

ABRIDGED DATA SHEET

MAX30003

**Ultra-Low Power, Single-Channel Integrated
Biopotential (ECG, R to R Detection) AFE**

General Description

The MAX30003 is a complete, biopotential, analog front-end solution for wearable applications. It offers high performance for clinical and fitness applications, with ultra-low power for long battery life. The MAX30003 is a single biopotential channel providing ECG waveforms and heart rate detection.

The biopotential channel has ESD protection, EMI filtering, internal lead biasing, DC leads-off detection, ultra-low power leads-on detection during standby mode, and extensive calibration voltages for built-in self-test. Soft power-up sequencing ensures no large transients are injected into the electrodes. The biopotential channel also has high input impedance, low noise, high CMRR, programmable gain, various low-pass and high-pass filter options, and a high resolution analog-to-digital converter. The biopotential channel is DC coupled, can handle large electrode voltage offsets, and has a fast recovery mode to quickly recover from overdrive conditions, such as defibrillation and electrosurgery.

The MAX30003 is available in a 28-pin TQFN and 30-bump wafer-level package (WLP), operating over the 0°C to +70°C commercial temperature range.

Applications

- Single Lead Event Monitors for Arrhythmia Detection
- Single Lead Wireless Patches for At-Home/ In-Hospital Monitoring
- Chest Band Heart Rate Monitors for Fitness Applications
- Bio Authentication and ECG-On-Demand Applications

Ordering Information appears at end of data sheet.

Benefits and Features

- Clinical-Grade ECG AFE with High-Resolution Data Converter
 - 15.5 Bits Effective Resolution with $5\mu\text{V}_{\text{P-P}}$ Noise
- Better Dry Starts Due to Much Improved Real World CMRR and High Input Impedance
 - Fully Differential Input Structure with CMRR > 100dB
- Offers Better Common-Mode to Differential Mode Conversion Due to High Input Impedance
 - High Input Impedance > 500M Ω for Extremely Low Common-to-Differential Mode Conversion
- Minimum Signal Attenuation at the Input During Dry Start Due to High Electrode Impedance
- High DC Offset Range of $\pm 650\text{mV}$ (1.8V, typ) Allows to Be Used with Wide Variety of Electrodes
- High AC Dynamic Range of $65\text{mV}_{\text{P-P}}$ Will Help the AFE Not Saturate in the Presence of Motion/Direct Electrode Hits
- Longer Battery Life Compared to Competing Solutions
 - 85 μW at 1.1V Supply Voltage
- Leads-On Interrupt Feature Allows to Keep μC in Deep Sleep Mode with RTC Off Until Valid Lead Condition is Detected
 - Lead-On Detect Current: 0.7 μA (typ)
- Built-In Heart Rate Detection with Interrupt Feature Eliminates the Need to Run HR Algorithm on the $\mu\text{Controller}$
 - Robust R-R Detection in High Motion Environment at Extremely Low Power
- Configurable Interrupts Allows the μC Wake-Up Only on Every Heart Beat Reducing the Overall System Power
- High Accuracy Allows for More Physiological Data Extractions
- 32-Word FIFO Allows You to Wake Up $\mu\text{Controller}$ Every 256ms with Full ECG Acquisition
- High-Speed SPI Interface
- Shutdown Current of 0.5 μA (typ)

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Functional Diagram

