

Mindful Health Technologies Qualcomm Prototype Funding Proposal

Patients with chronic diseases such as high-risk congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), or severe asthma do not require continuous monitoring in a hospital, however, could greatly benefit from periodic oxygen saturation monitoring to determine their state of health. Effective monitoring is challenging in the home because current pulse oximetric technologies have a limited data collection range, require patient cooperation and do not automatically share vital data with physicians. To solve these types of problems in outpatient care, our device automatically collects a patient's oxygen saturation reading and then transmits the data over the 2G/3G network directly to a web application. The physician and care team can access this web application and view the pulse oximetric data in real time. Ultimately this device could improve a patient's quality of life and provide insight to trends regarding the decline of health in patients with various chronic diseases.

The first iteration of the circuit board is displayed in figure 1 and comprised of the three main components of the device: a mounting area for the Smith's Medical Pulse Oximetry module, a wireless GSM transmission module, as well as the ATmega32U4 microcontroller. The base of the board was developed using the open hardware EAGLE files from Seedstudio (GSM module) and Arduino. A simple USB interface is also included through which debug and programming of the ATmega32U4 is carried out. The ATmega32U4 serves to host the Smith's Medical module by determining averaging modes, plethysmogram syncing and gain factors, as well as receiving and storing data. The ATmega32U4 also serves to host the GSM module. At appropriate intervals, a TCP/IP connection is made with the Internet database to upload the relevant physiological data of that was retrieved from the pulse oximetry module.

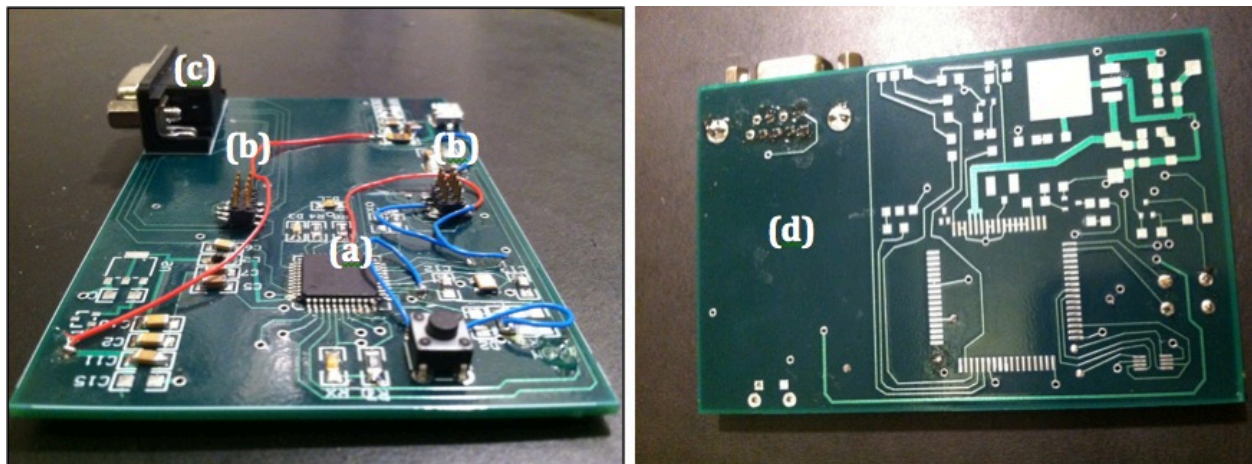


Figure 1. First iteration circuit board populated with ATmega32U4 microcontroller (a), BCI board connectors (b), and BCI sensor DB9 connector (c). Seedstudio GSM shield will be populated on the opposing side (d).

In our first iteration of the device, the BCI pulse oximeter board and sensor did not produce valid SpO2 data. We spent considerable time troubleshooting on our own before getting help from quality engineers at Smiths Medical BCI. At this point they are agreeing to have us send the board and sensor to them for testing. This could take months, so we would like to move past this bottleneck and continue development by purchasing a higher quality OEM solution from Masimo.

The board we would like to purchase is the new MS-2040 board, shown in figure 2. It boasts low power consumption, is small enough to work with our device, and has proven Measure-through Motion and Low Perfusion capabilities. The Measure-through Motion is important for our device as it is meant to be worn at all times, while the Low Perfusion capability ensures that we can get actionable data even when the signal is very small. Furthermore, in purchasing this board, we get the full support of a team of Masimo engineers that will help us to correctly implement it. Since we want to create the highest quality device possible, we believe that the Masimo board will give us the credibility we need to gain traction in our markets. This is the last financial hurdle for development, so any funding would be greatly appreciated.

Proposed item for purchase:

- \$1000.00 - MS-2040 Masimo SET OEM Board
 - Includes sensor and support from Masimo engineers

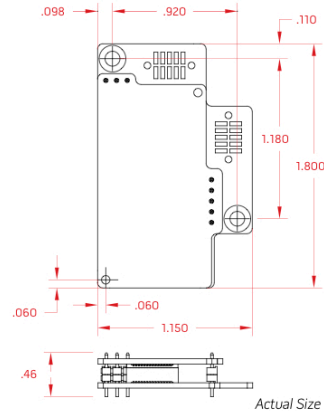
MS-2040 Double Stack

Masimo SET® OEM Board

DIMENSIONS

Dimensions	Typical
Width	1.15 inch
Length	1.80 inch
Stack Height	0.46 inch
Mounting Hole	0.110 inch
Top Height	0.100 inch
Bottom Height	0.100 inch

BOARD OUTLINE – TOP VIEW



CONNECTOR DATA

Connector Description	Power and Communications Connector	Sensor Connector
Number of Pins	10	10
Configuration	2 rows of 5	2 rows of 5
Angle	Vertical	Vertical
Pin Grid	0.050 inch	0.050 inch
Manufacturer Part #	Samtec SFM-105-02-S-D-A 10 2 9 1	Samtec SFM-105-02-S-D-A 10 2 9 1

DC POWER REQUIREMENTS

	Typical	Maximum
Input Voltage	+3.3V	±5%
Line/Load Regulation		0.2% rms
Avg. Power	< 45 mW	150 mW

SERIAL INTERFACE

Baud Rate (fixed)	9600 bps
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Masimo U.S.
Tel: 1 877 4 Masimo
info-america@masimo.com

Masimo International
Tel: +41 32 720 1111
info-international@masimo.com



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Figure 2. Massimo MS-2040 OEM pulse oximeter board.