

# Freescale's Wireless Connectivity Products Summary

Freescale Semiconductor offers embedded designers the silicon, software and hardware to implement a complete 250 Kbps, 2.4 GHz wireless network—from simple to complex. With five protocol stack alternatives to choose from—the broadest IEEE® 802.15.4-based protocol offering in the market—Freescale draws on extensive radio frequency (RF) and wireless experience accumulated from more than 50 years of developing semiconductor products. BeeKit graphical user interface (GUI) development software supports five protocol stacks, including simple media access controller (SMAC), IEEE 802.15.4 MAC, SynkroRF, BeeStack Consumer (ZigBee® RF4CE) and BeeStack (ZigBee/ZigBee Pro).

## BeeKit Codebases

### SMAC (approx. 4–8 KB memory)

- Proprietary SMAC software
- Cost-efficient solution
- Library of transceiver-related primitives
- Small size memory alternatives
- ANSI C source code provided
- Provides serial peripheral interface (SPI) and control interface of the transceiver from the MCU
- Ultra-low power requirements
- Repeater functionality
- Over-the-air programming

### IEEE 802.15.4-Compliant MAC (approx. 17–40 KB memory)

- IEEE 802.15.4-compliant physical layer (PHY) and MAC software
- Compliant to all IEEE 802.15.4 specifications
- Supports beaconed and non-beaconed networks
- Guaranteed time slots (GTS)
- Advanced Encryption Standard (AES) encryption

### SynkroRF (approx. 32 KB memory)

- When SMAC is too simple
- When ZigBee is too complex
- 802.15.4 based, easy to use
- Provides complete network stack API with Black Box design option
- Channel agility with dynamic interference avoidance
- Supports larger data transfers with fragmentation
- Low latency transmission features for enhanced performance in noisy environments

### ZigBee RF4CE (approx. 40 KB memory)

- Wireless for consumer electronics control, monitor and automation
- Reliable data delivery with CSMA-CA and message acknowledgement
- Additional interference avoidance techniques implemented
- Power saving modes
- Increased battery life
- Lower standby current
- Allows designs to meet Energy Star requirements
- Support for acknowledged, non-acknowledged, unicast and broadcast messages
- Support for non-secure and secure communications with AES 128-bit and CCM\* encryption
- Simple mechanism for pairing
- Only authorized paired devices can communicate
- Support for interoperability through standardized profiles

### ZigBee/ZigBee Pro (approx. 64–128 KB memory)

- Complete wireless networking standard—from antenna to application program interface (API)
- Supports ZigBee 2007
- Supports ZigBee Pro
- Supports ZigBee Smart Energy, Home Automation and Health Care profiles
- Provides interoperability among end products
- Established routing algorithm
- Network recovery and healing
- Wireless embedded or dongle options

## MC1323x System on Chip

| Product  | Supply Voltage V | Supply Current at 1% Duty Cycle, CPU at 1 MHz (Typ) mA | Standby Current (Typ) µA | Frequency Band GHz | Sensitivity at 1% PER (Typ) dBm | Data Rate (Spec) Kbps | MAC Options                          | Packages | Flash | RAM  | Core  | Interfaces and Peripherals                             | USD MSRP (10 Ku) |
|----------|------------------|--------------------------------------------------------|--------------------------|--------------------|---------------------------------|-----------------------|--------------------------------------|----------|-------|------|-------|--------------------------------------------------------|------------------|
| MC13233C | 1.8–3.6          | 27 TX, 31 RX                                           | 0.5–.75                  | 2.4–2.5            | -94                             | 250                   | SMAC, IEEE 802.15.4, SynkroRF, RF4CE | 48 LGA   | 82 KB | 5 KB | HCS08 | Timers, KBI, SCI/UART, I <sup>2</sup> C, SPI, CMT, RTC | \$2.99           |

## 1323x Development Kit Features

| Feature                              | 1323x USB Kit               | 1323x Developer Starter Kit          | 1323x Network Starter Kit                                                      |
|--------------------------------------|-----------------------------|--------------------------------------|--------------------------------------------------------------------------------|
| 1323x-MRB                            | 0                           | 2                                    | 4                                                                              |
| 1323x-REM                            | 0                           | 1                                    | 3                                                                              |
| 1323x-RCM                            | 0                           | 1                                    | 1                                                                              |
| 1323x-USB                            | 5                           | 0                                    | 0                                                                              |
| USB Multilink BDM                    | No                          | Yes, 1323xDSK-BDM only               | Yes, 1323xNSK-BDM and 1323xNSK-SFTW only                                       |
| CodeWarrior IDE                      | CodeWarrior Special Edition | CodeWarrior Special Edition          | CodeWarrior Special Edition, CodeWarrior Standard Edition (1323xNSK-SFTW only) |
| BeeKit                               | Yes                         | Yes                                  | Yes                                                                            |
| Batteries, Cables and Power Adapters | Yes                         | Yes                                  | Yes                                                                            |
| Out-of-Box Application               | N/A                         | Range Demo                           | RF4CE Remote Control                                                           |
| RoHS Compliant                       | Yes                         | Yes                                  | Yes                                                                            |
| USD MSRP—Part #                      | \$199—1323xUSB              | \$199—1323xDSK<br>\$279—1323xDSK-BDM | \$449—1323xNSK<br>\$529—1323xNSK-BDM<br>\$999—1323xNSK-SFTW                    |

## MC1322x Platform in a Package

| Product  | Supply Voltage V | Supply Current @ 1% Duty Cycle, CPU @ 1 MHz (Typ) mA | Standby Current (Typ) µA | Frequency Band GHz | Sensitivity at 1% PER (Typ) dBm | Data Rate (Spec) Kbps | MAC Options                                              | Packages | Flash  | RAM   | ROM   | Core                      | Interfaces and Peripherals                                                                                          | USD MSRP (10 Ku) |
|----------|------------------|------------------------------------------------------|--------------------------|--------------------|---------------------------------|-----------------------|----------------------------------------------------------|----------|--------|-------|-------|---------------------------|---------------------------------------------------------------------------------------------------------------------|------------------|
| MC13224V | 1.8–3.6          | 29 TX, 22 RX                                         | 0.3–0.675                | 2.4–2.5            | -95                             | 250                   | SMAC, IEEE 802.15.4, SynkroRF, RF4CE, ZigBee             | 99 LGA   | 128 KB | 96 KB | 80 KB | ARM7 <sup>TM</sup> TDMI-S | 12-bit ADC, Buck Converter, I <sup>2</sup> C, SPI, SCI, SSI/FS, 4–16-bit Timers/PWM(2), KBI, 2–8-ch., Up to 64 GPIO | \$4.50           |
| MC13226V | 1.8–3.6          | 29 TX, 22 RX                                         | 0.3–0.675                | 2.4–2.5            | -95                             | 250                   | SMAC, IEEE 802.15.4, SynkroRF, RF4CE, ZigBee, ZigBee Pro | 99 LGA   | 128 KB | 96 KB | 80 KB | ARM7 TDMI-S               | 12-bit ADC, Buck Converter, I <sup>2</sup> C, SPI, SCI, SSI/FS, 4–16-bit Timers/PWM(2), KBI, 2–8-ch., Up to 64 GPIO | \$4.50           |

## 1322x Development Kit Features

| Feature                              | 1322x USB Kit  | 1322x Developer Starter Kit | 1322x Network Starter Kit                                   | 1322x ZigBee Evaluation Kit                                  | 13226PRO Evaluation Kit           |
|--------------------------------------|----------------|-----------------------------|-------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------|
| 1322x-SRB                            | 0              | 1                           | 1                                                           | 4                                                            | 2                                 |
| 1322x-NCB                            | 0              | 1                           | 1                                                           | 3                                                            | 2                                 |
| 1322x-LPB                            | 0              | 0                           | 1                                                           | 2                                                            | N/A                               |
| 1322x-USB                            | 1              | 0                           | 1                                                           | 1                                                            | 1                                 |
| J-Link JTAG Debugger                 | No             | Yes                         | Yes                                                         | Yes                                                          | Yes                               |
| IAR IDE                              | IAR EWARM 32K  | IAR EWARM 32K               | IAR EWARM 32K<br>IAR EWARM 256K Edition (1322xNSK-IAR only) | IAR EWARM 32K<br>IAR EWARM 256K Edition (1322xEVK-SFTW only) | IAR EWARM 32K                     |
| BeeKit                               | Yes            | Yes                         | Yes                                                         | Yes                                                          | Yes                               |
| Batteries, Cables and Power Adapters | Yes            | Yes                         | Yes                                                         | Yes                                                          | Yes                               |
| Out-of-Box Application               | None           | Weather Station Demo        | 802.15.4 Network Demo                                       | ZigBee Environment Demo                                      | ZigBee Smart Energy Demonstration |
| RoHS Compliant                       | Yes            | Yes                         | Yes                                                         | Yes                                                          | Yes                               |
| USD MSRP—Part #                      | \$79—1322x-USB | \$379—1322xDSK-DBG          | \$579—1322xNSK-DBG<br>\$2599—1322xNSK-IAR                   | \$1999—1322xEVK<br>\$3999—1322xEVK-SFTW                      | \$699—13226PRO-DBG                |

All MSRP shown are 10 Ku price points unless otherwise specified. MSRPs are subject to change.



## MC1321x System in a Package

| Product | Supply Voltage V | Supply Current at 1% Duty Cycle, CPU at 2 MHz (Typ) mA | Standby Current (Typ) µA | Frequency Band GHz | Sensitivity @ 1% PER (Typ) dBm | Data Rate (Spec) Kbps | MAC Options                                  | Packages | Flash | RAM  | Core  | Interfaces and Peripherals                                       | USD MSRP |
|---------|------------------|--------------------------------------------------------|--------------------------|--------------------|--------------------------------|-----------------------|----------------------------------------------|----------|-------|------|-------|------------------------------------------------------------------|----------|
| MC13211 | 2.0–3.4          | 31.1 TX, 38.1 RX                                       | 0.2–0.675                | 2.4–2.5            | –92                            | 250                   | SMAC                                         | 71 LGA   | 16 KB | 1 KB | HCS08 | PC, SCI (2), Timer/PWM(2), KBI, 8-ch., 10-bit ADC, Up to 32 GPIO | \$2.94   |
| MC13212 | 2.0–3.4          | 31.1 TX, 38.1 RX                                       | 0.2–0.675                | 2.4–2.5            | –92                            | 250                   | SMAC, IEEE 802.15.4, SynkroRF, RF4CE         | 71 LGA   | 32 KB | 2 KB | HCS08 | PC, SCI (2), Timer/PWM(2), KBI, 8-ch., 10-bit ADC, Up to 32 GPIO | \$3.21   |
| MC13213 | 2.0–3.4          | 31.1 TX, 38.1 RX                                       | 0.2–0.675                | 2.4–2.5            | –92                            | 250                   | SMAC, IEEE 802.15.4, SynkroRF, RF4CE, ZigBee | 71 LGA   | 60 KB | 4 KB | HCS08 | PC, SCI (2), Timer/PWM(2), KBI, 8-ch., 10-bit ADC, Up to 32 GPIO | \$3.52   |

## 1321x Development Kit Features

| Feature                              | 1321x Consumer Starter Kit  | 1321x Developers Starter Kit           |
|--------------------------------------|-----------------------------|----------------------------------------|
| 1321x-SRB                            | 1                           | 2                                      |
| 1321x-NCB                            | 1                           | 0                                      |
| USB Multilink BDM                    | Yes, 1321xCSK-BDM only      | Yes, 1321xDISK-BDM only                |
| CodeWarrior IDE                      | CodeWarrior Special Edition | CodeWarrior Special Edition            |
| BeeKit                               | Yes                         | Yes                                    |
| Batteries, Cables and Power Adapters | Yes                         | Yes                                    |
| Out-of-Box Application               | RF4CE Virtual Remote Demo   | Triax                                  |
| RoHS Compliant                       | Yes                         | Yes                                    |
| USD MSRP—Part #                      | \$399—1321xCSK-BDM          | \$249—1321xDISK<br>\$349—1321xDISK-BDM |

## MC1320x Transceivers

| Product   | Supply Voltage V | Supply Current at 1% Duty Cycle (Typ) mA | Standby Current (Typ) µA | Frequency Band GHz | Sensitivity @ 1% PER (Typ) dBm | Control Interface | Data Rate (Spec) Kbps | TX/RX Switch | MAC Options                                  | Packages | USD MSRP |
|-----------|------------------|------------------------------------------|--------------------------|--------------------|--------------------------------|-------------------|-----------------------|--------------|----------------------------------------------|----------|----------|
| MC13201FC | 2.0–3.4          | 30 TX, 37 RX                             | 0.2–0.675                | 2.4–2.5            | –91                            | SPI               | 250                   | Yes          | SMAC                                         | 32 QFN   | \$1.91   |
| MC13202FC | 2.0–3.4          | 30 TX, 37 RX                             | 0.2–0.675                | 2.4–2.5            | –92                            | SPI               | 250                   | Yes          | SMAC, IEEE 802.15.4, SynkroRF, RF4CE, ZigBee | 32 QFN   | \$2.24   |

## MC1320x Development Kit Features

| Feature                              | 1320x RF Daughter Card Kit | 1320x Developer Starter Kit                     |
|--------------------------------------|----------------------------|-------------------------------------------------|
| 1320x-RFC                            | 1                          | 0                                               |
| 1320x-EVB                            | 0                          | 2                                               |
| HCS08 Daughter Card                  | 0                          | 2                                               |
| USB Multilink BDM                    | No                         | Yes 1320xDISK-BDM only                          |
| CodeWarrior IDE                      | No                         | CodeWarrior Special Edition                     |
| BeeKit                               | Yes                        | Yes                                             |
| Batteries, Cables and Power Adapters | Yes                        | Yes                                             |
| Out-of-Box Application               | NA                         | Dimmable Light and Dimmable Switch              |
| RoHS Compliant                       | Yes                        | Yes                                             |
| USD MSRP—Part #                      | \$79—1320xRFC              | \$349—1320x-QE128-DSK<br>\$399—1320x-QE-DSK-BDM |

All MSRP shown are 10 Ku price points unless otherwise specified. MSRPs are subject to change.

## Development Software

### BeeKit

**BeeKit Software Development Tool Complimentary to Freescale Customers<sup>1</sup>, Included in Hardware Development Kits or Downloadable from [freescale.com/zigbee](http://freescale.com/zigbee)**

BeeKit is Freescale's simplified integrated development environment (IDE) for 802.15.4 and ZigBee technology solutions. BeeKit is a GUI for creating, modifying and updating wireless networking designs. The BeeKit offers a comprehensive code base of wireless networking libraries, application templates and sample applications. Easily scalable to support new code bases and functionality, BeeKit is a complementary tool to the CodeWarrior IDE and the IAR EAWARM which support MCU application development. BeeKit is included in each development kit and may also be downloaded at [freescale.com/zigbee](http://freescale.com/zigbee). BeeKit includes SMAC, IEEE 802.15.4, SynkroRF and BeeStack (ZigBee RF4CE and ZigBee/ZigBee Pro) codebases. BeeKit supports the ZigBee Remote Control, Smart Energy and Health Care profiles.

### CodeWarrior

**CodeWarrior for HC(S)08/RS08**

Freescale's CodeWarrior Development Studio for Microcontrollers is a single, integrated tool suite designed to help embedded engineers get started on the design fast track for the HC(S)08 MCU. CodeWarrior provides optimized tools to take full advantage of the Freescale microcontroller selected for design. Visit [freescale.com/codewarrior](http://freescale.com/codewarrior) for licensing details.



**IAR EWARM™**

IAR Embedded Workbench for ARM® provides a full suite of development tools for ARM and the Freescale MC1322x family of Platform in a Package solutions. The integrated development environment offers a continuous workflow, efficient code generation and ease of use. The tools include an editor, compiler, linker, debugger, optional IAR J-Link and J-Trace hardware debug probes. Visit [IAR.com](http://IAR.com) for licensing details.

<sup>1</sup> Subject to license agreement and registration.

## Markets

### Consumer Electronics

- Remote control
- Blu-ray
- Digital TV
- Video player/recorder (VCR, DVR, others)
- Set-top box
- DTV
- Projector
- Satellite radio receiver
- Surround sound
- Consumer usage data
- Maintenance alerts
- Billing

### Smart Energy

- Automated metering
- Home area networks
- Lighting control
- HVAC
- Access control
- Demand response
- Security
- Irrigation control
- Window or fan control
- Load management
- Occupancy detection
- Water heater control

### Health and Wellness

- Home health
- Fitness monitoring
- Equipment/supplies tracking
- Independent living
- Child monitoring
- Drug access control
- Pulse oximetry
- Blood pressure monitor
- Fall warning
- Infusion pumps
- Glucose monitor

### General Market

- Gaming
- Security
- Flow detects
- Motion sensing
- Glass breakage
- Container monitoring
- Temperature status
- Animal locating
- Computer peripherals
- Cable replacement

## Learn More:

For more information about wireless connectivity products, please visit [freescale.com/ZigBee](http://freescale.com/ZigBee).

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