ECEN 5823
SPI tap sensor Assignment
Fall 2017

Objective: Adding the BMA280 accelerator via the SPI bus and enabling / disabling the BMA280 to implement load power management.

Note: This assignment will begin with the completed Low Energy ADC assignment.

Instructions:

1. Make any changes required to the Low Energy ADC assignment.

2. Connect the STK6101C extension board to the main development kit board.

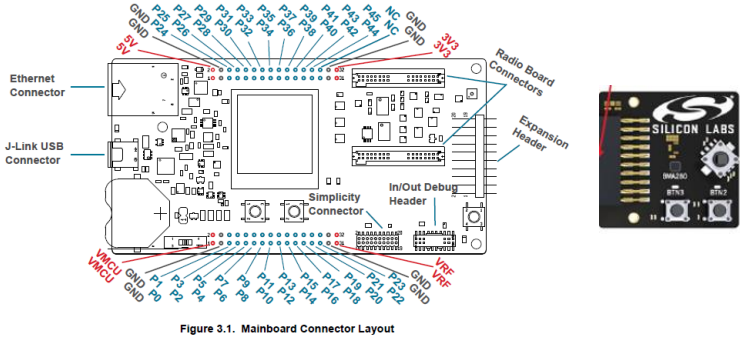

Figure 3.1. Mainboard Connector Layout

3. Program the ADC to sense / interrupt the Blue Gecko when an action occurs on the extension board's analog joystick.
    a. You must determine which pin the Joy Stick output is routed to the BGM121. One method is to trace the output of the Joy Stick to the extension board connector through the extension board of the main development kit board to the Radio Board connectors and finally to the BGM121 to determine which pin to use as the analog input.
    b. Program the designated analog input as an analog input pin

4. The ADC interrupt handler should be able to make the following distinctions when an event occurs:
    a. If Joy Stick is pressed away (north), enable the BMA280 (put in normal mode)
    b. If Joy Stick is pressed toward you (south), disable the BMA280 (suspend mode)
    c. If Joy Stick is pressed to the right (east), increment on time of LED0 by 500mS
    d. If Joy Stick is pressed to the left (west), decrement on time of LED0 by 500mS
    e. If Joy Stick button is depressed, reset to on-time to reset condition
    f. Note:

        i. Circuit should be software de-bounced so that only one increment or decrement of the on-time occurs per press / pulse of the Joy Stick.
    g. Note:
        i. LETIMER counters should only change in its interrupt handler
    h. Note:
        i. On-time cannot go below 0 time. The least amount of time should be the default / reset on-time.
        ii. On-time cannot go above 100% of period

5. BMA280 functionality:
    a. Upon power on reset or the Blue Gecko reset, the BMA280 should not be in normal mode
    b. Single tap should turn off LED1
    c. Double tap should turn on LED1

6. ADC's main parameters to enable grading are:
    a. 12-bit resolution
    b. No oversampling
    c. Continually sample the Joy Stick input 200 samples per second (200 Hz)
    d. 32 clocks for acquisition time
    e. ADC bias settings to lowest possible setting

7. BMA280 settings should be initialized to:
    a. Range +/- 4g
    b. Bandwidth 125Hz
    c. Tap quiet 30mS
    d. Tap samples 4
    e. Tap duration 200mS
    f. Tap shock 50mS
    g. Tap threshold 250mg

8. LETIMER0 should be set to the following conditions at startup / reset.
    a. Period = 1.75 seconds
    b. On-Time = 20mS (time that LED0 is on)
        i. LED0 should always be pulsing based on LETIMER0
        ii. The time that LED0 is on changes based on the joy stick being pressed to the east and west

9. The Blue Gecko should be running at the lowest possible energy state while the system is waiting for an input from the Joy Stick.

Questions:

In a separate document to be placed in the drop box with the program code, please answer the following questions:

NOTE: All average currents should be taken at a time scale of 200mS/div.

1. After the Blue Gecko has been reset or after power up, what is the lowest energy mode while LED0 is off?
    a. What is the average current when the LED0 is off?

2. Enable / place the BMA280 in normal mode by pushing the joy stick north. What is the lowest energy mode while the LED0 is off and the BMA280 is in normal mode and waiting for a tap?
    a. What is the average current when the LED0 is off and BMA280 is in normal mode?

3. With BMA280 enabled, suspend the BMA280 by pushing the joy stick south. What is the lowest energy mode while the LED0 is off and the BMA280 is in suspend mode?
    a. What is the average current when the LED0 is off and BMA280 is in suspend mode?

4. With the BMA280 in suspend mode, place the BMA280 in normal mode by pushing the joy stick north. What is the average current while LED0 is off?
    a. Reset the Blue Gecko by using the reset button on the dev kit. What is the average current while LED0 is off?

5. Does a double tap on the BMA280 turn on LED1?
    a. Does a single tap on the BMA280 turn off LED1?

Deliverables:

1. One document that provides the answers to Energy Mode Assignment.

2. The completed program project or required files to enable the code to be ran on the instructing team's computer for grading.