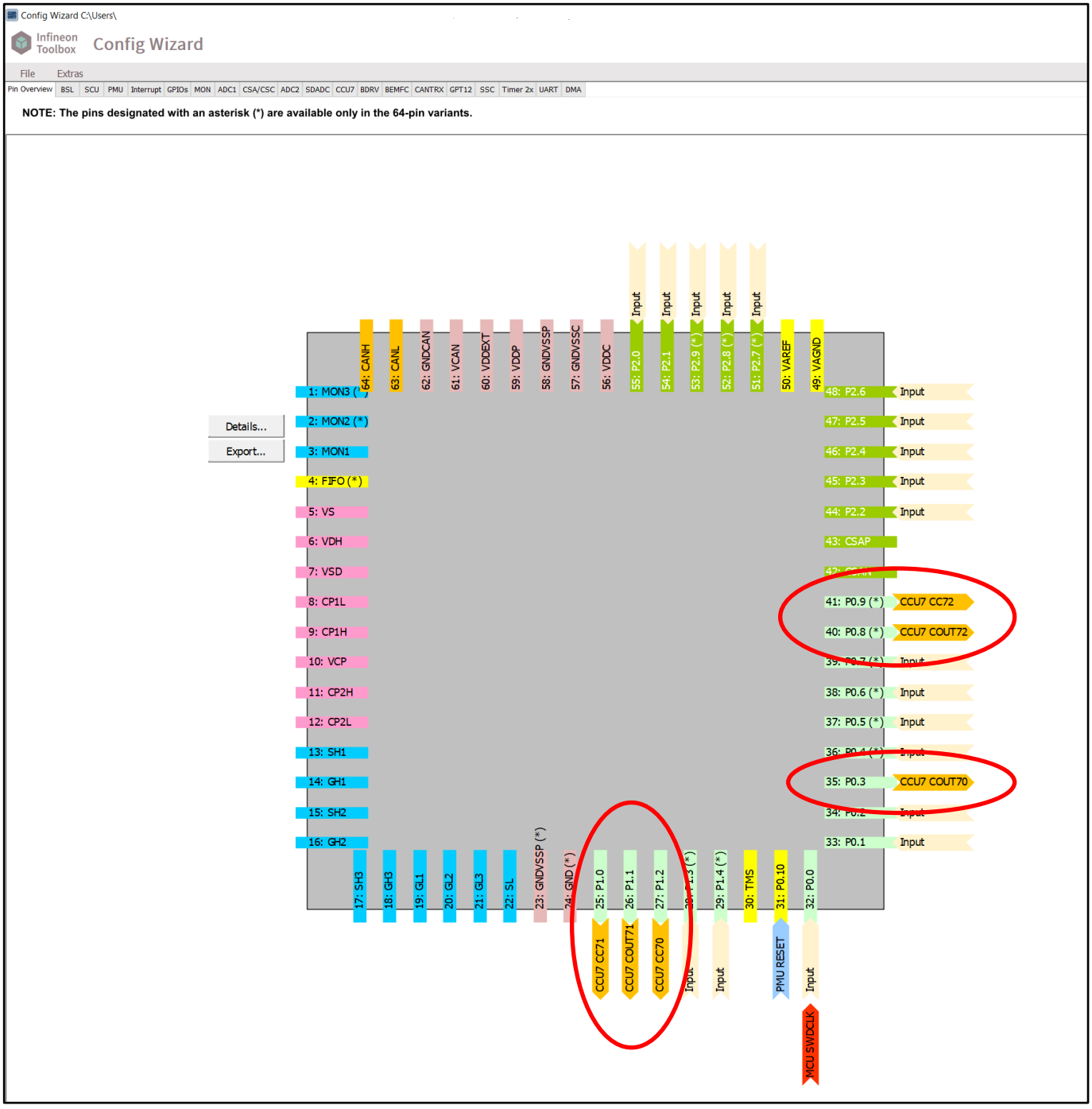

Figure 7 Config Wizard pin overview

In order to configure the CCU7 module for the TLE9893_2QKW62S_CCU7_PWM example, select the CCU7 tab.

Figure 8 shows the available settings for the CCU7 module.

The Timer T12 is used and configured in the blue box Timer, Clock (see Figure 9).

The behavior of the modulation is set in the pink box Modulation Configuration. For this example, all CC7X and their corresponding COUT7X signals are configured with the compare A/B registers (C7XA/B State Bit). Additionally, the level of the output after a compare can be set.

The output pins are configured in the yellow box Pin Select (see Figure 10).

The configured result (time behavior and output signals) is displayed on the right-hand side of the CCU7 module.

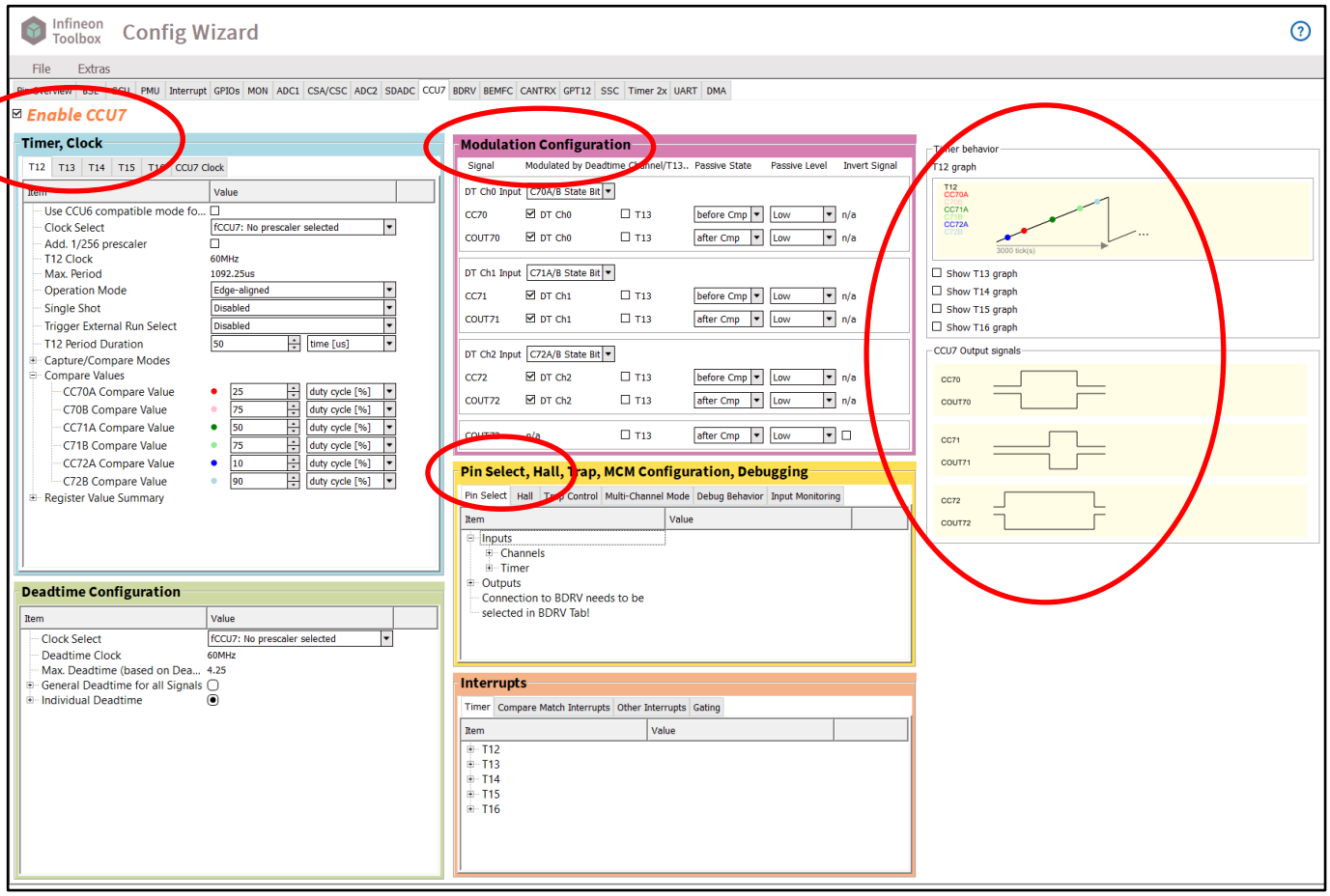

Figure 8 Config Wizard, module CCU7

Figure 9 shows the timer T12 settings in the blue box Timer, Clock:

- The operation mode is edge-aligned.
- The T12 period time is set to 50µs.
- Each of the three signals are modulated based on two compare values (see Table 1).

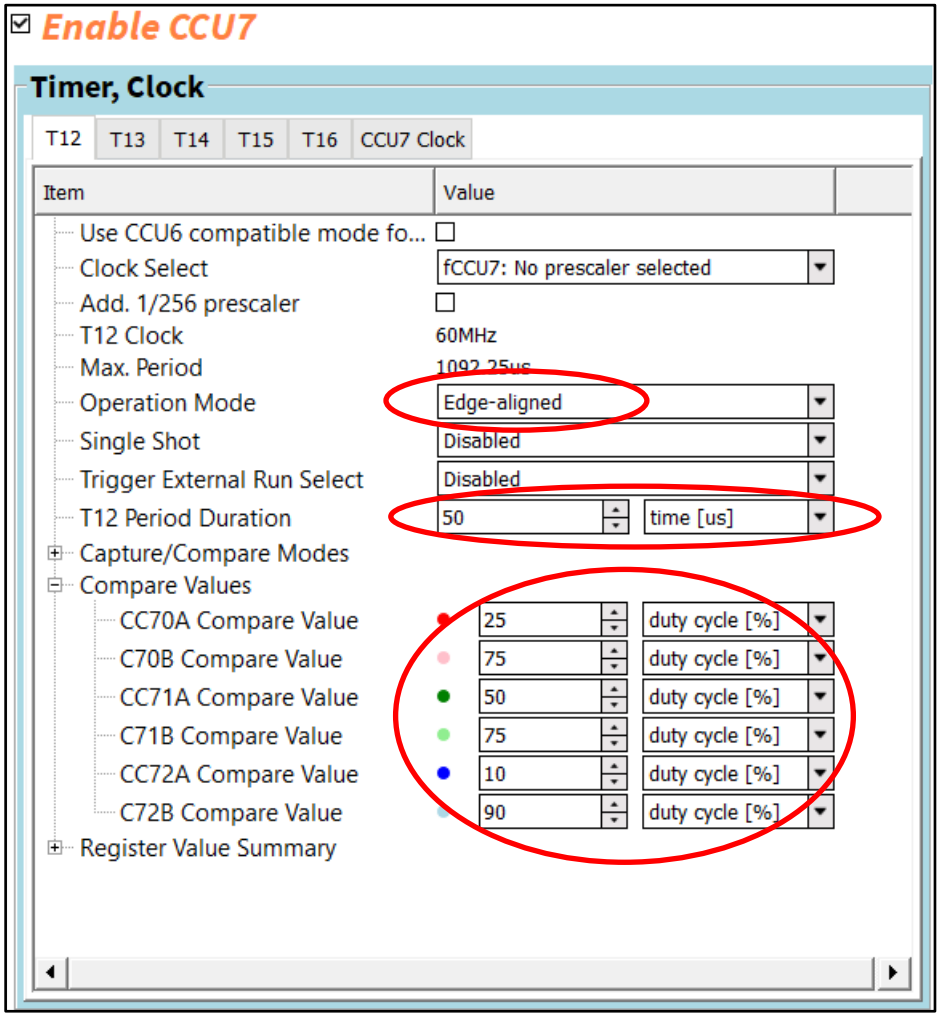

Figure 9 Module CCU7, Settings timer T12

Figure 10 shows the pin selection in the yellow box, in the tab Pin Select for the three modulated signals CC70, CC71 and CC72, as well as their corresponding inverted signals COUT70, COUT71 and COUT72. They are set to a physical GPIO pin. See the Table 1 for more details.

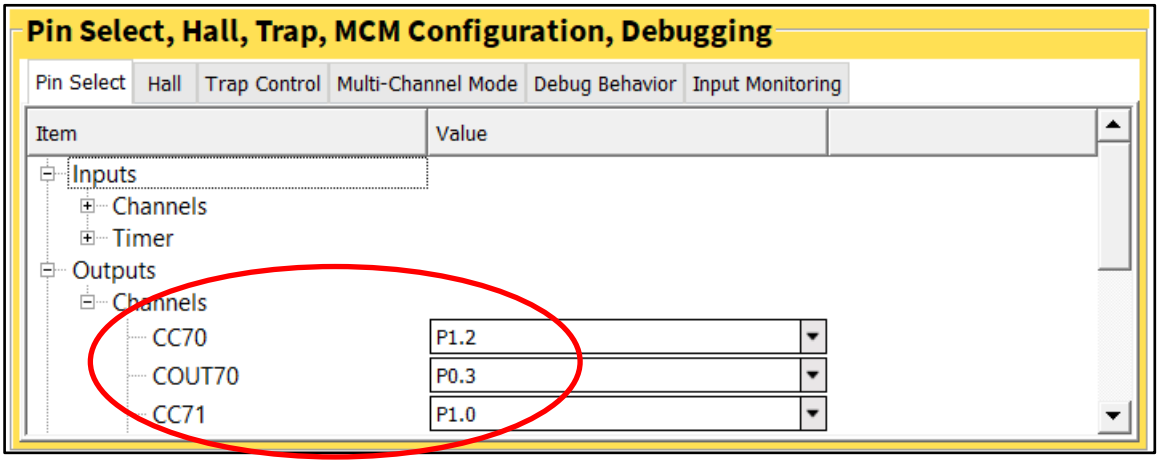

Figure 10 Module CCU7, Settings Pin Select

Finally, save your configuration to take these changes into account (File -> Save).

3.3 Sample code

Figure 11 shows the application code of the TLE9893_2QKW62S_CCU7_PWM example.

Basically, the only thing left to be done in the application code is to start the configured Timer T12 with the API call `CCU7_startT12()` on line 89 before the code jumps to an endless loop.

```
85    /* Clear bridge driver status flags */
86    BDRV->STSCLR.reg = 0xFFFFFFFFU;
87
88    /* Start timer T12 */
89    CCU7_startT12();
90
91    for (;;)
92    {
93      /* Main watchdog service */
94      (void) PMU_serviceFailSafeWatchdog();
95    }
96  }
```

Figure 11 TLE9893_2QKW62S_CCU7_PWM application code

References

See the code examples at **www.infineon.com**

Revision history

Document version	Date of release	Description of changes
1.0	2021-04-28	Initial version
1.1	2022-10-13	Editorial changes

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