Operational Description

ZigBee Endnode

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1. Introduction

This document details the operational description of the *ZigBee endnode*. The ZigBee endnode is intended for proprietary, IEEE 802.15.4 and ZigBee WPAN (*wireless personal area network*). The ZigBee endnode is based on the MC1321x family, i.e. Freescale's second-generation ZigBee platform which incorporates a low power 2.4 GHz transceiver and an 8-bit microcontroller into a single LGA package.

1.1 Microprocessor

The MC1321x contains a microcontroller based on the HCS08 family of 8-bit MCU (*microcontroller units*). The MC13213 has 60 KB of flash memory and 4 KB of RAM.

The MCU incorporates several functionalities such as UART, SPI, A/D converter, timer/pulse width modulator, keyboard interrupts and a debug module.

1.1.1 Reference Oscillator

The ZigBee endnode includes a reference oscillator. The reference frequency is 16.000 MHz with an accuracy below ±40 ppm over the entire operating temperature range.

1.2 Interfaces and Peripherals

This section provides an operational description for the peripherals and interfaces.

1.2.1 Background Debug Module

The ZigBee endnode includes a BDM (*background debug module*) interface. The BDM interface to the MCU provides an interface for programming the on-chip memory. The BDM interface can also be used for traditional debugging.

1.2.2 Communications Interface

The ZigBee endnode supports two serial interfaces that are selectable through firmware:

- UART interface
- I2C interface

1.2.3 LED

The ZigBee endnode includes a green LED. The functionality of the LED is application specific.

1.2.4 External Serial Memory

A serial memory acts as a storage for firmware images used during firmware upgrades of the MCU (*microcontroller unit*) internal program flash. The serial memory enables bootloading of the endnode firmware over air via SysMon (*System Monitor*; a maintenance software provided by Timelox) or through direct connection to the communications interface. The serial memory can be entirely shut off to conserve energy.

1.2.5 Voltage Detector

A voltage detector detects when the supply voltage goes below 2 V; if this is the case, a reset is made.

1.2.6 Battery Measurement

The endnode can measure the supply voltage through an external voltage divider that is controllable via firmware.

1.3 Power Supply

The ZigBee endnode includes a linear regulator with an output of 3 VDC to supply the entire device.

1.4 RF Front-End

This section provides a description of the RF front-end.

1.4.1 Transceiver

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), on-board power supply regulation and full spread-spectrum encoding and decoding.
An external LC-matching network steps the impedance down to 50Ω balanced and a small ceramic balun allows the differential to single-ended transformation. A 50:50Ω balun is used.

1.4.2 Rx/Tx Switch

The ZigBee endnode includes a *single pole double throw* (SPDT) switch from NEC. The SPDT switch has low insertion loss and high isolation. The Rx/Tx switch is controlled by the transceiver and the Tx chain is active at a logic “0” and the Rx chain is active at a logic “0”.

1.4.3 LC Filter

The ZigBee endnode includes an LC filter for suppression of spurious harmonics. The LC filter has a resonant frequency of approximately 2.80 GHz.

1.4.4 Antenna

The ZigBee endnode includes an integral PCB antenna. The PCB antenna is an inverted F-antenna with a resonant frequency of approximately 2.45 GHz. The maximum antenna gain is 3.5 dBi.

1.5 Shield Box

The following items are covered by a grounded shield box:

- microprocessor
- transceiver
- Rx/Tx switch
- LC filter
- Crystal
- Voltage detector

Revision history

Version	Date	Initials	Description
0.0.1	2009-03-26	JJO	Initiation of document
1.0.0	2009-03-27	JJO	Release of document
2.0.0	2012-09-17	KG	Revision for new endnode