Freescale Semiconductor
Application Note

AN2772
Rev. 0.0, 08/2004

Zigbee/802.15.4 Evaluation Kit

Quick Start Guide

1 Introduction

This document provides a detailed description of how to navigate through the Zigbee/802.15.4 application Evaluation Kit (EVK) package.

The EVK package contains two evaluation printed circuit boards (PCBs).

- DIG-528-2 EVK board
- DIG-536-2 ARD board

The boards are delivered with a pre-uploaded demonstration application. More demonstration applications can be uploaded with the delivered PC-tool which allows users to evaluate different application scenarios with the Freescale Zigbee/802.15.4 software solution. The delivered demonstration applications are PCB dependent, which means that a particular demonstration application designed for DIG-528-2 will not run on the DIG-536-2 SARD and vice versa.

Demonstration Applications for the DIG-528-2 EVK include, but are not limited to:

- PTC Demonstration (See AN2771/D for details.)

Contents

- Switch Demonstration (See AN2773/D for details.)

Demonstration Applications for the DIG-536-2 SARD include but are not limited to:

- Accelerometer (See AN2762/D and AN 2774/D for details.)

The Switch demonstration application is available with full source code which shows how to use some of the Zigbee/802.15.4 features and some of the main system features. This will show users how to interface to the 802.15.4 MAC/PHY and help users gain a better understanding about how to make their own applications. The source code is available for copying and modification. However, this requires that users build the source code, which requires that they have already installed the Metrowerks Codewarrior IDE for the HCS08 and have a full working license. Contact Metrowerks for more detailed information on how to get a license or to get a full working 30 day trial license.

2 Safety Information

Any modifications to this product may violate the rules of the Federal Communications Commission and make operation of the product unlawful.

47 C.F.R. Sec. 15.21

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

47 C.F.R. Sec.15.105(b)

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. The antenna(s) used for this equipment must be installed to provide a separation distance of at least 8 inches (20cm) from all persons.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

3 References

The following documents were used as references to build this application note.

1. 802.15.4 MAC/PHY Software Reference Manual, 802154MPSRM/D
2. Zigbee.hlp (see Test Tool installation directory.\help)
3. PTC Demonstration Application Note, AN2771/D
4. Switch Demonstration Application Note, AN2773/D
5. Embedded Bootloader User's Guide, MC13192FLUG/D
6. HCSO8 Flash Library Application Note, AN2770/D
7. EVK Hardware Description Application Note, AN2731/D
8. HCS08 Micro controllers Data Sheet, MC9S0GB60/GT60
9. MC13192 Transceiver Data Sheet, MC13192DS/D
10. PCB Dependency Application Note, AN2769/D

4 Primary Processor Overview

The EVK package contains two PCBs. The DIG-528-2 EVK board and the DIG-536-2 ARD board. The two primary processors on the PCBs are the Freescale MC908HCS08 GT60 MCU and the Freescale MC 13192 RF chip.

4.1 MCU MC908HCS08 GT60 Processor

The MC908HCS08 GT60 is a member of Freescale's 8 bit, low-cost, high-performance HCS08 family. It has a 60 KB embedded flash and a 4 KB embedded RAM. A flash sector is 512 bytes. For more details refer to the EVK Hardware Description Application Note, AN2731/D and the HCS08 Micro controllers Data Sheet, MC9S0GB60/GT60.

4.2 MC13192 Processor

The Freescale MC13192 RF transceiver is a small radio that operates in the 2.4GHz ISM band. It has a Serial Peripheral Interface (SPI) interface for communication with the MCU. For more details about the MC13192 see the MC13192 Transceiver Data Sheet, MC13192DS/D.

5 Printed Circuit Board Overview

As already stated, the EVK package contains two PCBs. The DIG-528-2 EVK board and the DIG-536-2 ARD board. This section highlights the hardware on both PCBs.

5.1 DIG-528-2 Board

The DIG-528-2 contains the following interfaces and hardware.

- One USB port
- An RS232 UART communication interface
- Four push buttons
- One reset button
- Four LEDs
- One power switch
- One F-antenna (Refer to AN2731 for more information.)
- Optional Low Noise Amplifier (LNA) can be enabled
- Powered through the USB connector

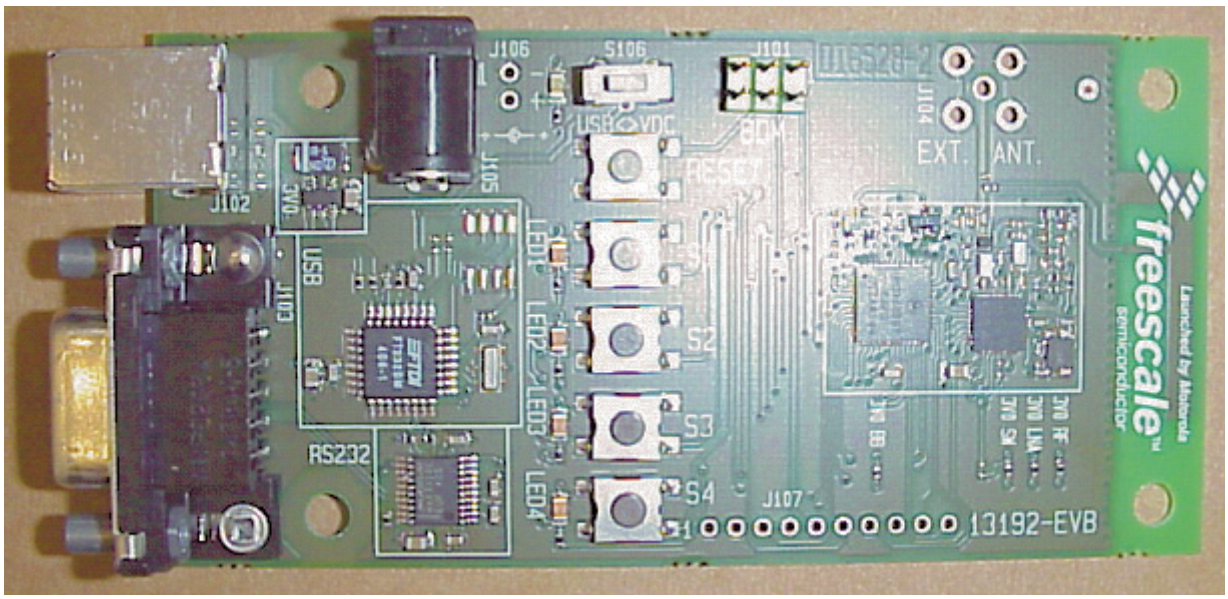

Figure 1. DIG-528-2 PCB (50x100 mm)

Refer to the EVK Hardware Description Application Note, AN2731/D for more details on antennas and LNAs.

5.2 DIG-536-2 Board

The DIG-536-2 has the following hardware and interface components:

- An RS232 UART communication interface
- Four push buttons
- One reset button
- Four LEDs
- One power switch
- A dipole antenna (Refer to AN2731 for more information.)
- The board contains an X-, Y-, and Z-axis accelerometer. The accelerometers can be disabled by removing jumper J105
- Powered by an external power adaptor

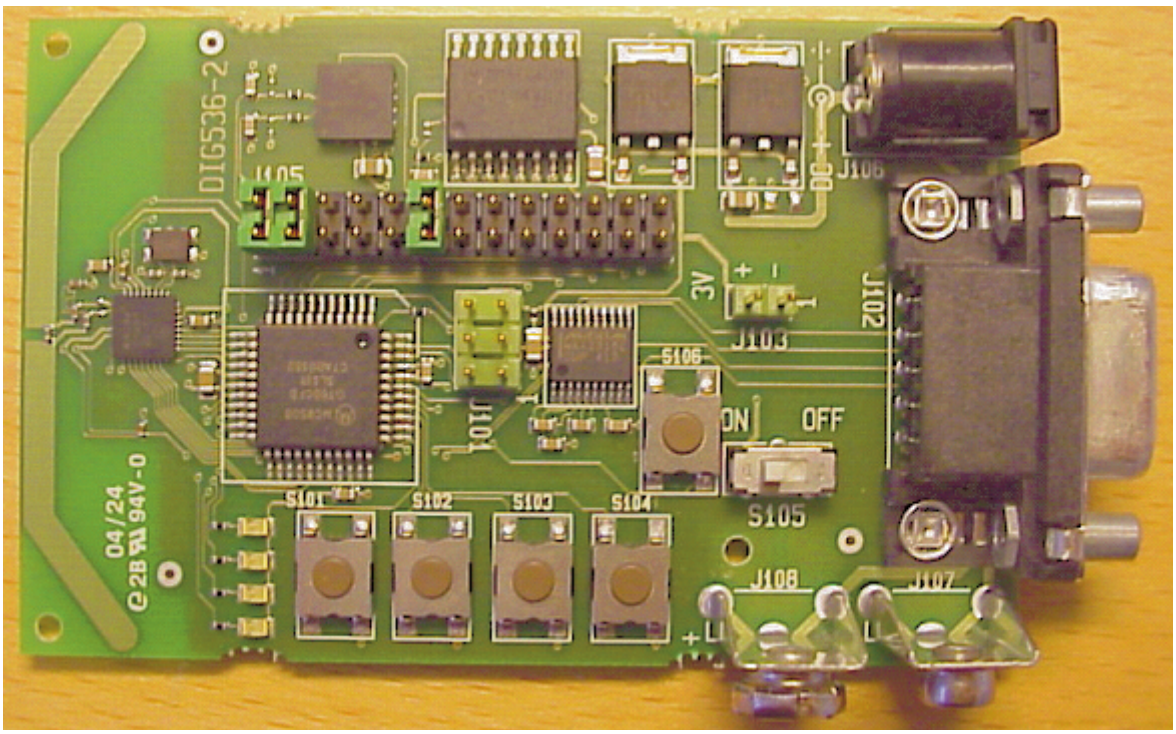

Figure 2. DIG-536-2 PCB (52x81 mm)

Refer to the EVK Hardware Description Application Note, AN2731/D for more details on antennas and LNAs.

6 Demonstration Applications

The EVK package contains a CD with several different demonstration applications that highlight various features of the 802.15.4 standard. These applications are for evaluation purpose only.

This section provides an overview of the delivered demonstration applications.

6.1 DIG-528-2 Demonstration Applications

The demonstration applications for the DIG-528-2 PCB use version 1.03 of the MAC and PHY layer. There is no network layer in the demonstration applications. All demonstration applications use the Embedded Bootloader for simplified firmware updates. For more information on the Embedded Bootloader, refer the Embedded Bootloader User's Guide, document number MC13192FLUG/D.

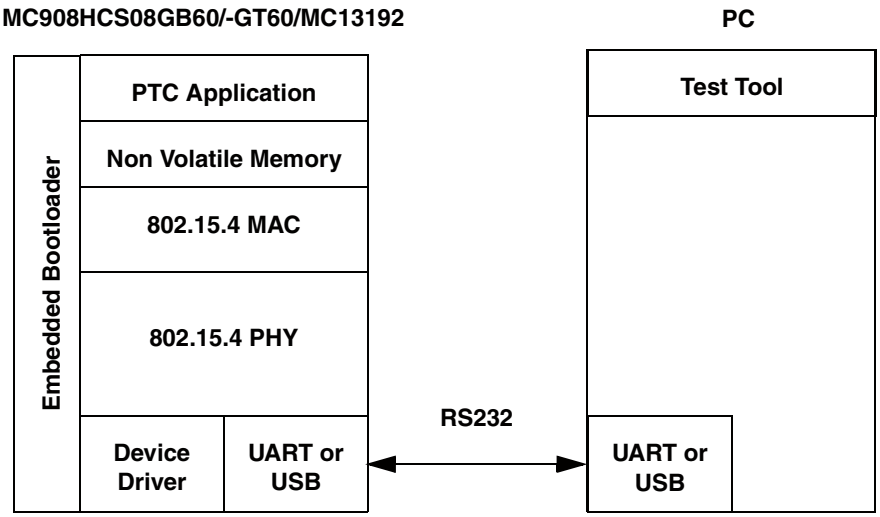

Figure 3. DIG-528-2 PTC Application Layers

6.1.1 PTC Demonstration Application:

The PTC is a user interactive application. Users can send commands from the Personal Computer (PC) to the PTC demonstration application to perform different actions. For example, read/write memory and RF and send/receive data from/to the connected PC. To use the PCB application, two PCBs are required.

Refer to Zigbee.hlp (see Test Tool installation directory.\help) and the PTC Demonstration Application Note, AN2771/D for more details.

6.1.2 Switch Demonstration Application

The Switch Demonstration application highlights several required features a true 802.15.4 application. It is built on version 1.03 of the MAC and PHY layer. This application requires two PCBs with the Switch Demonstration application already loaded. All the source code for this application is located on the CD.

Reference to the Switch Demonstration Application Note, AN2773 for more details.

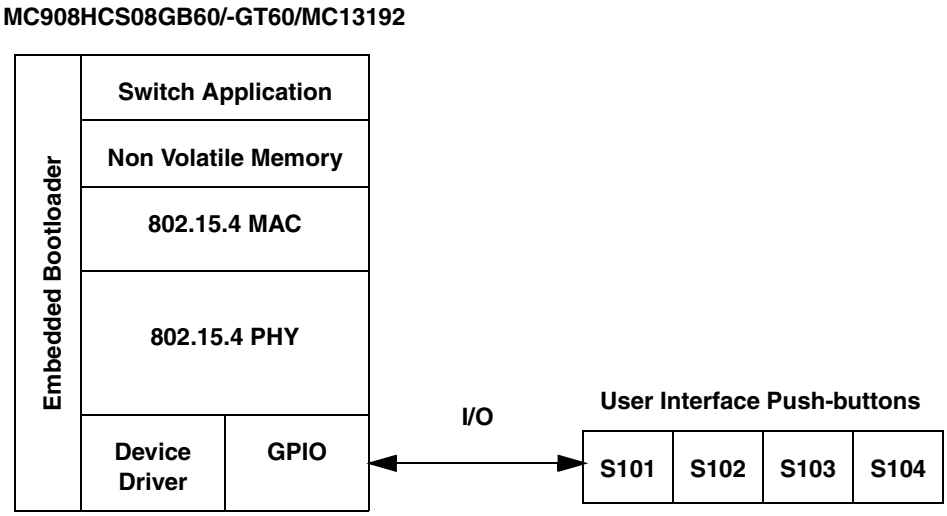

Figure 4. DIG-528-2 Switch Application Layers

6.2 DIG-536-2 Demonstration Applications

The demonstrating applications that run on the DIG-536-2 PCB use version 1.00 of the Simple Media Access Controller (SMAC). Refer to the SMAC Reference Manual, SMCRM/D for more details. The SMAC is a smaller and less complex implementation of the 802.15.04 MAC/PHY layer. There is no network layer in this application. All applications use the Freescale Embedded Bootloader for simplified firmware updates.

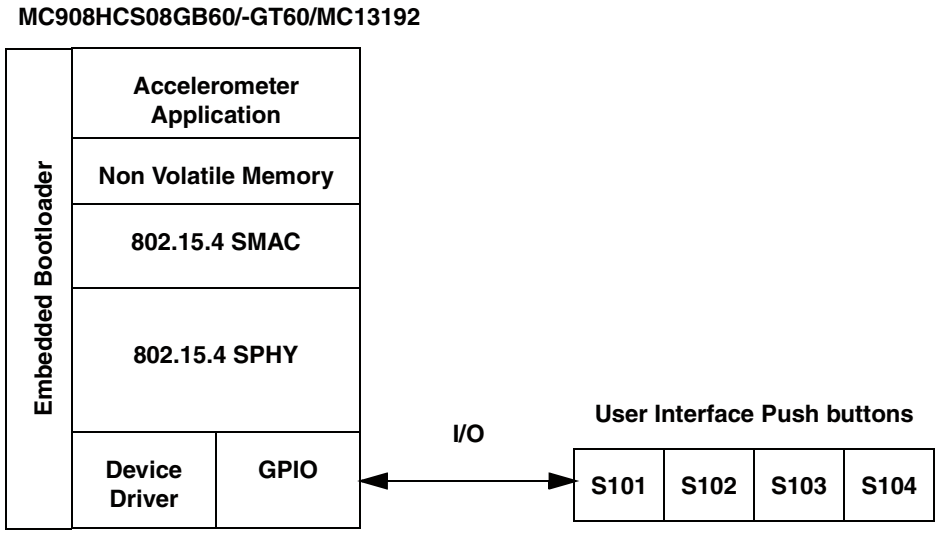

Figure 5. DIG-528-2 Accelerometer Application Layers

6.2.1 Accelerometer Demonstration Application

The Accelerometer demonstration application requires two DIG-536-2 boards with the Accelerometer Demonstration application already loaded. Perform the following steps.

1. Insert the MC13192 Resource CD into your CD-ROM drive. If auto install is disabled on your personal computer (PC), run the `home.htm` file from the root on the CD.
2. Select the serial connection and power-up the receiver SARD board.
3. Connect the first SARD board, which will be the receiver, to the PC serial port using a DB9 male/female serial cable included in the development kit. Verify that no jumpers are installed on this board.
4. Connect a 9V battery or a 5.5-9V power supply to the power supply connector and set switch S105 to the “ON” position. This board is now in receive mode.
5. The second board, which will be the transmitter, must have three jumpers installed to ensure proper operation. Verify that jumpers are placed on pins 1 & 2 (PTB0), pins 3 & 4 (PTB1), and pins 11 & 12 (PTB7).
6. Connect a 9V battery or a 5.5-9V supply to the power supply connector and power on the board by setting switch S105 to the “ON” position.
7. Hold any one of the switches (S101, S102, S103, or S104) down while at the same time holding down switch S106. First release S106, then release the other switch.

8. If led D104 is blinking repeatedly then the board is in Transmit mode. If led D104 is not blinking, then set switch S106 again. If the LED is still not blinking, repeat the previous step.
9. Verify that both boards are communicating correctly by checking the receiver board to verify if led D103 is blinking repeatedly. If led D103 is not blinking, then press switch S106 turn. If the boards are still unable to communicate, replace the batteries and perform Step 2 and Step 3 again.

Refer to the Accelerometer Quick Start Guide Application Note, AN2762 for more details.

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