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# CE218542 - PSoC 6 MCU Custom Tick Timer Using RTC Alarm

## Objective

This example demonstrates a custom tick timer using the periodic Alarm interrupt of the Real-time Clock (RTC).

## Overview

This code example demonstrates how to configure the RTC registers for a periodic alarm interrupt using the Peripheral Driver Library (PDL) RTC driver API. A GPIO output is included to toggle the LED to show the period of the interrupt.

## Requirements

**Tool:** PSoC Creator™ 4.2; Peripheral Driver Library (PDL) 3.0.1

**Programming Language:** C (Arm® GCC 5.4-2016-q2-update)

**Associated Parts:** All PSoC® 6 MCU parts

**Related Hardware:** CY8CKIT-062-BLE PSoC 6 BLE Pioneer Kit

## Hardware Setups

This example uses the kit's default configuration. See the kit guide to ensure the kit is configured correctly.

## Software Setup

None

## Operation

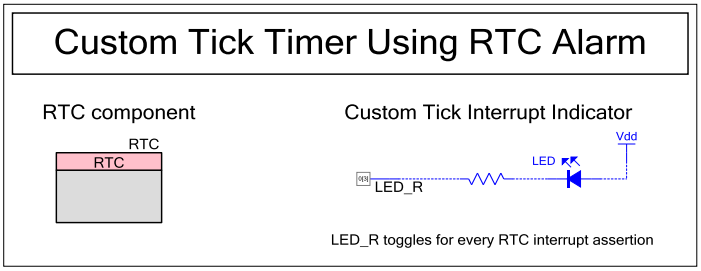
1. Open terminal software such as Tera Term and select the KitProg2's COM port with a baud rate setting of 115200 bps.
2. Build the project and program it into the PSoC 6 MCU device. Choose **Debug** > **Program**. For more information on device programming, see PSoC Creator Help. Flash for both CPUs is programmed in a single program operation.
3. Confirm that the red LED (LED_R, P0[3]) toggles every three seconds.
4. Change `TICK_INTERVAL` from (3u) to (1u) in *main_cm4.c* to make a 1-second tick timer.
5. Build the project and program the PSoC 6 MCU device.
6. Confirm that the red LED (P0[3]) toggles every one second.
7. Change the `USE_SECONDS` to (0u) and the `USE_MINUTES` to (1u) to make a 1-minute tick timer.
8. Build the project and program the PSoC 6 MCU device.
9. Confirm that the LED R (P0[3]) toggles every minute.
10. Change `TICK_INTERVAL` from (1u) to (2u) to make a 2-minute tick timer.
11. Build the project and program the PSoC 6 MCU device.
12. Confirm that the LED R (P0[3]) toggles every two minutes.

## Design and Implementation

This code example features one RTC and one GPIO for the indicating LED, as shown in Figure 1.

The periodic alarm is a slow timer that can be used as a custom tick timer. The custom timer can wake from either Deep Sleep or Hibernate mode. This is useful for monitoring the status of a peripheral devices over a long period.

Figure 1. Custom Tick Timer Using RTC Alarm




The alarm fields consist of second, minute, hour, day of week, date, and month. An alarm interrupt asserts when the current time fields match the alarm fields. The PDL allows you to disable the individual time fields to ignore them for alarm comparison. This is useful for making a periodic alarm. For example, if the alarm interrupt is required every morning at 7:00 AM, the second, minute, and hour fields are enabled while other time fields are disabled. The shortest interrupt period is one second because the RTC time increases every one second.

As Table 1 shows, you control the interrupt period by enabling or disabling match fields.

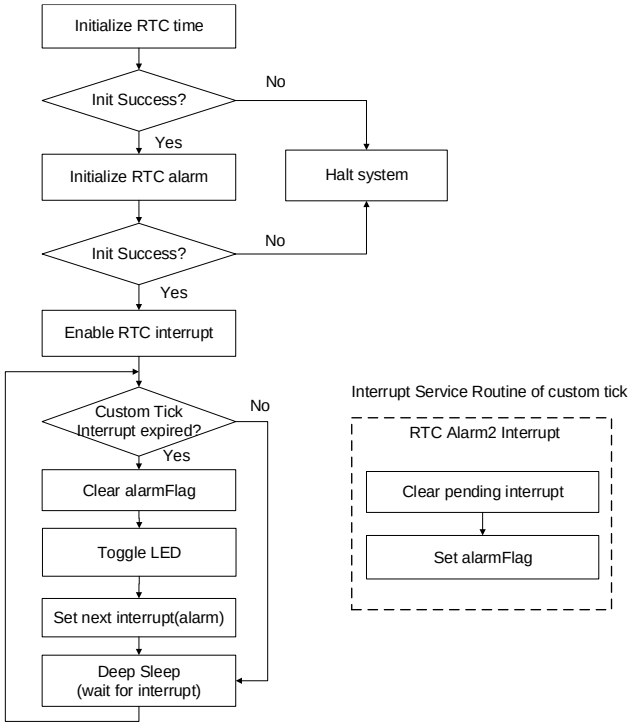
Table 1. Interrupt Period vs. Alarm Field configuration

| Interrupt every… | Alarm function | Month | Date | Day of Week | Hour | Minute | Second |
|---|---|---|---|---|---|---|---|
| Second | **Enabled** | Disabled | Disabled | Disabled | Disabled | Disabled | Disabled |
| Minute | **Enabled** | Disabled | Disabled | Disabled | Disabled | Disabled | **Enabled** |
| Hour | **Enabled** | Disabled | Disabled | Disabled | Disabled | **Enabled** | **Enabled** |

Although slightly counterintuitive, to have an alarm repeat at any given period, the match for that period is disabled. For an hourly alarm, the alarm goes off when the second and minute fields match, regardless of the hour. So, you do not want to match the hour.

Figure 2 shows the firmware flow of this code example.

Figure 2. Flowchart for the Custom Tick Timer Using RTC Alarm




## Design Considerations

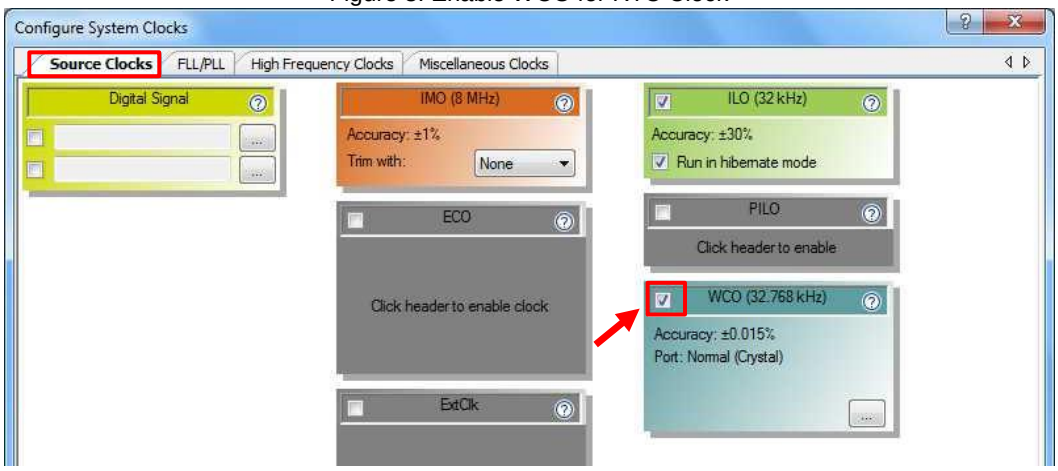
This code example runs on CY8CKIT-062-BLE, which has a PSoC 6 MCU device.

It is necessary to have a 32.768-kHz clock source for the RTC function in the backup power domain. For accurate RTC operation, it is recommended that you use a Watch Crystal Oscillator (WCO).

Perform the following steps to configure the RTC clock source (BakClk) as WCO.

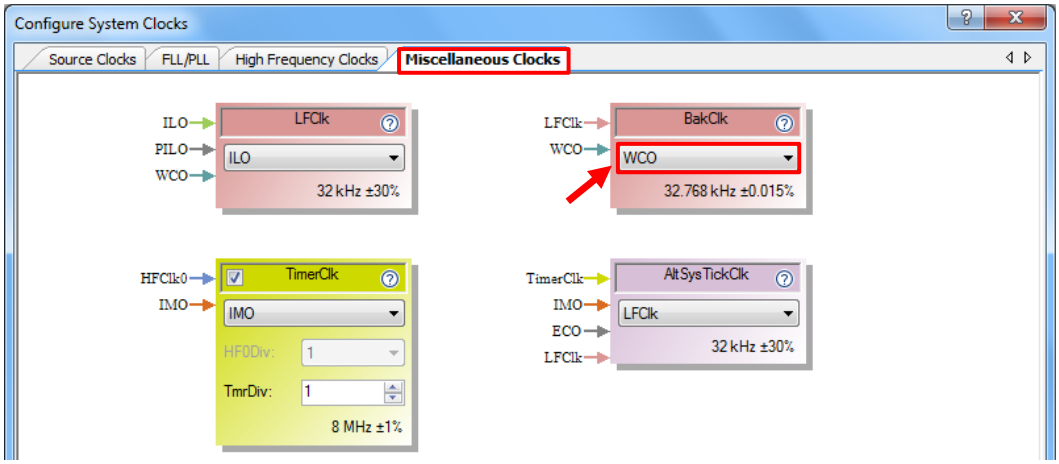
1. Double-click **locks** in Design Wide Resources.
2. Click **Edit Clock…** and open **Configure System Clocks**.
3. Enable WCO clock for the backup clock source in **Source Clocks**, as Figure 3 shows.

Figure 3. Enable WCO for RTC Clock



4. Select **WCO** for **BakClk** in the **Miscellaneous Clocks** tab, as Figure 4 shows.

Figure 4. Set the Backup Clock Source to WCO




## Components

Table 2 lists the PSoC Creator Components used in this example, as well as hardware resources used by each.

Table 2. List of PSoC Creator Components

| Component | Instance Name | Purpose | Parameter |
|---|---|---|---|
| Real Time Clock (RTC) | RTC | Provide current date and time information, and alarm functionality. | **[General tab]:**<br>Enable Interrupt: Check |
| Digital Output Pin | LED_R | Provide visual feedback | **[General tab]:**<br>HW connection: Uncheck<br>Drive Mode: Strong Drive<br>Initial drive state: High (1) |

Figure 5 shows the pin assignment for the project done through the **Pins** tab in the **Design Wide Resources** window. These assignments are compatible with CY8CKIT-062-BLE.

Figure 5. Pin Assignments


## Reusing This Example

This example is designed for the CY8CKIT-062-BLE pioneer kit. To port the design to a different PSoC 6 MCU device, kit or both, change the target device using the Device Selector and update the pin assignments in the Design Wide Resources Pins settings as needed. For single-core PSoC 6 MCU devices, port the code from *main_cm4.c* to *main.c*.

## Related Documents

| | |
|---|---|
| **Application Notes** | |
| AN210781 – Getting Started with PSoC 6 MCU with BLE Connectivity | Describes PSoC 6 MCU with BLE Connectivity devices and how to build your first PSoC Creator project |
| AN215656 – PSoC 6 MCU Dual-Core CPU system Design | Describes the dual-core CPU architecture in PSoC 6 MCU, and shows how to build a simple dual-core design |
| AN219434 – Importing PSoC Creator Code into an IDE for a PSoC 6 MCU Project | Describes how to import the code generated by PSoC Creator into your preferred IDE |
| **Code Examples** | |
| CE216825 PSoC 6 MCU Real-Time Clock Basics | |
| CE218964 PSoC 6 MCU RTC Daily Alarm | |
| CE219339 PSoC 6 MCU - MCWDT and RTC Interrupts (Dual Core) | |
| **PSoC Creator Component Datasheets** | |
| Pins | Supports connection of hardware resources to physical pins |
| RTC | Component provides an application interface for keeping track of time and date |
| **Device Documentation** | |
| PSoC 6 MCU: PSoC 63 with BLE Datasheet | PSoC 6 MCU: PSoC 63 with BLE Architecture Technical Reference Manual<br>PSoC 6 MCU: PSoC 63 with BLE Registers Technical Reference Manual |
| **Development Kit (DVK) Documentation** | |
| CY8CKIT-062-BLE Pioneer Kit | |

## Document History

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|---|---|---|---|---|
| *A | 5993957 | AJYA | 12/14/2017 | Initial Public Release |
| *B | 6079240 | AJYA | 04/02/2018 | Updated to PSoC Creator 4.2 |

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