

# MC1322x 2.4 GHz IEEE® 802.15.4/ZigBee® Platform in Package™

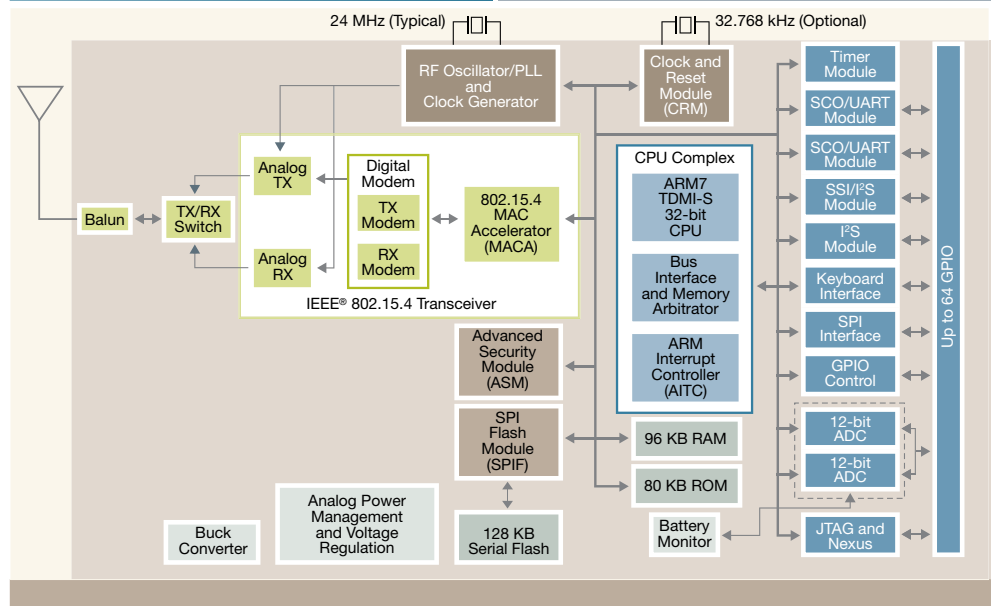
## Overview

Freescale Semiconductor's third-generation 2.4 GHz IEEE 802.15.4/ZigBee-ready platform takes a leap forward in processing power and system integration, while lowering power consumption over 50 percent from previous generations. The MC1322x was designed from the ground up to support low power, battery operated applications. The lower power consumption is ideally suited for applications that have a limited power budget or need to run on batteries as small as coin cells. With the optional buck converter, the device can provide over a decade of system life on standard lithium battery. Targeted for IEEE®802.15.4 and ZigBee™ applications, the device has plenty of memory to support the protocol stack and application.

With an optimized combination of ROM, RAM and Flash memory, users are assured the device will meet their current and future design requirements. The unique Platform in Package™ (PiP) design integrates the RF matching components allowing the user to connect a 50 Ohm antenna without worrying about complicated matching. This simplifies design while reducing overall board area and system cost. A designer is ready to start communicating by connecting the crystal, power and a 50 Ohm antenna.

Freescale has taken a platform approach that includes hardware, software, development tools and reference designs to help simplify development. Freescale's BeeKit™ Wireless Toolkit provides an easy to use software environment to configure network parameters for Freescale's variety of platform alternatives: Simple MAC (SMAC), IEEE 802.15.4 MAC, Synkro™ protocol stack and BeeStack™ ZigBee protocol stack. The BeeKit is unique to Freescale, providing customers a GUI wizard and drop down menus to help configure network parameters, vastly simplifying the network expertise needed, and allowing designers to concentrate on their application. Finally, while the MC1322x Platform in Package simplifies wireless network design, embedded designers may not have the background or experience to ensure robust and optimized RF designs.

MC1322x Block Diagram



Freescale has made a proactive investment in RF engineering by providing a number of reference designs which include all of the details from IC to antenna. These include the design information for the development boards in the each of the MC1322x development kits, as well as design alternatives that compare more in “form and factor” to real application solutions. Customers can take the Bill of Material (BOM), Gerbers, and schematics and simply copy the Freescale reference design or integrate that reference design into their project. The complete platform approach is offered to help designers reduce development time and speed time to market.

Freescale development kits provide the ideal development platform for the ZigBee protocol. The 1322x development kits are specifically targeted toward ZigBee-enabled device development, providing the necessary hardware, software, tools and demo applications to streamline the development process. These kits come with development boards programmed to allow developers to have a ZigBee network up and running in just 15 minutes.

## Applications

### Residential and Commercial Environmental Monitoring and Automation

- Security
- Access control
- Automated meter reading
- Heating, Ventilation and Air Conditioning (HVAC)
- Smart Energy Management
- Curtain window blind control

### Industrial Control

- Automated meter reading
- Asset tracking and monitoring
- Homeland security
- Process management
- Environmental monitoring and control

### Health Care

- Home health care
- Patient monitoring
- Fitness monitoring
- Institutional care

### Consumer

- Voice
- Wireless headset
- Streaming compressed audio
- Cable Replacement
- RF Remote Control
- Wireless Gaming

MC1322x Platform in Package is a robust and flexible solution for wireless sensing and control applications. The MC1322x benefits include:

- IEEE802.15.4-compliant transceiver provides a solid foundation for wireless networks
- High performance 32-bit microcontroller unit (MCU) offers plenty of CPU headroom to run applications
- Low power consumption and optional buck converter support applications that require long battery life
- Highly integrated package reduces complexity, component count and cost
- Extensive peripherals, including up to 64 GPIO, multiple serial interfaces and a 12-bit ADC, allow connections to a variety of devices
- Optimized Flash, RAM and ROM memory provide a single device to run the stack and application.

## Software Features

### Simple MAC

- Small footprint (<4 KB)
- Supports point-to-point and star networks with repeaters
- Support for over-the-air-programming

### 2006 802.15.4-Compliant MAC (contained in ROM)

- Support guaranteed time slots (GTS)
- Supports beacons and non-beacons networks
- Supports peer-to-peer, star and cluster tree networks

### BeeStack™ ZigBee Protocol Stack

- ZigBee 2006 compliant
- Supports mesh networks

### Platform Drivers in ROM

- Flash, security, clocks, interrupt controller, ADC, UART, SPI, timer/PWM, SSI, I<sup>2</sup>C, GPIOs

## Features Summary

- IEEE 802.15.4 standard compliant on-chip transceiver/modem
  - 2.4 GHz ISM band operation
  - 16 selectable channels
  - Programmable transmitter output power (-30 dBm to +5 dBm typical)
  - <-96 dBm typical receiver in DCD mode (<1% PER, 20-byte packets)
  - -100 dBm receiver sensitivity in NCD mode (additional 3-4mA power consumption) (<1% PER, 20-byte packets)

- Supports standard IEEE 802.15.4 signaling with 250 kbps data rate
- Hardware acceleration for IEEE 802.15.4 applications
  - MAC accelerator (sequencer and DMA interface)
  - Advanced encryption/decryption hardware engine (AES 128-bit)
- 32-bit ARM7TDMI-S CPU™ core with programmable performance up to 26 MHz
- Extensive on-board memory resources
  - 128 KB Flash memory (mirrored into SRAM)
  - 96 KB SRAM
  - 80 KB ROM
- Best-in-class power dissipation
  - 21 mA typical current consumption in RX mode with MCU active at 2MHz
  - 29 mA typical current consumption in TX mode with MCU active at 2 MHz
- Buck converter for extended battery life (up to 45 percent power savings)
- Extensive sleep mode control
  - Multiple low-power modes and wake-up circuits
  - Clock management
  - Onboard 2 kHz oscillator for wake-up timer
  - Optional 32.768 kHz crystal oscillator with a possible sleep period greater than 36 hours for accurate time of day
  - Wake up through programmable timer, external real-time interrupts, keyboard interface or ADC timer
- Extensive MCU peripherals
  - Two dedicated UART modules capable of 2 Mbps
  - SPI port with programmable master and slave operation
  - 8-pin KBI supports up to a 4 x 4 matrix capable of waking up device from low-power modes
  - 8 channel, 12-bit, dual analog-to-digital converters (ADCs)
  - Four independent 16-bit timers with PWM capability.
  - Inter-integrated circuit (I2C) interface
  - Synchronous serial interface (SSI) with I2S and serial peripheral interface (SPI) capability
  - Up to 64 programmable input/outputs (I/O) shared by peripherals and GPIO
- Powerful in-circuit debug and flash programming available via on-chip debug ports
  - JTAG debug port
  - Nexus extended feature debug port
- System protection features
  - Low battery detect
  - Watchdog timer (COP)
  - Sleep mode timers
- Low external component count
  - All RF matching components and balun in package
  - Only antenna needed for single-ended 50-Ω RF interface
  - Only a 13–26 MHz crystal is required for the main oscillator; programmable crystal load capacitors are on-chip
- 2.0V to 3.6V operating voltage with on-chip voltage regulators; 1.8V operating voltage with off-chip regulation
- -40°C to +105°C temperature range
- RoHS-compliant 9.5 mm x 9.5 mm 99-pin LGA package

## Orderable Parts

Part Number	Description
MC13224V	9.5 mm x 9.5 mm x 1.2 mm 99-pin LGA - Bulk 168/tray
MC13224VR2	9.5 mm x 9.5 mm x 1.2 mm 99-pin LGA Tape & Reel, 1500/reel

## Learn More:

For current information about Freescale products and documentation, please visit [www.freescale.com](http://www.freescale.com).

For more information about ZigBee family products, please visit [www.freescale.com/802154](http://www.freescale.com/802154).