

How to Use Wireless Sensing Triple Axis ZSTAR from Freescale

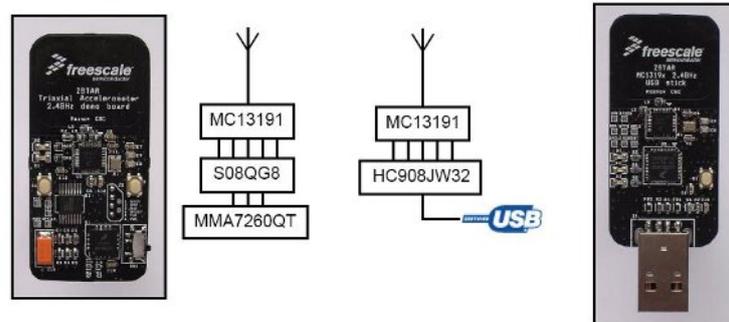
By *Emanuele*

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The **ZSTAR demo board** was designed to demonstrate Freescale's latest innovations in wireless connectivity, sensors and embedded flash microcontrollers.

If you want to know more about this **Freescale** product, please submit your request to **Arrow Italy** using [this form](#) ^[1] (this form is valid ONLY for Companies or Customers based in Italy and working in the Italian area)

The [Wireless Sensing Triple Axis Reference Design \(ZSTAR\)](#) ^[2] is a wireless successor of the popular STAR board. It is an improved demonstration tool that is designed to allow visualization of key accelerometer applications in the consumer industry as well as the low-cost 2.4 GHz wireless solution based on the MC13191 transceiver. The ZSTAR is a two-board design where a MMA7260QT ([datasheet](#) ^[3]) triple axis accelerometer is controlled by an 8-bit MCU MC9S08QG8 and connected via a wireless link to a computer. The USB stick connects via the computer's USB slot. For the USB communication, a Full-Speed USB 2.0 8-bit microcontroller MCHC908JW32 is employed.



ZSTAR demo board Featured Products

Triple Axis Accelerometer MMA7260QT

The ZSTAR board is a demonstration tool for the MMA7260QT, a 3-Axis Low-g accelerometer. The MMA7260QT has many unique features that make it an ideal solution for many consumer applications such as freefall protection for laptops and MP3 players, tilt detection for e-compass compensation and cell phone scrolling, motion detection for handheld games and game controllers, position sensing for g-mice, shock detection for warranty monitors, and vibration for out of balance detection.

Microcontroller MC9S08QG8

The MC9S08QG8 ([datasheet](#) ^[4]) is a highly integrated member of Freescale's 8-bit family of microcontrollers based on the high-performance, low-power consumption HCS08 core. Integrating features

normally found in larger, more expensive components, the MC9S08QG8 MCU includes a background debugging system and on-chip in-circuit emulation (ICE) with real-time bus capture, providing single-wire debugging and emulation interface. It also features a programmable 16-bit timer/pulse-width modulation (PWM) module (TPM) that is one of the most flexible and cost-effective of its kind.

MC13191 2.4 GHz ISM Band Low Power Transceiver

The MC13191 ([datasheet](#) [5]) is a short range, low power, 2.4 GHz Industrial, Scientific, and Medical (ISM) band transceiver. The MC13191 contains a complete packet data modem which is compliant with the IEEE® 802.15.4 Standard PHY (Physical) layer. This allows the development of proprietary point-to-point and star networks based on the 802.15.4 packet structure and modulation format. For full 802.15.4 compliance, the MC13192 and Freescale's 802.15.4 MAC software are required.

MC13192/MC13193 2.4 GHz Low Power Transceiver for the IEEE 802.15.4 Standard

The MC13192 ([datasheet](#) [6]) and MC13193 are short range, low power, 2.4 GHz Industrial, Scientific, and Medical (ISM) band transceivers. The MC13192/MC13193 contains a complete 802.15.4 physical layer (PHY) modem designed for the IEEE® 802.15.4 wireless standard which supports peer-to-peer, star, and mesh networking. The MC13192 includes the 802.15.4 PHY/MAC for use with the HCS08 Family of MCUs. The MC13193 also includes the 802.15.4 PHY/MAC plus the ZigBee? Protocol Stack for use with the HCS08 Family of MCUs. With the exception of the addition of the ZigBee? Protocol Stack, the MC13193 functionality is the same as the MC13192.

Microcontroller MCHC908JW32

The MCHC908JW32 is a member of the low-cost, high-performance M68HC08 Family of 8-bit microcontroller units (MCUs). All MCUs in the family use the enhanced M68HC08 central processor unit (CPU08) and are available with a variety of modules, memory sizes and types, and package types.

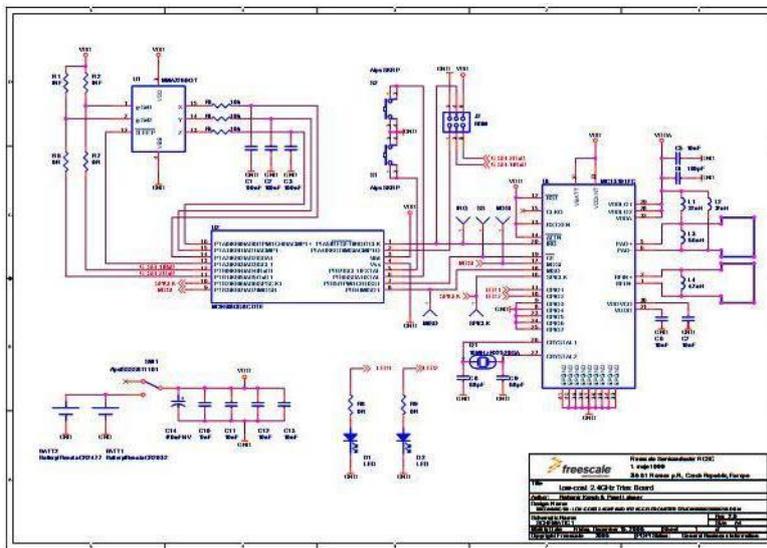
ZSTAR Reference Boards

The goal of the ZSTAR design was to provide a small portable board with the capability to demonstrate and evaluate various accelerometer applications that accommodate the low-cost low-power wireless connection. One of the considerations for design was to use a small and versatile tool (board size is 56 mm x 27 mm or 2.20" x 1.10"). The Sensor board includes two PCB 2.4 GHz antennas, CR2032 Lithium battery holder and the two pushbuttons. The USB stick board has the same two PCB 2.4 GHz antennas, one pushbutton and a USB type ?A? plug.

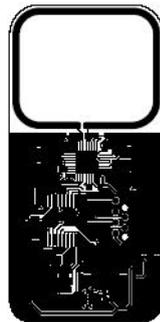
Software

This reference design contains two pieces of software. The first one is on the Sensor board MCU (MC9S08QG8). Its job is to collect sensor data from the MMA7260QT accelerometer, create a data packet and send it over the SMAC (Simple Media Access Controller) driver using the MC13191 RF Transceiver. The sensor data is measured over three channels of the Analog-to-Digital converter, while another GPIO pin controls the sleep mode of the MMA7260QT accelerometer to conserve power. Serial Peripheral Interface (SPI) is used for communication with the MC13191. The overall application is powered from the coin-sized CR2032 Lithium battery that is located on the bottom side of the board. The overall average current consumption is below 1 mA with 20 data transmissions per second rate. This allows approximately 10 days of continuous operation at this real-time data rate. The simple ZSTAR RF protocol also transfers the calibration data. These data are stored in non-volatile Flash memory and are transferred on request.

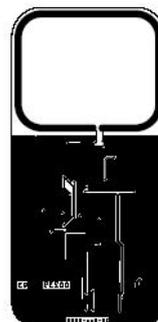
ZSTAR Boards Schematics and PCBs



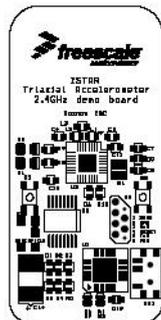
ZSTAR Sensor Board Schematics



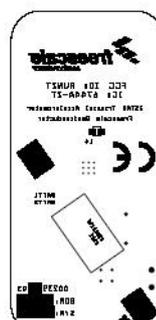
Top Layer of the Sensor Board



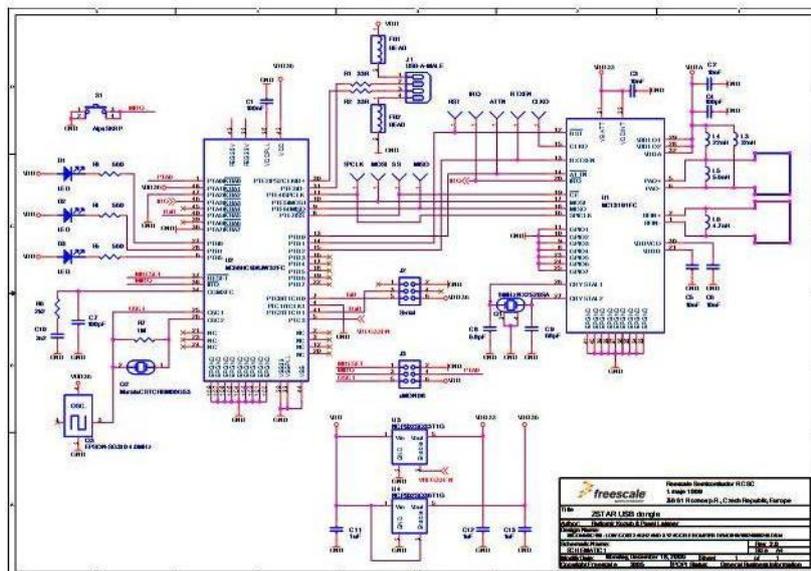
Bottom Layer of the Sensor Board



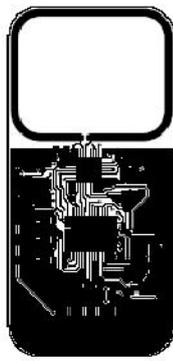
Top Component Placement of the Sensor Board



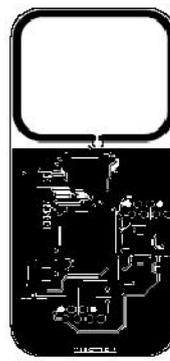
Bottom Component Placement of the Sensor Board



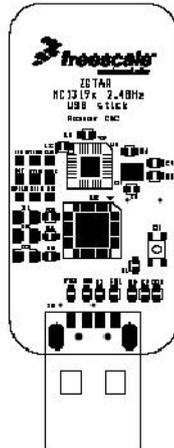
ZSTAR USB Stick Board Schematics



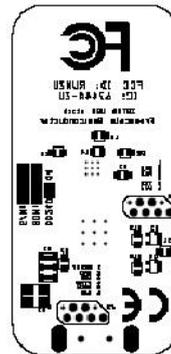
Top Layer of the USB Stick Board



Bottom Layer of the USB Stick Board



Top Component Placement of the USB Stick Board



Bottom Component Placement of the USB Stick Board

Read the Italian version: [Come usare il Wireless Sensing Triple Axis ZSTAR della Freescale](#) [7]

Documentation: [Using the Wireless Sensing Triple Axis Reference Design](#) [8] - here you'll find also the high resolution schematics.

CONTACT REQUEST

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[HowTo sensing triple axis wireless sensing zstar](#)

Trademarks

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Links:

- [1] <http://it.emcelettronica.com/contact/freescale>
- [2] http://www.freescale.com/webapp/sps/site/prod_summary.jsp?code=RD3152MMA7260Q
- [3] <http://datasheet.emcelettronica.com/freescale/MMA7260QT>
- [4] <http://datasheet.emcelettronica.com/freescale/MC9S08QG8>
- [5] <http://datasheet.emcelettronica.com/freescale/MC13191>
- [6] <http://datasheet.emcelettronica.com/freescale/MC13192>
- [7] <http://it.emcelettronica.com/come-usare-il-wireless-sensing-triple-axis-zstar-della-freescale>

[8] [http://www.freescale.com/files/sensors/doc/app_note/AN3152.pdf?fsp=1&WT_TYPE=Application Notes&WT_VENDOR=FREESCALE&WT_FILE_FORMAT=pdf&WT_ASSET=Documentation](http://www.freescale.com/files/sensors/doc/app_note/AN3152.pdf?fsp=1&WT_TYPE=Application%20Notes&WT_VENDOR=FREESCALE&WT_FILE_FORMAT=pdf&WT_ASSET=Documentation)