

# ECEN 5823

## I2C temp sensor Assignment

### Fall 2017

**Objective:** Adding the Si7021 accelerator via the I2C bus and enabling / disabling the Si7021 to implement load power management.

**Note:** This assignment will begin with the completed SPI tap sensor assignment.

**Due:** Saturday, October 7<sup>th</sup>, 2017 at 11:59pm

Instructions:

1. Make any changes required to the SPI tap sensor assignment.
2. Connect the STK6101C extension board to the main development kit board.

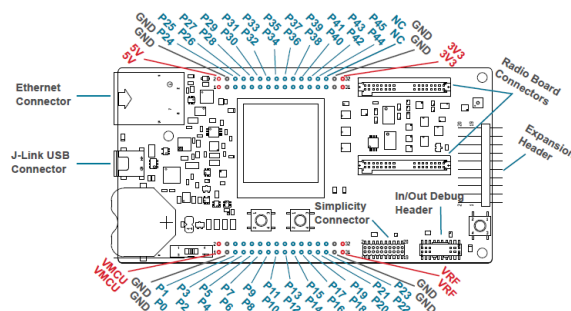


Figure 3.1. Mainboard Connector Layout



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), temperature set point is increased by 5 degrees C

- d. If Joy Stick is pressed to the left (west), temperature set point is decreased by 5 degrees C
  - e. 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.
- 5. BMA280 functionality:
  - a. Upon power on reset or the Blue Gecko reset, the BMA280 should be in **SUSPEND** mode
  - b. Single tap should enable the I2C sensor, Load Power Management ON, and no affect to LED1
  - c. Double tap should disable the I2C temp sensor, Load Power Management OFF, and no effect 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 = 2.50 seconds
  - b. No period, so no need to have the LETIMER0 to interrupt twice per period**
  - c. During the LETIMER0 period interrupt, it will request, receive, and process the temperature reading from the Si7021
- 9. Si7021 I2C temp sensor
  - a. It should be running at the lowest energy possible while enabled and while taking temperature measurements
  - b. Temperature measurements should be 14-bit and calculated in degrees C
  - c. There should be a define statement that sets the default temperature in degrees C to indicate whether the temperature is too low
    - i. The default temperature should be 15C

- d. If the temperature read from the Si7021 is below the set temperature, LED1 is latched on until cleared by pressing the joy stick button down
  - e. The temperature set point should increase by 5 degrees C every time the joy stick is pressed to the right
  - f. The temperature set point should decrease by 5 degrees C every time the joy stick is pressed to the left
  - g. If LED1 is turned off by pressing the joy stick button down and the temperature is still below the current set point, LED1 should turn on at the next temperature measurement
  - h. The temperature set point is not reset when the joy stick button is pressed down. The only function pressing the joy stick down should be to turn off LED1.
10. The Blue Gecko should be running at the lowest possible energy state while the system is waiting for an input from the Joy Stick.
11. LED0 is not used in this assignment

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 2.5mS/div.**

1. After the Blue Gecko has been reset or after power up, what energy mode is the Blue Gecko running in?
  - a. What is the average current when the LEDs are off?
2. Place the BMA280 in Normal mode by pressing the joy stick North. What energy mode is the Blue Gecko running in?
  - a. What is the average current when the LEDs are off?
3. Single tape the BMA280 to enable, load power management ON, the Si7021. What energy mode is the Blue Gecko running in?
  - a. What is the Energy Score?
  - b. What is the average current while the LEDs are off and the Si7021 is not taking a measurement?
  - c. What is the average current while the LEDs are off and the Si7021 is taking a measurement?
  - d. How long does the Si7021 require to take a measurement?
  - e. How does the Si7021 measurement time compare to the datasheet?
4. Suspend the BMA280 by pressing the joy stick south. What energy mode is the Blue Gecko running in?

- a. What is the Energy Score?
  - b. What is the average current while the LEDs are off and the Si7021 is not taking a measurement and not in the LETIMER interrupt handler?
  - c. What is the average current while the LEDs are off and the Si7021 is taking a measurement?
  - d. What is the current required by the Si7021 while not taking a measurement?
  - e. How does this compare to the Si7021 datasheet?
  - f. What is the current required by the Si7021 while taking a measurement?
  - g. How does this compare to the Si7021 datasheet?
5. What temperature is the Si7021 measuring? You will need to be viewing the variable in the debugger.
- a. How many pushes to the right, increasing the set point is required for LED1 to turn on?
  - b. After pushing the joy stick button down, does LED1 turn off and then turn on at the next measurement?
  - c. How many pushes to the left, decreasing the set point is required for LED1 to remain off after LED1 has been reset?

**Deliverables:**

1. One document that provides the answers to I2C temp sensor Assignment.
2. The completed program project or required files to enable the code to be ran on the instructing team's computer for grading.