DMA Worksheet

Lecture 20
E155 FA22

Learning Goals

The goal of this example project is to use the direct memory access (DMA) controller on the MCU to enable automatic printing of data to the computer terminal via UART without the need for processor intervention. We will be designing a system to meet the following requirements.

Specifications

1. Print out a single character from a specified character array at a frequency of ~10 Hz (one character every 100 milliseconds).
2. Use a UART baud rate of 9600.
3. Use update events from Timer 2 (TIM2) to trigger the DMA requests.
4. Use DMA Controller 1 (DMA1) to handle the direct memory transfers from the character array to the UART peripheral.

Answer the questions below. In your answers, write down the field for each and the value it should be set to. Where applicable, use CMSIS notation of `<Peripheral>_<Register>_<Field>` to specify your answer. For example, to configure PA2 as an output: `GPIO_MODER_MODE2, 0b10.`

Configure the DMA controller

1. Turn on the DMA controller in RCC. (Hint: Look in RCC registers).

2. Find the correct DMA channel that is triggered by update events from Timer 2 (TIM2).

3. Configure the DMA channel with the following settings.
    a. Set the priority level to 2

    b. Turn on memory address incrementing

    c. Turn on circular addressing

    d. Set the direction to be from memory to peripheral

4. Set the DMA source memory address to be the address of the character array

5. Set the DMA data transfer length to be the length of the character array (set with #define macro to be CHAR_ARRAY_SIZE)

6. Set the DMA destination memory address to be the address of the USART transmission data register.

7. Set the channel selection mux to the appropriate setting to select updates from TIM2.

8. Enable the DMA channel

Configure Timer

Set up timer to run at 10 Hz

1. Set prescaler register to 0 (TIM_PSC_PSC).
2. Set ARR to SystemCoreClock/10 (SystemCoreClock stores the current bus clock frequency in Hz).

Set up the timers to generate DMA requests when an update event is triggered.

1. Configure DMA request to be generated when an update event is triggered instead of when a capture compare event occurs (TIMx_CR2).

2. Enable DMA/Interrupt generation from update events (TIMx_DIER).

3. Enable the counter (TIMx_CR1).