

Comparison of MAX30205 and DS18B20 Temperature Sensors with Alternatives

1. MAX30205 Temperature Sensor Specifications

- **Temperature Range:** 0°C to +50°C
- **Accuracy:** $\pm 0.1^{\circ}\text{C}$
- **Current Consumption:**
 - 600 μA (typical operation)
 - 0.1 μA (shutdown mode)
- **Supply Voltage:** 2.7V to 3.3V
- **Communication Protocol:** I²C
- **Response Time:** Fast (optimized for real-time body temperature sensing)
- **Package Size:** 8-pin SOIC (4.9 x 3.9 mm)
- **Applications:** Wearables, medical devices, health monitors

Datasheet and Additional Details

- Datasheet: [MAX30205 Datasheet](#)
- Key Feature: Optimized for **human body temperature monitoring** with medical-grade accuracy.

2. DS18B20 Temperature Sensor Specifications

- **Temperature Range:** -55°C to +125°C
- **Accuracy:** $\pm 0.5^{\circ}\text{C}$
- **Current Consumption:**
 - Active: $\sim 1.5\text{ mA}$
 - Idle: $\sim 750\text{ }\mu\text{A}$
- **Supply Voltage:** 3.0V to 5.5V
- **Communication Protocol:** 1-Wire
- **Response Time:** Moderate (suited for slower temperature changes)

- **Package Size:** TO-92 (4.1 x 4.1 x 5.2 mm) or SOIC
- **Applications:** Industrial, environmental, and general-purpose temperature sensing

Datasheet and Additional Details

- Datasheet: [DS18B20 Datasheet](#)
- Key Feature: Cost-effective with a wide range for non-critical applications.

3. Alternatives to MAX30205

A. Texas Instruments TMP117

- **Temperature Range:** -55°C to +150°C
- **Accuracy:** $\pm 0.1^{\circ}\text{C}$ (high accuracy)
- **Current Consumption:**
 - Active: 3.5 μA (typical)
 - Shutdown: 150 nA
- **Supply Voltage:** 1.8V to 5.5V
- **Communication Protocol:** I²C
- **Package Size:** 10-pin DSBGA (1.5 x 1.5 mm)
- **Applications:** Wearables, industrial sensing, medical devices
- **Datasheet:** [TMP117 Datasheet](#)

Advantages over MAX30205:

- Lower power consumption.
- Wider temperature range.
- Smaller package size, ideal for ultra-compact wearables.

B. Silicon Labs Si7051

- **Temperature Range:** -40°C to +125°C
- **Accuracy:** $\pm 0.1^{\circ}\text{C}$ (high accuracy)
- **Current Consumption:**

- Active: 195 μA
- Standby: 60 nA
- **Supply Voltage:** 1.8V to 5.5V
- **Communication Protocol:** I²C
- **Package Size:** DFN (3 x 3 mm)
- **Applications:** Smart wearables, home automation, medical devices
- **Datasheet:** [Si7051 Datasheet](#)

Advantages over MAX30205:

- Ultra-low standby power consumption.
- Compact package for space-constrained applications.

C. Analog Devices ADT7420

- **Temperature Range:** -40°C to +150°C
- **Accuracy:** $\pm 0.1^\circ\text{C}$ (medical-grade)
- **Current Consumption:**
 - Active: 210 μA
 - Shutdown: 2 μA
- **Supply Voltage:** 2.7V to 5.5V
- **Communication Protocol:** I²C or SPI
- **Package Size:** 16-lead LFCSP (3 x 3 mm)
- **Applications:** Wearables, industrial equipment, healthcare devices
- **Datasheet:** [ADT7420 Datasheet](#)

Advantages over MAX30205:

- Compatibility with both I²C and SPI.
- Higher temperature range and similar accuracy.

4. Summary of Features and Recommendations

Sensor	Temperature Range	Accuracy	Current Consumption	Package Size	Key Features
MAX30205	0°C to +50°C	±0.1°C	600 µA (active)	4.9 x 3.9 mm	Medical-grade accuracy for wearables
DS18B20	-55°C to +125°C	±0.5°C	1.5 mA (active)	4.1 x 4.1 x 5.2 mm	Cost-effective, wide range
TMP117	-55°C to +150°C	±0.1°C	3.5 µA (active)	1.5 x 1.5 mm	Ultra-low power, compact size
Si7051	-40°C to +125°C	±0.1°C	195 µA (active)	3 x 3 mm	Ultra-low standby power
ADT7420	-40°C to +150°C	±0.1°C	210 µA (active)	3 x 3 mm	SPI compatibility, high range

Conclusion

- **Best for Medical Wearables:** MAX30205, TMP117, Si7051
- **Best for Compact Designs:** TMP117 (smallest size)
- **Best for Low Power Applications:** TMP117, Si7051
- **Best for General-Purpose Sensing:** DS18B20 (cost-effective)

Heart Rate & Oxygen Saturation Sensors

1. MAX30102

Specifications

- **Functionality:** Measures Heart Rate (PPG) and Oxygen Saturation (SpO2)
- **Power Consumption:**
 - Active: 1.6 mA (typical)
 - Shutdown: 0.7 µA
- **Communication Protocol:** I²C
- **Supply Voltage:**
 - VDD: 1.8V
 - LED Driver: 3.3V to 5.5V
- **Size:** 5.6 x 3.3 x 1.55 mm (very small)
- **Applications:** Wearables, fitness bands, health monitors
- **Additional Features:**
 - Integrated red and infrared LEDs
 - Ambient light cancellation for accurate readings

- Compact package for space-constrained designs

Datasheet: [MAX30102 Datasheet](#)

Advantages:

- Compact size makes it ideal for wearables.
- Compatible with ESP32 (via I²C interface).
- Low power consumption.

2. MAX30100 (Predecessor to MAX30102)

Specifications

- **Functionality:** Measures Heart Rate and Oxygen Saturation (SpO₂)
- **Power Consumption:**
 - Active: 1.6 mA
 - Shutdown: 0.7 μ A
- **Communication Protocol:** I²C
- **Supply Voltage:** 1.8V to 3.3V
- **Size:** 5.6 x 3.3 x 1.55 mm
- **Applications:** Basic wearables, fitness trackers
- **Additional Features:**
 - Integrated LEDs and photodetectors
 - Slightly less sensitive than MAX30102

Datasheet: [MAX30100 Datasheet](#)

Advantages:

- Cost-effective option for basic wearables.
- Compatible with ESP32 using I²C interface.

3. MAX30112

Specifications

- **Functionality:** High-performance PPG and SpO₂ sensing
- **Power Consumption:**
 - Active: 1.1 mA
 - Shutdown: 0.6 μ A

- **Communication Protocol:** I²C
- **Supply Voltage:** 1.7V to 3.6V
- **Size:** 5.6 x 3.3 mm
- **Applications:** Advanced health monitoring wearables
- **Additional Features:**
 - Higher accuracy than MAX30102
 - Optimized for low-power devices
 - Suited for continuous monitoring applications

Datasheet: [MAX30112 Datasheet](#)

Advantages:

- Advanced accuracy for medical-grade applications.
- Ultra-low power operation.

4. SparkFun Pulse Oximeter (MAX32664C Integrated) Specifications

- **Functionality:** Heart Rate, SpO₂
- **Power Consumption:**
 - Operating: ~0.7 mA
- **Communication Protocol:** I²C
- **Supply Voltage:** 1.8V to 3.3V
- **Size:** 12.7 x 10.2 mm (module size)
- **Applications:** Development and prototyping of wearable devices
- **Additional Features:**
 - Pre-calibrated sensor
 - Supports rapid prototyping with ESP32

Product Page: [SparkFun Pulse Oximeter](#)

Advantages:

- Simplified integration for rapid prototyping.
- Supports ESP32 with I²C interface.

5. AFE4404 by Texas Instruments

Specifications

- **Functionality:** Highly accurate PPG measurement (Heart Rate, SpO2)
- **Power Consumption:**
 - 30 μ A in low-power mode
 - 1.6 mA in active mode
- **Communication Protocol:** I²C
- **Supply Voltage:** 3.3V
- **Size:** 6 x 6 mm (small for advanced features)
- **Applications:** Medical-grade devices, wearables
- **Additional Features:**
 - Integrated analog front-end (AFE) for precision measurements.
 - Designed for medical and fitness applications.

Datasheet: [AFE4404 Datasheet](#)

Advantages:

- High accuracy for clinical-grade measurements.
- Configurable power modes for battery optimization.

6. BH1792GLC by ROHM

Specifications

- **Functionality:** Optical heart rate monitoring (PPG)
- **Power Consumption:**
 - 10 μ A (standby)
 - 500 μ A (active mode)
- **Communication Protocol:** I²C
- **Supply Voltage:** 2.5V to 3.6V
- **Size:** 2.8 x 2.8 x 0.9 mm
- **Applications:** Ultra-compact wearables
- **Additional Features:**
 - Minimal power consumption for continuous monitoring.

- Compact size ideal for slim wearables.

Datasheet: [BH1792GLC Datasheet](#)

Advantages:

- Extremely small size.
- Optimized for ultra-low power wearable devices.

Comparison Table						
Sensor	Heart Rate (PPG)	SpO2	Power (Active)	Size	Communication	Best Use
MAX30102	Yes	Yes	1.6 mA	5.6 x 3.3 x 1.55 mm	I²C	Compact wearables, fitness trackers
MAX30100	Yes	Yes	1.6 mA	5.6 x 3.3 x 1.55 mm	I²C	Basic wearable prototypes
MAX30112	Yes	Yes	1.1 mA	5.6 x 3.3 mm	I²C	Advanced health monitoring
SparkFun (MAX32664C)	Yes	Yes	0.7 mA	12.7 x 10.2 mm	I²C	Prototyping wearable devices
AFE4404	Yes	Yes	1.6 mA	6 x 6 mm	I²C	Clinical-grade accuracy
BH1792GLC	Yes	No	500 µA	2.8 x 2.8 x 0.9 mm	I²C	Ultra-compact, low-power wearables

Recommendations for a Watch-Style Wearable

- **Small Form Factor:** Choose **BH1792GLC** or **MAX30102** for their compact sizes.
- **Low Power:** Opt for **MAX30112** or **BH1792GLC** for extended battery life.
- **Advanced Accuracy:** Use **AFE4404** or **SparkFun Pulse Oximeter** for medical-grade reliability.