Freescale IEEE® 802.15.4 Development Kits

Wireless design made simple

freescale™
semiconductor

Freescale's Wireless Portfolio

Overview

Freescale's portfolio of 802.15.4 platforms lets the developer choose the best platform for their technical requirements and cost objectives. Whether they simply need to add a wireless transceiver to their existing design or create stand-alone wireless functionality, Freescale has the solution to meet their needs.

Freescale draws on extensive radio frequency (RF) and wireless experience from more than 50 years of radio product development. With our depth of experience in this area, we are qualified to offer comprehensive IEEE® 802.15.4 standard-compliant and ZigBee® compliant platform solutions. Freescale makes wireless simple by providing a one-stop shop for customers, complete with RF transceivers, MCUs, sensors, network protocol stacks, including 802.15.4 and ZigBee, reference designs 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.

Software Development

While developers and users seek nirvana through a singular technology that solves all of their market needs, this rarely happens. Wireless sensing and control is no exception, however 802.15.4 is a solid foundation and Freescale has developed a number of protocol stacks based on it to meet specific application needs. Freescale's 802.15.4 platform supports Freescale's simple media access controller (SMAC), IEEE 802.15.4 MAC, SynkroRF, RF4CE and BeeStack ZigBee/ZigBee Pro protocol stacks. These give developers the flexibility to build products optimized for different features, such as cost, performance, complexity and interoperability. Freescale solutions are delivered in conjunction with Freescale's BeeKit Wireless Connectivity Toolkit. The BeeKit provides a simple GUI approach to configure network settings, allowing the embedded designer to concentrate on building the application. BeeKit helps reduce development time for developers lacking extensive networking experience.

BeeKit and BeeStack Solutions

IEEE 802.15.4 provides a solid foundation for wireless control and monitoring applications, enabling developers to take their applications to new levels of functionality. However, with this increased functionality comes increased complexity for the developer. Freescale steps in with an extensive portfolio of development kits based on our 802.15.4 platforms. Whether the customer is developing simple point-to-point applications or a complex mesh network using ZigBee technology, Freescale's development kits provide the flexibility for whatever wireless application is needed. The development kits combine the hardware, software, tools and accessories needed to help streamline the development process.

BeeKit

Freescale's 802.15.4 protocol stacks allow application developers to enhance their product offerings and take their applications to new levels of functionality. However, with this increased functionality comes increased complexity as developers now have to concern themselves with issues such as network and protocol management options. Freescale stepped in to specifically develop the BeeKit Wireless Connectivity Toolkit to help minimize these issues. BeeKit provides a development environment where these design considerations can be managed in a straightforward, uncomplicated approach.

BeeKit offers a graphical user interface which includes codebases for Freescale's SMAC, IEEE 802.15.4 MAC, SynkroRF, RF4CE and BeeStack ZigBee/ZigBee Pro protocol stacks. BeeKit comes in all of Freescale's development kits and may also be downloaded at freescale.com. All protocol stacks are complimentary.

SMAC

SMAC is a simple and cost-effective start to wireless networking. Based on the 802.15.4 PHY, it provides commands to create simple point-to-point and star networks. The small 2.5–4K code size allows a low-cost platform for many applications requiring simple but effective wireless communication.

MC1323X Block Diagram
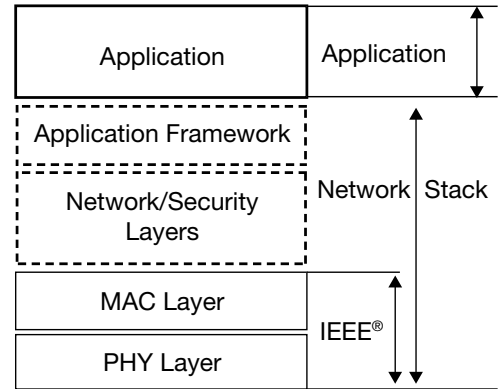
SMAC Features

- Small memory footprint
- Supports point-to-point and star networks with repeaters
- Support for over the air programming

IEEE 802.15.4 MAC

Freescale's fully compliant IEEE 802.15.4 MAC provides a robust building block for point-to-point, star and mesh networks. While the MAC is part of the SynkroRF, RF4CE and BeeStack protocol stacks, it is often used as the foundation for proprietary stacks as well.

IEEE 802.15.4 MAC Features

- Fully compliant IEEE 802.15.4 MAC
- Supports optional features, including beaconed networks and guaranteed time (GTS)
- Supports peer-to-peer, star and mesh networks

SynkroRF

Synkro RF is optimized for very quick design cycles and an easy to follow design process. When SMAC is too simple and ZigBee is too complex, designers have the opportunity to utilize Synkro RF for proprietary 802.15.4 wireless monitoring and control. The network stack allows for application development with the API which uses the embedded processor running SynkroRF or the BlackBox which provides access to the complete API through a serial command set. Enhanced functionality includes features such as channel agility,

larger data transfer with fragmentation, and low latency transmission. SynkroRF is the alternative when interoperability is not required.

SynkroRF Features

- Easy to use IEEE 802.15.4 standards-based protocol
- Approximately 32 KB of memory
- For wireless monitoring and control, wire replacement
- API or BlackBox development options
- Enhanced interference avoidance with channel agility and low latency transmissions

RF4CE

Freescale's RF4CE protocol is a lightweight networking stack built on top of the IEEE 802.15.4 standard. The protocol was created to control, monitor and automate consumer electronics, including televisions, DVD players and recorders, set-top boxes, audio video receivers, remote controls and many others. RF4CE overcomes the growing technology challenges that today's consumer electronic products face with 30 year old infrared (IR) technology by removing the line of sight and field of vision issues while providing a fast bidirectional link to enhance the user experience. Freescale's RF4CE starts with 802.15.4, but incorporates improvements in interference avoidance by adding channel agility and low latency transmissions to address the specific needs of consumer electronics.

RF4CE Features

- Lightweight networking stack built on the IEEE 802.15.4 standard
- Approximately 32 KB of memory
- For RF control, monitor and automation of consumer electronics products
- Optimized memory with standard command tables
- Two development options
  - Cost-effective API using embedded processor running
  - BlackBox with complete access to API through serial command set
- Improved interference avoidance capabilities with channel agility and low latency transmissions

BeeStack

BeeKit Block Diagram
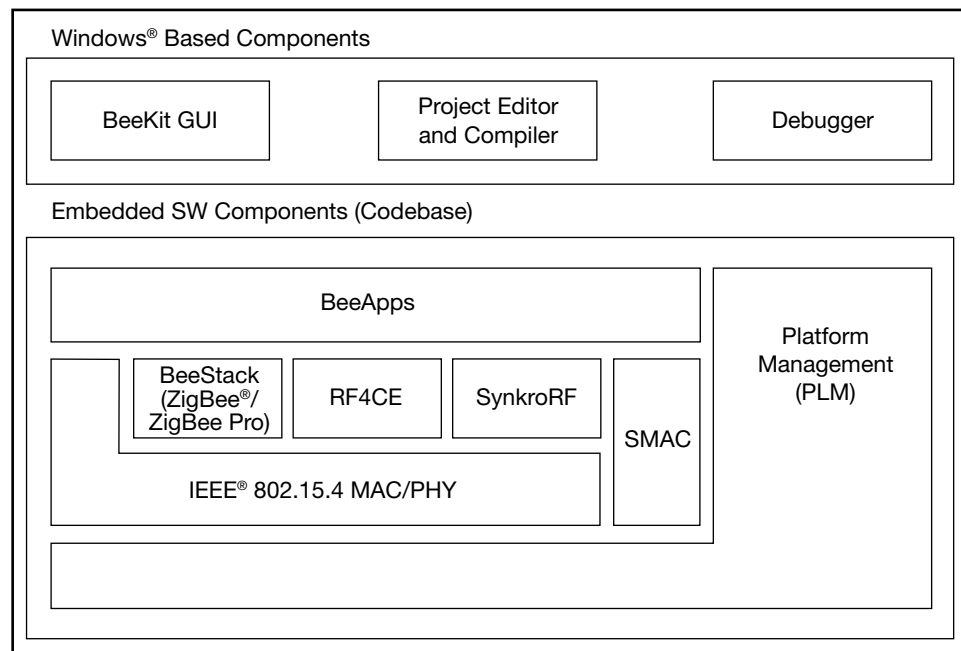
ZigBee technology provides the ideal solution for larger, more complex networking, a robust and reliable option for self-forming and self-healing mesh networks. Since ZigBee is an open standard, it also allows for interoperability of products from different vendors. BeeStack is Freescale's ZigBee protocol stack that delivers a reliable and robust platform for ZigBee development.

BeeStack Features

- Supports ZigBee 2007
- Supports ZigBee Pro
- Supports Smart Energy Profile
- Supports Health Care Profile
- Supports Home Automation Protocol

Technical Features

- Operating system support
  - Windows® 2000
  - Windows XP
  - Windows 7
  - Windows Vista®
- Networking protocol code components and network application samples (code bases)
  - SMAC
  - 802.15.4 MAC
  - SynkroRF
  - RF4CE
  - BeeStack (ZigBee/ZigBee Pro)
- Target devices supported
  - MC13233 (HCS08)
  - MC13226 (ARM7)
  - MC13224 (ARM7)
  - MC13213 (HCS08)
  - MC13212 (HCS08)
  - MC13211 (HSC08)
  - MC9S08GT60
- Development kits supported
  - 1323XUSB/DSK/NSK
  - 1322XUSB/DSK/NSK/EVK
  - 13226PRO-DBG
  - 1321XCSK/DSK
  - 1320XRFC
  - 1320XEQ128DSK plus MC68EVB908GB60E 1320X-QE-DSK
- Integrated development environments (IDE)
  - CodeWarrior Development Studio for Microcontrollers (CW-MICROCONTROLLERS)
  - IAR EWARM for ARM7™

MC1323X Development Kits

Overview

Freescale offers a full set of hardware platforms for evaluation of the cost-effective MC1323X System on Chip (SoC) solutions. Designers may choose the hardware and software platform that achieves their design goals. The newest SoC product family integrates the 2.4 GHz transceiver, HCS08 series microcontroller, memory and input/output (I/O) in a single package. The 8-bit integrated alternative allows easy implementation of cost-effective solutions for those familiar with Freescale's HCS08 family and for those just starting out with embedded wireless design. The MC1323X kits are optimized to support SynkroRF and RF4CE consumer applications as well as many general market applications while allowing designers to achieve their end system cost targets.

MC1323X family development kits are built on three modular boards, each of which offer features and functions targeted at consumer electronics applications. The modular boards are assembled into specific configurations to allow straightforward system development. The modularity of the solutions offers designers the opportunity to select specific structures (using reference design materials and content) for direct implementation into their end systems, thereby reducing design time and associated costs.

Modular Boards

1323X-MRB (Modular Reference Board)

The 1323X-MRB contains the MC13233 integrated circuit and all necessary input/output connects. It is a self contained module in a compact reference design.

1323X-RCM (Remote Control Reference Motherboard)

The 1323X-RCM highlights the features of the MC1323X family for remote control design.

1323X-REM (Remote Extender Reference Motherboard)

The 1323X-REM is a remote extender.

1323X-USB

The USB plug-in board offers a small form-fit alternative for wireless design.
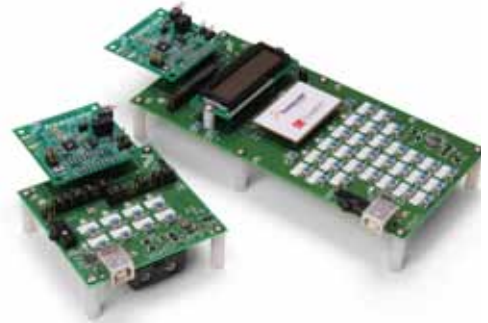
Assembled Boards

1323X-RCB (Remote Control Board)

The 1323X-RCB consists of the 1323X-MRB and 1323X-RCM. The boards are assembled together within the development kits.

1323X-REB (Remote Extender Board)

The 1323X-REB consists of the 1323X-MRB and 1323X-REM. The boards are assembled together within the development kits.

1323X Evaluation Kit

Kit Features

- MC13233 802.15.4 2.4 GHz PiP
- LCD (RCM)
- Four LCD soft touch push buttons (RCM)
- 36 button keypad (RCM)
- Eight direction plus select joystick (RCM)
- IR transmitter (RCM)
- Buzzer (RCM)
- Digital accelerometer (RCM)
- Digital gyroscope (RCM)
- I/O header (REM)
- USB connection
- Power LED and six status LEDs (REM)
- Power LED and six status LEDs (RCM)
- Six push buttons (REM)
- IR receiver and transmitter (REM)
- Printed F antenna (REM)
- On/Off switch
- Battery connectors
- Test points

MC1323X Development Kits

Feature	1323x USB Kit	1323x Developer Starter Kit	1323x Network Starter Kit
1323x-MRB	N/A	2	4
1323x-REM	N/A	1	3
1323x-RCM	N/A	1	1
1323x-USB	5	N/A	N/A
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
Freescale Network Analyzer	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
MSRP USD—Part #	$199—1323XUSB	$199—1323XDSK $279—1323XDSK-BDM	$449—1323XNSK $529—1323XNSK-BDM $999—1323XNSK-SFTW

MC1322X Development Kits

Overview

Freescale has created the most complete set of hardware platforms for evaluating the MC1322X Platform in a Package (PiP) solution, allowing developers to select the hardware and software platform that best meets their needs. The unique PiP design integrates the 2.4 GHz transceiver, ARM7TDMI™ core, memory, I/O and RF matching components into a single package, significantly reducing the component cost and solution size. The MC1322X development kits are the ideal platforms for more complex 802.15.4 and ZigBee applications, providing plenty of memory and expansion capabilities. For designers who have ZigBee Pro applications to implement and prefer an ARM7 solution, the newest 13226PRO-DBG development kit is optimized for ZigBee Pro designs.

1322X-SRB (Sensor Reference Board)

The 1322X-SRB contains an MC13224 PiP, an MMA7260Q three-axis acceleration sensor, MPXV5010G pressure sensor and a temperature sensor. The SRB provides a complete platform for evaluating the MC13224 PiP.

1322X-NCB (Network Coordinator Board)

The 1322X-NCB contains the MC13224 IC and a graphic LCD, creating the ideal demonstration platform for network coordinators. The LCD enables network monitoring by providing status messages.

1322X-LPB (Low Power Board)

The 1322X-LPB contains the MC13224 and is ideal for power measurements. The small form factor supports both AAA batteries and coin cell use and has the optional buck converter enabled to provide a low-power option.

1322X-USB

The 1322X-USB is programmed to function as an 802.15.4/ZigBee packet sniffer and can be used with the Daintree Sensor Network Analyzer software. The device can also be reprogrammed to support customer applications, providing a small form factor device for PC connectivity.

Features

- MC1322X 802.15.4 2.4 GHz PiP
  - MC13224
  - MC13226 (ZigBee Pro)
- MMA7260Q three-axis acceleration sensor (1322X-SRB only)
- MPXV5010G pressure sensor (1322X-SRB only)
- Temperature sensor (1322X-SRB only)
- Printed F antenna
- SMA connector (1322X-NCB only)
- Color graphic LCD display (1322X-NCB only)
- Speaker
- Joystick, buttons and LEDs
- J-TAG interface for debug and programming
- Nexus debug interface (1322X-NCB only)
- Supports on-chip buck converter (1322X-LPB only)
- On-board expansion capabilities for external application-specific development

1322X Evaluation Kit

- LEDs and switches for demonstration monitoring and control
- Connections for battery or external power supply
- USB port to interface with PC
- Cables, batteries and power adapters
- Scalable software support for easy development of customer-specific network topologies

MC1322X Development Kits					
Feature	1322X USB Kit	1322X Developer Starter Kit	1322X Network Starter Kit	1322X ZigBee EVK	13226 ZigBee Pro Kit
1322X-SRB	N/A	1	1	4	2
1322X-NCB	N/A	1	1	3	2
1322X-LPB	N/A	N/A	1	2	1
1322X-USB	1	N/A	1	1	N/A
J-Link JTAG Debugger	No	Yes	Yes	Yes	Yes
IAR IDE	IAR 32K Edition	IAR 32K Edition	IAR 32K Edition, IAR 256K Edition with NSK-IAR	IAR 32K Edition, IAR 256K Edition with EVK-SFTW	IAR 32K Edition
BeeKit with BeeStack ZigBee® Protocol Stack	Included	Included	Included	Included	Included
Batteries, Cables and Power Adapters	Yes	Yes	Yes	Yes	Yes
Pre-Programmed Demonstration Application	None	Weather Station Demo, SynkroRF Demo	802.15.4 Network Demo	ZigBee environment demonstration (ZeD)	ZigBee Smart Energy Demo
RoHS Compliant	Yes	Yes	Yes	Yes	Yes
MSRP USD—Part #	$79— 1322XUSB	$379— 1322XDSK-DBG	$579— 1322XNSK-DBG $2599— 1322XNSK-IAR	$1999— 1322XEVK $3999— 1322XEVK-SFT	$699— 13226PRO-DBG

MC1321X Development Kits

Overview

Freescale offers several different development kits for evaluating the MC1321X system in package (SiP), allowing developers to select the hardware and software platform that best meets their needs. The MC13213 device contains a 2.4 GHz RF transceiver and MC9S08GT60 MCU with 60K of flash and 4K of RAM in a 64-pin 9 mm x 9 mm LGA package. The development boards can be programmed with example demonstration applications or custom applications.

1321X-SRB

The 1321X-SRB contains an MC13213 IC, an MMA7260Q three-axis acceleration sensor and a temperature sensor. The SRB provides a complete platform for evaluating the MC13213 SiP.

1321X-NCB

The 1321X-NCB contains the MC13213 IC and an LCD, creating the ideal demonstration platform for network coordinators. The LCD enables network monitoring by providing status messages.

Features

- MC13213 ZigBee-compliant 2.4 GHz SiP
- MMA7260Q three-axis acceleration sensor (1321X-SRB only)
- Temperature sensor (1321X-SRB only)
- Printed F antenna
- On-board expansion capabilities for external application-specific development
- Programmable 60K flash with 4K of RAM
- On-board BDM port for flash reprogramming and in-circuit hardware debugging
- LEDs and switches for demonstration monitoring and control
- LCD for demonstration messaging (1321X-NCB only)
- Connections for battery or external power supply
- RS232 and USB ports to interface with PC

1321X Evaluation Kit

- USB multilink BDM debugger/programmer (BDM kits only)
- Cables, batteries and power adapters
- Scalable software support for easy development of customer-specific network topologies

MC1321X Development Kits

Feature	1321X Consumer Starter Kit	1321X Developer's Starter Kit
1321X-SRB	1	2
1321X-NCB	1	N/A
CodeWarrior IDE	Special Edition	Special Edition
BeeKit with BeeStack ZigBee® Protocol Stack	Included	Included
ZigBee Packet Analyzer Hardware	No	No
Protocol Analyzer	No	No
Batteries, Cables and Power Adapters	Yes	Yes
Pre-Programmed Demonstration Application	SynkroRF Demo	Accelerometer Demo
RoHS Compliant	Yes	Yes
MSRP USD—Part #	$399—1321XCSK-BDM	$249—1321XDSK $349—1321XDSK-BDM

MC1320X
Development Kit

Overview

The MC1320X-QE128-DSK is based on the MC13202 2.4 GHz RF transceiver and the HC9S08QE128 MCU. This platform combines RF capabilities of the MC13202 with the low power and increased memory option of the QE MCU. This is an attractive solution for customers that wish to remain in the S08 MCU family, but require more flash memory than offered by the MC1321X family. The HC9S08QE128 board provides 128K of flash, 8K of RAM and an extensive peripheral set to provide enough headroom for complex ZigBee applications. In addition, the QE low power consumption is ideal for applications that require extended battery life. Like all of the 802.15.4 development kits, it is supported by Freescale's BeeKit Wireless Connectivity Toolkit and supports the SMAC, MAC and BeeStack protocol stacks.

Features

- Two 1320X-QE128-EVB development boards
- MC13202 802.15.4-compliant 2.4 GHz transceiver
- MC9S08Q128 MCU daughter card
- Printed F antenna
- On-board expansion capabilities for external application-specific development
- Programmable 60K flash with 4K of RAM
- On-board BDM port for flash reprogramming and in-circuit hardware debugging
- LEDs and switches for demonstration monitoring and control

1320X-QE128-EVB

- 2 x 16 character LCD for demonstration messaging
- Connections for battery or external power supply
- RS232 and USB ports to interface with PC
- 16-pin and 10-pin user headers for selected GPIO and data interfaces
- USB multilink BDM debugger/programmer (BDM kits only)
- Cables, batteries and power adapters
- Scalable software support for easy development of customer-specific network topologies

Ordering Information

Part Number and MSRP USD	Description
1320X-QE128-DSK $349 USD	1320X-QE128 Developers Starter Kit
1320X-QE-DSK-BDM $399 USD	1320X-QE128 Developers Starter Kit BDM

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