Freescale MC13213 ZigBee 解决方案

关键词:无线通信,无线宽带,ZigBee,

摘要:Freescale 的 MC1321x 系列是第二代 ZigBee 平台,在 9x9x1mm 71 引脚 LGA 封装中集成了低功耗的 2.4GHz RF 收发器和 8 位微控制器.MC13213 器件具有 60KB 的闪存.MC1321x 解决方案能在简单的点对点连接到完整的 ZigBee 网状网络中用作无线连接.小占位面积封装中的无线电收发器和微控制器的组合使它成为成本效益的解决方案.MC1321x 中的 RF 收发器工作在 2.4GHz ISM 频段,和 802.15.4 标准兼容.收发器包括低噪音放大器,1mW 输出功率,带 VCO 的功率放大器(PA),集成的发送/接收开关,板内的电源稳压器以及完全的扩展频谱的编码和译码. MC1321x 中的微控制器是基于 HCS08 系列微控制器单元(MCU),HCS08 A 版本,高达 60KB 的闪存和 4KB 的 RAM.

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Freescale MC13213: 2.4GHz RF transceiver and 8-bit MCU with 60K of Flash for ZigBee applications

The MC1321x family is Freescale's second-generation ZigBee platform which incorporates a low power 2.4GHz radio frequency transceiver and an 8-bit microcontroller into a single 9x9x1 mm 71-pin LGA package. The MC1321x solution can be used for wireless applications from simple proprietary point-to-point connectivity to a complete ZigBee mesh network. The combination of the radio and a microcontroller in a small footprint package allows for a cost-effective solution. The MC1321x contains an RF transceiver which is an 802.15.4 Standard compliant radio that operates in the 2.4 GHz ISM frequency band. The transceiver includes a low noise amplifier, 1mW nominal output power, PA with internal voltage controlled oscillator (VCO), integrated transmit/receive switch, on-board power supply regulation, and full spread-spectrum encoding and decoding.
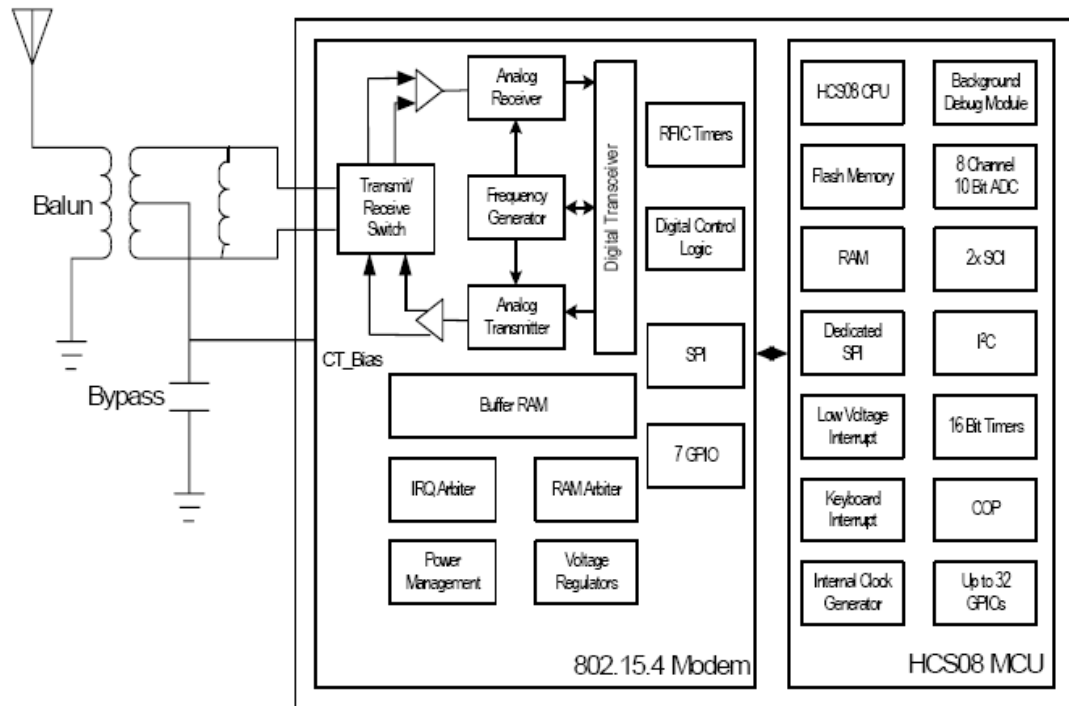
Figure 1. MC1321x 系统级方框图

The MC1321x also contains a microcontroller based on the HCS08 Family of Microcontroller Units (MCU), specifically the HCS08 Version A, and can provide up to 60KB of flash memory and 4KB of RAM. The onboard MCU allows the communications stack and also the application to reside on the same system-in-package (SIP). The MC1321x family is organized as follows:

• The MC13211 has 16KB of flash and 1KB of RAM and is an ideal solution for low cost, proprietary applications that require wireless point-to-point or star network connectivity. The MC13211 combined with the Freescale Simple MAC (SMAC) provides the foundation for proprietary applications by supplying the necessary source code and application examples to get users started on implementing wireless connectivity.

• The MC13212 contains 32K of flash and 2KB of RAM and is intended for use with the Freescale fully compliant 802.15.4 MAC. Custom networks based on the 802.15.4 Standard MAC can be implemented to fit user needs. The 802.15.4 Standard supports star, mesh and cluster tree topologies as well as beaconed networks.

• The MC13213 contains 60K of flash and 4KB of RAM and is also intended for use with the Freescale fully compliant 802.15.4 MAC where larger memory is required. In addition, this device can support ZigBee 2006 applications that use Freescale's BeeStack.

应用范围:

Applications include, but are not limited to, the following:

• Residential and commercial automation

— Lighting control

— Security

— Access control

— Heating, ventilation, air-conditioning (HVAC)

— Automated meter reading (AMR)

• Industrial Control

— Asset tracking and monitoring

— Homeland security

— Process management

— Environmental monitoring and control

— HVAC

— Automated meter reading

• Health Care

— Patient monitoring

— Fitness monitoring

• Consumer

— Human interface devices (keyboard, mice, etc.)

— Remote control

— Wireless toys

通用平台特性:

• 802.15.4 Standard compliant on-chip transceiver/modem

— 2.4GHz

— 16 selectable channels

— Programmable output power

• Multiple power saving modes

• 2V to 3.4V operating voltage with on-chip voltage regulators

• -40°C to +85°C temperature range

• Low external component count

• Supports single 16 MHz crystal clock source operation or dual crystal operation

• Support for SMAC, 802.15.4 Standard, and ZigBee software

• 9mm x 9mm x 1mm 71-pin LGA

微控制器特性:

• Low voltage MCU with 40 MHz low power HCS08 CPU core

• Up to 60K flash memory with block protection and security and 4K RAM

— MC13211: 16KB Flash, 1KB RAM

— MC13212: 32KB Flash, 2KB RAM

— MC13213: 60KB Flash, 4KB RAM

• Low power modes (Wait plus Stop2 and Stop3 modes)

• Dedicated serial peripheral interface (SPI) connected internally to 802.15.4 modem

• One 4-channel and one 1-channel 16-bit timer/pulse width modulator (TPM) module with selectable input capture, output capture, and PWM capability.

• 8-bit port keyboard interrupt (KBI)

• 8-channel 8-10-bit ADC

• Two independent serial communication interfaces (SCI)

• Multiple clock source options

— Internal clock generator (ICG) with 243 kHz oscillator that has +/-0.2% trimming

resolution and +/-0.5% deviation across voltage.

— Startup oscillator of approximately 8 MHz

— External crystal or resonator

— External source from modem clock for very high accuracy source or system low-cost option

• Inter-integrated circuit (IIC) interface.

• In-circuit debug and flash programming available via on-chip background debug module (BDM)

— Two comparator and 9 trigger modes

— Eight deep FIFO for storing change-of-flow addresses and event-only data

— Tag and force breakpoints

— In-circuit debugging with single breakpoint

• System protection features

— Programmable low voltage interrupt (LVI)

— Optional watchdog timer (COP)

— Illegal opcode detection

• Up to 32 MCU GPIO with programmable pullups
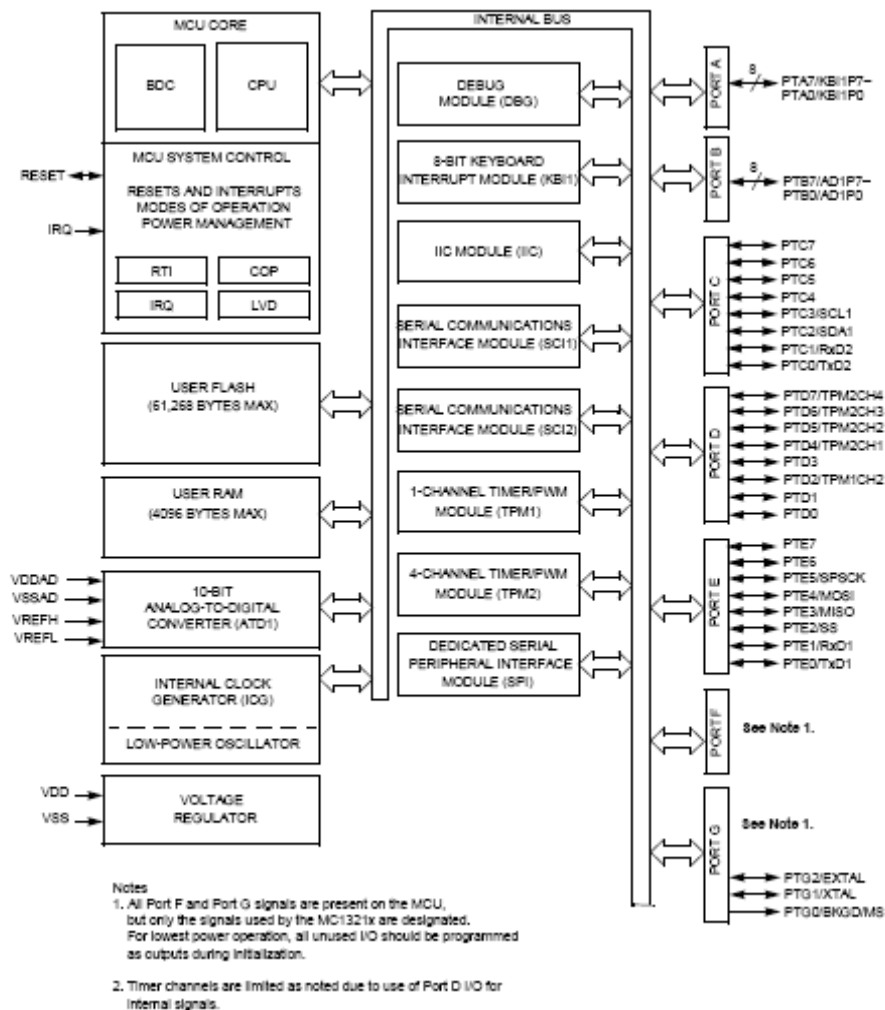
MC13213 MCU 方框图(HCS08, Version A)

RF调制解调器特性:

• Fully compliant 802.15.4 Standard transceiver supports 250 kbps O-QPSK data in 5.0 MHz channels and full spread-spectrum encode and decode

• Operates on one of 16 selectable channels in the 2.4 GHz ISM band

• -1 dBm to 0 dBm nominal output power, programmable from -27 dBm to +3 dBm typical

• Receive sensitivity of <-92 dBm (typical) at 1% PER, 20-byte packet, much better than the 802.15.4 Standard of -85 dBm

• Integrated transmit/receive switch

• Dual PA ouput pairs which can be programmed for full differential single-port or dual-port operation that supports an external LNA and/or PA.

• Three low power modes for increased battery life

• Programmable frequency clock output for use by MCU

• Onboard trim capability for 16 MHz crystal reference oscillator eliminates need for external variable capacitors and allows for automated production frequency calibration

• Four internal timer comparators available to supplement MCU timer resources

• Supports both packet data mode and streaming data mode

• Seven GPIO to supplement MCU GPIO
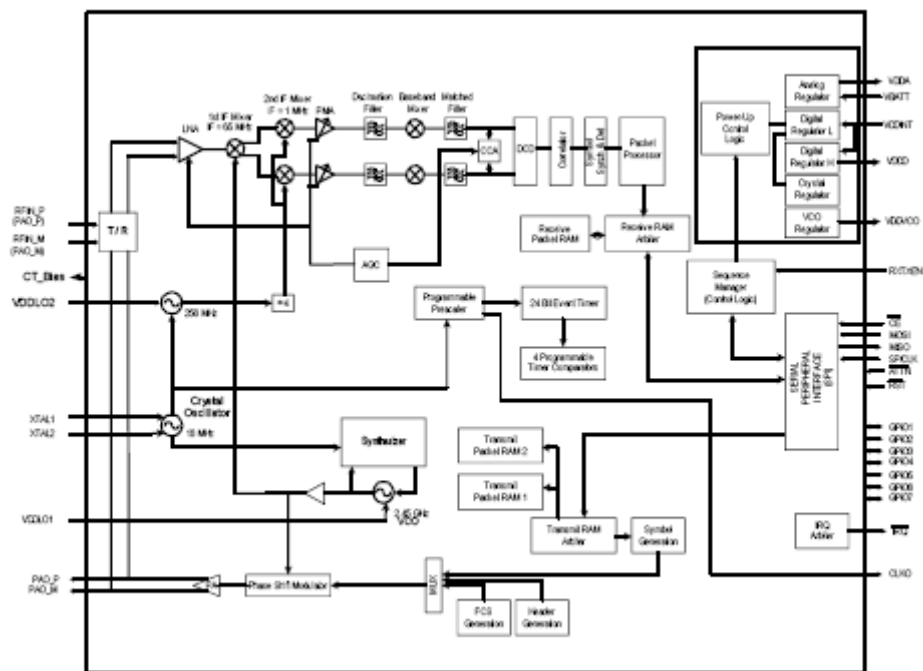
MC13213 802.15.4标准调制解调器方框图

软件特性:

Freescale provides a wide range of software functionality to complement the MC1321x hardware. There are three levels of application solutions:

● Simple MAC

             Small memory footprint (< 4 KB)

Supports point-to-point and star network configurations

ANSI C source code

- IEEE 802.15.4 compliant MAC

    Supports star, mesh and cluster tree topologies

    Supports beaconed and non-beaconed networks

    Supports guaranteed time slots (GTS) for predicable latency

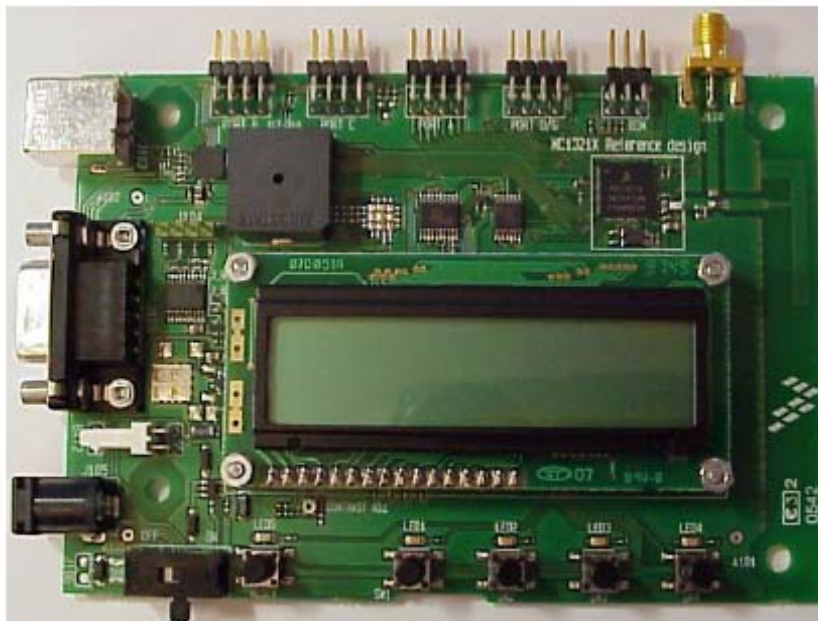   128-bit Asymmetric Encryption Standard (AES)

    Object Code

- BeeStack ZigBee Protocol Stack

    ZigBee 2006 Complian Platform
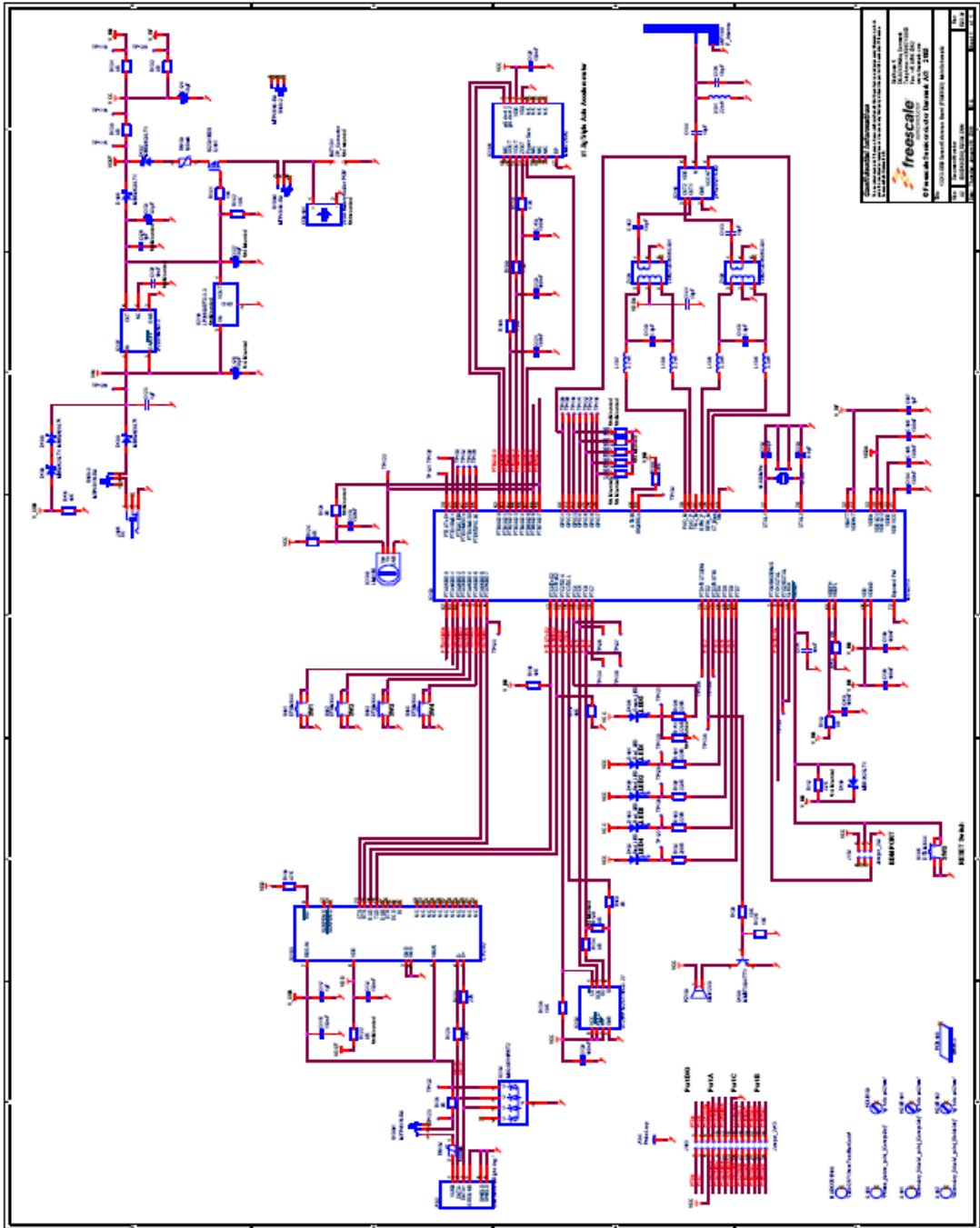
    Object Code

下面是13213-NCB 网络协调板的外形图和电路图:

13213-NCB 电路图(1 of 2)

13213-NCB 电路图(2 of 2)

下面是13213-SRB 传感器参考板外形图和电路图:

13213-SRB 电路图