DigiPen Institute of Technology Singapore

Embedded Systems

CS 397

Trimester 3, AY 2021/22

Assignment 3

GPIO DAC ADC USART

Q1. Create a STM32 project with STM32CubeIDE to implement a STM32F767ZI microcontroller-based application. The implemented embedded program must have the following settings/functions:

1. Start a new STM32 Project using the Nucleo-F767ZI Board.
2. Disable ETH and USB_OTG_FS functions and reset all ETH and USB related pins.
3. Select, under Pinout & Configuration, System Core -> SYS -> Debug: Trace Asynchronous Sw
4. Use bypass high speed clock source (8 MHz) input.
5. Set APB2 peripheral clocks = 64 MHz and APB1 peripheral clocks = 32 MHz
6. Configure a debug channel via USART3 with baud rate = 115200 bits/s, 8 data bits, no parity, one stop bit, and oversampling at 16 samples.
7. Print/display debug message at the rate of 1 Hz with a counter (xx.x : 2 digits, a point, and 1 digit) running at a resolution of 0.1, i.e., display “CS397 xx.x ”, with xx.x in the range of 00.0 to 20.9, and repeat the display.
8. Configure two 12-bit DAC channels (DAC_1 & DAC_2) (with both output buffers disabled) to output 0 – 3.3 V independently.
9. Set the two DAC channels to 0 V and 1.65 V initially.
10. Increase the DAC outputs in a step equal to 100 times the DAC resolution at the rate of 1 Hz.
11. Reset any DAC channel to zero after DAC reading > 4095 (3.3 V).
12. Configure four ADC channels; three for ST Zio terminals, A3 (PF3), A4 (PF5), and A5 (PF10), and one for internal temperature sensing. Each ADC sampling time is set at 144 ADC clock cycles.
13. Connect A3 to DAC_1, A4 to DAC_2, and A5 to a 3.3 V output.
14. Display the DAC and ADC data, i.e., print via USART3 debug channel at the rate of 1 Hz.

15. Use the interrupt enabled user-button (B1) to reset the counter to 00.0 and reset the DACs output to their initially values at any time.
16. Blink the green LED (LD1) at a rate of 1 Hz.
17. Turn on the blue LED (LD2) when count = 00.0, 10.0, and 20.0.
18. Turn on the red LED (LD3) when either DAC output is equal or greater than 3.0 V.
19. The ADC polling method is not allowed in this implementation.
20. Both the DAC and ADC readings including temperature value (in ℃) must be displayed via USART3, i.e., show all analogue values and temperature. Note, display of digital values is not required.

Note: 1. Enable the EXTI line [15:10] interrupts.
2. Generate peripheral initialization as a pair of '.c/.h' files per peripheral.

Q2. Questions:

Q2-1 The **Nucleo-F767ZI** board uses a microcontroller with part number **STM32F767ZIT6.** Describe the meaning of **ZIT6** stated in the part number.

Q2-2 What is the allowable maximum current consumption by the **Nucleo-F767ZI** board when the **U5V** input is chosen?

Q2-3 Name the document(s) and page numbers of **STM32F767ZIT6** that the microcontroller temperature sensor equation/formula and characteristics (parameter values) can be obtained.

Notes on Submission:

1. A new STM32 project must be created with project name:
   A3_SN_name_17Jul2022
   where SN is your serial number (A01 – A19).
2. Submit the implemented project in a zip file with filename:
   A3_SN_name_17Jul2022.zip
3. The above zip file should include all STM32 project folders and files (except with debug folder deleted), generated report files (.pdf &.txt), and assignment Q&A file (A3_SN_name_QAns_17Jul2022.pdf).
4. Submission deadline is on **17 July 2022, 2359 hrs.**

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