Introduction to Wiced Sense

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Contents

1 What is Wiced Sense?

Figure 1: Wiced Sense Tag

- WICED Sense is a BLE device manufactured by Broadcom* which can provide wireless connectivity to wide range of embedded applications.

- The WICED Sense TAG is made up of the BCM20737S Bluetooth Low Energy SoC and five ST Microelectronics sensors: gyroscope, accelerometer, magnetometer , pressure, humidity and temperature. The BCM20737S connects directly to the sensors without the need for an external microprocessor.(* 5 July,2016 onwards Broadcoms IoT business is acquired by Cypress.)

- ST Microelectronics Devices used in the WICED Smart Kit:

    - Gyroscope (L3GD20)
    - Accelerometer (LIS3DSH)
    - Magnetometer (LSM303D)
    - Pressure sensor (LPS25H)
    - Humidity and Temperature sensor (HTS221)

2   Description about BCM20737

Figure 2: BCM20737 chip

- The BCM20737 is a an advanced Bluetooth low energy (aka Bluetooth Smart) SoC(System On Chip) that supports wireless charging, includes advanced security features and introduces new software support for NFC (Near Field Communiction) pairing.

- The BCM20737 is designed to support the entire spectrum of Bluetooth Smart use cases for the medical, home automation, accessory, sensor, Internet Of Things, and wearable market segments. The BCM20737 radio has been designed to provide low power, low cost, and robust communications for applications operating in the globally available 2.4 GHz unlicensed Industrial, Scientific, and Medical (ISM) band.

- The single-chip Bluetooth low energy SoC is a monolithic component implemented in a standard digital CMOS process and requires minimal external components to make a fully compliant Bluetooth device. The BCM20737 is available in a 32-pin, 5 mm x 5 mm 32-QFN package as well as WLBGA SIP and die packages.

- Microprocessor Unit

  - The BCM20737 microprocessor unit (MPU) executes software from the link control (LC) layer up to the application layer components. The microprocessor is based on an ARM Cortex M3, 32-bit RISC processor with embedded ICE-RT debug and JTAG interface units. The MPU has 320 KB of ROM for program storage and boot-up, 60 KB of RAM for scratch-pad data, and patch RAM code. The SoC has a total storage of 380 KB, including RAM and ROM.

- Applications

  The following profiles are supported in ROM :

  - Battery status
  - Blood pressure monitor
  - Find me
  - Heart rate monitor
  - Proximity
  - Thermometer
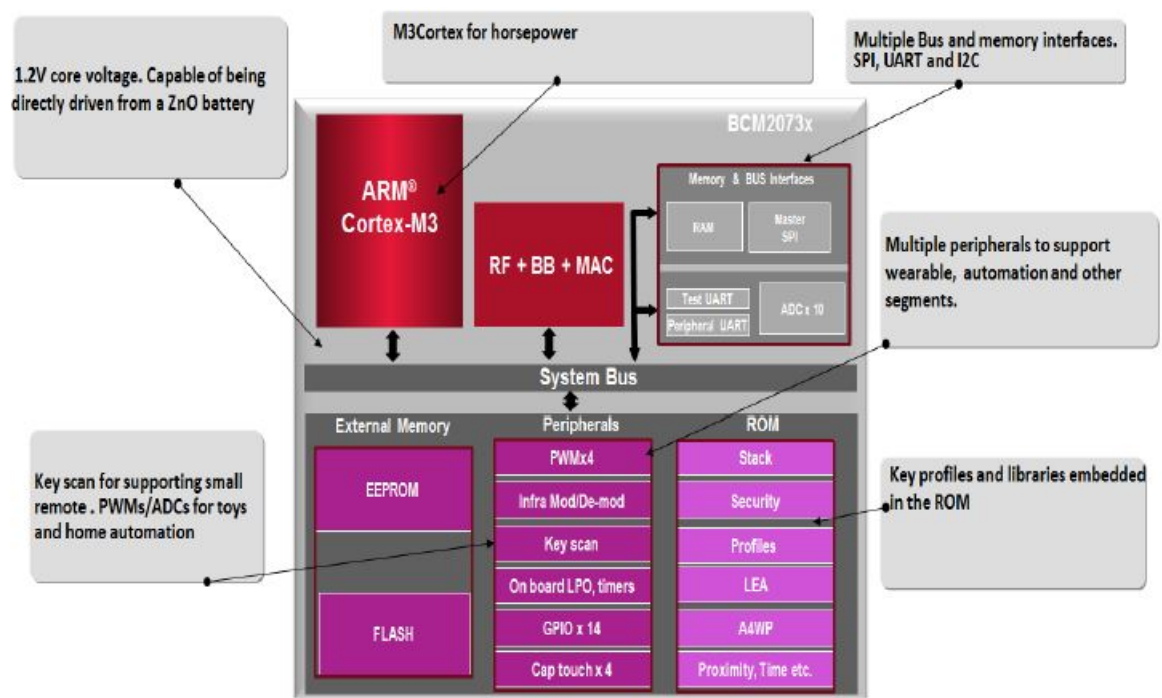 - Weight scale
  - Time

3

- BCM20737 Architecture

Figure 3: BCM20737 Architecture
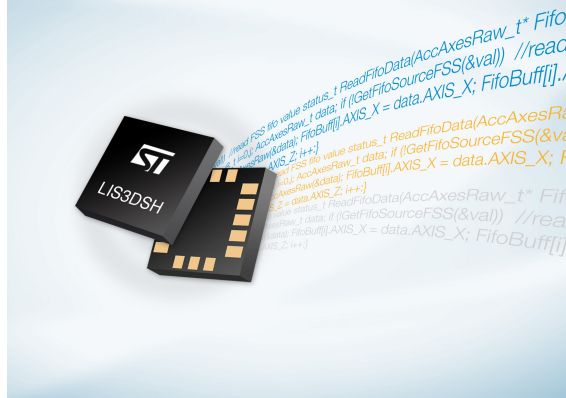
3 Sensor 1 : Accelerometer(LIS3DSH)

Figure 4: STMicroelectronics LIS3DSH

- An accelerometer is a dynamic sensor capable of a vast range of sensing. Accelerometers measure acceleration in one, two, or three orthogonal axes.

- The LIS3DSH is an ultra low-power high performance three-axis linear accelerometer belonging to the nano family with embedded state machine that can be programmed to implement autonomous applications.

- The LIS3DSH has dynamically selectable full scales of 2g/4g/6g/8g/16g ('g' represents gravitational force) and it is capable of measuring accelerations with output data rates from 3.125 Hz to 1.6 kHz.

- The self-test capability allows the user to check the functioning of the sensor in the final application.

- The device can be configured to generate interrupt signals activated by user defined motion patterns.

- The LIS3DSH has an integrated first in, first out (FIFO) buffer allowing the user to store data for host processor intervention reduction.

- The LIS3DSH is available in a small thin plastic land grid array package (LGA) and it is guaranteed to operate over an extended temperature range from -40 degree Celsius to +85 degree Celsius.

- Its applications are :

    - Motion controlled user interface
    - Gaming and virtual reality
    - Pedometer
    - Intelligent power saving for handheld devices
    - Display orientation
    - Click/double click recognition
    - Impact recognition and logging
    - Vibration monitoring and compensation
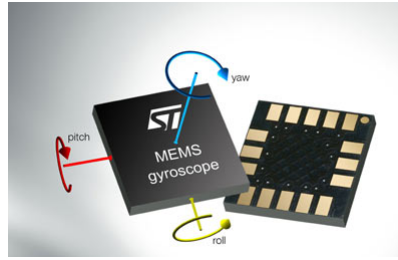
4   Sensor 2 : Gyroscope (L3GD20)

Figure 5: STMicroelectronics L3GD20

- A gyroscope is a device used primarily for navigation and measurement of angular velocity.

- The L3GD20 is a low-power three-axis angular rate sensor.

- It includes a sensing element and an IC interface capable of providing the measured angular rate to the external world through a digital interface (I2C/SPI).

- The sensing element is manufactured using a dedicated micro-machining process developed by STMicroelectronics to produce inertial sensors and actuators on silicon wafers.

- The L3GD20 has a full scale of 250/500/2000 dps (degree per second) and is capable of measuring rates with a user-selectable bandwidth.

- The L3GD20 is available in a plastic land grid array (LGA) package and can operate within a temperature range of -40 degree Celsius to +85 degree Celsius.

- Features

  - Three selectable full scales (250/500/2000 dps)
  - I2C/SPI digital output interface
  - 16 bit-rate value data output
  - 8-bit temperature data output
  - Two digital output lines (interrupt and data ready)
  - Integrated low- and high-pass filters with user selectable bandwidth
  - Wide supply voltage: 2.4 V to 3.6 V
  - Low voltage-compatible IOs (1.8 V)
  - Embedded power-down and sleep mode
  - Embedded temperature sensor
  - Embedded FIFO
  - High shock survivability

- Applications

  - Gaming and virtual reality input devices
  - Motion control with MMI (man-machine interface)
  - GPS navigation systems
  - Appliances and robotics

5 Sensor 3 : Magnetometer (LSM303D)

Figure 6: STMicroelectronics LSM303D

- The magnetometer sensor the modern solid state technology to create a miniature Hall-effect sensor that detects the Earth's magnetic field along three perpendicular axes X, Y and Z. The Hall-effect sensor produces voltage which is proportional to the strength and polarity of the magnetic field along the axis sensor is directed. The sensed voltage is converted to digital signal representing the magnetic field intensity.

- The LSM303D is a system-in-package featuring a 3D digital linear acceleration sensor and a 3D digital magnetic sensor.

- The LSM303D has linear acceleration full scales of 2g / 4g / 6g / 8g / 16g and a magnetic field full scale of 2 / 4 / 8 / 12 gauss.

- The LSM303D includes an I2C serial bus interface that supports standard and fast mode (100 kHz and 400 kHz) and SPI serial standard interface.

- The system can be configured to generate an interrupt signal for free-fall, motion detection and magnetic field detection. Thresholds and timing of interrupt generators are programmable by the end user.

- Magnetic and accelerometer blocks can be enabled or put into power-down mode separately.

- The LSM303D is available in a plastic land grid array package (LGA) and is guaranteed to operate over an extended temperature range from -40 degree Celsius to +85 degree Celsius.

- Applications

    - Tilt-compensated compasses
    - Map rotation
    - Position detection
    - Pedometers
    - Display orientation
    - Gaming and virtual reality input devices
    - Impact recognition and logging
    - Vibration monitoring and compensation

6 Sensor 4 : Pressure Sensor (LPS25H)

Figure 7: STMicroelectronics LPS25H

- This sensor measures the pressure relative to atmospheric pressure.

- The LPS25H is an ultra compact absolute piezoresistive pressure sensor. It includes a monolithic sensing element and an IC interface able to take the information from the sensing element and to provide a digital signal to the external world.

- The sensing element consists of a suspended membrane realized inside a single mono-silicon substrate. It is capable to detect the absolute pressure and is manufactured with a dedicated process developed by ST.

- The membrane is very small compared to the traditionally built silicon microma-chined membranes.Membrane breakage is prevented by an intrinsic mechanical stop-per.

- The IC interface is manufactured using a standard CMOS process that allows a high level of integration to design a dedicated circuit which is trimmed to better match the sensing element characteristics.

- The LPS25H is available in a cavity holed LGA package (HCLGA). It is guaranteed to operate over a temperature range extending from -30 degree Celsius to +105 degree Celsius. The package is holed to allow external pressure to reach the sensing element.

- Applications

    - Altimeter and barometer for portable devices
    - GPS applications
    - Weather Station Equipment
    - Sport Watches

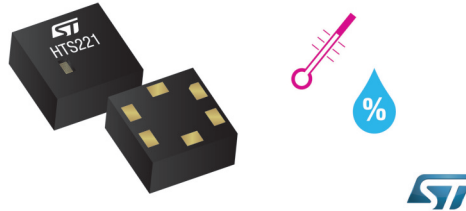# 7 Sensor 5 : Humidity and Temperature Sensor (HTS221)

Figure 8: STMicroelectronics HTS221

- A temperature sensor is a device, typically, a thermocouple or RTD, that provides for temperature measurement through an electrical signal.

- A humidity sensor (or hygrometer) senses, measures and reports the relative humidity in the air. It therefore measures both moisture and air temperature.

- The HTS221 is an ultra compact sensor for relative humidity and temperature. It includes a sensing element and a mixed signal ASIC (Application-specific integrated circuit) to provide the measurement information through digital serial interfaces.

- The sensing element consists of a polymer dielectric planar capacitor structure capable of detecting relative humidity variations and is manufactured using a dedicated ST process.

- The HTS221 is available in a small top-holed cap land grid array (HLGA) package guaranteed to operate over a temperature range from -40 degree Celsius to +120 degree Celsius.

- Applications

    - Air conditioning, heating and ventilation
    - Air humidifier
    - Refrigerators
    - Wearable devices
    - Smart home automation
    - Industrial automation

8   References

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