July, 2009

Freescale Zigbee Solutions in 8 and 32-bit

Web Seminar, Brazil

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Brazil Sales Team
IEEE® 802.15.4 Technology Overview
IEEE® 802.15.4 breaks the “bigger and faster” mold to address the unique needs of monitoring and control

- Machine-to-machine
- Low cost
- Low power
- Low duty cycle
- Small packets
- Fast power-on latency
- Self-forming, self-healing mesh networking
IEEE® 802.15.4 2003

Simple packet data protocol for lightweight wireless networks

• Global standard based solution released in May 2003
  - Technology in mass production since 2003
  - Over 20 Million units shipped
  - Variety of sources

• Defines the physical (PHY) and data (MAC) layers
  - Upper layers are defined by developer
    – Allows the designer to concentrate on the application and their customers’ needs

Technology Advantages

• Optimized for low duty cycle applications
  - Longer battery life (months to years)

• Interference avoidance
IEEE® 802.15.4 Applications

- WirelessHART™
- ZigBee®
- Building Control
- Home Control
- Industrial Control
- Building Control
- Medical Monitoring
- Security
- Smart Energy
- Proprietary Networks (802.15.4 and SMAC)
- Gaming and Toys
- SynkroRF and RF4CE
- Smart Energy
- Security
- Gaming and Toys
- Proprietary Networks (802.15.4 and SMAC)

Cost
802.15.4 Summary

802.15.4 is designed to provide a solid foundation for sensing and control applications

Providing a global standard
  • 2.4 GHz provides global support for products
  • Additional sub 1 GHz work adding options for Asia, Europe, and US

Technology is real and available
  • Mass production since 2003
  • 20 Million units shipped

Provides a variety of sources for chipsets and network stacks
  • Eliminates the concerns with a single source
  • Provides lower cost and increased competition

Provides for key technology advantages for monitoring and control
  • Optimized for low duty cycle applications
  • Longer battery life (months to years)

Proving to be robust in the presence of interference
  • Channel Alignment – ideal for co-existence with other 2.4 GHz technologies
  • Clear Channel Assessment – improves collision avoidance
  • Short burst transmission

Used as the foundation for many protocol stacks
  • ZigBee® technology, WirelessHART™ technology, ISA 100.11a protocol stack, RF4CE consortium, etc.
Freescale 802.15.4 Software Overview
Consider the variety of the 802.15.4 protocol stack offerings

802.15.4 is becoming the foundation for many protocol stacks
  • ZigBee® technology, WirelessHART™ technology, ISA 100.11a protocol stack, RF4CE consortium, etc.

Freescale has an advanced portfolio of 802.15.4 protocol stacks
  • Freescale #1 for 2008 with 61% market share (In-Stat 2008 report)
<table>
<thead>
<tr>
<th>Feature</th>
<th>SMAC</th>
<th>802.15.4 MAC</th>
<th>SynkroRF</th>
<th>RF4CE</th>
<th>ZigBee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical Applications</td>
<td>Cable Replacement</td>
<td>Wireless Control</td>
<td>Cable Replacement</td>
<td>RF Remote Control</td>
<td>Home Automation</td>
</tr>
<tr>
<td></td>
<td>Wireless Toys and Games</td>
<td>Wireless Automation</td>
<td>Wireless Control</td>
<td>Home Entertainment and Control</td>
<td>Smart Energy</td>
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<tr>
<td></td>
<td></td>
<td>Wireless Meter Reading</td>
<td></td>
<td>Home Automation</td>
<td>Building Automation</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Patient Monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Security</td>
</tr>
<tr>
<td>Network Stack</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Network Profiles</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Memory Requirements</td>
<td>4-8K</td>
<td>30-40K</td>
<td>32K</td>
<td>40K</td>
<td>50-100K</td>
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<tr>
<td>Network Topology</td>
<td>Point-to-Point</td>
<td>Peer-to-Peer</td>
<td>Co-existing Star</td>
<td>Co-existing Star</td>
<td>Tree</td>
</tr>
<tr>
<td></td>
<td>Star</td>
<td>Tree</td>
<td>Star</td>
<td></td>
<td>Mesh</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mesh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical # of Nodes</td>
<td>2-100</td>
<td>2-1000*</td>
<td>32 per Controlled Device</td>
<td>32 per Target Device</td>
<td>2-250 ZigBee</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2-1000 ZigBee Pro</td>
</tr>
<tr>
<td>Typical IC Cost</td>
<td>$1-2</td>
<td>$2-3</td>
<td>$2-3</td>
<td>$2-3</td>
<td>$3-5</td>
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<td>Typical Data Throughput</td>
<td>50-115K</td>
<td>90-115K</td>
<td>70-100K</td>
<td>70-100K</td>
<td>30-70K</td>
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## Freescale’s 802.15.4 Platform Positioning

<table>
<thead>
<tr>
<th>Complexity</th>
<th>Interoperability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IEEE® 802.15.4</strong></td>
<td><strong>BeeStack™ ZigBee® Protocol Stack</strong></td>
</tr>
<tr>
<td><strong>Is</strong></td>
<td><strong>Is</strong></td>
</tr>
<tr>
<td>- IEEE Standard</td>
<td>- Mesh Networks</td>
</tr>
<tr>
<td>- Proprietary Networks</td>
<td>- Simple</td>
</tr>
<tr>
<td>- 60 KB</td>
<td>- Simple</td>
</tr>
<tr>
<td>- Low Cost ($3-4 IC Cost)</td>
<td>- Mobile</td>
</tr>
<tr>
<td><strong>Is Not</strong></td>
<td><strong>Is Not</strong></td>
</tr>
<tr>
<td>- Interoperable</td>
<td>- Medium to large networks (over 100 nodes)</td>
</tr>
<tr>
<td>- Simple</td>
<td>- Low cost</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Simple MAC</strong></th>
<th><strong>SynkroRF and RF4CE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Is</strong></td>
<td><strong>Is</strong></td>
</tr>
<tr>
<td>- Freescale Proprietary</td>
<td>- CE Remote Control</td>
</tr>
<tr>
<td>- Simple</td>
<td>- Standard (2H08)</td>
</tr>
<tr>
<td>- 2.5-4 KB</td>
<td>- 60 KB</td>
</tr>
<tr>
<td>- Lowest Cost ($2-3 IC Cost)</td>
<td>- Low Cost ($3-4 IC Cost)</td>
</tr>
<tr>
<td><strong>Is Not</strong></td>
<td><strong>Is Not</strong></td>
</tr>
<tr>
<td>- Interoperable</td>
<td>- Mesh</td>
</tr>
<tr>
<td>- Mesh Networks</td>
<td>- Large Networks</td>
</tr>
<tr>
<td>- Medium to large networks (over 100 nodes)</td>
<td></td>
</tr>
</tbody>
</table>
Simple Point-to-Point Solution
- Perfect for small low cost applications using 4-8 KB
- Easily portable to other Freescale MCUs
- Supports point-to-point and star networks with repeaters

Broad Portfolio of ICs
- MC13201 and MC13202
- MC13211, MC13212, and MC13213
- MC13224

Applications
- Cable replacement
- Simple remote control
- Toys and games
Proprietary Solutions SMAC (Simple Media Access Controller)

Features Highlights
- Portfolio’s lowest cost solution
- Perfect for small applications using 4-8KB MCUs
- 9 Sample applications

Enhanced compatibility
- Native support for HCS08GB/GT family
- Guide for porting to HCS08QD4 and other low end MCUs available on Q4
- Easy portability to custom hardware

Cost Efficient solution
- Lower development tools’ cost: compatible with Codewarrior Special Edition license
- BeeKit compatible: short development time

Simple but powerful
- Proprietary Point-to-Point and Star networks with optional repeaters
- Security and Over the Air Programming functionality

When to Design in
- Simple point-to-point or Star/Extended Star topologies
- Cable Replacement
- Lowest cost
- Proprietary
IEEE® 802.15.4
Proprietary IEEE® 802.15.4 Solutions

Full Breath of IEEE 802.15.4 Networks
- Suitable for simple to very complex networks
- Fully compliant IEEE 802.15.4 MAC proprietary solution
- Peer-to-peer, star, mesh, and cluster tree networks

Broad Portfolio of ICs
- MC13202
- MC13212 and MC13213
- MC13224

Applications
- Control
- Automation
- Meter reading
IEEE 802.15.4 Standard-Based Proprietary

Feature Highlights
- Supports MC1319x, MC1320x, MC1321x, MC1322x
- Supports robust networks

Provided in Object Code
- Allows for optimization of code space by removing
  - features not needed

Network Attributes
- Peer-to-peer, star, and mesh/cluster-tree networks
- Robust communication and timing critical protocol
- Network standard not needed
- Interoperability not needed

Processors Supported
- HCS08
- ARM7 TDMI-S

When to design in
- Peer-to-peer, star, and mesh/cluster-tree topologies
- Simple to very complex networks
- Wireless control, automation, and meter reading
- Proprietary
Freescale’s 802.15.4 Platform Differentiators

Best in class platform
- Complete lineup of IC offerings
  - RF-IC, SiP and PiP, MCUs (Controller Continuum) and Sensors
- Robust software offering
  - Scalable Protocol Stack (SMAC, 802.15.4 MAC, SynkroRF™ and BeeStack™)
- Reference Designs and documentation
  - Provide extensive documentation and reference design

Superior technology
- Low component count
  - Reduces complexity and solution cost
- High sensitivity radio solution
  - Improves range and lowers power consumption
- Operating voltage range optimized for alkaline or lithium primary cells
  - Nearly 100% of available battery life whether Alkaline or Lithium

Premiere Development Tools
- Comprehensive and flexible development kit offering
- “15 minute” out of box experience
- BeeKit™ simplifies network development

Value added ecosystem partners
- Hardware design
- Software design
- Consulting services
- Training
- System certification
Light Weight Networks
• Provides a standardized networking layer optimized for light weight networks
• Subset of IEEE® 802.15.4
• Low cost

Broad Portfolio of ICs
• MC13213
• MC13224

Applications
• Cable replacement
• Wireless control
SynkroRF Entertainment Control Platform

Features Highlights
- Complete platform solution targeted for wireless control and cable replacement
- Provides the network stack up to the API
- True universal approach
- Provides channel agility and low latency options

Enhanced compatibility
- Supported as a complimentary code base within BeeKit
- Black box and API approaches available

When to design in
- Need low cost wireless option with the complete network stack
- Interference avoidance
- Channel agility
- Low latency transmission for high duty cycle interferes
- Easy device paring
Remote and Home Control

- A platform solution for wireless monitoring, control and complete automation for home entertainment products.
- Enhanced RF technology, two-way communication, easy design configuration
- Multiple-star network topology

Broad Portfolio of ICs

- System in Package (SiP)
- Platform in Package (PiP)

Applications

- RF remote control
- Home entertainment and control
- Home automation
Entertainment Control – Today with IR

Line of sight transmission
- Decades-old technology

Field of vision limitations
- Remote needs to be pointed at IR receiver in equipment being controlled

Unidirectional unacknowledged transfers
- Unreliable communication
- Cannot send information to remote control or between components (DTV, set top box, etc.)

Requires manufacturer-specific IR databases
- Each product has its own control commands
- Requires larger memory for storing lookup tables
  - Savings from 8 to 32 KB

Technology Challenge
- Plasma TV contains high frequency inverter that obstructs IR signals
- LCD back lighting absorbs IR
- DTVs field of vision
  - IR diode placed near edge of TV which many times is outside IR field of vision

Power consumption
- Multiple redundant transmissions for each command
- Higher TX power required to avoid interference created by plasma/LCD screens
- Typically over 100mA required per IR transmission
Entertainment Control – Move to RF

Value Drivers

Provides product differentiation to a price sensitive market
- Faster communications
  - Enables enhanced user interfaces
  - Pointing capability
- Bi-directional capability
  - More reliable communications
  - Send program guides, stock quotes, etc to remote
  - Allows for communications between devices

802.15.4 RF consumes 25% of the power used by IR solutions

802.15.4 selected for cost and interference avoidance capabilities with benefit of IEEE standard
- DSSS
- CSMA-CCA
Zigbee
Mesh Networking and Interoperability
- Freescale supports both ZigBee and ZigBee Pro
- Provides for memory optimization
- Simplified network configuration reduces development time

Broad Portfolio of ICs
- MC13202
- MC13213
- MC13224

Applications
- Home automation
- Smart energy
- Building automation
- Security
- Patient monitoring
- Actuator
- Sensor applications
Fully Compliant ZigBee® - BeeStack™

Features Highlights
- ZigBee Compliant Platform
  - Freescale ZigBee 2006 & 2007 Golden Unit
  - Freescale BeeStack smallest in industry
- Supports Star, Tree, & Mesh Networks
- Established Routing Algorithm
- Network Formation, Recovery, and Healing
- Device Interoperability via standard profiles
  - Home Automation (HA)
  - Smart Energy (SE)
  - Commercial Building Automation (CBA) – Q309
- Clusters: Standard Interfaces for Actuators & Sensors
- Designed for small to large networks (1000+)
- Stack Provided in Header Files & Libraries
- Sample Applications and Platform Code Provided in Source

When to design in
- Mesh Networking
- Interoperability
- Low Power
- Robust
What is ZigBee®

A standard global protocol developed and supported by companies around the globe

- Based on 802.15.4
- Defines network, security and application software layers

Meets key market needs

- Reliability
  - Self healing mesh networks
- Scalability
  - Supports thousands of devices
- Secure
  - Symmetric Key with AES-128
- Long battery life
  - Years on AA batteries
- Interoperable
  - Platform Conformance Certification
- Low cost
ZigBee® Protocol Summary

ZigBee technology relies upon the robust IEEE 802.15.4 PHY/MAC to provide reliable data transfer in noisy, interference-rich environments
- Message acknowledgement
- Mesh Networks

Products shipping in market now from numerous vendors
Primary markets are smart energy devices in residential and commercial environment

Ideal For
- Low data rate monitoring and control applications that require a robust network
  - Low latency, infrequent, low data rate and small packet data
- Large area coverage
  - Using the mesh networks that support 1000 of devices
- Ultra low power monitoring applications that operate for years on inexpensive alkaline batteries

Not Ideal For
- Applications requiring all battery operated devices (routers)
- Mobile applications
- Streaming data
Freescale 802.15.4 Hardware Overview
MC1320x Overview

Features:
- 802.15.4 compliant 2.4 GHz RF transceiver
  - 250 kbps O-PQSK modulation
  - 16 selectable channels
- Auto-trim feature for crystal accuracy
  - Eliminate need for external variable capacitors
  - Allows for automated production frequency calibration
- Programmable from -27 dBm to +3 dBm
- RX sensitivity of -92 dBm
- Integrated Transmit/Receive switch
  - Supports single-ended or full differential operation
- Power supply range: 2.0 to 3.4 V
- Multiple low power modes
  - < 1 μA Off Current
  - 3.0 μA Typical Hibernate Current
  - 40 μA Typical Doze Current
- Programmable frequency clock output for MCU
  - Requires a single 16 MHz crystal
- 7 General Purpose Input/Output ports (GPIO)
- Operating Temperature Range: -40°C to 85°C
- Small form factor 5x5mm QFN-32 Package
- Meets Moisture Sensitivity Level (MSL) 3
- 260°C Peak Reflow temperature
- RoHS compliant

Availability
- Shipping in volume since April 2004

Feature Comparison Table:

<table>
<thead>
<tr>
<th>Features</th>
<th>MC13201</th>
<th>MC13202</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protocol Stack</td>
<td>SMAC</td>
<td>SMAC</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.15.4</td>
<td>ZigBee</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>-91 dBm</td>
<td>-92 dBm</td>
</tr>
<tr>
<td>Data Mode</td>
<td>Packet</td>
<td>Streaming and Packet</td>
</tr>
<tr>
<td>2009 1K SRP</td>
<td>$2.01</td>
<td>$2.36</td>
</tr>
</tbody>
</table>
MC1320x End Product Benefits

MC1320x is the ideal platform for SMAC and IEEE 802.15.4
• Fully compliant RF Transceiver operating in the 2.4 GHz frequency band
• Provides the foundation for an easy to implement proprietary solution

Integrated TX/RX switch
• Lowers the component count and system cost while multiple low power modes decrease the system power consumption

SPI Interface to MCU
• The MC1320x can easily connect with Freescale’s vast portfolio of MCU’s

MC1320x Features
• The MC1320x features help make this an ideal solution for cost-sensitive, energy-efficient sensing and control applications
MCU Features
- 40 MHz HCS08 low-voltage, low-power core
- Flash and memory dependent on part
- Multiple 16-bit timers
- Up to 38 GPIO
- 8-bit port keyboard interrupt (KBI)
- 8-channel 10-bit analog-to-digital converter (ADC)
- SCI interface supporting up to 115.2 kBaud
- I2C with 100 kbps maximum bus loading
- Low-voltage detection
- In-circuit debug and Flash programming
- Common on-chip processor (COP) watchdog timer

RF Features
- 802.15.4 compliant 2.4 GHz RF transceiver
  - 250 kbps O-PQSK modulation
  - 16 selectable channels
- Auto-trim feature for crystal accuracy
  - Eliminate need for external variable capacitors
  - Allows for automated production frequency calibration
- Programmable from -27 dBm to +3 dBm
- RX sensitivity of -92 dBm
- Integrated Transmit/Receive switch
  - Supports single-ended or full differential operation

Features
- -40 to +85 degrees C operating temperature
- 2V to 3.4V
- Low external component count
  - Requires a single 16 MHz crystal
  - Programmable frequency clock output for MCU
- 9x9x1 mm 71-pin LGA package
- RoHS compliant

Availability
- Shipping in volume since September 2006
MC1321x is the ideal platform for SMAC, IEEE 802.15.4, SynkroRF, and RF4CE

- Low cost solution for applications that do not require full ZigBee mesh networks
- Fully compliant 802.15.4 platform integrates the MC13202 2.4 GHz transceiver with the MC9S08GT MCU to provide a single package solution.

Memory Scalability

- Three flash memory configurations are available to optimize solution costs based on application needs.

Integrates MC9S08GT MCU

- The System in Package (SiP) integrates an 8-bit HCS08 MCU with a low voltage and a low power core further reducing the size and cost of the MC1321x solution.
MC1322x Platform in a Package (PiP)

Features

- Integrated 2.4 GHz transceiver with 32-bit CPU
  - 802.15.4 Compliant transceiver
  - ARM7TDMI up to 26Mhz
- Lowest power
  - Significant power reduction – up to 45%
  - 22 mA Rx & 29 mA Tx with radio and MCU
- Plenty of memory for ZigBee Applications
  - ROM, Flash, RAM
- Improved RF performance
  - -96 dBm sensitivity (DCD mode)
  - -100 dBm (NCD mode, +3-4 mA current)
  - +4 dBm power output
- Hardware accelerator reduces MCU overhead
  - MAC accelerator
  - AES 128-bit hardware encryption/decryption
- Best in class peripherals
  - UART, SPI, KBI, 8 channel 12-bit ADC, 4x16-bit timer, I²C, SSI (I2S), 64 GPIO
- Unique platform in a package
  - RF matching in package
  - Requires power, crystal and 50 Ohm antenna
  - 9.5 mm x 9.5 mm 99-pin LGA

Availability – Now
Pricing – 2009 1K SRP = $4.74
Mc1322x Software Introduction – Flash, ROM, RAM content

- **128 KB Flash**
  - Application image
  - Stack NVM sector

- **96 KB RAM**
  - APPLICATION/PROFILES
  - APPLICATION FRAMEWORK
  - NETWORK/SECURITY LAYERS

- **80 KB ROM**
  - MAC LAYER
  - PHY LAYER
  - Low Level Drivers
  - Bootstrap

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IEEE

ZigBee Alliance

OEM
MC1322x End Product Benefits

MC13224 is the ideal platform for ZigBee
  - Flexible memory configuration provides enough memory to run the complete stack and application profile
RAM based part allows Firmware to be upgraded without an external storage such as and EEPROM
  - Can update Flash directly
Lower RX and TX power consumption lowers ZigBee power budget requirements.
  - Ideal for battery applications as well as main powered applications were power budget is low
Highly integrated package reduces design time and cost.
  - Reduces design complexity and through reduced integrated RF front end
  - Reduces total cost through lower component inventories, less board space, etc.
<table>
<thead>
<tr>
<th></th>
<th>MC1320x</th>
<th>MC1321x</th>
<th>MC13224V</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Supply Voltage V</strong></td>
<td>2.0-3.4</td>
<td>2.0-3.4</td>
<td>2.0-3.4</td>
</tr>
<tr>
<td><strong>Supply Current @ 1% Duty Cycle, CPU @ 2MHz (Typ) mA</strong></td>
<td>30, TX: 37, RX</td>
<td>31.1, TX: 38.1, RX</td>
<td>20, TX: 20, RX</td>
</tr>
<tr>
<td><strong>Sensitivity @ 1% PER (Typ) dBm</strong></td>
<td>-92</td>
<td>-92</td>
<td>-96</td>
</tr>
<tr>
<td><strong>External Component Count</strong></td>
<td>14</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td><strong>Protocol Stack Support</strong></td>
<td>MC13201: SMAC</td>
<td>MC13211: SMAC</td>
<td>SMAC</td>
</tr>
<tr>
<td></td>
<td>MC13202: SMAC, IEEE 802.15.4, ZigBee®</td>
<td>MC13212: SMAC, IEEE 802.15.4</td>
<td>IEEE 802.15.4, ZigBee®</td>
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<tr>
<td></td>
<td>MC12313: SMAC, IEEE 802.15.4, SynkroRF, ZigBee®</td>
<td></td>
<td></td>
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<tr>
<td><strong>Package</strong></td>
<td>5 x 5 mm, 32-pin QFN</td>
<td>9 x 9 mm, 64-pin LGA</td>
<td>9.5 x 5.5 mm, 99-pin LGA</td>
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<tr>
<td><strong>Flash/RAM/ROM</strong></td>
<td>-</td>
<td>MC13211: 16KB/1KB</td>
<td>128KB/96KB/80KB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MC13212: 32KB/2KB</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MC12313: 60KB/4KB</td>
<td></td>
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<tr>
<td><strong>Core</strong></td>
<td>-</td>
<td>HCS08</td>
<td>ARM7 TDMI-S</td>
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<tr>
<td><strong>Silicon Cost 2009 SRP</strong></td>
<td>$2.36</td>
<td>$3.70</td>
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<tr>
<td><strong>External Component Cost (Antenna not included)</strong></td>
<td>$1.06</td>
<td>$.77</td>
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<tr>
<td><strong>Total Solution Cost</strong></td>
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<tr>
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<td>IEEE 802.15.4</td>
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<tr>
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<tr>
<td>MC13201</td>
<td>Yes</td>
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<td>MC1202</td>
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<td>MC13212</td>
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<td>MC13213</td>
<td>Yes</td>
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<td>Yes</td>
</tr>
<tr>
<td>MC13224</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes (Q3 2009)</td>
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Freescale 802.15.4 Product Positioning

ZigBee®
- MC13224 (ZigBee and ZigBee Pro)
  - Designed for ZigBee providing lowest power consumption and smallest solution size. Only solution that supports ZigBee Pro
- MC13202 + QE128 (ZigBee)
  - Provides plenty of memory for stack and applications while keeping the S08 architecture
- MC13213 (ZigBee)
  - Provides a low cost solution when using ZigBee as an end node

IEEE® 802.15.4
- MC13224
  - Provides lowest power consumption and smallest solution size
- MC13213
  - Provides the lowest cost solution when using
- MC13202 + QE128 (ZigBee)
  - Provides plenty of memory for stack and applications

SynkroRF™ and RF4CE
- MC13213
  - Provided the lowest cost solution

Simple MAC (SMAC)
- MC13211-MC13213
  - Provides plenty of memory for SMAC applications. Scalable from 16-60K
- MC13201 + S08
  - Provides lowest costs solution when only 4-8K of flash is required

Mesh/Tree Networks

Star Networks
Summary and Wrap Up
Summary

One size does not fit all for monitoring and control applications
  • Need to look at key requirements such as cost, complexity, interoperability, etc
  • 802.15.4 offers a solid foundation

Freescale offers a scalable platform to meet the specific needs of the application
  • SMAC, 802.15.4 MAC, SynkroRF™ and ZigBee®

Freescale offers a best in class platform
  • Complete lineup of IC offerings
    ▪ Transceivers, MCUs, SiPs and PiPs
  • Robust software offering
    ▪ Scalable Protocol Stack (SMAC, 802.15.4 MAC and BeeStack)
  • BeeKit™ simplifies network development
  • Reference Designs and documentation
    ▪ Provide extensive documentation and reference design
  • Premiere Development Tools
    ▪ Comprehensive and flexible development kit offering
    ▪ “15 minute” out of box experience
  • Value added ecosystem partners
    ▪ Hardware design
    ▪ Software design
    ▪ Consulting services
    ▪ Training
    ▪ System certification
Q&A