EM MICROELECTRONIC

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Optimized Bluetooth® Low Energy V5.0 Companion or SoC

General Description

The EM9304 is a tiny, low-power, integrated circuit (IC) optimized for *Bluetooth®* v5.0 low energy enabled products. The flexible architecture of the EM9304 allows it to act as a companion IC to any ASIC or MCU-based product, or as a complete System-on-Chip (SoC). Custom applications can execute from one-time-programmable (OTP) memory, and digital peripherals (SPI or I2C) can be used to interface with external devices such as sensors, memory, display, or touch drivers. A floating point unit can be exploited to implement advanced algorithms such as sensor fusion.

Included in ROM is a Bluetooth v5.0 link layer with a Host Controller Interface (HCI), a Bluetooth stack with proprietary Application Controller Interface (ACI), several profiles, and over-the-air firmware (FOTA) updating routines. The Bluetooth low energy controller and host can be configured to support up to eight simultaneous connections. Secure connections and extended packet length are also supported per the Bluetooth v5.0 standard.

The EM9304 includes a sophisticated on-chip power management system with automatic configuration for 1.5V or 3V batteries. Current consumption is minimized for all modes of the application utilizing an efficient scheduler and memory manager. Several memory configuration options allow for optimum performance for any given application. A stable, low-power sleep oscillator (RC or crystal based) minimizes power consumption while in a connected state.

The EM9304 features a state-of-the-art 2.4GHz transceiver: an extremely low-power receiver with excellent sensitivity/selectivity, and a programmable transmitter for optimized output power and current consumption.

The PCB footprint and cost is minimized with a very low external component count and several package options. The circuit is offered in a WLCSP-21 wafer level chip-scale package, a plastic QFN-28 package, and bare die/ wafer form. The device and reference design is qualified over the industrial temperature range.

Customer support for PCB design, and FCC/CE certification are available. A hardware and software development kit are available, including commercially available tools with IDE and debugger. A website and forum are also available to help with your custom developments.

Features

| System-on-Chip
- Energy efficient, industry standard, ARC EM4, 32-bit MCU running at 24MHz
- Floating point unit for sensor processing
- 136kB ROM including link layer and stack
- 128kB OTP for parameters, profiles and applications - 24MHz execution speed
- 4, 8 or 20kB sleep mode retention data RAM
- 28kB total data RAM
- 48kB instruction RAM for development
- Universal, sleep and protocol timers
- I2C and SPI masters
- Up to 12 GPIO

| Bluetooth v5.0 low energy technology
- Full on-chip link layer and stack in ROM
- SPI and UART HCI/ACI Transport Layers
- Up to eight simultaneous connections supported
- Extended PDU length and enhanced security

| Security features
- True Random Number Generator
- AES-128 Hardware Encryption Engine
- Key Generation (ECC-P256)

| Firmware Over-the-Air Updating
- Per application, function or configuration

| Sophisticated power management system
- Digital step up/down DCDC operation
- Supports 1.5V and 3.0V batteries
- Scheduler and memory manager
- Low frequency RC or crystal oscillator time base

| Low current consumption
- 3.5mA typical peak receiver current
- 5.5mA typical peak transmitter current at 0dBm
- 0.9µA connected sleep mode
- 0.05µA disable mode

| High performance RF
- -96dBm Bluetooth Low Energy receiver sensitivity
- -40 to +5dBm transmitter output power range

| Low component count and cost:
- 3 DC caps, 1 DCDC coil, 1 ferrite bead
- Single ended 50Ω antenna pin (no balun)
- 48MHz XTAL, 32kHz XTAL (optional)

| Packaging
- QFN-28 (4x4mm), WLCSP-21, and bare-die/wafer

| Industrial Operating Temperature Range: -40C to +85C

| Customer Support
- Hardware, software development kits
- FCC/CE certification support
- Forum for hardware and software support

![EM Microelectronic logo]

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FACT SHEET | EM9304
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Version 3.3, 3-March-17
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PRELIMINARY

Typical Applications

Bluetooth Low Energy applications such as:
l Beacons
l Wearables and Sports Equipment
l Healthcare Monitoring
l Remote Sensing
l Motion and Tracking Devices
l Home Automation
l Light Control Applications
l Wireless Mice and Keyboards
l Alarms and Security System
l Toys
Enabled by the mobile phone as access point to the Internet

Package Information

The versions below are considered standards and should be readily available. Please make sure to give the complete part number when ordering.
l WLCSP21, 5x5 array, 0.4mm pitch, 2x2mm
l QFN-28, 0.4mm pitch, 4x4mm
l Bare die in wafer format

Please contact EM Microelectronic-Marin S.A. for more information.

Product and Developer Support

The following product support is available:
l Hardware Development Kit (DVK)
l Software Development Kit (SDK)
l Getting Started guide and PC Tools
l Integrated Development Environment (IDE) for ARC Metaware and MetawareLite Tools
l Reference designs with schematics, PCB layouts, and bill-of-materials
l Developer forum for hardware and software support
 · www.emdeveloper.com
l PCB Antenna Design Support
l FCC/CE Test Support

Availability

QFN samples are available and full production expected early 2017

Typical Application Diagram

The EM9304 is the ideal Bluetooth Low Energy companion for any MCU or ASIC application, as illustrated in Figure 1. It may be easily connected with
l standard 3V MCU's within the very rich catalog of any microprocessor vendor,
l standard 1.5V MCU's such as ultra-low-power watch microprocessors from EM Microelectronic,
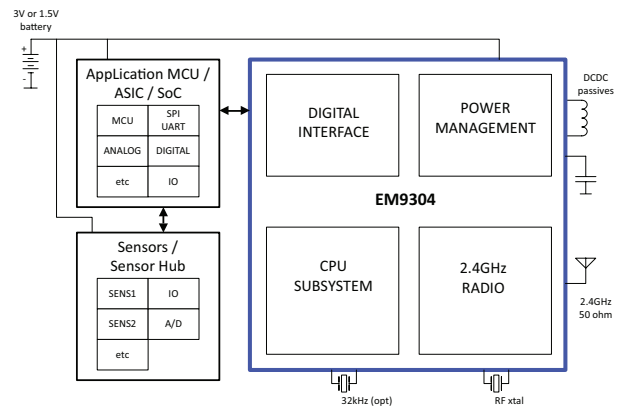l any custom sensor processing ASIC for customers requiring a simple add-on function.

Figure 1: Typical application schematic – Bluetooth Low Energy Companion IC to any MCU or ASIC.

The EM9304 is a flexible solution which may also be used without an external MCU for simple applications such as beacons. As illustrated in Figure 2, it may be directly connected to external digital sensors which may exploit the EM9304's internal 32-bit processing capability, or with sensor hubs such as from EM's SENtral platform. Other applications using A/D converters, EEPROMs, display and/or touch interfaces can also be implemented.

The EM9304 can be supplied from a 3V battery (e.g. Lithium coin-cell). In such case, the DCDC converter is put into step-down configuration. The EM9304 can also be supplied from a 1.5V battery (e.g. Alkaline, Silver-Oxide, or Zinc-Air single cells). In such case, the DCDC converter is put into step-up configuration.

Finally, configurations are also possible without the DCDC converter (no inductor required), for systems already with power management, or for systems that require the lowest bill of materials.
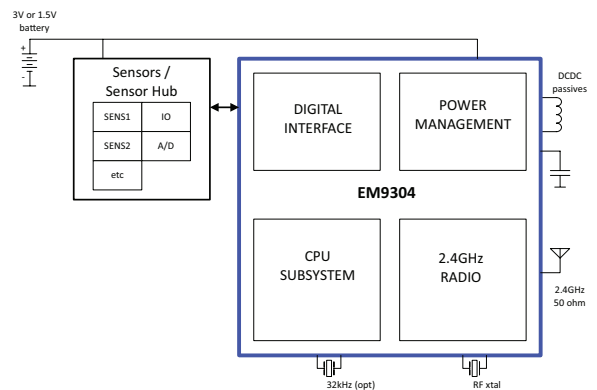

Figure 2: Typical application schematic – EM9304 connected with digital sensors / sensor hubs.