Pulse oximeter and heart rate integrated sensor module aids wearable designs

Steve Taranovich - January 14, 2016

While at CES 2016, I got a sneak preview of the MAX30102 optical sensor. I met with Maxim Integrated and saw a really neat optical heart rate IC for the wrist, finger, or even the ear. Any reasonably translucent site on the body with adequate blood flow can be used.

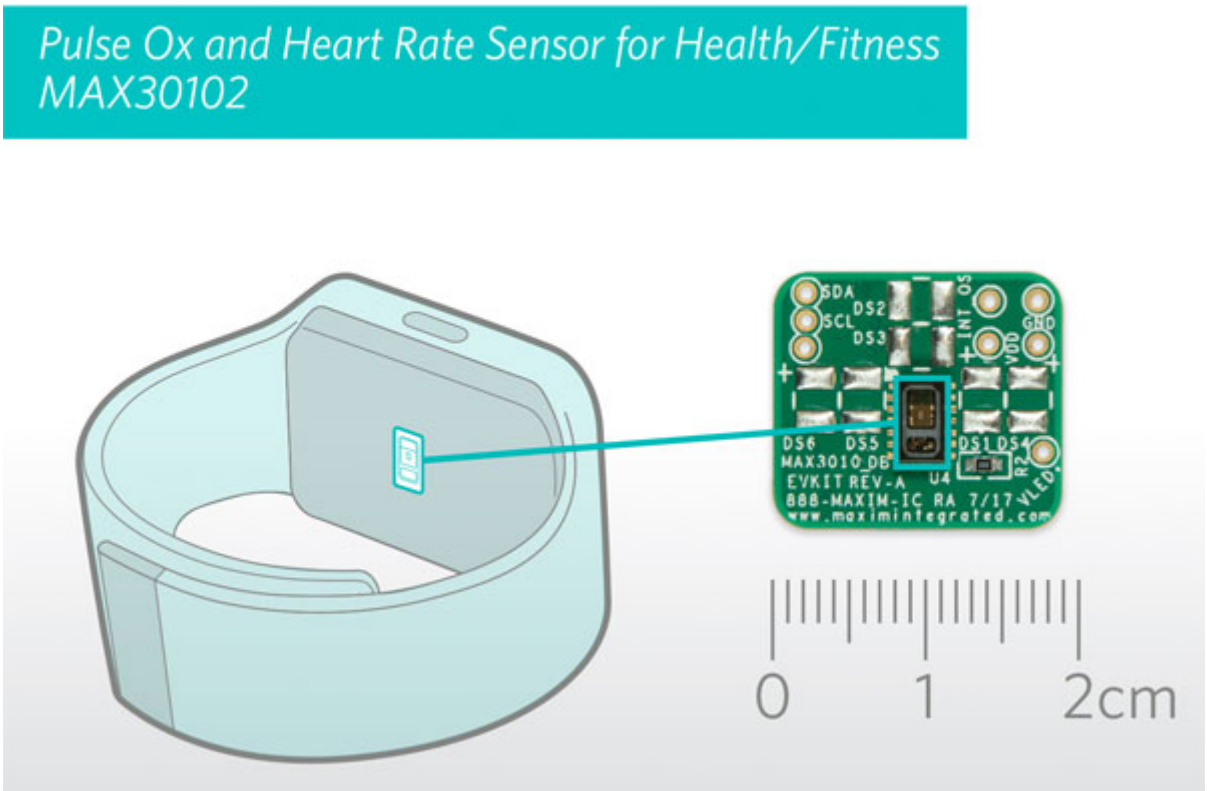
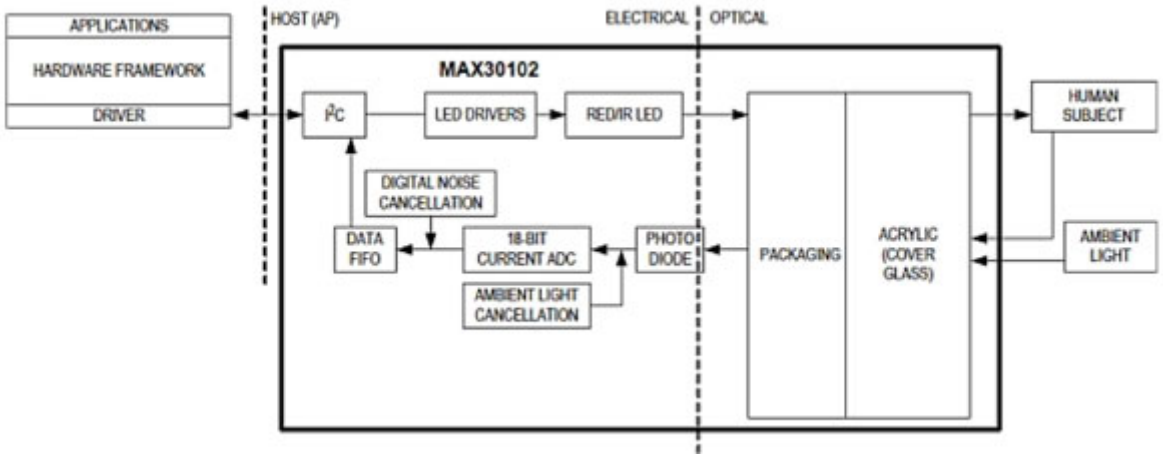


Image courtesy of Maxim Integrated

Pulse oximetry works by oxygen binding to hemoglobin in red blood cells as it moves through your lungs. Arterial blood flow carries this all through your body. A pulse oximeter uses two frequencies of light (red and infrared) to determine the percentage of hemoglobin in the blood that is saturated with oxygen. This percentage is called blood oxygen saturation, or SpO_2.

The pulse oximetry principle is based upon the red and infrared light absorption characteristics of oxygenated and deoxygenated (or reduced) hemoglobin. Oxygenated hemoglobin absorbs more infrared light and allows more red light to pass through. Deoxygenated hemoglobin absorbs more red light and allows more infrared light to pass through. Red light is in the 600-750 nm wavelength light band, while infrared light is in the 850-1000 nm wavelength light band.

The pulse oximeter can measure and display pulse rate simultaneously with the SpO_2 level. This is a non-invasive, real-time technique particularly in vital sign monitoring during an operation or under anesthesia.



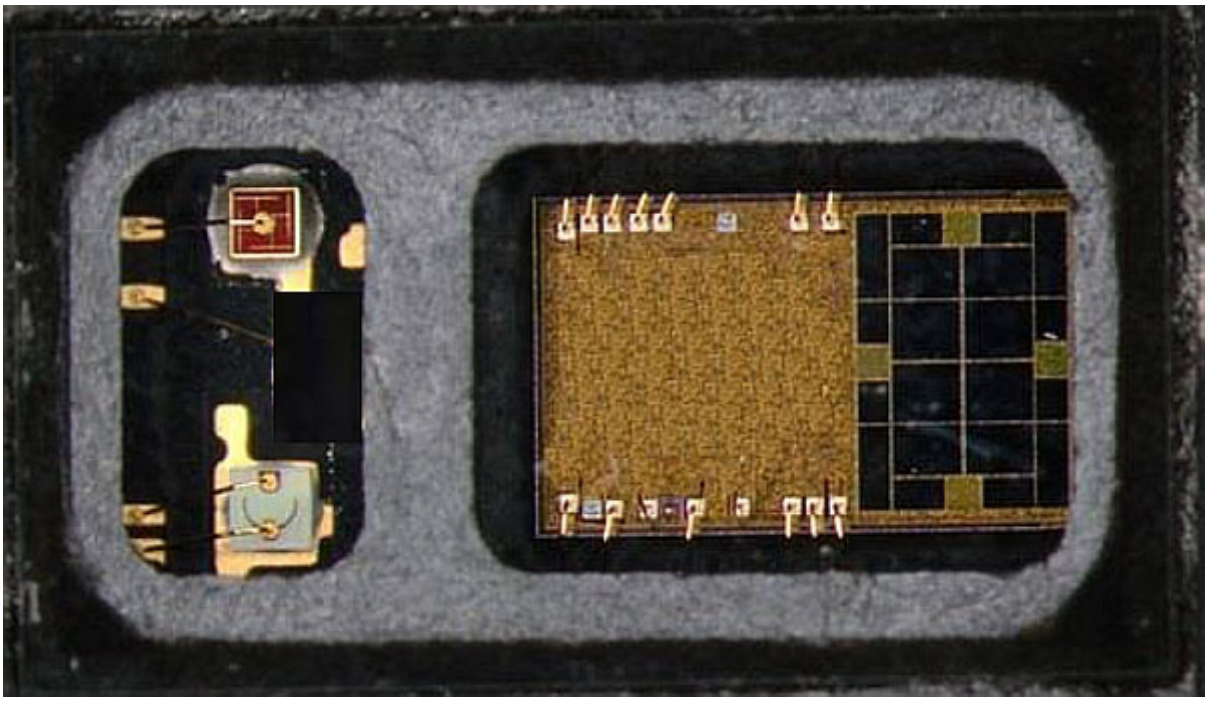
A typical system block diagram. (Image courtesy of Maxim Integrated)

I can see how this product will shorten design time to market for wearables and other types of healthcare solutions. The IC is low power, operating on a single 1.8V supply with a separate 5V supply for the internal LEDs and small footprint so that it easily can be integrated into the wearables market. The analog integration is central to the performance of this chip which integrates red and IR LEDs to modulate LED pulses for oxygen saturation (SpO_2) and heart rate measurements.

The IC also integrates the photo-detectors, optical elements, and low-noise electronics with ambient light rejection, using an integrated cover glass to improve accuracy of the measurement. The IC has high SNR to allow for robust artifact resilience as well.

Pricing and packaging

With a −40ºC to +85ºC operating temperature range, the MAX30102 is available in a tiny 14-pin optical module (5.6×3.3×1.55 mm). Pricing starts at $4.13 (1000-up, FOB USA).



The MAX30102 advanced optical packaging. (Image courtesy of Maxim Integrated)

Evaluation kit

There is an all-important evaluation platform, the MAX30102ACCEVKIT, with the integrated module and an accelerometer that provides designers a quick and easy way to evaluate the module.

The MAX30102 evaluation kit (EV kit) provides a proven design to evaluate the MAX30102 integrated pulse-oximetry and heart-rate monitor IC. The EV kit consist of two boards: The USBOSMB is the mother board and MAX30102DBEVKIT is the daughter board that includes the MAX30102 and an accelerometer. The EV kit is powered using the USB supply to generate +1.8V for the sensor and +4.5V for the internal LEDs of the MAX30102, and +3.3V for the accelerometer. The EV kit comes with a MAX30102EFD+ installed in a 14-pin OESIP package.

This kit allows real-time monitoring, is USB-powered, has an on-board accelerometer and is Windows 7- and Windows 8/8.1-compatible software. The board Gerber files will speed time to market as well for the designer.

For more information visit Maxim Integrated.

Also see:

- 4 reasons Fitbit is being sued for inaccurate heart-rate monitors
- Optical heart-rate measurement's top 5 challenges
- Simple pulse oximetry for wearable monitor