Drive 4-Phase Step Motor

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	This example shows how to drive 4-phase step motor on NUC230_240 series chips.
BSP Version	NUC230_240 Series BSP CMSIS V3.01.001
Hardware	NuEdu-EVB-NUC240 V1.0

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1 Function Description

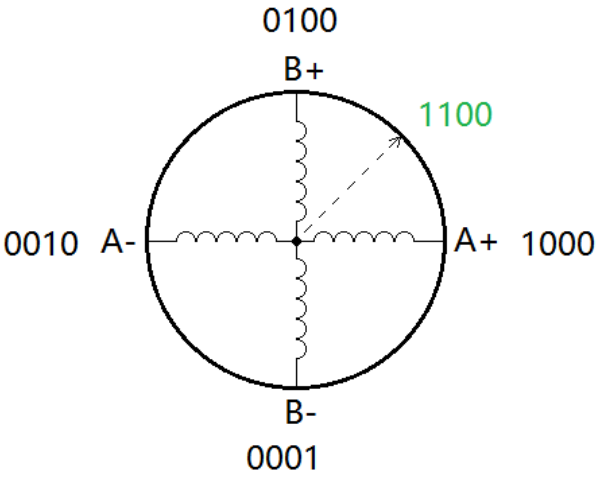
1.1 Introduction

NUC230_240 series MCU can output signals to drive a 4-phase step motor. This document is to introduce how NUC240-NuEdu board outputs those signals to drive a 4-phase step motor.

1.2 Principle

A 4-phase step motor has 4 inductor cores, which are powered in turn when step motor rotates. The center of inductor cores must connect to power or GND. Driving by 1000->0100->0010->0001 in turn, step motor will rotate in clockwise direction. If in turn of 1000->0001->0010->0100, it will rotate in anti-clockwise direction.

If adding 1100 between 1000 and 0100, step motor will rotate even smoothly. The same as adding 0110 between B+ and A-, adding 0011 between A- and B-, and adding 1001 between B- and A+.



So, the signals to drive step motor must be following：

A+	1	1	0	0	0	0	0	1
B+	0	1	1	1	0	0	0	0
A-	0	0	0	1	1	1	0	0
B-	0	0	0	0	0	1	1	1

1.3 Demo Result

The following waveform can display on oscilloscope when testing PA0~PA3.

2 Code Description

The following are the routines.

```
unsigned char Table_StepMotor_Output[8] = {0x08, 0x0C, 0x04, 0x06, 0x02, 0x03, 0x01, 0x09};
    void CW_MOTOR(unsigned int deg)
    {
        int i = 0, j = 0;

        for (j = 0; j < deg; j += 8)
        {
            for (i = 0; i < 8; i++)                                  // Clockwise rotation
            {
                PA->DOUT = Table_StepMotor_Output[i];
                CLK_SysTickDelay(5000);
            }
        }
    }

    void CCW_MOTOR(unsigned int deg)
    {
        int i = 0, j = 0;

        for (j = 0; j < deg; j += 8)
        {
            for (i = 7; i >= 0; i--)                                 // Anti-clockwise rotation
            {
                PA->DOUT = Table_StepMotor_Output[i];
                CLK_SysTickDelay(5000);
            }
        }
    }
```

Main function will call those two routines to make step motor rotate clockwise or anti-clockwise.

```
int main(void)
{
    uint32_t Cnt ;
    /* Unlock protected registers */
    SYS_UnlockReg();
```

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

    /* Lock protected registers */
    SYS_LockReg();

    /* Init UART0 for printf */
    UART0_Init();

    /* PA0~PA3(PIN71~PIN74) is configured as output to driver step motor */
    GPIO_SetMode(PA, BIT0, GPIO_PMD_OUTPUT);
    GPIO_SetMode(PA, BIT1, GPIO_PMD_OUTPUT);
    GPIO_SetMode(PA, BIT2, GPIO_PMD_OUTPUT);
    GPIO_SetMode(PA, BIT3, GPIO_PMD_OUTPUT);

    while (1)
    {
        CW_MOTOR(d360);

        for (Cnt = 0; Cnt < 10000000; ++Cnt) __nop();

        CCW_MOTOR(d180);

        for (Cnt = 0; Cnt < 100000000; ++Cnt) __nop();
    };
}
```

3 Software and Hardware Environment

Software Environment

- BSP version
  - NUC230_240 Series BSP CMSIS V3.01.001
- IDE version
  - Keil uVersion 5.26

Hardware Environment

- Circuit components
  - NuEdu-EVB-NUC240 V1.0

4 Directory Information

- EC_NUC230_240_Drive_4phase_Step_Motor_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, double click NUC230_240_Drive_4phase_Step_Motor.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
Apr. 5, 2019	1.00	1. Initially issued.

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