LoTiBloxy
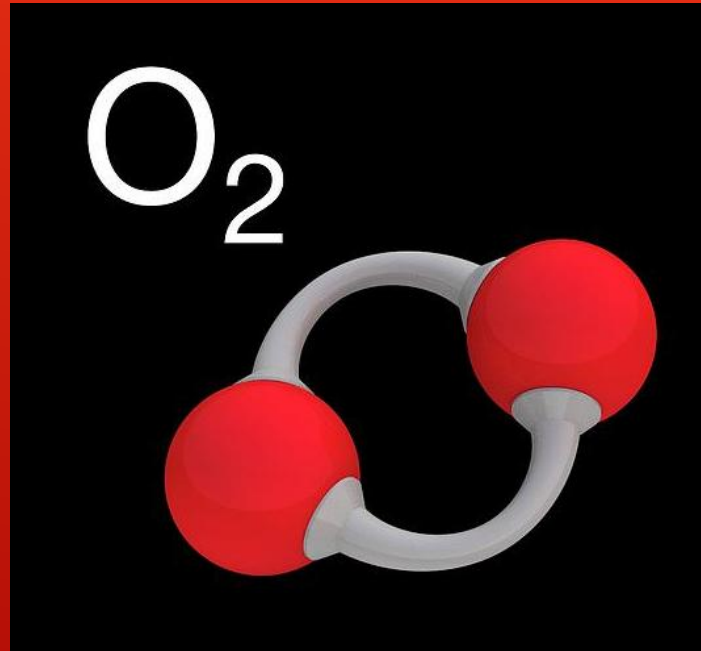# LowPower-Tiny-Bluetooth-Oxymeter

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PROJECT DESCRIPTION

▸ Project's Goal:

  ▸ Non-bulky reflective pulse oximeter system determining the   Oxygen percentage in the blood through a LED and photodiode-based Sensor board.

  ▸ Collected percentage is sent via Bluetooth to an Android Application   along with the photoplethysmosgraph (oxygen level over time)

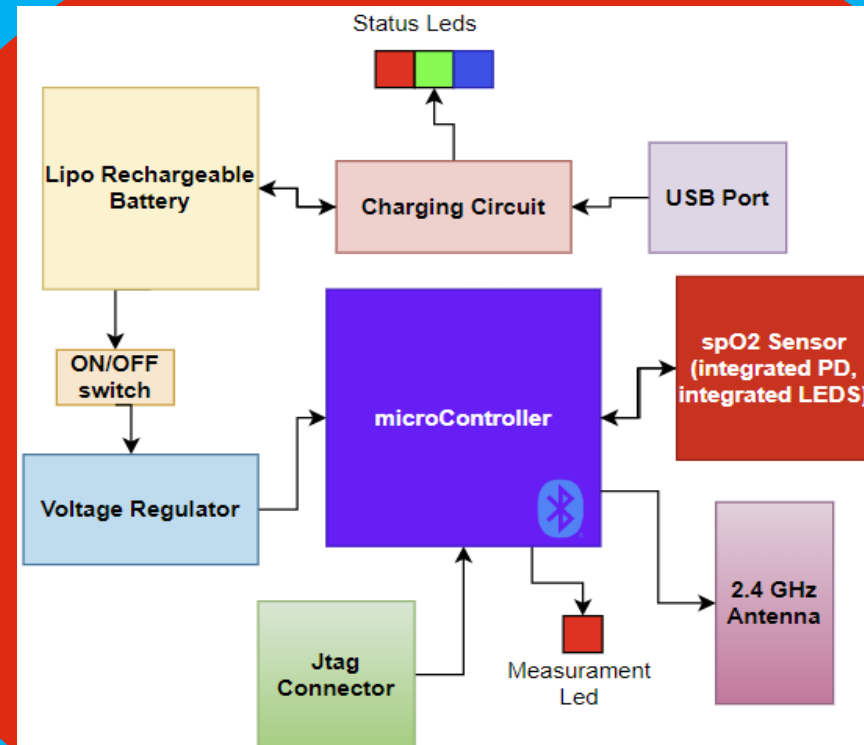 ▸ Low-Power Device thanks to proximity Mode sensor

▸ General PulseOxymeter Information:

  ▸ Oxygen Saturation (spO2) measures the percentage of oxyhemoglobin (oxygen-bound hemoglobin) in the blood.

  ▸ Oximeters Measure this value by confronting the ratio of absorbed red light to infrared light detected by a photodevice-based component.

LED   PD
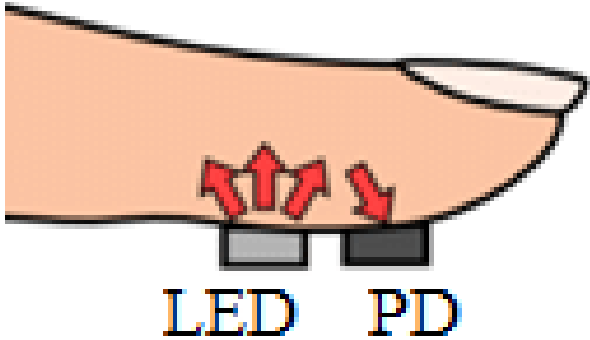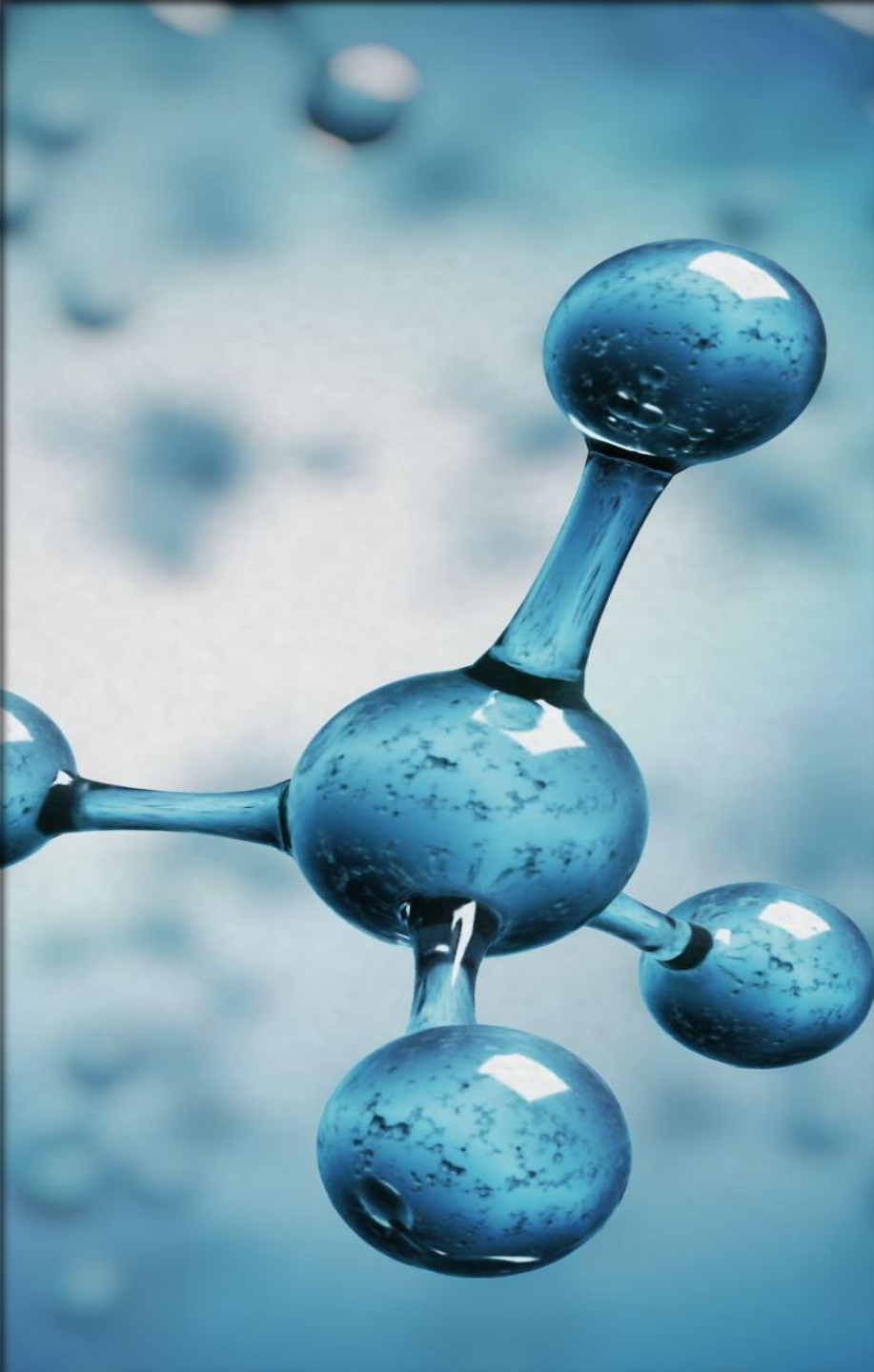
BLOCK DIAGRAM

- Manufacturer: Maxim
- Transmission Info: Integrated Infrared, Red, Green LEDs
- Reception Info: Integrated PhotoDiode
- Embedded Ambient Light Cancellation, 19 bit DAC
- I2C interface for MCU
- FIFO depth: 256 words
- Ultra Low Power Sensor , (proximity mode)
- System supply Voltage: min: 3.0V, max: 5.5V
- Small dimensions: 2.9mm x 4.3 mm x 1.2 mm
- Programmable active current, and LowPower current
- Automatic Proximity Mode (Low Power Mode)
- Contains Digital and Analog Ambient Light cancellations for accurate more accurate samples
- Cost: € 11.83 from Mouser Electronics
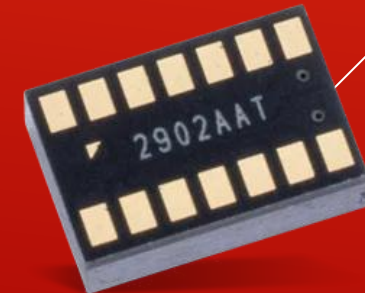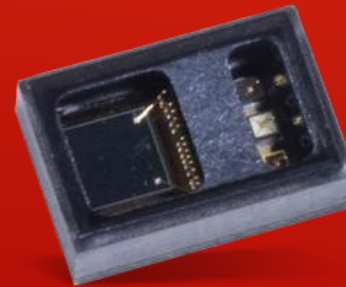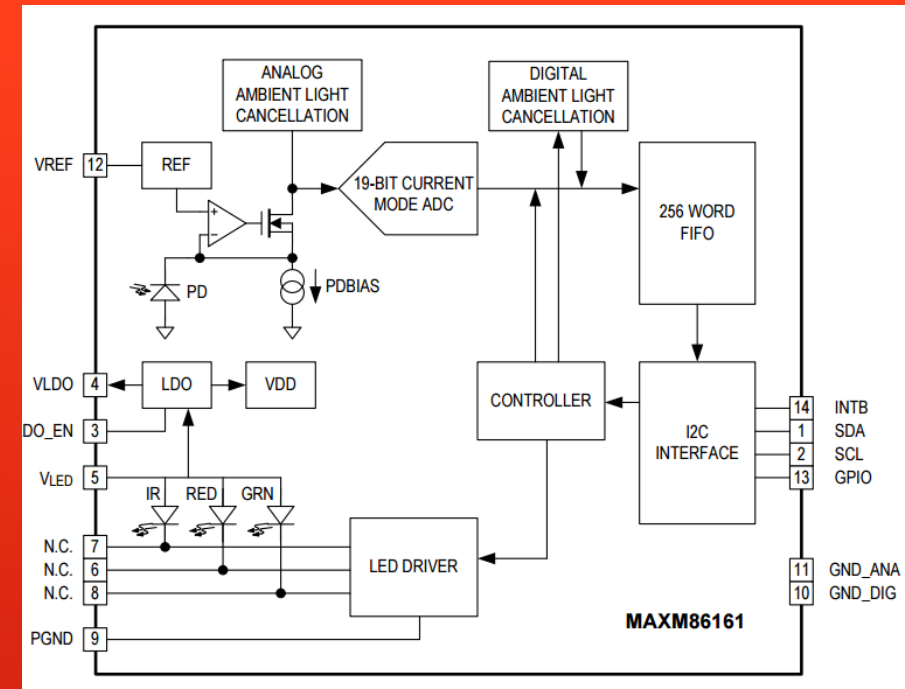
★ SENSORS – **MAXM86161**

- Manufacturer: Maxim (New Product)
- Supply: 1.8V supply voltage
- Led Driver Supply: 2.7 to 5 Volts
- Dimensions: 1.7 mm x 1.8 mm x0.4mm
- Interfaces: SPI and I2C protocols
- FIFO depth: 256 Words
- Programmable active current, and LowPower current
- PhotoDiode and Leds not integrated (drawback)
- Cost: € 5.7(MAX86174A) + € 0.99 (TEMT6200FX0 PD)+

    € 0.88 (SFH4059S IR LED SMD) + € 0.81(HSMC-C170-T0000 RED LED)

    = € 8.31 from DigiKey Electronics and Mouser
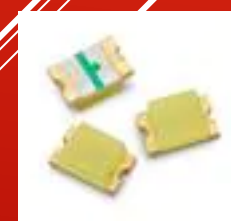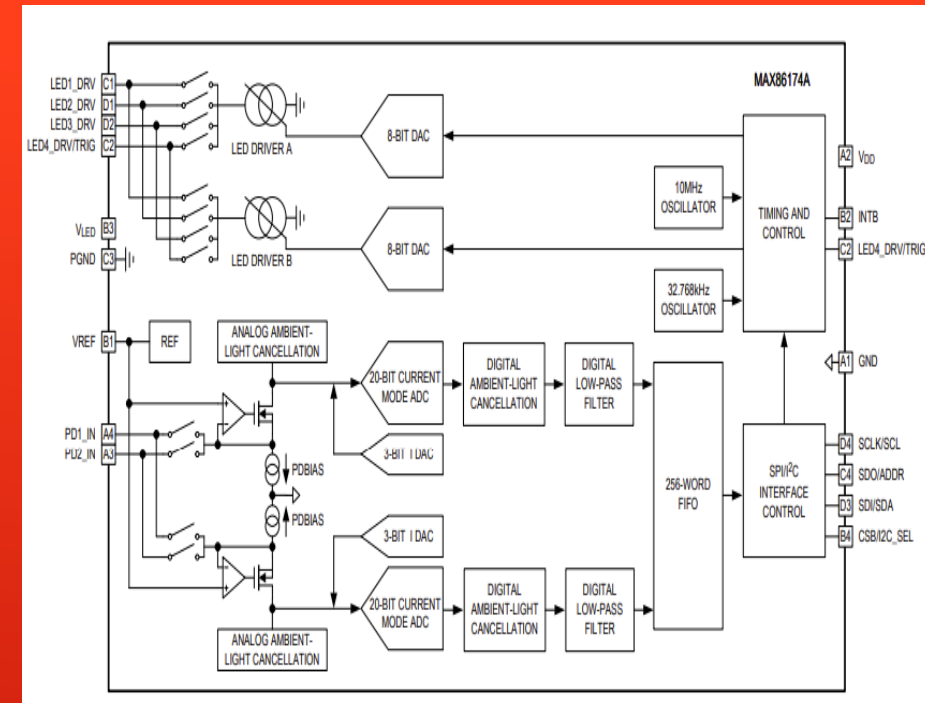
TEMT6200FX0 PD

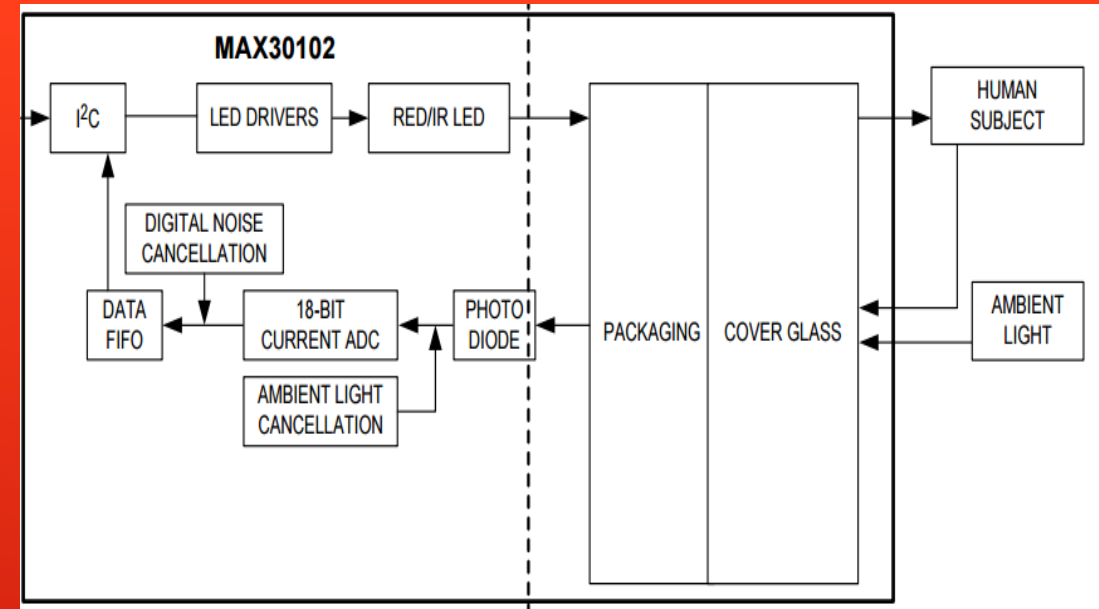HSMC-C170-T0000 RED, IR LEDs

SENSORS - **MAX86174A**

- Manufacturer: Maxim
- Transmittance Side: integrated IR, RED LED
- Reception Side: integrated Photodiode
- 18 Bit DAC precision
- Dimensions: 3.5mm x 7.0mm x 1.5mm
- FIFO depth: 32 Words.
- Interface: 12C protocol
- 1.8V supply voltage (separate 5V voltage for
   Leds)
- Costs: € 13.31 from DigiKey Electronics

SENSORS – **MAX30102EFD+T**

- Manufacturer: Texas Instruments
- ARM Cortex M3 ISA
- Clock Speed : 48 MHz
- Supply Voltage: 1.8 to 3.8 V
- Dimensions: 5 mm x 5 mm x 0.88 mm
- Interfaces: I2C or SPI
- Integrated Bluetooth Module
- Interface: 12C protocol
- Costs: € 4.74 from DigiKey Electronics

MCU – **CC2640R2LRHBR**
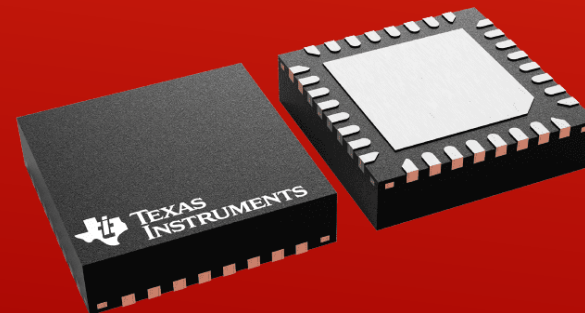
- Rechargeable Lipo Battery: 3.7 V, 150 mAh, Connector **LP402025**, cost € 4.51 from Eckstein Komponente

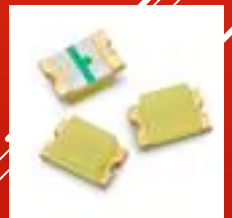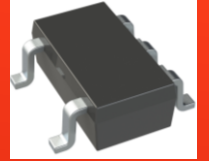- USB Battery Charger: programmable Charge current 15 to 500 mA **MCP73831T-2ACI/OT,** cost: € 0.76 from DigiKey Electronics

- ON/OFF Power switch about € 1

- Red measurement led: HSMC-C170-T0000, € 0.94

- charge pump **MAX1759** €8.28

- SMLP34RGBN1W3 (RGB Battery Status Led),

- Passive components

   about € 5
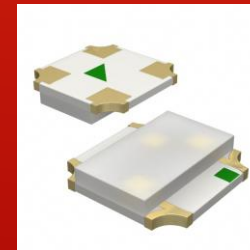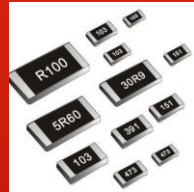
OTHER COMPONENTS

Assuming a measurement lasts 15 seconds, and we measure once every 5 minutes.

Sensor Values: Assuming the programmed current while in proximity mode is 0.12 mA and the device has 100Hz sample frequency.

- MCU :
  - Active-Mode 1,45mA+31µA/MHz
  - Stand-by-Mode 1,5µA
  - Transmitting Mode 9.1mA
- MAXM86161:
  - Measuring-Mode: 1.3 mA
  - Proximity-Mode: 0.12 mA
- External Leds Contribution
  - Active-Mode: 5 mA
  - Reverse current: 0.01 mA

((stand-by)285*1,5µA + (transmitting)15*9.1mA + 15*(1.45 + 0.031*48)mA)/300s = 0.6mA

(measurement)15*1.3mA + (Proximity)285s*0.12mA)/300s = 0.18mA

BatteryStatusLed: (1*(5mA) + 299(0.01mA))/300s = 0.01mA

MeasuramentLed: (15*(5mA) + 285(0.01mA))/300 = .26mA

Estimated Longevity:150mAh/(.6 mA + 0.23 mA + 0.27 mA) =
136 hours under specified conditions

POWER ESTIMATION

► COST ESTIMATION

- MAXM86161 SENSOR: 11.83 €
- TEXAS INSTRUMENTS CC2640:   4.74 €
- RECHARGEABLE BATTERY: 4.51 €
- CHARGER MCP73831:   0.76 €
- REGULATING CHARGE PUMP MAX1759   8.28 €
- SMLP34RGB BATTERY STATUS LED   1.52 €
- MEASURAMENT STATUS LED   0.94 €
- SWITH BUTTON   1.00 €
- PASSIVES COMPONENTS   5.00 €
- CONNECTORS   3.00 €
- NRE COSTS   4.00 €

ESTIMATED TOTAL = 45.58 €

(NRE cost calculation):

- .05 € per hour due to designer's (me) first PCB design and inexperience with orCad.

- 80 hours of work In 40 days.

NRE costs = 80*.05 = 4 €

PRELIMINARY BOM ESTIMATION

- The Market is very competitive. Overall Solutions for pulse oximeters are based on the Transmittance measurement concept.

- Overall product prices are about 30 euros.

- The present reflective pulse Oximeter project needs still a lot of time and development to reach the market price.

- Additionally, the time to Market is not favourable now as there are many competitors with low price range.

MARKET ANALYSIS AND GANTT DIAGRAM