# eSi-MediSense

**EnSilica**
your trusted IC partner

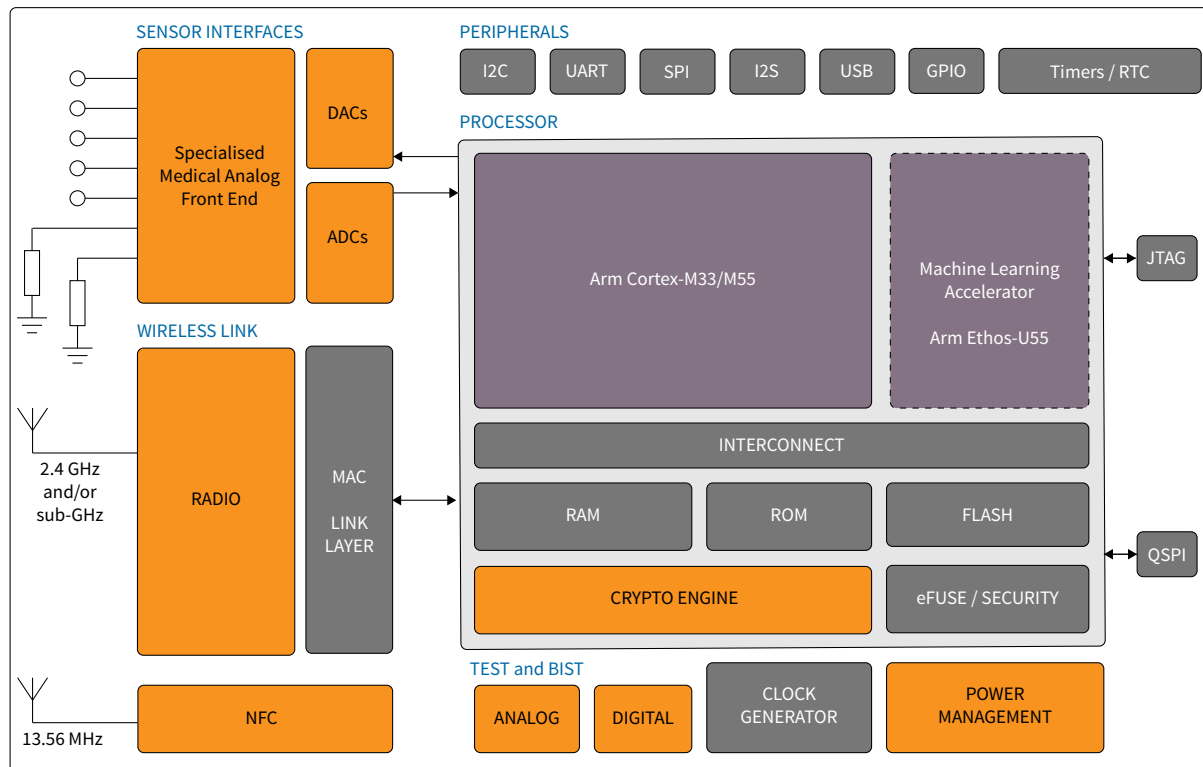# Wireless Medical Sensor
## Customisable ASIC Platform

The eSi-MediSense is a customizable Arm based ASIC platform for ultra-low-power wireless vital signs and medical monitoring products. This versatile platform allows for fast time to market of medical and healthcare sensor wearables requiring sub GHz ISM band, BLE and/or NFC wireless connectivity. A high-performance configurable processor provides on-chip pre-processing of the sensor data with an optional machine learning accelerator providing the capability of performing AI at the edge.

The platform supports the accurate and reliable measurement of ECG, heart rate, respiration rate, and temperature. A flexible interface is also provided for electro chemical-based measurement such as amperometric, voltammetric or impedance measurements.

EnSilica's ASIC design team have the expertise to develop and integrate additional custom sensor interfaces with demanding performance requirements. External sensor chips can be interfaced using SPI or I$^2$C and powered from the device's power management unit. The ASIC offers a high level of integration with minimum external components, low power consumption and a small footprint, and is designed to meet the relevant medical safety and performance requirements.

## Typical Application Areas

- Vital signs monitoring
- Disposable medical sensors
- Sports and healthcare devices


HEALTH SENSORS

### Block Diagram

**SENSOR INTERFACES**
- Specialised Medical Analog Front End
- DACs
- ADCs

**PERIPHERALS**
- I2C
- UART
- SPI
- I2S
- USB
- GPIO
- Timers / RTC

**PROCESSOR**
- Arm Cortex-M33/M55
- Machine Learning Accelerator — Arm Ethos-U55
- INTERCONNECT
- RAM
- ROM
- FLASH
- CRYPTO ENGINE
- eFUSE / SECURITY

**WIRELESS LINK**
- RADIO
- MAC LINK LAYER
- 2.4 GHz and/or sub-GHz
- NFC — 13.56 MHz

**TEST and BIST**
- ANALOG
- DIGITAL
- CLOCK GENERATOR
- POWER MANAGEMENT

JTAG

QSPI

## Customizable wireless ASIC platform for low power vital signs and medical monitoring

## Embedded Processor

- 1 or 2 Arm Cortex-M33/M55 CPUs
- Optional machine learning accelerator (ML) such as the Arm Ethos-U55

## Sensor Interfaces

- Single lead and multi-lead electrocardiogram (ECG)
- Clinical grade/professional medical accuracy
- R-R Heart rate
- Temperature sensor interfaces to ISO 80601-2-56
- Bioimpedance channel capable of measuring respiration
- Multi-channel electrochemical impedance spectroscopy (EIS) measurement capability
- Electrodes 'Leads-Off' and 'Leads-On' detection
- Built-in self-test

## Wireless Connectivity

- ISM band radio
  - 2.4 GHz ISM band and MBANs
  - BLE 5.0, IEEE 802.15.4, IEEE 802.15.6 and proprietary physical layer support
  - Sub 1GHz: IEEE 802.15.6 and proprietary physical layer support
- Extensive range and reliable secure service
  - Input receiver sensitivity & transmit output power to provide >10m non-line-of-sight indoor wireless range from small form factor
  - 128-bit AES CCM
  - BLE Services & Profiles including HealthCare/Medical and Sports & Fitness
- NFC-A tag
  - Simplified Bluetooth pairing
  - The sensor or diagnostic data can be read from a smartphone's NFC Reader

## Device Management

- Arm Pelion device management provides simple, secure, and flexible IoT management capabilities for a range of device profiles

## Power Management and Clocking

- Sophisticated internal power management unit
- Supported voltages between 1.0V and 3.6V
- Multiple power states delivering a standby current of <1uA
- Minimal external components
- Operates from a single low-cost crystal

## Memory

- 700 KB embedded Flash
- Flash expandable via stacked die QSPI
- 128 KB SRAM as 8 banks of 16 KB with selectable modes for each power state
- 1 KB SRAM for retaining data in ultra-low power hibernate mode
- 32 Kb via programmable ROM

## Security and Cryptography

- Crypto accelerators: AES-256, SHA-512 and ECC-384
- True-random number generator (NIST 800-22)
- JTAG debug port disabled via eFuse

## International Safety Standards

- Designed to conform to: IEC 60601-1, IEC 60601-2-27 and IEC60601-2-49

## Software Support

- Range of RTOSs including FreeRTOS, ThreadX and Mbed OS
- Feature rich DSP software library for easy algorithm programming
- Full featured BLE stack
- Example BLE and NFC phone applications

## Packaging Options

- Low-pin count QFN or B/LGA,
- Bare die for flip-chip bumping directly on PCB

### IP Partner

arm

APPROVED
DESIGN
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