



# Low-power\_Wakeup\_from\_RTC\_Alarm for KIT\_T2G-B-H\_LITE

Customer training workshop

Q3 2024



## Scope of work

- This code example demonstrates how to enter the DeepSleep and Hibernate mode and wake up using the RTC alarm. This multicore application has the main function running on the CM7\_0 core.
- **Device**
  - The TRAVEO™ T2G CYT4BF8CDS device is used in this code example
- **Board**
  - The TRAVEO™ T2G KIT\_T2G-B-H\_LITE board is used for testing

# Introduction

## – MCU supports the following power modes:

- Active: All peripherals are available
- Low-Power Active (LPACTIVE) profile: Low-power profile of Active mode where all peripherals including the CPU are available, but with limited capability
- Sleep: all peripherals except the CPU are available
- Low-power Sleep (LPSLEEP) profile: Low-power profile of Sleep mode where all peripherals except the CPU are available, but with limited capability
- DeepSleep: Only low-frequency peripherals are available
- Hibernate: The device and I/O states are frozen and the device resets on wakeup
- XRES: The device enters this state when the XRES\_L pin is asserted

## Introduction (contd.)

### – Power modes have the following features:

- Software can use power modes to optimize power consumption in an application
- Low-power DeepSleep mode with support for multiple wakeup sources and configurable amount of SRAM retention
- Ultra-low-power Hibernate mode with wakeup from I/O and timer alarms

The power consumption in different power modes is controlled by using the following methods:

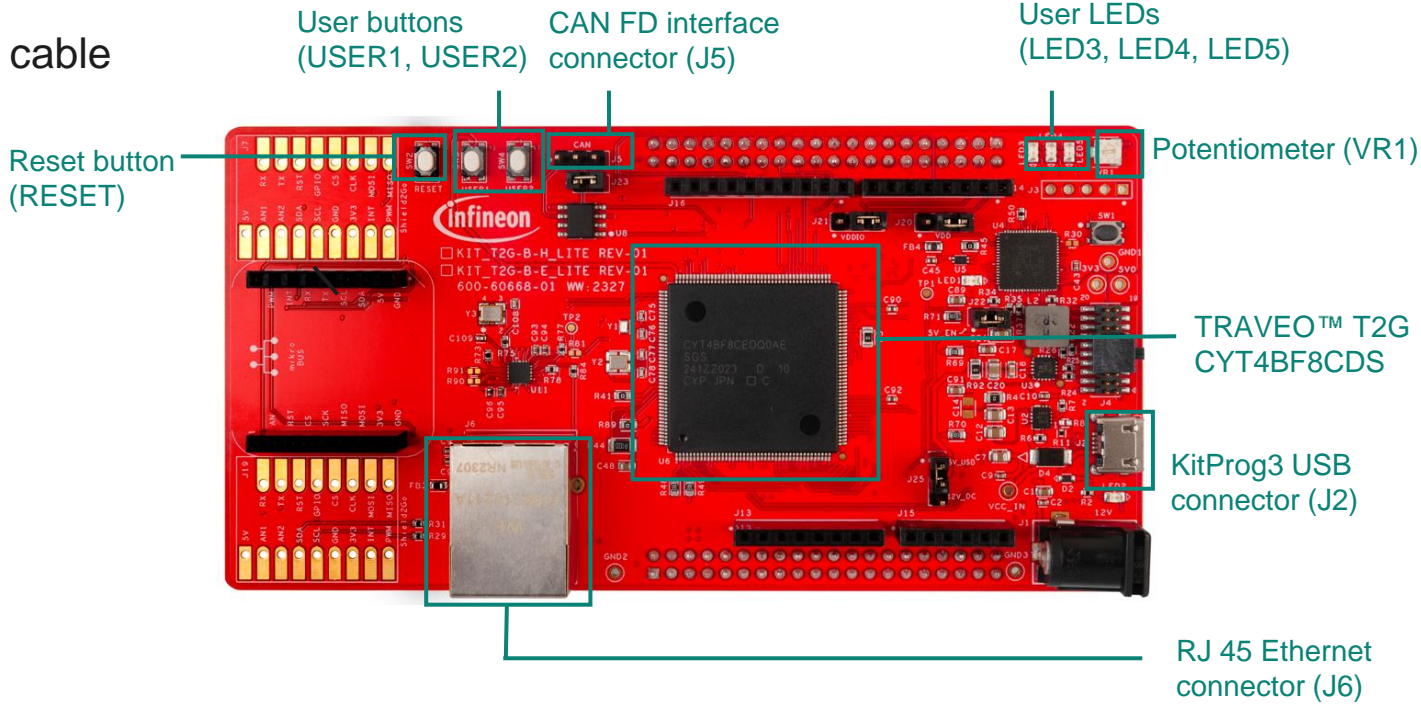
- Enable and disable the clocks to peripherals
- Power on/off clock sources
- Power on/off peripherals and parts inside the device

## Introduction (contd.)

- **RTC has the following features:**
  - Fully-featured RTC
  - Year/Month/Date, Day-of-Week, Hour : Minute : Second fields (all fields Integer)
  - Supports both 12-hour and 24-hour formats
  - Automatic leap year correction
  - Configurable alarm function
  - Alarm on Month/Date, Day-of-Week, Hour : Minute : Second fields
  - Two independent alarms
  - Calibration for 32768-Hz WCO
  - Calibration waveform output
  - Supports 512 Hz, 1 Hz, and 2 Hz
  - Backup registers

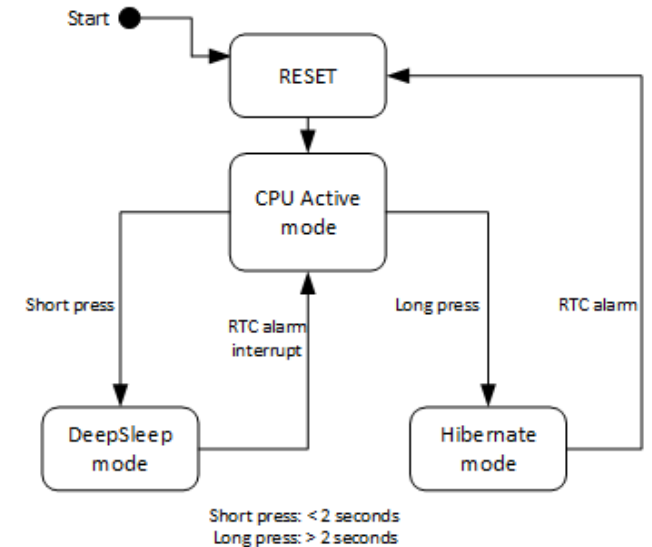
# Hardware setup

- This code example has been developed for the KIT\_T2G-B-H\_LITE board
- Connect the PC to the board using the provided USB cable through the KitProg3 USB connector (J2)



# Implementation

- This code example demonstrates how to enter the DeepSleep and Hibernate mode and use RTC to generate an RTC alarm to wake up the MCU from DeepSleep and Hibernate mode. The main loop checks if the user button (USER1) is pressed and duration of the press.
- **Follow these steps to configure this code example:**
  - CM0P core enables CM7\_0 core and CM7\_1 core
  - CM0P core and CM7\_1 core go to DeepSleep
  - Running the power modes and RTC control on the CM7\_0 core
- **CM0P core enables CM7\_0 core and CM7\_1 core**
  - Enable CM7\_0 core and CM7\_1 core by calling [Cy\\_SysEnableCM7\(\)](#) function
- **CM0P core and CM7\_1 core goes to DeepSleep**
  - Both CM0P and CM7\_1 core go to DeepSleep by calling [Cy\\_SysPm\\_CpuEnterDeepSleep\(\)](#)



## Implementation (contd.)

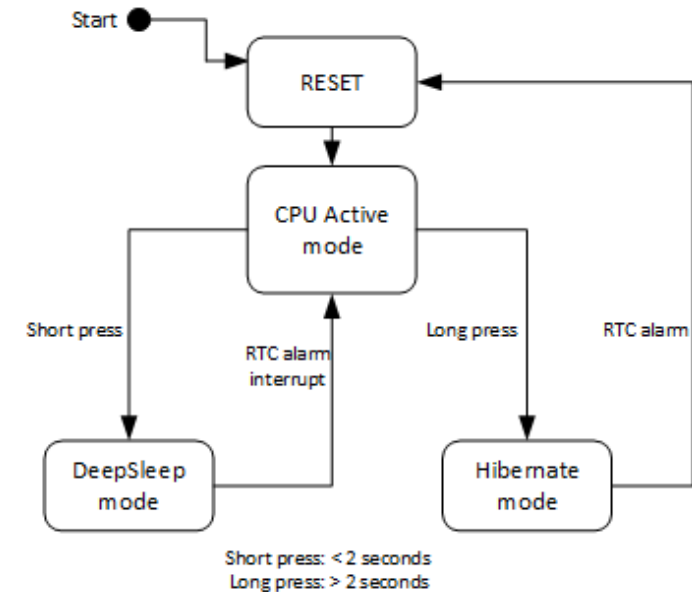
- **Running the power modes and RTC control on the CM7\_0 core**
  - Initialize the UART block for display messages on the terminal
    - Call the [cy\\_retarget\\_io\\_init\(\)](#) function to use UART
    - Initialize P0.1 as UART TX, P0.0 as UART RX (these pins are connected to KitProg3 COM port)
    - The serial port parameters changes to 8N1 and 115200 baud
  - Initialize the user button.
    - Call the [cyhal\\_gpio\\_init\(\)](#) function to initialize the user button (P5.3)
  - Register power management callbacks
    - Call the [cyhal\\_syspm\\_init\(\)](#) function to initialize system power management that is needed for future operations
  - Initialize RTC
    - Call the [cyhal\\_rtc\\_init\(\)](#) function to initialize RTC
    - Call the [cy\\_SysLib\\_GetResetReason\(\)](#) function to check the reset reason and call the [cyhal\\_rtc\\_write\\_direct\(\)](#) function to set date/time to RTC if reset reason is not **CY\_SYSLIB\_RESET\_HIB\_WAKEUP**
    - Call the [cyhal\\_rtc\\_enable\\_event\(\)](#) function to enable RTC to wake-up the MCU



# Implementation (contd.)

- Go to DeepSleep mode or Hibernate mode by pressing the user button
  - The user button state is read by cyhal\_gpio\_read() in the get\_switch\_event() function
  - Before going to each mode, set RTC alarm to 10 sec later to wakeup by calling cyhal\_rtc\_set\_alarm\_by\_seconds() in the set\_rtc\_alarm\_date\_time() function
  - Call the cyhal\_syspm\_deepsleep() function to set CPU to DeepSleep mode
  - Call the cyhal\_syspm\_hibernate() function to set the system mode to Hibernate
- Wakeup from DeepSleep mode/Hibernate mode
  - RTC alarm will wake up the device after 10 seconds

Short press : ~2 seconds	DeepSleep mode
Long press : >2 seconds	Hibernate mode

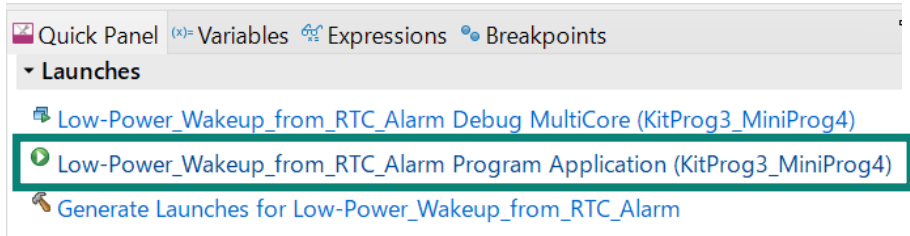


# Compiling and programming

1. Connect to power and USB cable
2. Use Eclipse IDE for ModusToolbox™ software for compiling and programming
3. For compilation:
  - a. Select the target application project in the Project Explorer
  - b. In the Quick Panel, scroll down, and click **Build Application** in Low-Power\_Wakeup\_from\_RTC\_Alarm (KIT\_T2G-B-H\_LIT
4. Open a terminal program (such as Tera Term) and select the KitProg3 COM port. Set the serial port parameters to **8N1** and **115200 baud**.
5. For programming:
  - a. Select the target application project in the Project Explorer
  - b. In the Quick Panel, scroll down, and click **Low-Power\_Wakeup\_from\_RTC\_Alarm Program Application (KitProg3\_MiniProg4)** in the Launches



KitProg3 USB connector (J2)



# Run and test

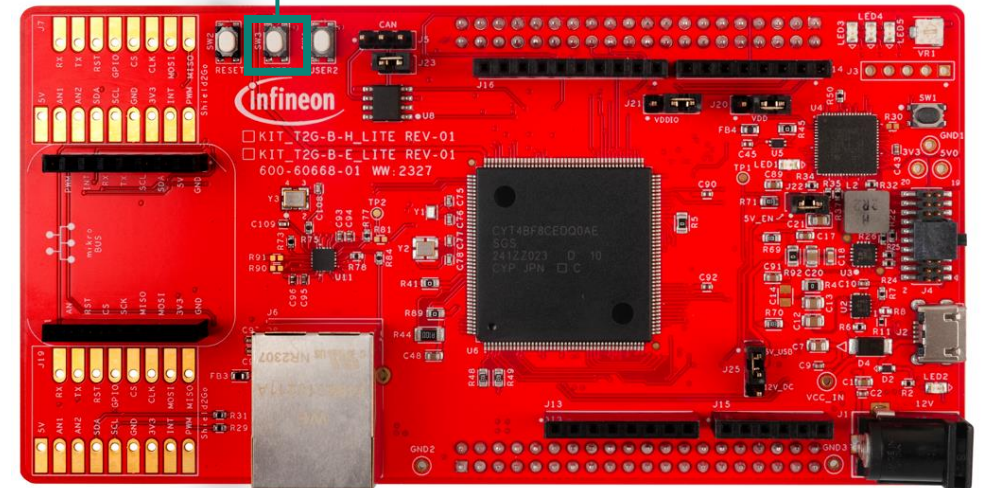
1. After successful programming, the terminal displays the following message as shown in the figure.
2. Short press the user button (USER 1) to go to DeepSleep mode or long press the user button (USER 1) to go to Hibernate mode. Observe the results in the terminal window as shown in the figure.
3. After long pressing the user button (USER 1), Hibernate mode wakes up the terminal application and displays the message as shown in the figure.

```

COM14 - Tera Term VT
File Edit Setup Control Window Help
*****
HAL: Low power wakeup from RTC alarm
*****
Short press 'SW2' key to DeepSleep mode, long press 'SW2' key to Hibernate mode.

16:17:00 2022-02-28: Current date and time.
16:17:02 2022-02-28: Go to DeepSleep mode
16:17:02 2022-02-28: RTC alarm will be generated after 10 seconds
16:17:12 2022-02-28: Wakeup from DeepSleep mode
16:17:17 2022-02-28: Go to Hibernate mode
16:17:17 2022-02-28: RTC alarm will be generated after 10 seconds
  
```

User button (USER1)



```

*****
HAL: Low power wakeup From RTC alarm
*****
Short press 'SW2' key to DeepSleep mode, long press 'SW2' key to Hibernate mode.

16:17:27 2022-02-28: Wakeup from the Hibernate mode
16:17:27 2022-02-28: Current date and time.
  
```

# References

- **Datasheet**
  - [CYT4BF TRAVEO™ T2G 32-bit Automotive MCU based on Arm® Cortex®- M7 dual](#)
  
- **Architecture reference manual**
  - [TRAVEO™ T2G Automotive MCU body controller high architecture reference manual](#)
  
- **Registers reference manual**
  - [TRAVEO™ T2G Automotive MCU: TVII-B-H-8M body controller high registers reference manual](#)
  
- **PDL/HAL**
  - [Peripheral driver library \(PDL\)](#)
  - [Hardware abstraction layer \(HAL\)](#)
  
- **Training**
  - [TRAVEO™ T2G training](#)

# Revision History

Revision	ECN	Submission Date	Description of Change
**	7782616	2022/07/06	Initial release
*A	7876702	2023/03/01	Changed CySysEnableCM7 to Cy_SysEnableCM7 in "Implementation" Removed Cy_SysPm_CpuSleepOnExit() in "Implementation" Changed figures in "Compiling and programming"
*B	8079889	2024/10/04	Replaced development board from KIT_T2G-B-H_EVK to KIT_T2G-B-H_LITE

