Customer training workshop: HAL_PWM_Square_Wave for KIT_T2G-B-H_EVK

TRAVEO™ T2G CYT4BF series Microcontroller Training
V1.0.1 2023-02

Scope of work

- This code example generates a square wave using the PWM driver. An LED connected to the PWM output pin blinks at 2 Hz.

- 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 of 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 (contd.)

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'.

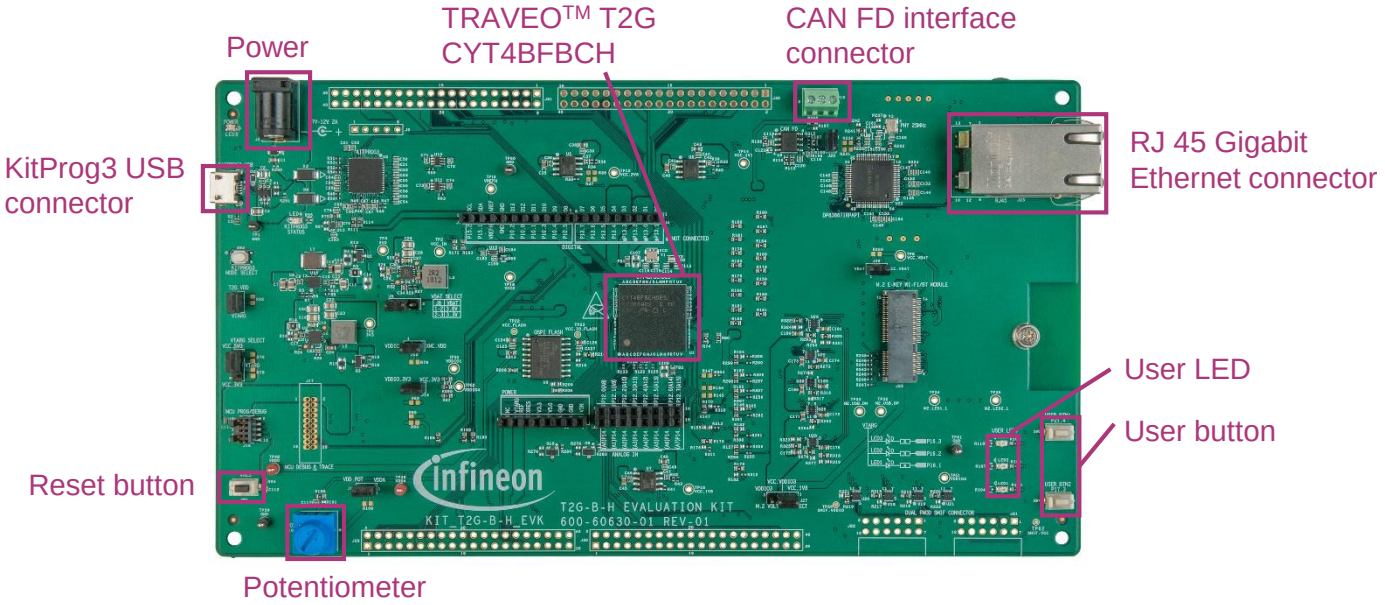
Introduction (contd.)

- **TCPWM has the following features**
  - Two types of input triggers for each counter:
    - General-purpose triggers used by all counters
    - One-to-one triggers for 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

In this example, the PWM output duty cycle is set to 50%, which generates a square wave.
The output of the PWM is connected to an LED that blinks at 500 ms (inverse of the PWM output frequency, 2 Hz).
After the PWM starts, the CPU is put to Sleep mode to save power.

Follow these steps to configure this code example:

- STDOUT setting
- PWM initialization
- PWM output frequency and duty cycle configuration
- Start the PWM
- Go to Sleep mode

Implementation (contd.)

STDOUT setting

› Call the ***cy_retarget_io_init()*** function to use UART as STDOUT

- Initialize P13.1 as UART TX, P13.0 as UART RX (these pins are connected to the KitProg3 COM port)
- The serial port parameters change to 8N1 and 115200 baud

PWM initialization

› The ***cyhal_pwm_init ()*** function initializes the PWM out peripheral and the pin configuration once.

- User LED is connected to P16.1 as output

PWM output frequency and duty cycle configuration

› The ***cyhal_pwm_set_duty_cycle ()*** function configures the PWM output frequency and duty cycle once.

- You can change the PWM output frequency and duty cycle by modifying these parameters
  - ***PWM_FREQUENCY*** (default="2u": 2 Hz)
  - ***PWM_DUTY_CYCLE*** (default="50.0f": 50 %)

Implementation (contd.)

Start the PWM

› The ***cyhal_pwm_start ()*** function starts the PWM generation and outputs on pin.

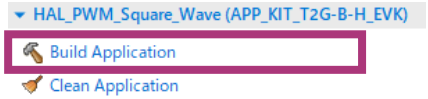
Go to Sleep mode

› Go to Sleep mode using the ***cyhal_syspm_sleep ()*** function

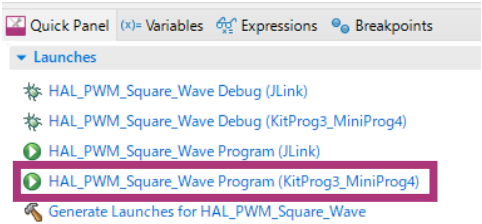
  – The PWM is output even if the CPU goes into Sleep mode

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 HAL_PWM_Square_Wave Application" in HAL_PWM_Square_Wave (KIT-T2G-B-H-EVK)

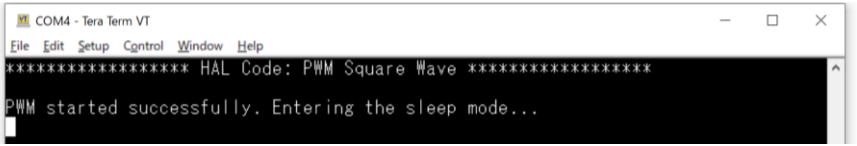


4. Open a terminal program and select the KitProg3 COM port. Set the serial port parameters to 8N1 and 115200 baud.
5. Programming
   a) Select the target application project in the Project Explorer
   b) In the Quick Panel, scroll down, and click "HAL_PWM_Square_Wave Program (KitProg3_MiniProg4)" in Launches

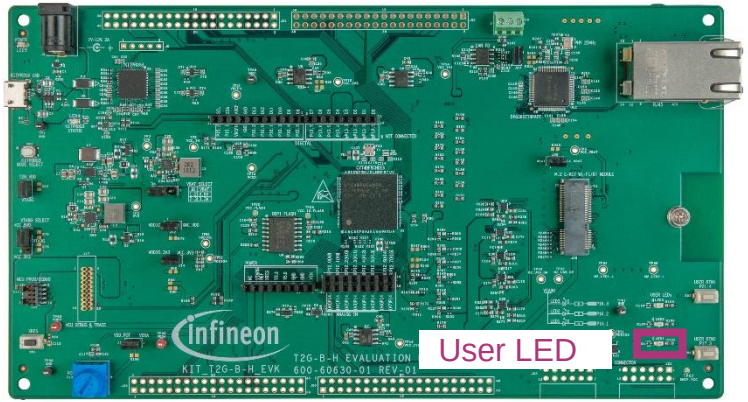


Run and test

1. After successful programming, the terminal should display the message as follows:



2. Observe that the user LED (P16.1) blinks at half-second intervals (2 Hz)
3. The terminal shows the PWM initialization status



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
**	7781912	2022/07/05	Initial release
*A	7876269	2023/02/20	Updated the title Updated figures in “Compiling and programming”

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