Adjust PWM Duty Cycle by EADC

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	This sample code adjust the PWM duty cycle according to the EADC input voltage
BSP Version	M451 Series BSP CMSIS V3.01.003
Hardware	NuTiny-EVB-M451-LQFP100 V1.3

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1 Function Description

1.1 Introduction

This sample code adjusts the PWM duty cycle according to the EADC input voltage.

1.2 Principle

The EADC be able to convert analog input voltage to digital value 0 ~ 4095. The PWM be able to output signal with duty cycle from 0% to 100%. This sample code uses simple formula to convert digital value 0 ~ 4095 to duty cycle 0% ~ 100% in order to set PWM with new duty cycle.

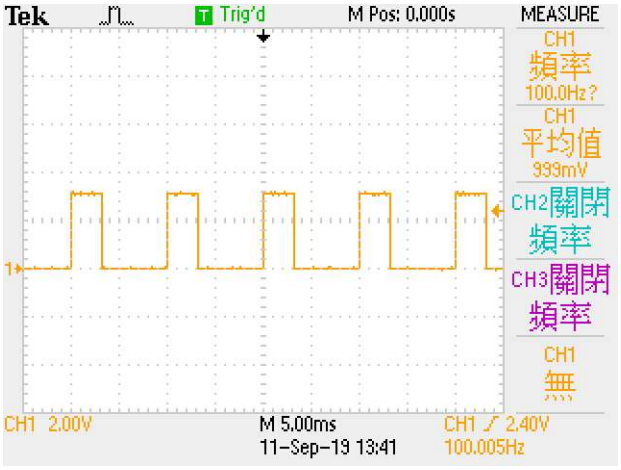
PWM duty cycle = (EADC conversion result) * 100 / 4095

1.3 Demo Result

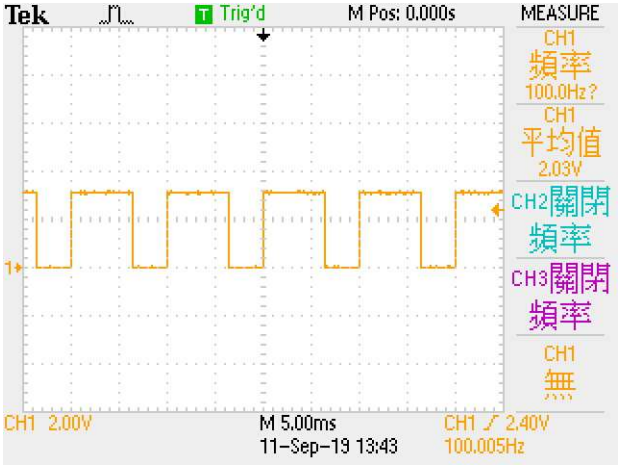
```
PLL Clock = 144000000 Hz
Core Clock = 72000000 Hz

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

The demo result will be show on PWM output pin that can be monitor by scope. When the EADC input voltage changes, the PWM output signal also immediately reflects the new duty cycle.

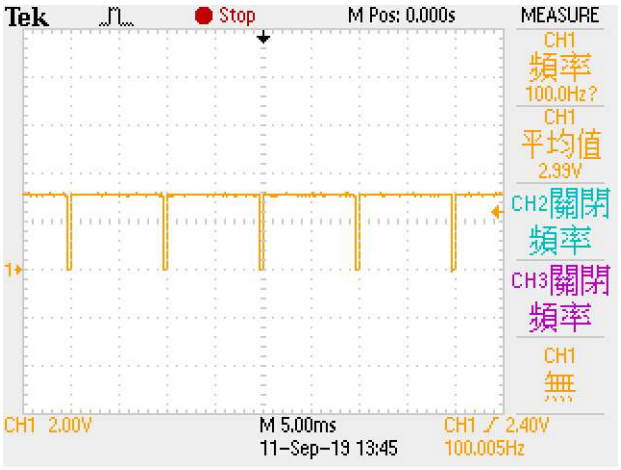
EADC input voltage 1V



EADC input voltage 2V



EADC input voltage 3V



2 Code Description

Configure EADC to use 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);
```

Configure PWM0 to use channel 2 with a default duty cycle 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);
```

In an infinite loop, the EADC uses a formula to continuously convert the input voltage and convert it to a duty cycle, then set the PWM with new duty cycle.

```
    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 Software and Hardware Environment

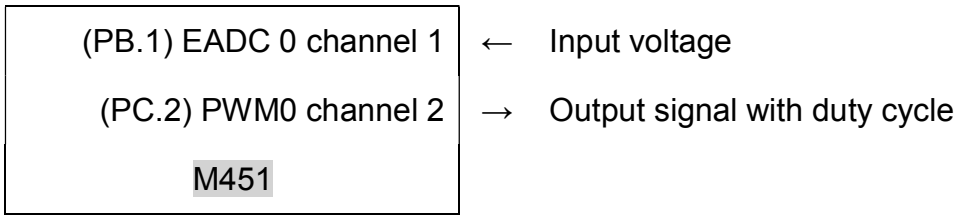
Software Environment

- BSP version
  - M451 Series BSP CMSIS V3.01.003
- IDE version
  - Keil uVersion 4.74

Hardware Environment

- Circuit components
  - NuTiny-EVB-M451-LQFP100 V1.3
- Diagram

M451 uses EADC module 0 channel 1 (PB.1) to convert input voltage and uses PWM0 channel 2 (PC.2) to output signal with duty cycle.



4 Directory Information

- 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 How to Execute Example Code

1. Browsing into sample code folder by Directory Information (section 4) and double click M451_ADC_PWM.uvproj.
2. Enter Keil compile mode
   a. Build
   b. Download
   c. Start/Stop debug session
3. Enter debug mode
   a. Run

6 Revision History

Date	Revision	Description
Sep. 11, 2019	1.00	1. Initially issued.

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