

Using General-Purpose Input Output on MCF5213 ColdFire Microcontrollers

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1 Introduction

This application note provides a basic example that demonstrates one use of the general-purpose input/output (GPIO) module for the MCF5213 MCUs. Basic knowledge about the functional description and configuration options will give you a better understanding of how the GPIO module works. The examples given are intended to be modified to suit the specific needs of any application.

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2 MCF5213 GPIO Features

The MCF5213 ports include these distinctive features:

- Control of primary function use on all ports
- Digital I/O support for all ports
- Registers for:
 - Storing output pin data
 - Controlling pin data direction
 - Reading current pin state
 - Setting and clearing output pin data registers

2.1 Description

The MCF5213 MCU has 11 GPIO ports with respective configuration registers. The MCF5213 ports may also be used as GPIO. These ports are organized in groups of eight bits; some ports do not use all eight bits. The GPIO module configures the pins for reading, writing, clearing, setting, direction of data, and selection of slew rates and drive strength.

3 Example Code

The example code was developed using the MCF5213 evaluation board (EVB). This code uses the four LEDs from the EVB that are located on port C. These pins are used as outputs. The SW1 and SW2 push buttons are also used to test the functionality of the inputs.

The code configures the registers, allowing the use of the GPIO module. When this is done, the code starts to poll SW1 and SW2. If SW1 is pushed, it lights the four LEDs from the EVB. If SW2 is pushed, it performs a shift to the left of the value 0001b until it reaches the fourth LED and starts again.

3.1 Registers

In the ports where not all of the eight bits are usable, writing to the non-usable bits has no effect. Refer to the MCF5213 ColdFire Integrated Microcontroller Reference Manual for more information.

3.1.1 Port Output Data Registers (PORTn)

These registers store the data to be driven out when they are configured as outputs. The next lines of code show how to write to the PORTn register.

```
/* Writing via Portn */
MCF_GPIO_PORTTC = (unsigned char)counter;
```

3.1.2 Port Data Direction Registers (DDRn)

These registers control the direction of the data when the port is configured as GPIO. Setting DDRn will configure it as output; clearing it will do the opposite. The next lines of code show how to configure the data direction of the selected ports.

```
/* DATA DIRECTION configuration */
/* PORTTC data direction as output PORTTC (3, 2, 1, 0) = 1; */
MCF_GPIO_DDRTC = 0
    | MCF_GPIO_DDRTC_DDRTC3
    | MCF_GPIO_DDRTC_DDRTC2
    | MCF_GPIO_DDRTC_DDRTC1
    | MCF_GPIO_DDRTC_DDRTC0;

/* IRQ4 IRQ5 data direction configured as inputs */
/* this operation avoids changing the former values of the other pins in PORTNQ */
MCF_GPIO_DDRNQ = MCF_GPIO_DDRNQ
    & ~MCF_GPIO_DDRNQ_DDRNQ4
    & ~MCF_GPIO_DDRNQ_DDRNQ5;
```

3.1.3 Port Pin Data/Set Data Registers (PORTnP/SETn)

The PORTnP/SETn registers have two functions. When reading the current data in the port and setting bits in the port, clearing has no effect. They are used when some bits must be set. (Only one instruction is needed.) Below is the code for reading and setting PORTnP/SETn.

```

/* Reading value from PORTnP */
unsigned char portValue;
...
portValue = MCF_GPIO_SETnQ;
/* Setting port from SETn */
MCF_GPIO_SETnTC = 0
    | MCF_GPIO_SETnTC_SETn0
    | MCF_GPIO_SETnTC_SETn1
    | MCF_GPIO_SETnTC_SETn2
    | MCF_GPIO_SETnTC_SETn3;

```

3.1.4 Port Clear Output Data Registers (CLRn)

Writing 0s to a CLRn register clears the corresponding bits in the PORTn register. Writing 1s has no effect. Reading from the CLRn register returns 0s. It is used when some bits must be cleared. (Only one instruction is needed.) Below is the code for using the CLRn register.

```

/* Clear all 4 leds of PORTnTC via CLRn (if no SW is pushed) */
MCF_GPIO_CLRnTC = (unsigned char)255
    & ~MCF_GPIO_CLRnTC_CLRn0
    & ~MCF_GPIO_CLRnTC_CLRn1
    & ~MCF_GPIO_CLRnTC_CLRn2
    & ~MCF_GPIO_CLRnTC_CLRn3;

```

3.1.5 Pin Assignment Registers

There are three kinds of these registers: dual function, quad function, and one for the NQ assignment register.

By writing 0s to dual function pin assignment registers will assign them to GPIO function. Writing 1s will assign them to their primary function. All bits are cleared to 0s at reset.

The quad function pin assignment registers allow each pin controlled by each register bit to be configured among the GPIO function, primary function, alternate 1 function, and the alternate 2 function. In this case, each pin requires two bits for function assignment. Table 1 shows the double pin assignment for the quad function registers.

Table 1. Double Bit Pin Assignment Register Bit

Bit Value	Pin Assignment
00	GPIO function
01	Primary function
10	Alternate 1 function
11	Alternate 2 function

Example Code

```

/* PORTC pins (leds in 5213EVB) Quad function*/
MCF_GPIO_PTCPAR = 0
    | MCF_GPIO_PTCPAR_TIN3_GPIO
    | MCF_GPIO_PTCPAR_TIN2_GPIO
    | MCF_GPIO_PTCPAR_TIN1_GPIO
    | MCF_GPIO_PTCPAR_TIN0_GPIO;

```

The port NQ pin assignment register contains both quad function (for IRQ1) and dual function pin assignment controls. Refer to the previous two sections for the encodings for the different fields.

```

/* IRQ4 IRQ5 pins (SW1 SW2 on 5213EVB) */
MCF_GPIO_PNQPARG = 0
    | MCF_GPIO_PNQPARG_IRQ4_GPIO
    | MCF_GPIO_PNQPARG_IRQ5_GPIO;

```

3.1.6 Pad Control Registers

The pin slew rate register is read/write and each bit resets to 0. Setting the register makes the slew rate approximately 10 times slower. Clearing it configures the pin to a fast slew rate. Each bit resets to 0 in single chip mode and to 1 in EzPort/FAST mode.

The pin drive strength register is read/write, and each bit resets to 0 in single chip mode (MCF5213 default) and 1 in EzPort and fast mode. For high drive strength (10 mA) set the register bits; for low drive strength (2 mA) clear the bits in the register. Each bit resets to 0 in single chip mode and to 1 in EzPort/fast mode.

3.2 Summary

To use the GPIO module, you must:

- Assign the GPIO functionality to the pins
- Set the direction of the data (input or output)
- Depending on the direction of the data, you may use one register or another to input or output data.

3.3 Conclusion

Before using the GPIO module is important to know first which register to configure. The MCF5213 MCU's ability to switch between a main function and GPIO allows the user to select any module and configure it as a GPIO when needed.

3.4 Considerations and References

To find the newest software updates and configuration files for the MCF5213 MCU on the Freescale Semiconductor home page, visit www.freescale.com

- MCF5213 Devices Supported: MCF5211, MCF5212, MCF5213.
- M5213EVB Evaluation Board for Freescale MCF5213 MCU Hardware User Manual Doc. Rev. C
- For more information on GPIO module refer to MCF5213 ColdFire Integrated Microcontroller Reference Manual. Rev 1.3
- The GPIODemo was developed with the CodeWarrior development tool for ColdFire® version 6.2 or higher.

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