# 喚醒時延遲進入中斷服務

NuMicro® 32 位系列微控制器範例代碼介紹

## 文件資訊

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|---|---|
| 代碼簡述 | 使用 TIMER 喚醒系統並延遲進入中斷服務，先執行主程式。 |
| BSP 版本 | M051 Series BSP CMSIS v3.01.002 |
| 開發平台 | NuTiny-EVB-M051_V3.0 |

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# 1 功能介紹

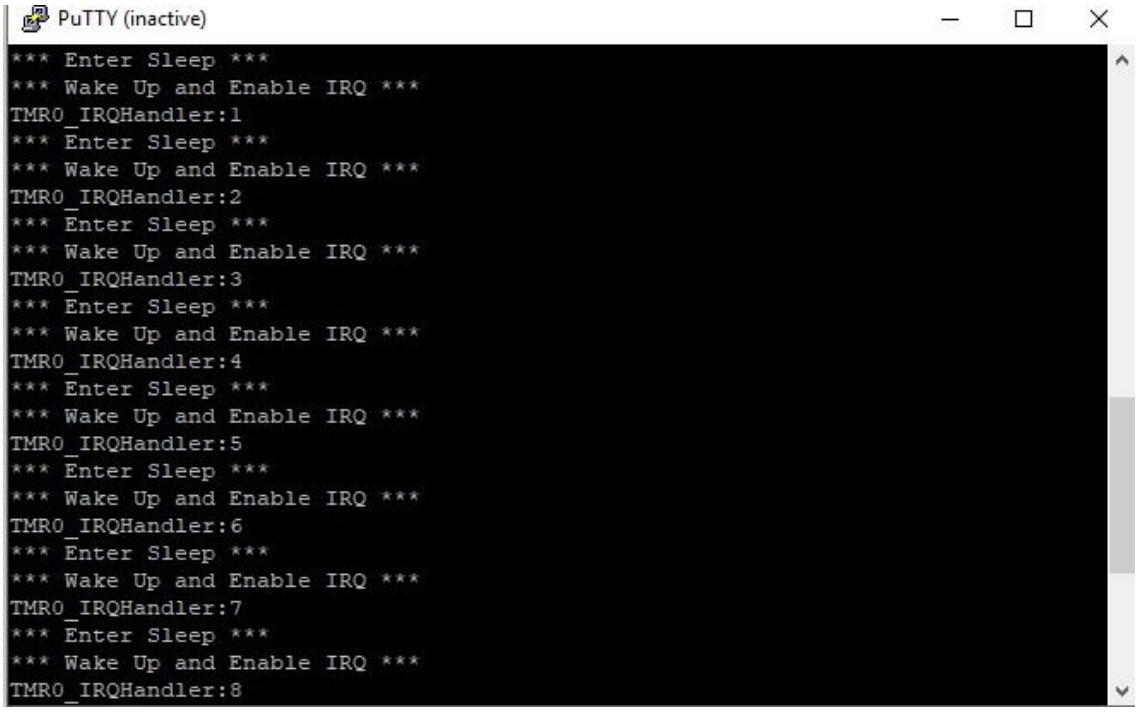
## 1.1 簡介

正常情況下，省電模式被喚醒時，會先進入中斷服務程式，再執行喚醒後主程式尚未執行的部分。此範例是透過ARM提供的指令，讓系統在省電模式被喚醒後，延遲進入中斷服務，先執行主程式，再執行中斷服務程式的實現。

## 1.2 原理

首先設定計數器(TIMER0)的週期計數中斷模式與中斷喚醒。開啟計數器後，使用ARM提供的禁用中斷指令，然後系統進入省電模式。等待計數器計數週期到，產生中斷喚醒系統後，使用ARM提供的啟用中斷指令來進入中斷服務程序。

## 1.3 執行結果



# 2 代碼介紹

TIMER 中斷服務程式，清除中斷旗標與喚醒旗標，印出進入中斷服務程式的次數：

```
void TMR0_IRQHandler(void)
{
    if (TIMER_GetIntFlag(TIMER0) == 1)
    {
        /* Clear Timer0 time-out interrupt flag */
        TIMER_ClearIntFlag(TIMER0);
        TIMER_ClearWakeupFlag(TIMER0);

        g_au32TMRINTCount[0]++;
        printf("TMR0_IRQHandler:%d\n", g_au32TMRINTCount[0]);
    }
}
```

設定 TIMER 喚醒功能與對應的中斷服務程式，以此喚醒系統：

```
/* Open Timer0 frequency to 1 Hz in periodic mode, and enable interrupt */
TIMER_Open(TIMER0, TIMER_PERIODIC_MODE, 1);
TIMER_EnableInt(TIMER0);
TIMER_EnableWakeup(TIMER0);
/* Enable Timer0 NVIC */
NVIC_EnableIRQ(TMR0_IRQn);
/* Start Timer0 counting */
TIMER_Start(TIMER0);
```

使用中斷服務開關指令並印出程式執行的時間點：

```
    __disable_irq();

    printf("*** Enter Sleep ***\n");
    UART_WAIT_TX_EMPTY(UART0);
    CLK_PowerDown();

    printf("*** Wake Up and Enable IRQ ***\n");
    __enable_irq();
```

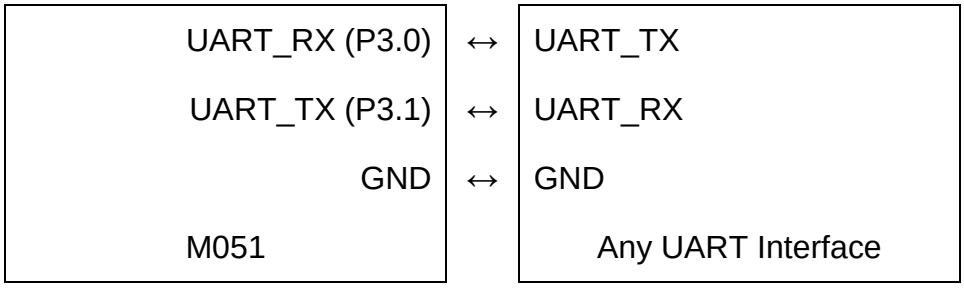
# 3 軟體與硬體環境

## ● 軟體環境

- ■ BSP 版本
  - ◆ M051 Series BSP CMSIS v3.01.002
- ■ IDE 版本
  - ◆ Keil uVersion 5.26

## ● 硬體環境

- ■ 電路元件
  - ◆ NuTiny-EVB-M051_V3.0
- ■ 示意圖



# 4 目錄資訊

- EC_M051_Pending_IRQ_On_WakeUp_V1.00
  - Library — Sample code header and source files
    - CMSIS — Cortex® Microcontroller Software Interface Standard (CMSIS) by Arm® Corp.
    - Device — CMSIS compliant device header file
    - StdDriver — All peripheral driver header and source files
  - SampleCode
    - ExampleCode — Source file of example code

# 5 如何執行範例程式

1. 根據目錄資訊章節進入 ExampleCode 路徑中的 KEIL 資料夾，雙擊 M051_Pending_IRQ_On_WakeUp.uvproj。
2. 進入編譯模式介面
   a. 編譯
   b. 下載代碼至記憶體
   c. 進入 / 離開除錯模式
3. 進入除錯模式介面
   a. 執行代碼

# 6 修訂紀錄

| Date | Revision | Description |
|---|---|---|
| Aug. 30, 2019 | 1.00 | 1. 初始發布. |

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