Customer training workshop: HAL_TCPWM_Timer for KIT_T2G-B-H_EVK

TRAVEO™ T2G CYT4BF series Microcontroller Training
V1.0.1 2023-03

Scope of work

- This code example generates an interrupt at every second with the Timer driver, and toggles the user LED when a timer interrupt is generated.

- Device
  - The TRAVEO™ T2G CYT4BFBCH device is used in this code example.

- Board
  - The TRAVEO™ T2G KIT_T2G-B-H_EVK board is used for testing.

Introduction

- **TCPWM has the following features:**
  - Supports up to four counter groups (device-specific)
  - Each counter group consists up to 256 counters (counter group-specific)
  - Each counter can run in one of the following seven function modes:
    - Timer-counter with compare
    - Timer-counter with capture
    - Quadrature decoding
    - Pulse width modulation (PWM)/stepper motor control (SMC) for pointer instruments
    - PWM with dead time/three-phase motor control Brushless-DC (BLDC)
    - Pseudo-random PWM
    - Shift register mode
  - 16-bit or 32-bit counters (counter group specific)
  - Up, down, and up/down counting modes
  - Clock prescaling (division by 1, 2, 4, ... 64, 128)

Introduction

TCPWM has the following features:

- Up to two capture and compare functions (counter group specific)
- Double buffering of all compare/capture and period registers
- Two output trigger signals for each counter to indicate underflow, overflow, and capture/compare events; they can also directly be connected with the line output signal
- Supports interrupt on:
  - Terminal count - Depends on the mode; typically occurs on overflow or underflow
  - Capture/Compare - The count is captured in the capture registers or the counter value equals the value in the compare register
- Line out selection feature for stepper motor application including two complementary output lines with dead time insertion
- Selectable start, reload, stop, count, and two capture event signals for each TCPWM with rising edge, falling edge, both edges, and level trigger options
- Each counter with up to 254 (device-specific) synchronized input trigger signals and two constant input signals: '0' and '1'.

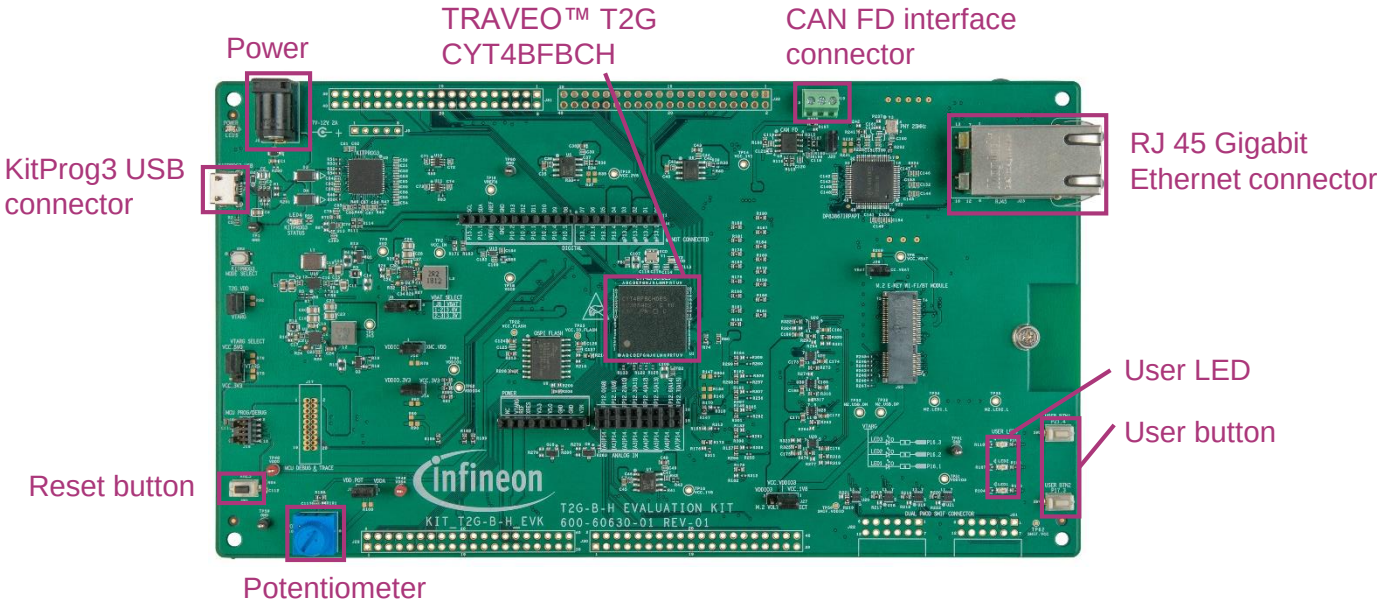
Introduction

- **TCPWM has the following features:**
  - Two types of input triggers for each counter:
    - General-purpose triggers used by all counters
    - One-to-one trigger for a specific counter
  - Synchronous operation of multiple counters
  - Debug mode support

Hardware setup

› This code example has been developed for the KIT-T2G-B-H-EVK board.

› Connect your PC to the board using the provided USB cable through the KitProg3 USB connector.



Implementation

- Code example design
  - The timer is configured as 10000-Hz frequency with count up and continuous mode. Enable the timer ***CYHAL_TIMER_IRQ_TERMINAL_COUNT*** interrupt to generate an interrupt for each 1s. Invert the user LED while generating the timer interrupt.

Follow these steps to configure this code example:

- GPIO port pin initialization
- TCPWM initialization
- ISR registration
- Enable TCPWM
- Blink LED

Implementation

GPIO port pin initialization

- The ***cyhal_gpio_init()*** function initializes the GPIO port pin once.
  - Initialize P16.1 as output (initial level = H, LED turns off)

TCPWM initialization

- Call the ***cyhal_timer_init()*** function to get the timer object.
  - Clock source is not changed, and timer pins are not used
  - The TCPWM channel to be used is automatically allocated and set into the timer object
- Call the ***cyhal_timer_configure()*** function to initialize TCPWM.
  - Configure TCPWM with parameters in structure ***timer_cfg***
- Call the ***cyhal_timer_set_frequency()*** function to set the timer cycle.
  - The ***TIMER_TARGET_FREQUENCY*** changes the cycle

Implementation

ISR registration

› The ***cyhal_timer_register_callback()*** function registers the interrupt service routine (ISR); in this sample, the name is ***isr_timer()***.

Enable TCPWM

› Call the ***cyhal_timer_register_callback()*** function to set the interrupt factor and enable interrupt.

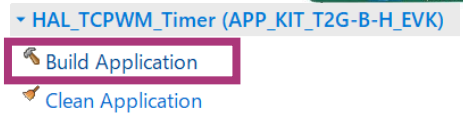
› Call the ***cyhal_timer_start()*** function to start the TCPWM timer.

Blink LED

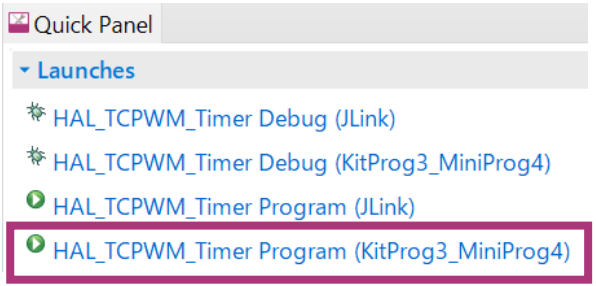
› Once the TCPWM timer starts, the ISR function ***isr_timer()*** will be called when the timer expires and it calls the ***cyhal_gpio_toggle()*** function to toggle the user LED.

Compiling and programming

1. Connect to power and USB cable
2. Use Eclipse IDE for ModusToolbox™ software for compiling and programming
3. Compile
   a) Select the target application project in the Project Explorer.
   b) In the Quick Panel, scroll down, and click "Build Application" in HAL_TCPWM_Timer (APP_KIT-T2G-B-H-EVK)

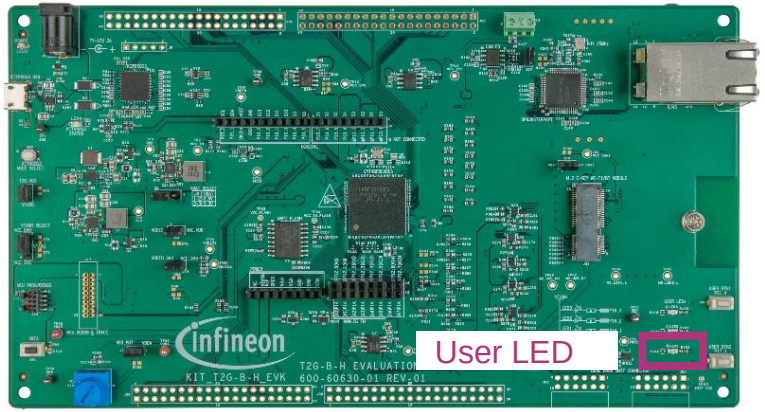


4. Programming
   a) Select the target application project in the Project Explorer
   b) In the Quick Panel, scroll down, and click "HAL_TCPWM_Timer Program (KitProg3_MiniProg4)" under Launches



Run and test

After programming, the application starts automatically. Confirm that the user LED on the kit blinks at 1 second.



References

Datasheet

› CYT4BF datasheet 32-bit Arm® Cortex®-M7 microcontroller TRAVEO™ T2G family

Architecture technical reference manual

› TRAVEO™ T2G automotive body controller high family architecture technical reference manual

Registers technical reference manual

› TRAVEO™ T2G automotive body controller high registers technical reference manual

PDL/HAL

› PDL

› HAL

Training

› TRAVEO™ T2G Training

Revision History

Revision	ECN	Submission Date	Description of Change
**	7782110	2022/07/05	Initial release
*A	7876704	2023/03/01	Changed the title Removed STDOUT setting in “Implementation” Changed figures in “Compiling and programming” Removed UART terminal message in “Run and test”

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