

PWM Trigger PWM

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	PWMA channel 0 trigger PWMA channel 2 when PWMA channel 0 outputs high.
BSP Version	NUC230/240 Series BSP v3.01.002
Hardware	NUC240VE3AN NuEdu Board V1.0

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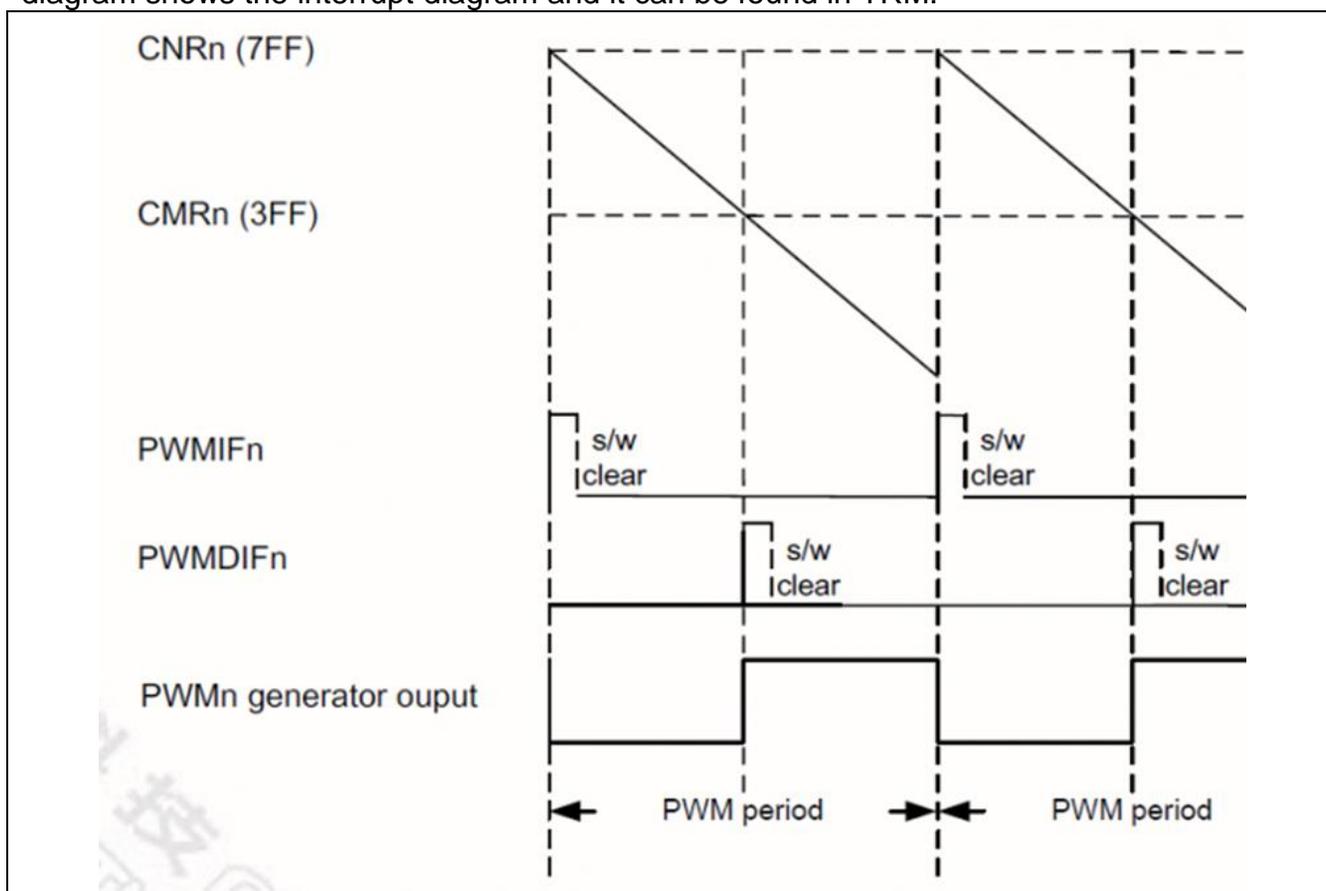
1 Function Description

1.1 Introduction

This sample code is using PWMA channel 0 to trigger PWMA channel 2. When PWMA channel 0 outputs high level voltage, then PWMA channel 2 can be enabled and output waveform. When PWMA channel 0 outputs low level voltage, then PWMA channel 2 can be disabled and output low.

1.2 Principle

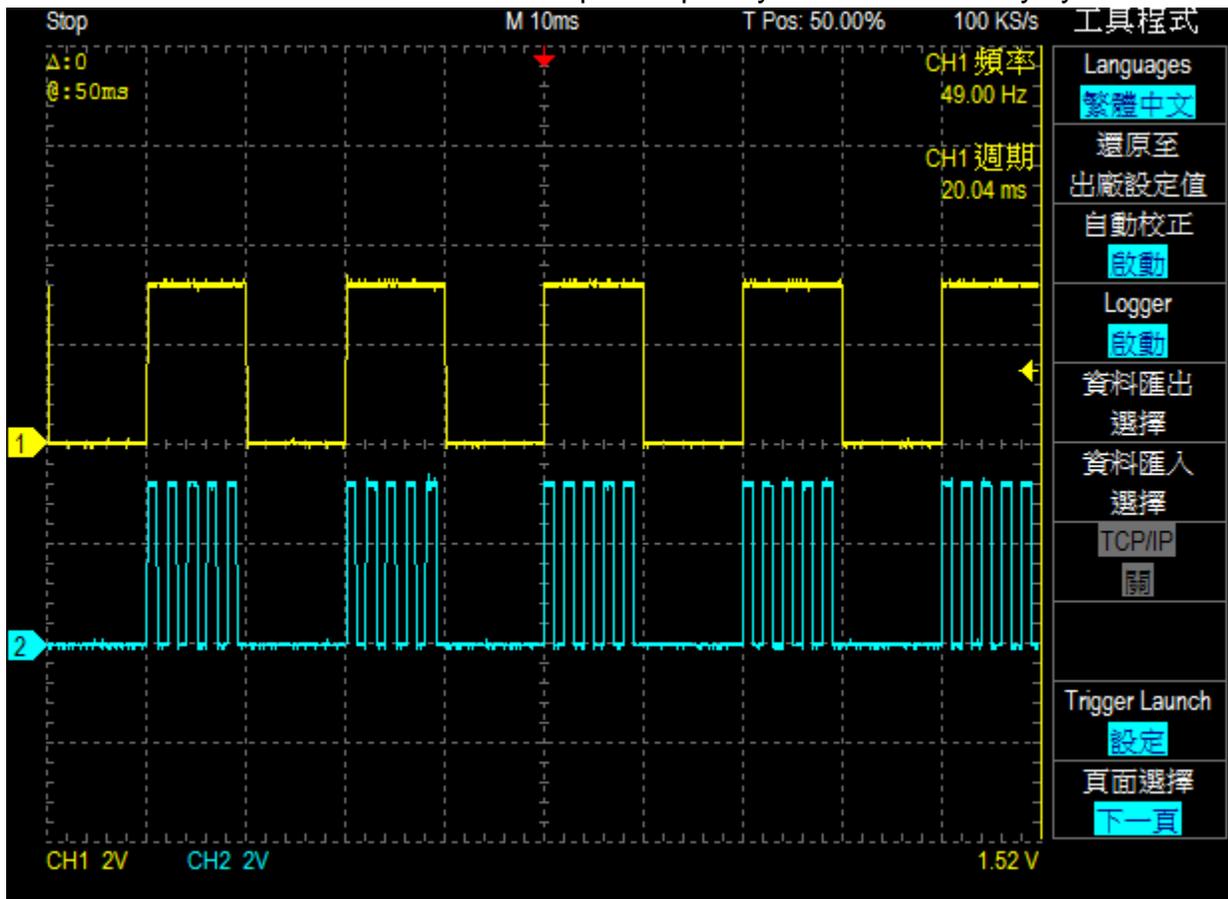
The duty interrupt and period interrupt of PWMA are used in the implementation. Below diagram shows the interrupt diagram and it can be found in TRM.



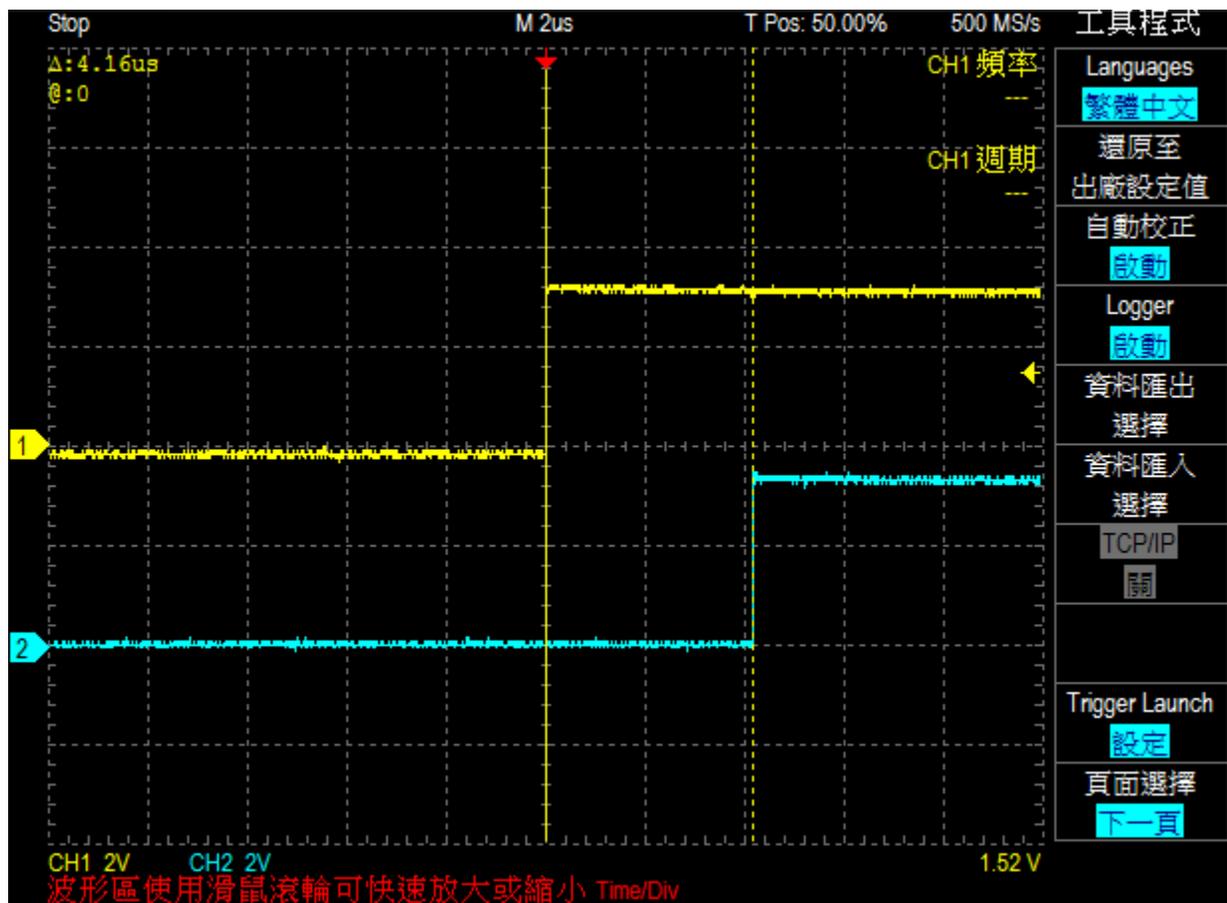
The current PWM counter can be known by reading the PDR register. The period interrupt is occurred when the PDR register of PWMA channel 0 is reloaded as CNR register. The duty interrupt of PWMA channel 0 is occurred when the value of PDR register is the same the value of CMR register. The PWMA channel 2 is enabled when enter duty interrupt handler. The PWMA channel 2 is disabled when enter period interrupt handler.

1.3 Demo Result

The generated waveforms with this example are as below.
 The yellow line is PWMA channel 0. Its output frequency is 50 Hz and duty cycle is 50%.
 The blue line is PWMA channel 2. Its output frequency is 500Hz and duty cycle is 50%.



The below diagram shows there are 4.16 us latency between two channels in rising edge.



2 Code Description

The sample code is as follows.

To check duty interrupt of PWMA channel 0 in PWMA_IRQHandler(), then starts PWMA channel 2 and clear duty interrupt flag.

```

/* PWMA IRQ handler */
void PWMA_IRQHandler(void)
{
    ...
    /* Check duty interrupt of PWMA channel 0 */
    if (PWM_GetDutyIntFlag(PWMA, 0))
    {
        /* Stat PWMA channel 2 */
        PWMA->PCR |= PWM_PCR_CH2EN_Msk;
        /* Clear duty interrupt flag of PWMA channel 0 */
        PWM_ClearDutyIntFlag(PWMA, 0);
    }
}

```

To check period interrupt of PWMA channel 0 in PWMA_IRQHandler(), then stop PWMA channel 2 and clear period interrupt flag.

```

/* PWMA IRQ handler */
void PWMA_IRQHandler(void)
{
    /* Check period interrupt of PWMA channel 0 */
    if (PWM_GetPeriodIntFlag(PWMA, 0))
    {
        /* Stop PWMA channel 2 */
        PWMA->PCR &= ~PWM_PCR_CH2EN_Msk;
        /* Clear period interrupt flag of PWMA channel 0 */
        PWM_ClearPeriodIntFlag(PWMA, 0);
    }
    ...
}

```

Enable PWM module clock, select its clock source. Configure the MFP function of PA12 as PWM0 and configure the MFP function of PA14 as PWM2 in SYS_Init().

```

void SYS_Init(void)
{
    ...
    /* Enable PWM module clock */
}

```

```

CLK_EnableModuleClock(PWM01_MODULE);
CLK_EnableModuleClock(PWM23_MODULE);

/* Select PWM module clock source */
CLK_SetModuleClock(PWM01_MODULE, CLK_CLKSEL1_PWM01_S_HXT, 0);
CLK_SetModuleClock(PWM23_MODULE, CLK_CLKSEL1_PWM23_S_HXT, 0);

/* Reset PWMA channel0~channel13 */
SYS_ResetModule(PWM03_RST);

/* Update System Core Clock */
SystemCoreClockUpdate();

/*-----*/
/* Init I/O Multi-function */
/*-----*/
/* Set GPA multi-function pins for PWMA Channel 0 and Channel 2 */
SYS->GPA_MFP = SYS_GPA_MFP_PA12_PWM0 | SYS_GPA_MFP_PA14_PWM2;
}

```

Configure PWM output settings, enable PWMA interrupt, enable output of PWMA channel 0/channel 2, and start PWMA in main().

```

int32_t main(void)
{
    /* Unlock protected registers */
    SYS_UnlockReg();

    /* Init System, IP clock and multi-function I/O */
    SYS_Init();

    /* Lock protected registers */
    SYS_LockReg();

    /* set PWMA channel 0 and channel 2 output configuration */
    /* PWMA channel 0: output frequency is 50 Hz, and duty cycle is 50% */
    PWM_ConfigOutputChannel(PWMA, PWM_CH0, 50, 50);
    /* PWMA channel 2: output frequency is 500 Hz, and duty cycle is 50% */
    PWM_ConfigOutputChannel(PWMA, PWM_CH2, 500, 50);

    /* PWMA channel 2 output polar inverse */
    PWMA->PCR |= 0x00020000;
}

```

```
/* Enable PWM Output path for PWMA channel 0 and channel 2 */
PWM_EnableOutput(PWMA, 0x5);

/* Enable PWM channel 0 period interrupt and duty interrupt */
PWMA->PIER = PWM_PIER_PWMIE0_Msk | PWM_PIER_PWMDIE0_Msk;
/* Enable PWMA NVIC interrupt */
NVIC_EnableIRQ(PWMA_IRQn);

/* Start PWM */
PWM_Start(PWMA, 0x5);

while (1);
}
```

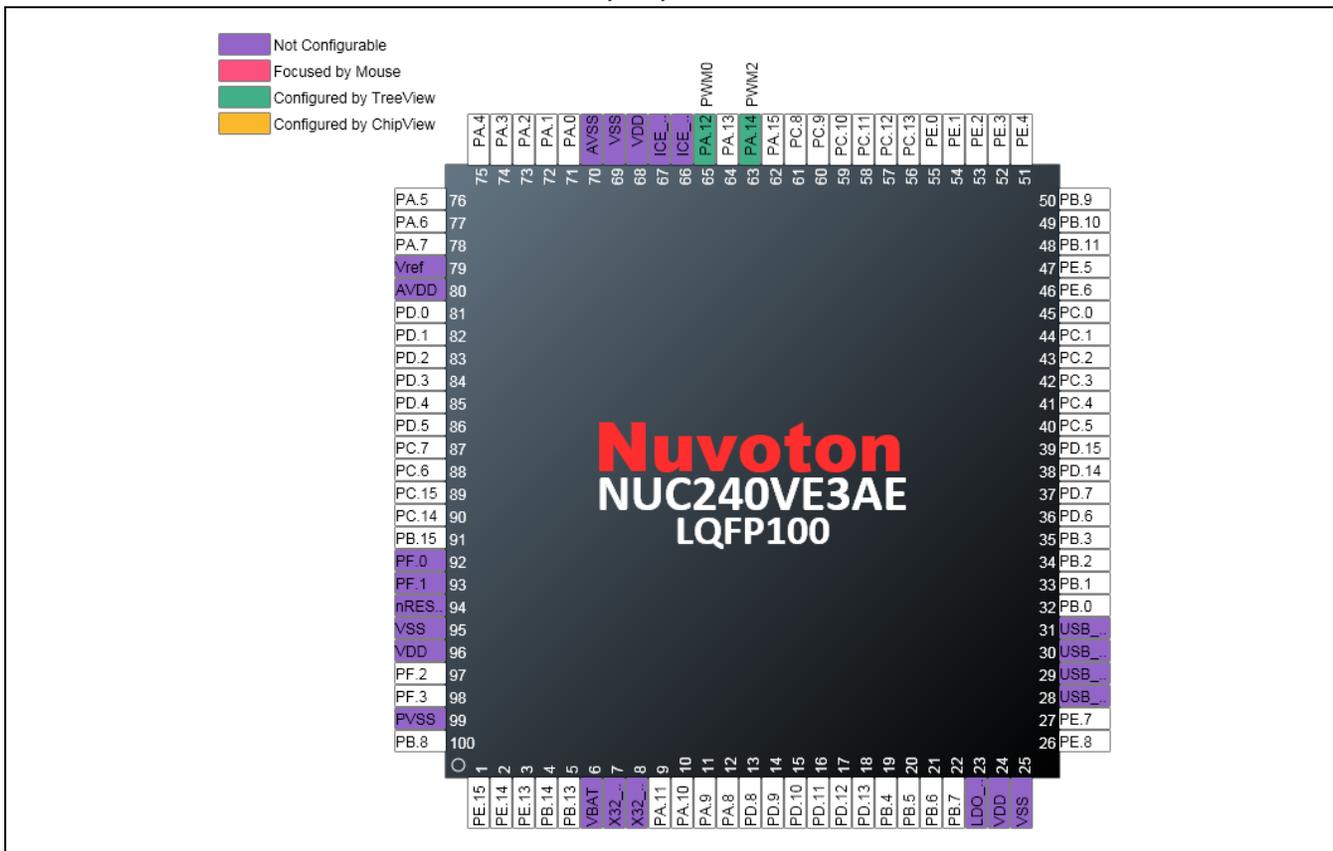
3 Software and Hardware Environment

- **Software Environment**

- BSP version
 - ◆ NUC230/240 Series BSP v3.01.002
- IDE version
 - ◆ Keil uVersion 5.26

- **Hardware Environment**

- Circuit components
 - ◆ NUC240VE3AN NuEdu Board V2.0
- Diagram
 - ◆ PWM0: PA12, this is the output pin of PWMA channel 0.
 - ◆ PWM2: PA14, this is the output pin of PWMA channel 2.



4 Directory Information

 EC_ NUC240_PWM_Trigger_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 NUC240_PWM_Trigger_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
Jul. 30, 2019	1.00	1. Initially issued.

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