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

› This code example shows how to configure low-voltage detection (LVD) to monitor $V_{DDD}$ and generate an interrupt when $V_{DDD}$ 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:**
  - $V_{DDD}$ power supply voltage range of 2.7 V to 5.5 V.
  - Core supply rail ($V_{CCD}$).
  - Independent multiple power supply rails ($V_{DDD}$, $V_{DDA}$, $V_{CCD}$, and multiple $V_{DDIO}$ 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 ($V_{CCD}$) and high-voltage ($V_{DDD}$ and $V_{DDA}$) BOD circuits are available in all power modes except Hibernate and XRES modes.
  - Low-voltage ($V_{CCD}$) and high-voltage ($V_{DDD}$ and $V_{DDA}$) OVD circuits are available in all power modes except Hibernate and XRES modes.
Introduction (contd.)

› **Power supply subsystem has the following features:**
  
  - Two LVD circuits to monitor $V_{DDD}$ 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.
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.)

Follow these steps to configure this code example:

› Disable LVD
› Adjust the $V_{DDD}$ 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\textsubscript{DDD} voltage threshold**

› Configure the threshold value and set it as 2.8V.
  - Set a threshold for monitoring the V\textsubscript{DDD} 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\textsubscript{DDD} 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.
Enable LVD

› Enables the LVD output when the $V_{\text{DDD}}$ voltage is at or below the threshold by calling the `Cy_LVD_HT_Enable()` function.
   - It needs to wait 25 µs 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 $V_{\text{DDD}}$ (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 $V_{\text{DDD}}$ from 3.3V to below 2.8V and notice LED2 blinking five times.
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

<table>
<thead>
<tr>
<th>Revision</th>
<th>ECN</th>
<th>Submission Date</th>
<th>Description of Change</th>
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<tbody>
<tr>
<td>**</td>
<td>7782924</td>
<td>2022/07/07</td>
<td>Initial release</td>
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<tr>
<td>*A</td>
<td>7841591</td>
<td>2022/11/08</td>
<td>Changed the function from Cy_GPIO_Inv() to cyhal_gpio_toggle() and added the details. The figure on page10 has been updated.</td>
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<tr>
<td>*B</td>
<td>7876708</td>
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<td>Added the link for functions in “Implementation”</td>
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