# SimpleLink™ Wi-Fi® SensorTag

The SimpleLink™ Wi-Fi® SensorTag from Texas Instruments™ (model CC3200SensorTag) provides a demo platform for showcasing the capabilities of the CC3200 device. With this easy-to-use platform, environmental sensing and other Internet of Things (IoT) applications can be done with ease.

The CC3200 device is part of the SimpleLink microcontroller (MCU) platform which consists of Wi-Fi®, *Bluetooth*® low energy, Sub-1 GHz and host MCUs. All share a common, easy-to-use development environment with a single core software development kit (SDK) and rich tool set. A one-time integration of the SimpleLink platform lets you add any combination of devices from the portfolio into your design. The ultimate goal of the SimpleLink platform is to achieve 100 percent code reuse when your design requirements change. For more information, visit www.ti.com/simplelink.

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## Trademarks

# 1 Introduction

## 1.1 CC3200 SensorTag

The high-performance CC3200 device is the industry's first single-chip microcontroller (MCU) with built-in Wi-Fi connectivity for easy system application. Created for the Internet of Things (IoT), the SimpleLink™ Wi-Fi CC3200 device is a wireless MCU that integrates a high-performance ARM® Cortex®-M4 MCU that allows customers to develop an entire application with a single device. With on-chip Wi-Fi, internet, and robust security protocols, no prior Wi-Fi experience is needed for fast development.

The CC3200 SensorTag is a low-cost IoT demo platform for ARM® Cortex®-M4F-based microcontrollers. The SensorTag design highlights the CC3200 Internet-on-a chip™ solution and Wi-Fi capabilities. The CC3200 SensorTag features programmable user buttons, LEDs, reed relay, digital microphone, and a buzzer for user interaction. Onboard sensors, gyroscope, accelerometer, and compass allow for easy environmental sensing and IoT applications. shows the CC3200 SensorTag.

## 1.2 Key Features

The key features of the CC3200 SimpleLink Wi-Fi and IoT SensorTag are as follows:

- CC3200, SimpleLink Wi-Fi, Internet-on-a chip solution with integrated MCU
- Onboard inverted-F antenna with RF connector for conducted testing
- Two buttons, two LEDs, reed relay, digital microphone, and a buzzer for user interaction
- Sensors, gyroscope, accelerometer, and compass for easy integration in IoT application
- Debug and JTAG interface for flash programing

# 2 Hardware Description

## 2.1 Block Diagram

Figure 1 shows a block diagram of the CC3200 SensorTag.

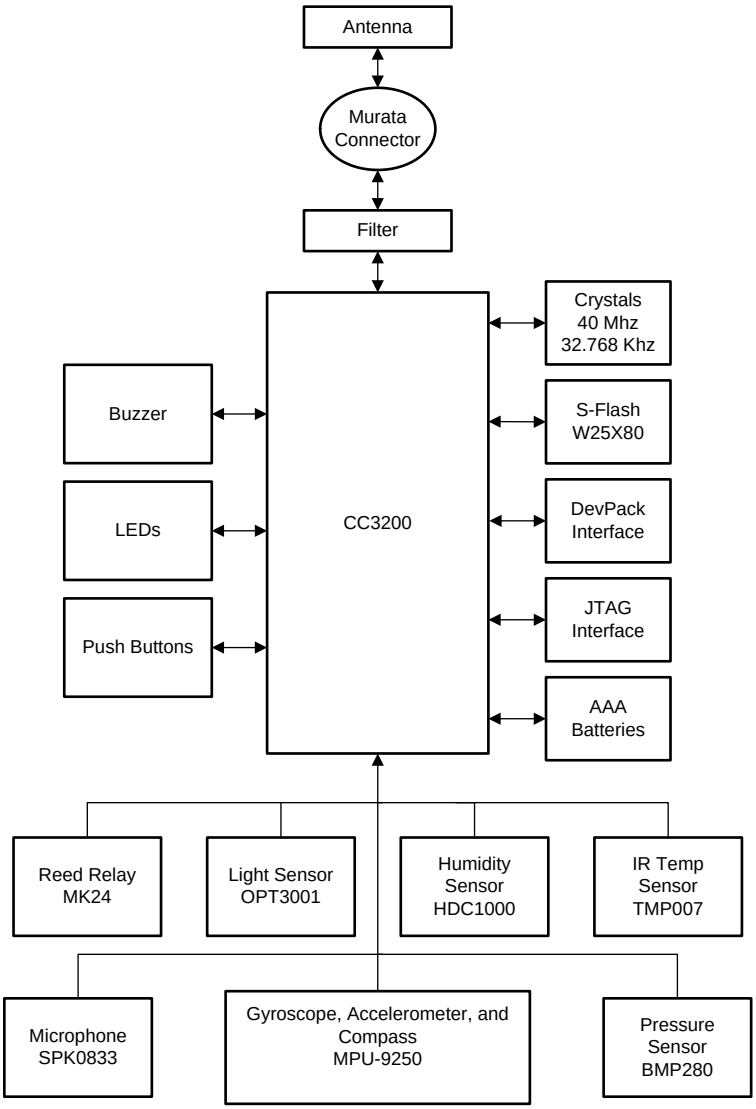




**Figure 1. CC3200 SensorTag Block Diagram**

## 2.2 Hardware Features

The hardware features of the CC3200 SensorTag are as follows:

- CC3200, SimpleLink Wi-Fi, internet-on-a chip solution with integrated MCU
- 20-pin DevPack SKIN connector and 10-pin JTAG connector
- Onboard inverted-F antenna with RF connector for conducted testing
- Two buttons, two LEDs, a reed relay, a digital microphone, and a buzzer for user interaction
- Gyroscope, accelerometer, and compass for easy integration in IoT application
- Debug and JTAG interface for flash programing
- AAA battery connector interface
- Infrared Thermopile Sensor, Pressure Sensor, Humidity Sensor, and Light Sensor
- Onboard 1-MB serial flash memory

## 2.3 RF Function and Frequency Range

The CC3200 SensorTag device is designed to operate in the WLAN 2.4-GHz band. The CC3200 SensorTag device also supports Channels 1 through 11 (2142 MHz to 2462 MHz). The SensorTag design uses the SimpleLink Wi-Fi CC3200 Internet-on-a chip device (see *CC3200 SimpleLink™ Wi-Fi® and IoT SensorTag Design Files*).

**NOTE:** The maximum RF power transmitted in each WLAN 2.4-GHz band is 16.5 dBm (EIRP power).

## 2.4 Sensors and Peripherals

### 2.4.1 Reed Relay

The MK24-A reed relay is good for low-power operations (see [1]). The reed relay is suitable for IoT applications with a contact resistance of 350 MΩ, a maximum operating time of 0.25 ms, and a release time of 0.15 ms.

### 2.4.2 Digital Microphone

The SPH0641LU4H device is suitable for a varying range of applications; it provides a means for sensing sounds (see [2]). The SPH0641LU4H is a low-power microphone with high performance and good RF immunity. The microphone can be operated in the five modes that follow:

- Powered down mode, VDO = 0 V
- Sleep mode, VDO ranges from 3.6 V to 1.62 V
  $f_{CLOCK} \leq 250$ kHz
- Low-power mode, VDO ranges from 3.6 V to 1.62 V
  351 kHz ≤ $f_{CLOCK}$ ≤ 815 kHz
- Ultrasonic mode, VDO ranges from 3.6 V to 1.62 V
  3.072 MHz ≤ $f_{CLOCK}$ ≤ 4.8 MHz
- Standard performance mode, VDO ranges from 3.6 V to 1.62 V
  1.024 MHz ≤ $f_{CLOCK}$ ≤ 2.475 MHz

### 2.4.3 Buzzer

The HCS0503B device can be used as an alarm (see [3]). Some of the specifications follow:

- Rated voltage of 3 V
- Output S.P.L ≥ 80 dB
- Coil resistance of 12 Ω ±3

- Rated frequency of 4000 Hz

### 2.4.4 Gyroscope, Accelerometer, and Compass

The MPU-9250 device is a multichip module consisting of a 3-axis gyroscope, a 3-axis accelerometer, and a 3-axis magnetometer for position tracking (see [4]). The MPU-9250 features three 16-bit ADCs each for the gyroscope, accelerometer, and magnetometer. Some other features of the MPU-9250 are as follows:

- High-precision clock
- Precision tracking of fast and slow motions
- VDD operating range of 2.4 V to 3.6 V
- I2C and SPI serial communication interface

### 2.4.5 Infrared Thermopile Sensor

The TMP007 device is a fully-integrated microelectromechanical system (MEMS) thermopile sensor that measures the temperature of an object without direct contact (see [5]). The thermopile absorbs passive infrared energy from an object at wavelengths of 4 µm to 16 µm within the end-user defined field of view. Some other features are as follows:

- 14-bit local temperature sensor for cold junction reference
- Two-wire serial interface options
- Low power

### 2.4.6 Pressure Sensor

The BMP280 device is a digital pressure sensor for measuring barometric pressure conditions (see [6]). The BMP280 can also be used to determine altitude. Some other features of the sensor include the following:

- Wide pressure range of 300 hPa to 1100 hPa
- High accuracy
- Low current consumption of 2.7 µA @ 1 Hz sampling rate
- I2C and SPI serial communication interface

### 2.4.7 Humidity Sensor

The HDC1000 device is a digital humidity sensor with a relative humidity (RH) operating range of 0% to 100% that provides excellent measurement accuracy at very low power (see [7]). Some other features are:

- Relative humidity accuracy ±3%
- 14-bit measurement resolution
- Supply voltage range of 3 V to 5 V

### 2.4.8 Light Sensor

The OPT3001 device is a sensor that measures the intensity of visible light (see [8]). The device can sense a light spectrum similar to that of the human eye. Some other features follow:

- Measurements: 0.01 lux to 83k lux
- Wide power-supply range: 1.6 V to 3.6 V
- Low operating current: 1.8 µA
- Flexible interrupt system

# 3 Design Files

## 3.1 Hardware

All design files include schematics, layout, bill of materials (BOM), Gerber files, and documentation. All documentation materials are available for download from SimpleLink Wi-Fi CC3200 LaunchPad Reference Design.

# 4 PCB Revision

| PCB Revision | Description |
|---|---|
| Rev 1.2 | Baseline |

## 5 References


1. *MK24 Series Reed Sensor*
2. Knowles SPH0641LU4H Digital Microphone
3. *HCS0503B Buzzer*
4. *MPU-9250 Nine-Axis (Gyro + Accelerometer + Compass) MEMS MotionTracking™ Device*
5. *TMP007 Infrared Thermopile Sensor with Integrated Math Engine Data Sheet*
6. *BMP280 Barometric Pressure Sensor*
7. *HDC1000 Low Power, High Accuracy Digital Humidity Sensor with Temperature Sensor Data Sheet*
8. *OPT3001 Ambient Light Sensor (ALS) Data Sheet*
9. Watch DevPack
10. SimpleLink Wi-Fi CC3200 LaunchPad Reference Design
11. *CC3200 SimpleLink™ Wi-Fi® and IoT SensorTag Design Files*


## Revision History

| Date | Revision | Notes |
|---|---|---|
| February 2017 | SWRU514* | Initial release |

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