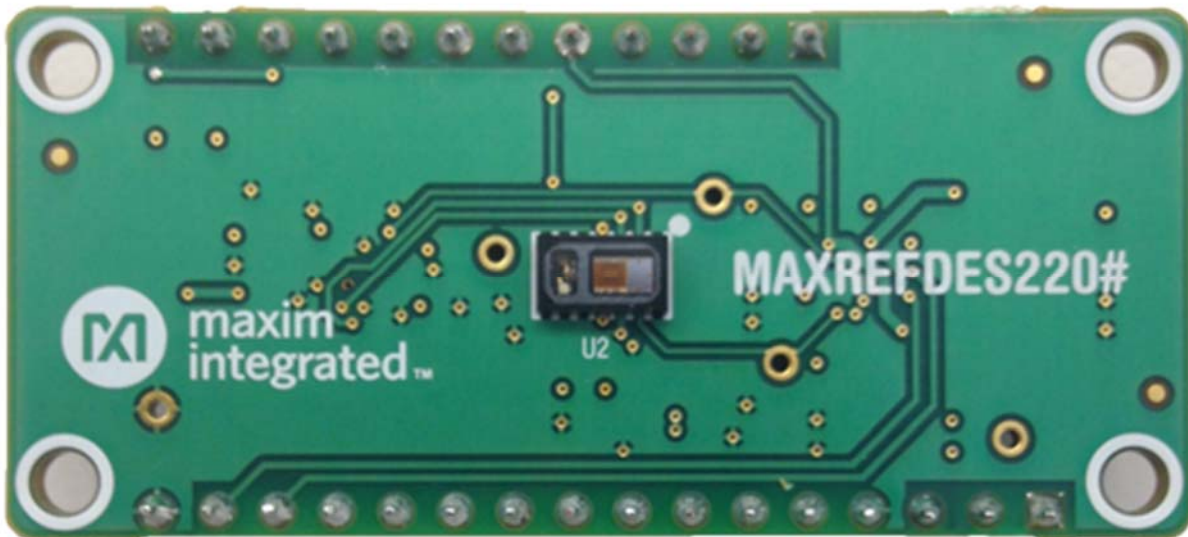![maxim integrated™ logo]

System Board 6657

MAXREFDES220#: Finger Heart Rate and Pulse Oximeter Smart Sensor with Digital Signal Processing

MAXREFDES220# System Board

The MAXREFDES220# reference design provides everything you need to quickly prototype your product to measure finger-based heart rate and blood oxygen saturation level (SpO2).

The MAX30101 and the MAX32664 provide an integrated hardware and software solution for multiple finger-based applications. The MAX32664 firmware provides digital signal processing to process the data. The reference design also includes a tri-axis accelerometer to compensate for motion artifacts.

A MAX32630FTHR is provided to emulate a host system for easy development.

Design files, firmware, and software can be found on the Design Resources tab. The board is also available for purchase.

- MAX30101 Heart Rate Monitor and Pulse Oximeter
  - Tiny 5.6mm × 3.3mm × 1.55mm 14-Pin Optical Module
  - Integrated Cover Glass for Optimal, Robust Performance
  - Ultra-Low Power Operation for Mobile Devices (< 1mW)
  - Programmable Sample Rate and LED Current for Power Savings
  - High SNR (Signal-to-Noise) ratio, typically greater than 80dB
- MAX32664 Sensor Hub
  - Maxim-licensed firmware provides complete algorithmic support for finger heart rate and blood oxygen saturation calculations
  - Communicates with host controller over industry standard I²C interface.
  - Secure firmware updates authenticated by dedicated bootloader.
- 3-Axis Accelerometer Provides Greater Accuracy
  - Compensates for motion artifacts.

Applications/Uses

- Portable Medical Devices
- Telemedicine
- Sensor Hubs
- Android or IOS devic

Introduction

The MAXREFDES220# provides detailed design information to use Maxim Integrated devices to quickly implement end-to-end measurement of heart rate and SpO2 using reflective photo plethysmography (PPG).

The MAX30101 operates from a 1.8V power supply and a separate 5.0V power supply for the internal LED. Many device parameters are configurable by the MAX32644. The module can be shut down through software with zero standby current, allowing the power rails to remain powered at all times.
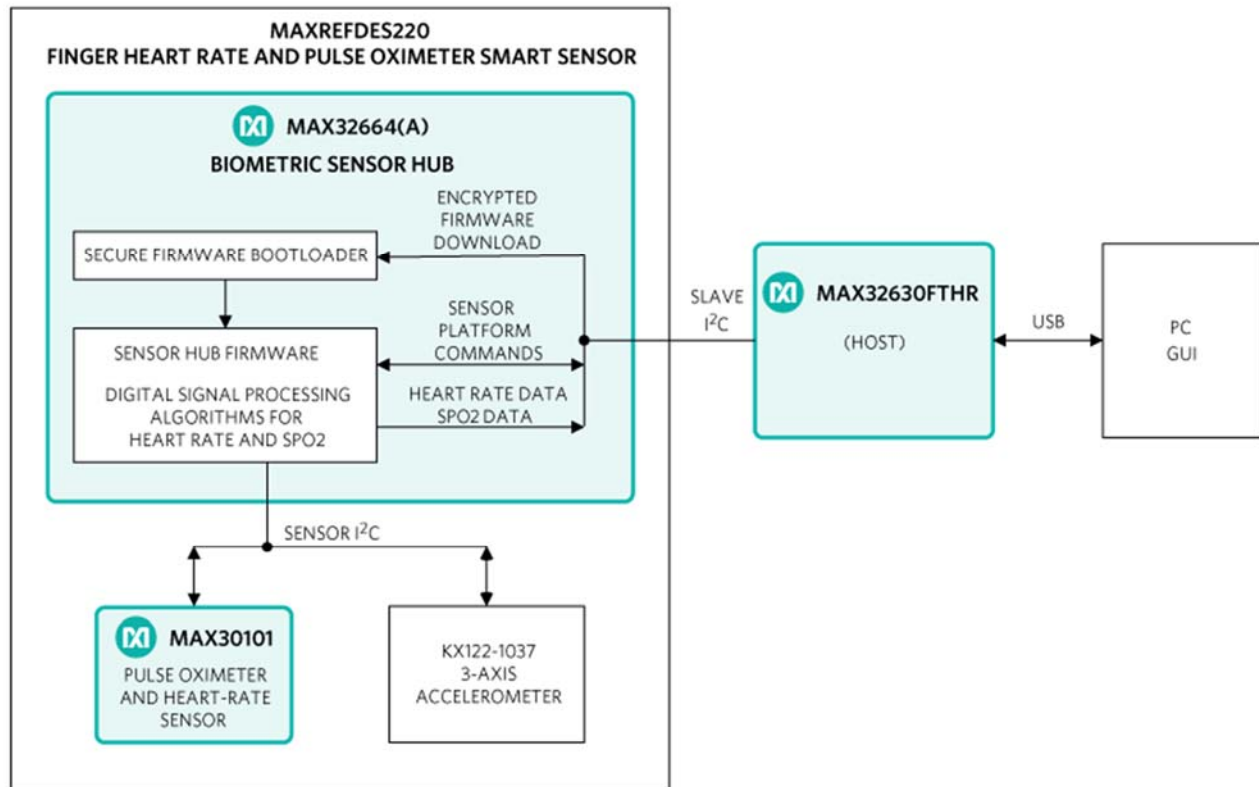
The MAX32664 is a small, low cost, power-optimized sensor hub for finger-based pulse applications using the MAX30101. The hub collects and processes the output of the PPG and accelerometer transparently through a dedicated I²C interface. A second,standard-mode I²C interface connects to the host through a dedicated command set.

A Windows®-based GUI configures the sensors and graphically displays raw and processed heart rate and SpO2 data. It also provides the ability to collect and log sensor output for off-line evaluation.

The provided MAX32630FTHR board emulates a host system for easy development. Source code for the MAX32630FTHR firmware is freely available on the mbed site to allow customers to implement their own custom host on any platform.

As with all Maxim reference designs, the bill of materials (BOM), schematics, layout files, Gerber files, firmware, and software are all available online.

System Diagram

Quick Start Guide

Installation Procedure

1. Assemble and connect the reference design hardware.

    a. Remove the MAX32630FTHR and MAXREFDES220# sensor board from the package.
    b. Connect the MAX32630FTHR and Smart Sensor Boards together.
    c. Connect a mini-USB cable between the PC and the MAX32630FTHR.

2. Verify the operation of the MAX32630FTHR host

    a. Immediately after connecting the USB cable, observe the LED on the MAX32630FTHR.
    b. If the LED briefly turns yellow, and then blinks green, the MAX32630FTHR is programmed correctly and ready for use.

c. If the LED blinks yellow, then the MAX62630FTHR has been initialized but the sensor board is not responding. Unplug the USB cable. Separate and then reconnect the sensor board and MAX32630FTHR, and then connect the USB cable again. If the condition persists, please contact Maxim technical support for assistance.

d. If the LED turns red or blinks any other pattern or does not illuminate at all, update the MAX32630FTHR as described below.

3. Download and install the Maxim licensed MAX32644A firmware.
4. Download and install the Maxim DeviceStudio GUI software.

   a. Navigate to the Maxim Integrated website, enter MAXREFDES220# into the search tool. Select the entry for MAXREFDES220# in the Product Results section.
   b. On the product QuickView page, select Design Resources and download the files under "Software Files".
   c. Extract the downloaded files into any directory.

Operating the GUI

1. After the hardware and software installations have been completed, make sure the MAX32630FTHR is connected to the PC using the USB cable.
2. Launch the Maxim DeviceStudio application.
3. Uncheck "ADB" under Scan Options
4. Press the scan button to auto-detect the Smart Sensor board that shows as PPG under "Connected Devices".
5. Click "Launch Tool" to run the MAXREFDES220#-specific features.
6. Configure the PPG settings as desired. Do not change the FIFO settings from their default values.
7. Select "Accelerometer Data" to display X-axis and Y-axis accelerometer results from the Sensor Board.
8. Select "Algorithm Data" to display the data from the IR and red LED sensors.

Updating the MAX32630FTHR firmware

These steps are only necessary if the MAX32630FTHR does not initialize as described above.

1. Navigate to the Maxim Integrated website, enter MAXREFDES220# into the search tool. Select the entry for MAXREFDES220# in the Product Results section.
2. From the product page, select Design Resources and download the files under "Firmware Files".
3. Extract the .bin file into any directory.
4. Connect one end of the ribbon cable to the black header J4 on the MAX32630FTR.
5. Examine the other end of the ribbon cable carefully. One side of the cable going into the black header SWD is marked by the red wire. Connect the cable and SWD header, making sure the red wire is furthest from the letters SWD.
6. Connect a mini USB cable between the USB connector labeled HDK and the PC.

7. Open a File Explorer window. The programming adapter shows as a new USB drive.
8. Drag and drop the downloaded .bin file onto the icon for the new USB drive. The LED begins to flash red while the MAX32630FTHR is being programmed.
9. When the LED stops flashing, remove the ribbon. Press the reset button on the MAX32630FTHR and verify the operation of the MAX32630FTHR

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Part Number
MAXREFDES220#

Status
Active

Carrier Type
Box