M480_GPIO_SPI

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	This document describes how to use GPIO to emulate SPI function.
BSP Version	M480 Series BSP CMSIS v3.03.000
Hardware	NuMaker-ETM-M487 v1.1

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1 Function Description

1.1 Introduction

This example code uses GPIO to emulate SPI function that reading SPI Flash ID. GPIO port D0/D1/D2/D3 plays the role as CS/CLK/DO/DI of SPI respectively. Hence, please connect GPIO port D0/D1/D2/D3 to CS/CLK/DO/DI pins of SPI Flash while running this example code.

1.2 Demo Result

We compile the example code and download it to the NuMaker-ETM-M487 v1.1 development board. The program reads SPI Flash ID, as shown in Figure 1.

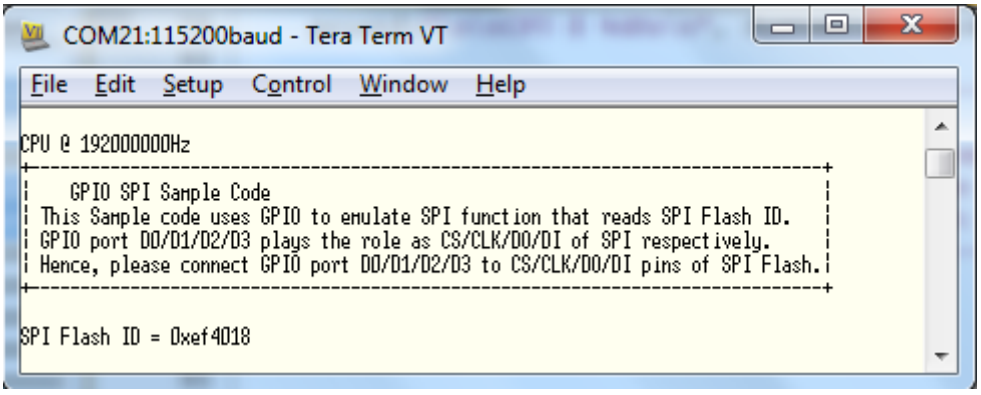


Figure 1 GPIO emulates SPI to read SPI Flash ID

Besides, use LA to monitor GPIO port D0/1/2/3. The waveform is as below.

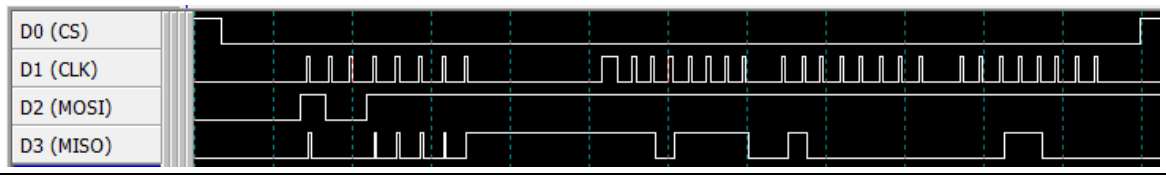


Figure 2 Waveform of GPIO D0/1/2/3

2 Code Description

In this example, we have to configure UART clock setting. Following is the related code segment in SYS_Init() of main.c

```
    /* Enable UART module clock */
    CLK_EnableModuleClock(UART0_MODULE);

    /* Select UART module clock source as HXT and UART module clock divider as 1 */
    CLK_SetModuleClock(UART0_MODULE, CLK_CLKSEL1_UART0SEL_HXT, CLK_CLKDIV0_UART0(1));
```

Set GPD0/1/2/3 multi-function pins to GPIO.

```
    /* Set GPD0/1/2/3 multi-function pins to GPIO */
    SYS->GPD_MFPL &= ~(SYS_GPD_MFPL_PD0MFP_Msk | SYS_GPD_MFPL_PD1MFP_Msk |
                       SYS_GPD_MFPL_PD2MFP_Msk | SYS_GPD_MFPL_PD3MFP_Msk);
    SYS->GPD_MFPL |= (SYS_GPD_MFPL_PD0MFP_GPIO | SYS_GPD_MFPL_PD1MFP_GPIO |
                      SYS_GPD_MFPL_PD2MFP_GPIO | SYS_GPD_MFPL_PD3MFP_GPIO);
```

In gpio_spi.c, some subroutines using GPIO to emulate SPI including CS/CLK/DO/DI control.

```
    int CS_Low(void);
    int CS_High(void);
    int CLK_Low(void);
    int CLK_High(void);
    int Write_SPI(uint8_t bNumOfByte, uint8_t *pbData);
    int Read_SPI(uint8_t bNumOfByte, uint8_t *pbData);
```

Subroutine GPIO_SPI_Init() initializes GPIO D0/1/2 to GPIO output mode and GPIO D3 to input mode.

```
void GPIO_SPI_Init(void)
{
    /* Use PD0/1/2/3 to emulate SPI CS/CLK/DO/DI */
    GPIO_SetMode(PD, BIT0, GPIO_MODE_OUTPUT); /* PD0 : CS */
    GPIO_SetMode(PD, BIT1, GPIO_MODE_OUTPUT); /* PD1 : CLK */
    GPIO_SetMode(PD, BIT2, GPIO_MODE_OUTPUT); /* PD2 : DO */
    GPIO_SetMode(PD, BIT3, GPIO_MODE_INPUT);  /* PD3 : DI */

    /* Init PD0/1/2 output */
    PD0 = 1;
    PD1 = 0;
    PD2 = 0;
}
```

In main routine uses these functions to perform a SPI command reading SPI Flash ID.

```
/* Emulate sending a command(0x9F) to read SPI Flash ID */
/* Activate CS */
CS_Low();
/* Send command (0x9F) to read SPI Flash ID */
Write_SPI(1, &ReadID);
/* Read three bytes of SPI Flash ID */
Read_SPI(3, ID);
/* Deactivate CS */
CS_High();
```

3 Software and Hardware Environment

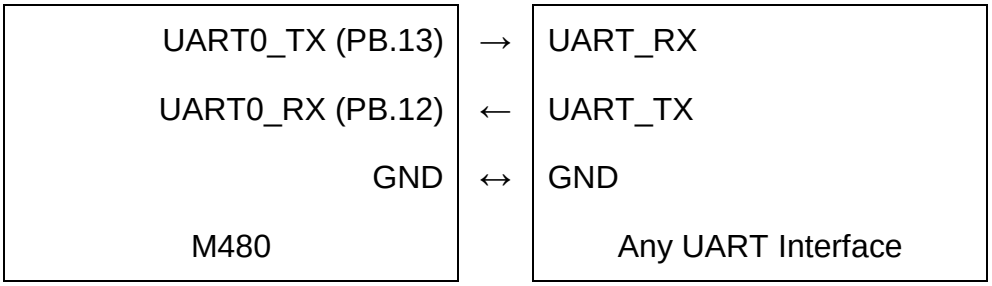
Software Environment

- BSP version
  - M480 Series BSP CMSIS v3.03.000
- IDE version
  - Keil uVersion 5.26

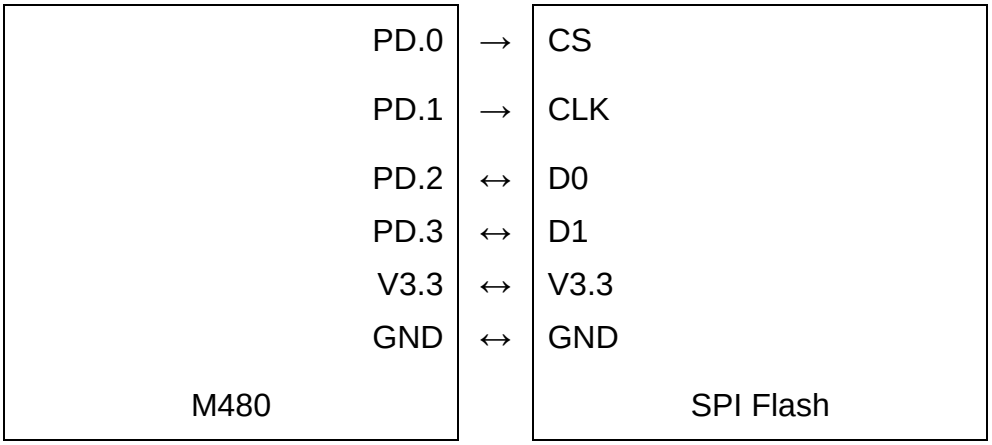
Hardware Environment

- Circuit components
  - NuMaker-ETM-M487 v1.1
- Diagram

We use printf function to output current time related message. The UART0 TX RX pins are PB.13 and PB.12 respectively.



Besides, we use GPIO to access SPI Flash. Hence, please connect PD.0, PD.1, PD.2, PD.3 with SPI Flash CS, CLK, D0, D1 pins respectively.



4 Directory Information

- EC_M480_GPIO_SPI_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 section 4 Directory Information and double click GPIO_SPI.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
July. 11, 2019	1.00	1. Initially issued.

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