

# ZigBee™ Technology from Freescale



**Start with a Leader. Finish Strong.**

Freescale Semiconductor, Inc.\*, a subsidiary of Motorola, Inc., draws on extensive radio frequency and wireless experience accumulated from over 50 years of developing semiconductor products. With our depth of experience in this area, we are qualified to offer a comprehensive IEEE® 802.15.4 standard-compliant, ZigBee™ technology-enabled platform solution. Freescale makes wireless simple by providing a one-stop shop for customers, complete with RF transceivers, MCUs, sensors, MAC software, Z-Stack ZigBee software and a flexible development tool suite. Virtually any low data rate, monitoring, control or automation application that requires long battery life and networking capability can benefit from the wireless connectivity solutions provided by the IEEE 802.15.4 standard and ZigBee technology.

## Wireless Made Simple

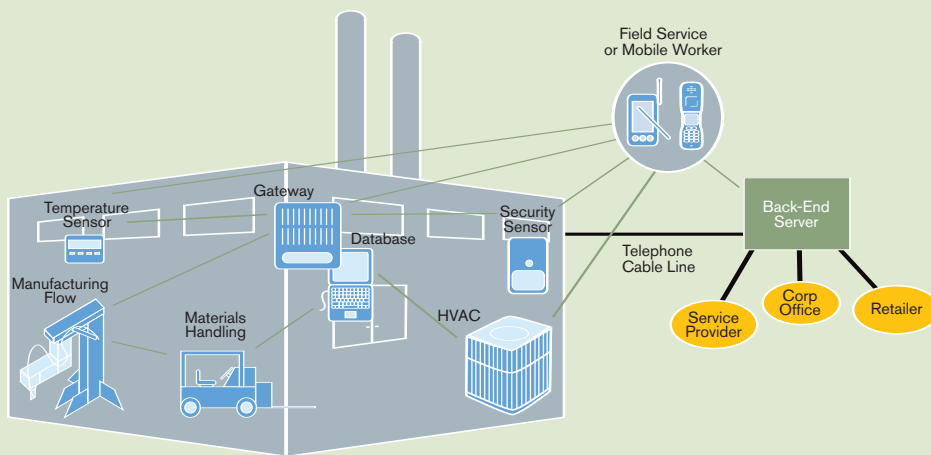
The IEEE 802.15.4 standard is a simple packet data protocol for lightweight wireless networks and specifies the MAC and PHY networking layers. ZigBee technology takes full advantage of the IEEE 802.15.4 standard and adds the logical network, security and application software. ZigBee technology provides static and dynamic star, cluster tree and mesh networking structures that allow large area network coverage, scalable networks and single point of failure avoidance. Now customers do not have to be tied to complex, costly proprietary solutions that increase their design time. They can use a standards-based solution, such as ZigBee technology.

Because ZigBee technology is based on an industry standard, it provides interoperability, allowing communication

amongst devices from different manufacturers, and offers system integrators and consumers flexible purchasing options. ZigBee technology also offers simplicity and a cost-effective approach through building construction and remodeling with wireless technology. Furthermore, these battery-powered networks are sustained by the low power consumption features of ZigBee technology.

In addition to retrofitting, ZigBee technology may reduce costs for Original Equipment Manufacturers (OEMs) because typical target applications already use an MCU; thus, there is only a minimal incremental cost needed for additional memory added to the MCU to house the MAC and ZigBee software. Finally, Freescale's 2.4 GHz band MC13192 RF transceiver data modem can be used worldwide, eliminating the need to redesign and certify a product for various markets or regions.

### INDUSTRIAL PRODUCT ZIGBEE™ EXAMPLES



## Making Connections Everywhere

The benefits of simple, cost-effective, low-power wireless connectivity that ZigBee technology provides address a variety of markets, including industrial and home monitoring, control and automation, as well as health care diagnostics.

In the industrial sector, ZigBee technology can help improve utility and energy management, logistics and inventory tracking, as well as security and access control. Other systems can be tracked for preventative maintenance and performance monitoring. Seismic detectors, inclinometers, robotics and security systems are just examples. Many other applications can apply.

# Freescale's Advantage

From its position in cell phone technology and extensive knowledge of RF semiconductor processes, Freescale is positioned to offer the IEEE 802.15.4 standard-compliant MC13192 RF data modem. This feature-rich, two-way, 2.4 GHz transceiver has a data modem that can be used in ZigBee technology applications and has an optimized digital core with functionality to help reduce MCU processing power and execution cycle time. Four timer comparators can reduce cost by using a low performance and affordable MCU. Extensive interrupt servicing options provide software development flexibility. A simple serial peripheral interface (SPI) between the RF IC and MCU allows the use of virtually any MCU in Freescale's vast portfolio. Link quality and energy detection provide necessary data for network formation and maintenance. These examples demonstrate just a few of the features that the MC13192 provides.

- > Designed to the IEEE 802.15.4 standard and for ZigBee technology
- > Full spectrum encoding and decoding
- > Cost-effective CMOS design requires few external components
- > Programmable clock out for use by baseband MCU
- > Standard four-wire SPI (operates at 4 MHz or greater)
- > Extended range capability (using an external low-noise amplifier (LNA) power amplifier)
- > Programmable output power, 0 dB typical
- > Ultra-low power modes
- > Seven GPIO lines

## Microcontrollers and Beyond

The RF transceiver is just one component in the ZigBee technology-ready platform solution. A processing device, such as an MCU or DSP, is required to complete the entire solution by housing the IEEE 802.15.4 MAC and ZigBee software. In this regard, Freescale offers a comprehensive, compliant and ZigBee technology-ready solution with the necessary pieces of the system. Freescale

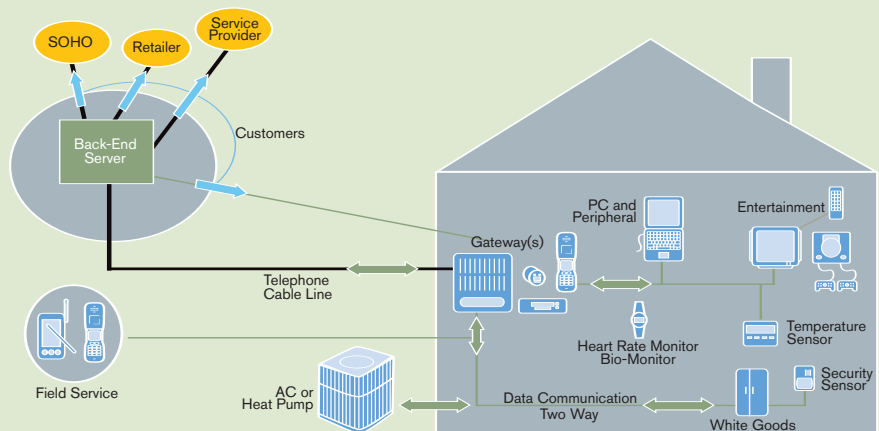
offers a vast array of microcontroller families and development tools. Freescale has unveiled the HCS08 family of low-voltage, low-power microcontrollers, targeted for use with the MC13192 in ZigBee technology applications. These cost-effective, high-performance 8-bit MCUs offer features to extend battery life, deliver high performance and integrate peripheral and memory combinations. They include:

- > MC9S08GB32
- > MC9S08GB60
- > MC9S08GT16
- > MC9S08GT60

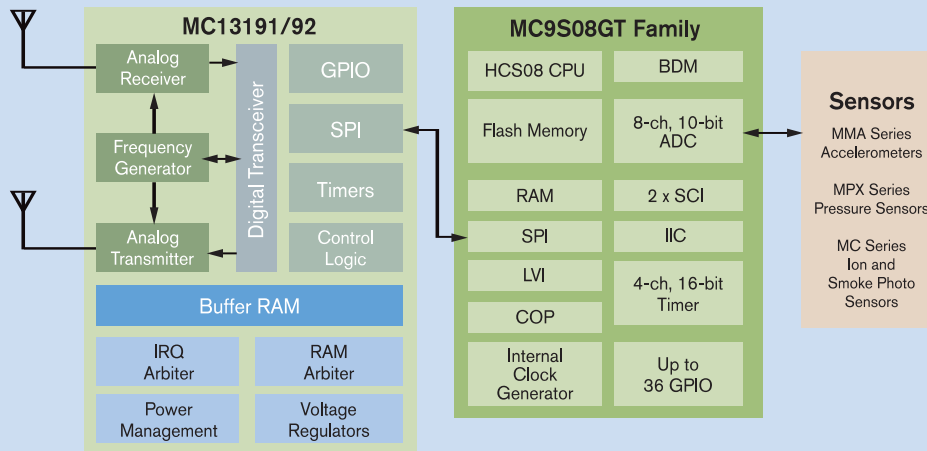
For applications that require higher performance, other processor families that could be used include ColdFire® processors, i.MX applications processors, 56800/E hybrid controllers and PowerQUICC™ integrated communications processors containing PowerPC® cores.

Consumer products in the home using ZigBee technology include home automation systems with lighting and HVAC control devices, security systems, blind and curtain controls, as well as remote controls for set-top boxes and other entertainment devices. Consumer products with accessory interfaces can add ZigBee technology functionality after purchase. Compact Flash or PCMCIA slots in PDAs or notebook PCs are examples. The health care and fitness markets can also benefit from ZigBee technology. Health tracking devices, such as pedometers and heart rate monitors, are typical target applications. Equipment used in sports medicine and physical therapy can become more mobile by introducing a wireless component.

## HOME AND DIAGNOSTICS ZIGBEE™ EXAMPLES



**FREESCALE ZIGBEE™-READY PLATFORM SOLUTION  
EXAMPLE BLOCK DIAGRAM FOR A SENSOR APPLICATION**



**Sensors**

Freescale also has developed a family of ZigBee technology-compatible sensors. Customers using wireline control networks can easily incorporate Freescale's ZigBee technology-compatible acceleration and pressure sensors to their applications. Based on micro-electromechanical systems (MEMS) technology, the sensors use standard OEM hardware interfaces. Customers can choose from a broad range of Freescale sensor solutions featuring the MMA series accelerometers, MPX series pressure sensors and the MC series ion and photo smoke ICs.

**MAC Layer Software**

Freescale has developed the IEEE 802.15.4 MAC software as part of its ZigBee technology-ready platform solution. It is standard-compliant and is considerably smaller in size than Bluetooth™ technology; thus, IEEE 802.15.4 technology requires less on-chip memory and minimal processing power from a microcontroller. The following highlights some features:

- > Designed to support peer-to-peer, star and mesh network topologies
- > Designed to support optional upper Z-Stack ZigBee layers
- > Power saving modes (doze and hibernate, application configurable)
- > Security
- > Carrier sense multiple access with collision avoidance (CSMA-CA) channel access
- > Optional super-frame structure with beacons
- > Guaranteed time slot (GTS) mechanism

**Freescale—The One-Stop Shop**

Freescale provides all the building blocks used in a complete ZigBee technology-ready platform solution: the RF transceiver, MAC and ZigBee software, microcontrollers and sensors. One solution, one provider—built, tested, compatible and ready for integration.

To learn more about Freescale's ZigBee technology portfolio, go to [www.freescale.com/ZigBee](http://www.freescale.com/ZigBee).

\*The Semiconductor Products Sector of Motorola, Inc. became Freescale Semiconductor, Inc. in 2004.

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