

# TECH 3812

## Lab #x

### Using I2C

Ver 0.55

#### Background:

For this experiment we will be using a Real Time Clock (RTC) Module (Sparkfun BOB-12708 based on the DS1307 RTC IC) as the Slave. This will be connected to an Arduino acting as the Master for the I2C Bus.

Since, as you can see in the schematic for the board, pullup resistors are already on the board for the I2C bus:

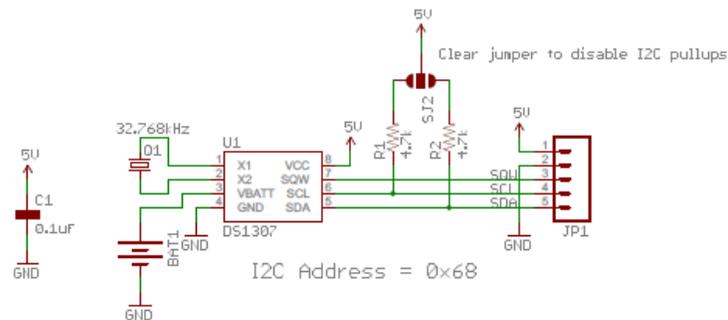


Figure 1- BOB-12708 Schematic

Since the BOB-12708 breakout board is based on the DS1307, we will **refer to the datasheet** extensively for this lab. Even though it is 14 pages, it is suggested you print it out for reference during this lab (link provided on the class website).

Here we review special conditions:

Start	Repeated Start*	Acknowledge (ACK)	Not Acknowledge* (NACK)	Stop Condition (P)
* - not in power point slides for lecture 10				

**Procedure:**

Hook up the preprogrammed Arduino and the BOB-12708 as shown below (using a protoboard to plug the RTC into and wire it to the Arduino from there. This will allow you to connect the Rigol Scope in the next step to perform the required analysis):

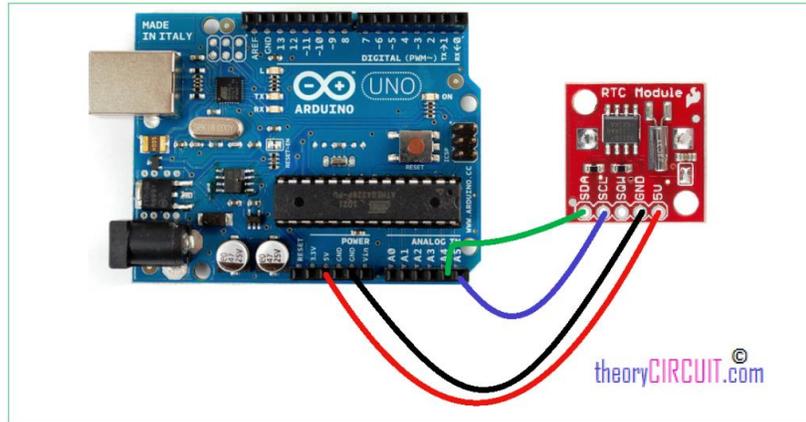


Figure 2- Wiring of the RTC<sup>ii</sup>

Connect the Rigol scope as follows using the Logic Probe inputs:

Channel	Pin on RTC
D0	SDA
D1	SCL
GND	GND

Make sure you have Invert On for all captures!

Use the single button to capture an overall image of the full packet (once the Run/Stop button is illuminated RED – DO NOT rerun the capture or the data will change).

Note the Rigol Scope SHOULD have translated the packet for you. Given the datasheet and noting that the Arduino is doing TWO Data Read (Write Point, Then Read) packets, interpret the data shown. Do this by printing out the full image and, using the datasheet – especially table 2, interpret the meaning of each  and  in the image (regardless of color). Translate this data to Date and Time and write it on the page. (Label the page as “Overall”).

Now adjusting the time scale, zoom into each  and  and capture individual images of each. For  use a time scale of 20uSec and for each  use a time scale of 5uSec and center the block on the screen (it is ok if surrounding blocks are still visible). This should generate 24 individual images. Print each image and label each image from 1 – 24.

[Analyze Overall as described above]

Analyze image 1 (include start, address, write, ack)

Analyze image 4 (include ack and repeat start)

Analyze image 5 (repeat start, address, read, ack)

Analyze image 9 (start, data, ack)

Analyze image 11 (start, data, nack, stop)

Analyze image 21 (start, data, ack)

Analyze image 24 (nack, stop)

Using image 24 to measure the time of the last bit's clock signal and then calculate the frequency.

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<sup>i</sup> <https://cdn.sparkfun.com/datasheets/BreakoutBoards/RTC-Module.v14.pdf>

<sup>ii</sup> <https://theorycircuit.com/rtc-ds-1307-arduino/>