利用EADC調整PWM佔空比

NuMicro® 32 位系列微控制器範例代碼介紹

文件資訊

代碼簡述	本範例代碼利用 EADC 轉換結果調整 PWM 輸出訊號的佔空比
BSP 版本	M451 Series BSP CMSIS V3.01.003
開發平台	NuTiny-EVB-M451-LQFP100 V1.3

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1 功能介紹

1.1 簡介

本範例代碼利用EADC輸入電壓的轉換結果調整PWM輸出訊號的佔空比。

1.2 原理

EADC可以將類比輸入電壓轉換成0~4095的數值。PWM可以設定輸出訊號成0%~100%的佔空比。本範例代碼利用簡單的公式將0~4095換算成0%~100%，就可以用EADC的輸入電壓來直接調整PWM的輸出訊號佔空比。

PWM佔空比 = (EADC轉換結果) * 100 / 4095

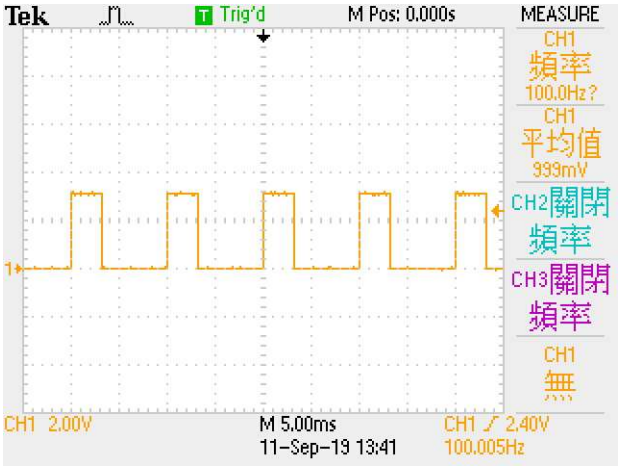
1.3 執行結果

執行結果，以及打印資料。

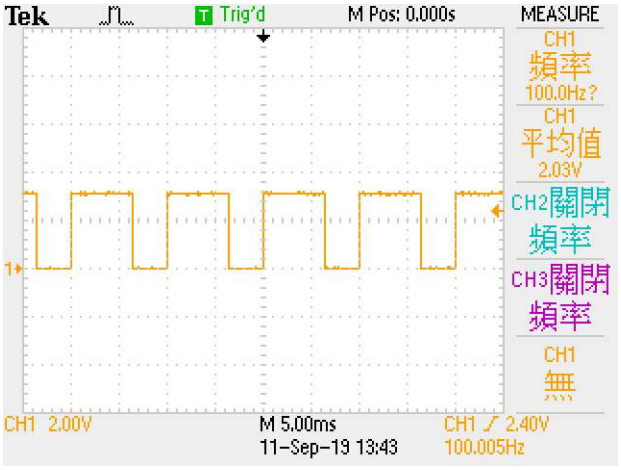
```
PLL Clock = 144000000 Hz
Core Clock = 72000000 Hz

+------------------------------------------------------+
|         M451 Series ADC + PWM Sample Code            |
+------------------------------------------------------+
```

執行結果主要反應在PWM的輸出引腳。可以用示波器觀察PWM輸出訊號，當EADC輸入電壓改變時，PWM輸出訊號也會立即反應新的佔空比。

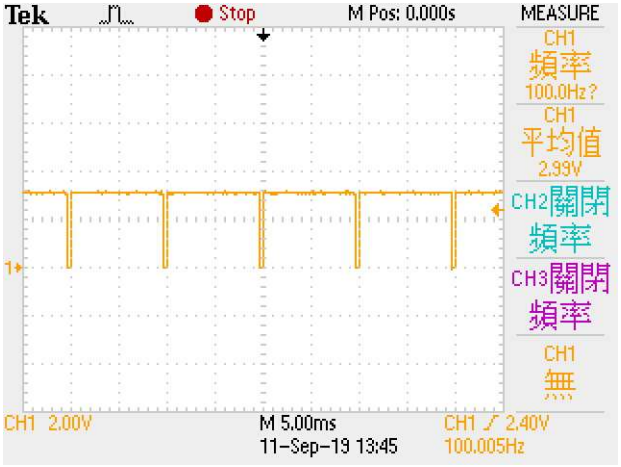
EADC輸入電壓1V



EADC輸入電壓2V



EADC輸入電壓3V



2 代碼介紹

設定 EADC，使用 EADC module 0 channel 1：

```
    /* Reset EADC module */
    SYS_ResetModule(EADC_RST);
    /* Set the EADC internal sampling time, input mode as single-end and enable the A/D
converter */
    EADC_Open(EADC, EADC_CTL_DIFFEN_SINGLE_END);
    /* Set EADC module 0 channel 1 trigger source to software */
    EADC_ConfigSampleModule(EADC, 0, EADC_SOFTWARE_TRIGGER, EADC_CHANNEL);
    /* Select ADINT0 as interrupt source of EADC module 0 and enable it */
    EADC_ENABLE_SAMPLE_MODULE_INT(EADC, 0, BIT0);
```

設定 PWM0，使用 channel 2，佔空比預設為 50%：

```
    /* Reset PWM0 module */
    SYS_ResetModule(PWM0_RST);
    /* Set PWM0 channel 2 output configuration: 100Hz with 50% duty cycle */
    PWM_ConfigOutputChannel(PWM0, PWM0_CHANNEL, 100, 50);
    /* Enable PWM Output path for PWM0 channel 2 */
    PWM_EnableOutput(PWM0, PWM_CH_2_MASK);
    /* Enable PWM1 channel 2 */
    PWM_Start(PWM0, PWM_CH_2_MASK);
```

在無窮迴圈中，EADC 持續轉換輸入電壓，並利用公式換算成佔空比，再重新設定 PWM 使用新的佔空比：

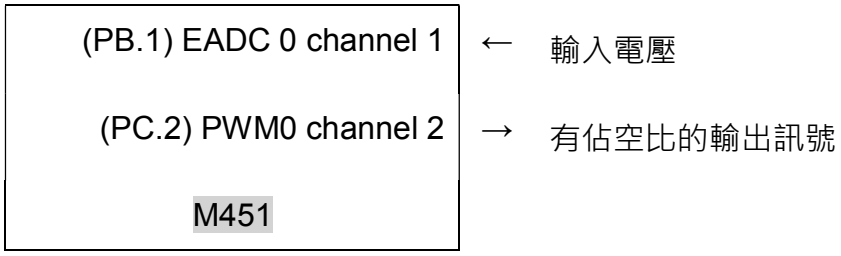
```
    while (1)
    {
        /* EADC start to convert input voltage */
        EADC_START_CONV(EADC, BIT0);

        /* Wait EADC conversion completed */
        while (EADC_GET_INT_FLAG(EADC, BIT0) == 0);

        /* Get the conversion result */
        volume = EADC_GET_CONV_DATA(EADC, 0);
        /* Clear interrupt flag for EADC conversion completed */
        EADC_CLR_INT_FLAG(EADC, BIT0);
```

```
        /* Change PWM0 duty cycle according to ADC conversion result */
        PWM_ConfigOutputChannel(PWM0, PWM0_CHANNEL, 100, (volume * 100 / 4095));

        /* Just delay */
        for (delay = 0; delay < 100000; delay++);
    }
```

3 軟體與硬體環境

- **軟體環境**
  - BSP 版本
    - M451 Series BSP CMSIS V3.01.003
  - IDE 版本
    - Keil uVersion 4.74
- **硬體環境**
  - 電路元件
    - NuTiny-EVB-M451-LQFP100 V1.3
  - 示意圖

M451 使用 EADC module 0 channel 1 (PB.1) 來讀取輸入電壓，並使用 PWM0 channel 2 (PC.2) 來輸出有佔空比的 PWM 訊號。硬體外部線路連接如下。



4 目錄資訊

- EC_M451_ADC_PWM_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 M451_ADC_PWM.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
Sep. 11, 2019	1.00	1. 初始發布.

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