

# Customer training workshop: LVD\_Interrupt for KIT\_T2G-B-H\_EVK

TRAVEO™ T2G CYT4BF series Microcontroller Training  
V1.0.2 2023-03



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## Scope of work

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- › This code example shows how to configure low-voltage detection (LVD) to monitor  $V_{DD}$  and generate an interrupt when  $V_{DD}$  drops lower than the configured threshold.
  
- › 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

## › Power supply subsystem has the following features:

- $V_{\text{DDD}}$  power supply voltage range of 2.7 V to 5.5 V.
- Core supply rail ( $V_{\text{CCD}}$ ).
- Independent multiple power supply rails ( $V_{\text{DDD}}$ ,  $V_{\text{DDA}}$ ,  $V_{\text{CCD}}$ , and multiple  $V_{\text{DDIO}}$  rails) for peripherals.
- Multiple on-chip regulators.
  - Active regulator to power the MCU in Active/Sleep mode in case of low current consumption
  - DeepSleep regulator to power peripherals operating in DeepSleep mode
  - High-current regulator to support higher current load by using an external pass transistor or by controlling for an external power management integrated circuit (PMIC) or low-dropout (LDO) regulator
- Low-voltage ( $V_{\text{CCD}}$ ) and high-voltage ( $V_{\text{DDD}}$  and  $V_{\text{DDA}}$ ) BOD circuits are available in all power modes except Hibernate and XRES modes.
- Low-voltage ( $V_{\text{CCD}}$ ) and high-voltage ( $V_{\text{DDD}}$  and  $V_{\text{DDA}}$ ) OVD circuits are available in all power modes except Hibernate and XRES modes.

## Introduction (contd.)

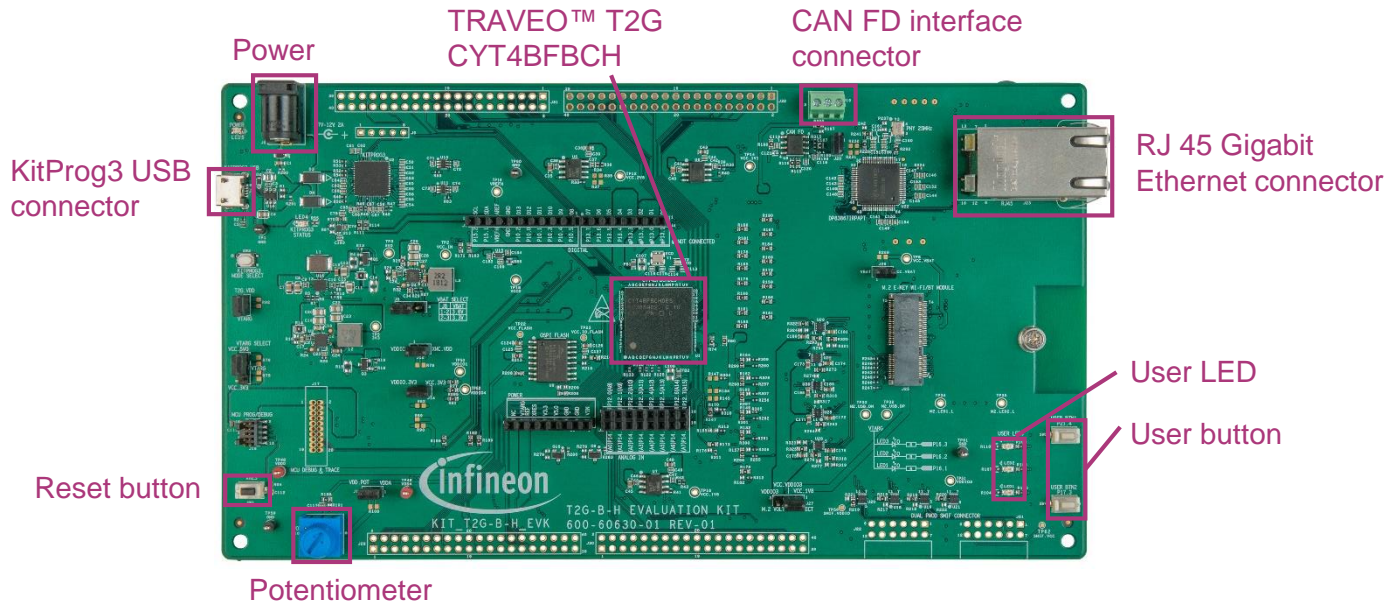
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### › **Power supply subsystem has the following features:**

- Two LVD circuits to monitor  $V_{DD}$  for falling detection (LVD), rising detection (HVD), or both in all power modes except Hibernate and XRES modes.
- OCD circuit to monitor  $V_{CCD}$  current in all power modes except Hibernate and XRES modes. OCD is not monitored for PMIC.

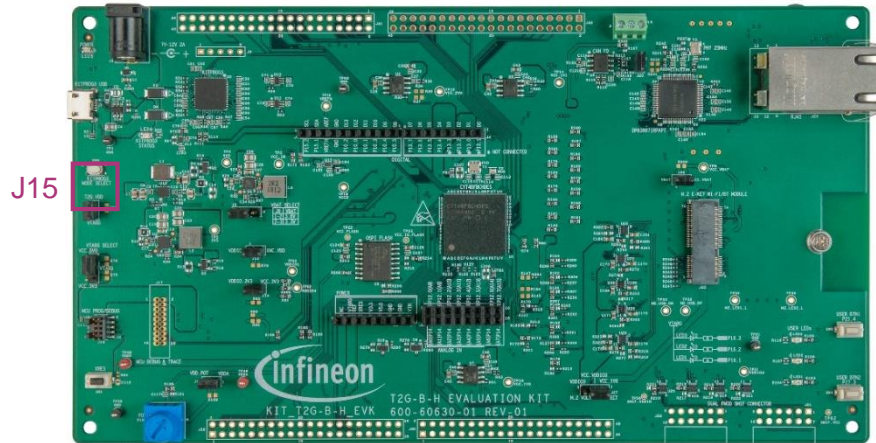
# Hardware setup

- › 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

- › This code example shows how to configure low-voltage detection (LVD) to generate an interrupt when  $V_{DD}$  drops lower than the configured threshold
- › This example needs a power supply to power the KIT\_T2G-B-H\_EVK board's J15. Please remove the jumper from J15, and connect the power supply to Pin1 of J15. Power it with 3.3V. Other  $V_{DD}$  uses the board's default configuration.
- › After programming, the application starts automatically. Confirm that LED1 is blinking at 20Hz. Drop the external  $V_{DD}$  from 3.3V to below 2.8V using the external power supply on Pin1 of J15. The LVD interrupt will occur and LED2 will toggle.



## Implementation (contd.)

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### Follow these steps to configure this code example:

- › Disable LVD
- › Adjust the  $V_{DD}$  voltage threshold
- › Set the interrupt of LVD
- › Enable LVD
- › LVD interrupt handler

### Disable LVD

- › Call the [Cy\\_LVD\\_HT\\_Disable\(\)](#) function to disable a particular LVD.
- › Call the [Cy\\_LVD\\_HT\\_ClearInterruptMask\(\)](#) function to disable LVD interrupts.

## Implementation (contd.)

### Adjust the $V_{DD}$ voltage threshold

- › Configure the threshold value and set it as 2.8V.
  - Set a threshold for monitoring the  $V_{DD}$  voltage by calling [Cy\\_LVD\\_HT\\_SetThreshold\(\)](#).

### Set the LVD Interrupt

- › Set an action configuration after the LVD block reaches the threshold by calling the [Cy\\_LVD\\_HT\\_SetActionConfig\(\)](#) function.
- › The [Cy\\_LVD\\_HT\\_SetInterruptConfig\(\)](#) function configures the LVD interrupt.
  - This function sets which edge(s) will trigger an interrupt or fault for LVDs, and select the falling edge for LVD\_1. When  $V_{DD}$  is below the threshold, LVD will generate an interrupt.
- › Call the [Cy\\_LVD\\_HT\\_SetInterruptMask\(\)](#) function to enable the LVD interrupt.
  - Before enabling LVD interrupt, please clear the LVD interrupt first using the [Cy\\_LVD\\_HT\\_ClearInterrupt\(\)](#) function.



## Implementation (contd.)

### Enable LVD

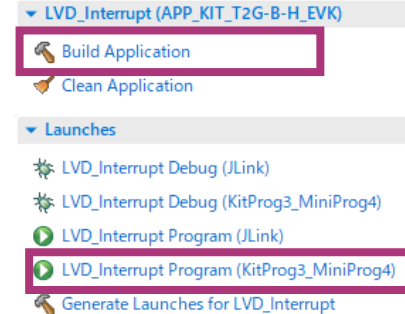
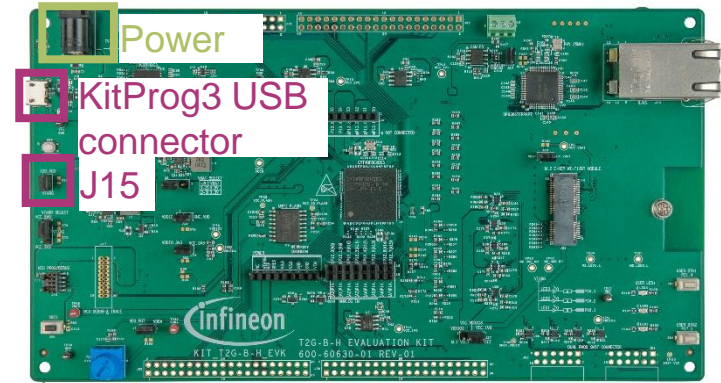
- › Enables the LVD output when the  $V_{DD}$  voltage is at or below the threshold by calling the [Cy\\_LVD\\_HT\\_Enable\(\)](#) function.
  - It needs to wait 25  $\mu$ s until it stabilizes; therefore, the code calls [Cy\\_SysLib\\_DelayUs\(\)](#) after enabling LVD.
- › Enables selected LVD during DeepSleep mode by calling the [Cy\\_LVD\\_HT\\_DeepSleepEnable\(\)](#) function.

### LVD interrupt handler

- › Call the [Cy\\_SysInt\\_Init\(\)](#) function to register *ISR\_LVD\_1()* as the ISR.
- › The ISR clears the interrupt by calling the [Cy\\_LVD\\_HT\\_ClearInterrupt\(\)](#) function; then, set the 'flagLVDIRQ' flag to notify to the main loop that the interrupt has occurred.
- › When the flag is set, the main loop calls the [cyhal\\_gpio\\_toggle\(\)](#) function to toggle LED2.

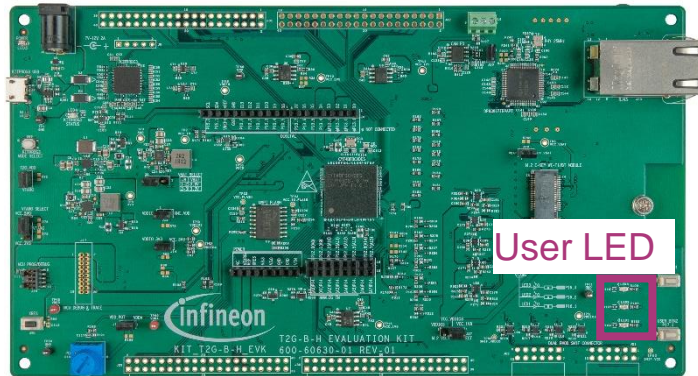
# Compiling and programming

1. Connect the board to your PC using the provided USB cable through the KitProg3 USB connector.
2. Power  $V_{DD}$  (J15) with 3.3V from external power supply.
3. Use Eclipse IDE for ModusToolbox™ software for compiling and programming
4. Compile
  - a) Select the target application project in Project Explorer.
  - b) In the Quick Panel, scroll down and click “Build LVD\_Interrupt Application” in LVD Interrupt(APP\_KIT-T2G-B-H-EVK)
5. Programming
  - a) Select the target application project in the Project Explorer
  - b) In the Quick Panel, scroll down and click “LVD\_Interrupt Program (KitProg3\_MiniProg4)” under Launches



## Run and test

1. After programming, the application starts automatically. Confirm that LED1 is blinking at 20Hz.
2. Drop external  $V_{DD}$  from 3.3V to below 2.8V and notice LED2 blinking five times.



# References

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## 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
**	7782924	2022/07/07	Initial release
*A	7841591	2022/11/08	Changed the function from Cy_GPIO_Inv() to cyhal_gpio_toggle() and added the details. The figure on page10 has been updated.
*B	7876708	2023/03/01	Added the link for functions in "Implementation"

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