# Socionext RF CMOS Sensors

Product Brief

socionext

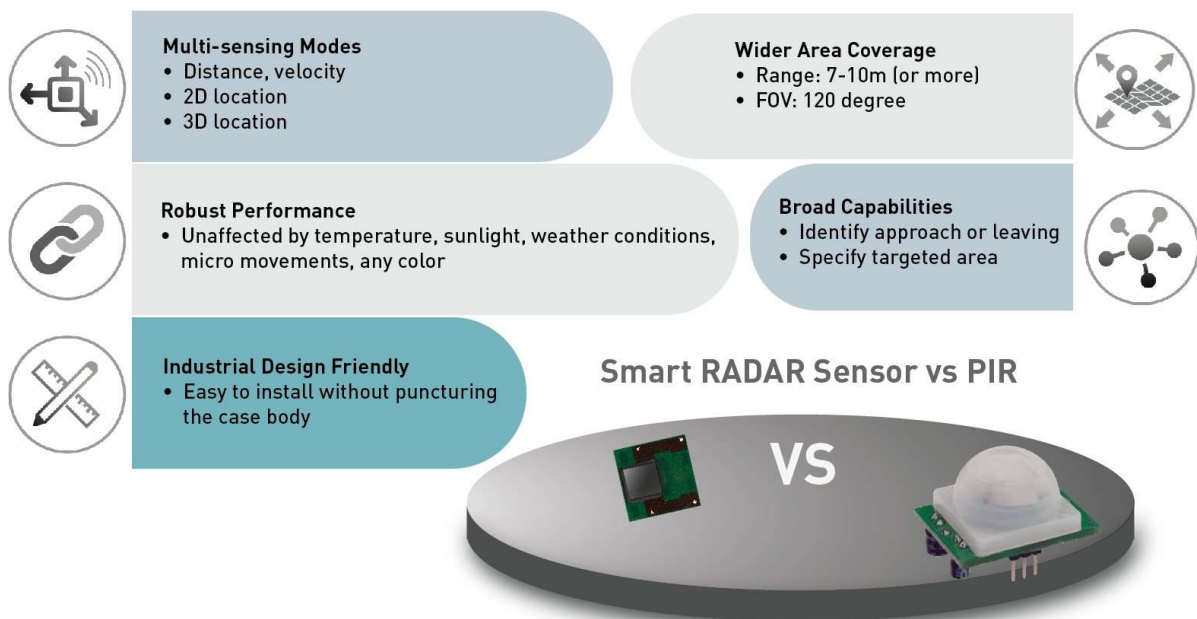How Smart Sensors Are Reshaping Our Lives

Sensors are embedded in consumer and industrial electronics commonly found in homes and workplaces. They are ubiquitous and central to applications used for monitoring, process control and human safety.

A smart sensor, unlike traditional sensors, gathers input from a physical environment such as light, temperature, motion and pressure. Then it uses its built-in compute resources to perform predefined functions upon detection of specific input and processes the data before passing it on. The information generated can also be shared with other connected devices and management systems.
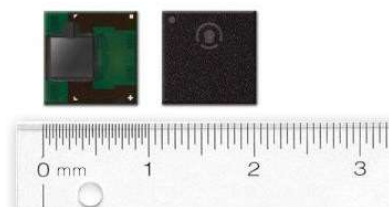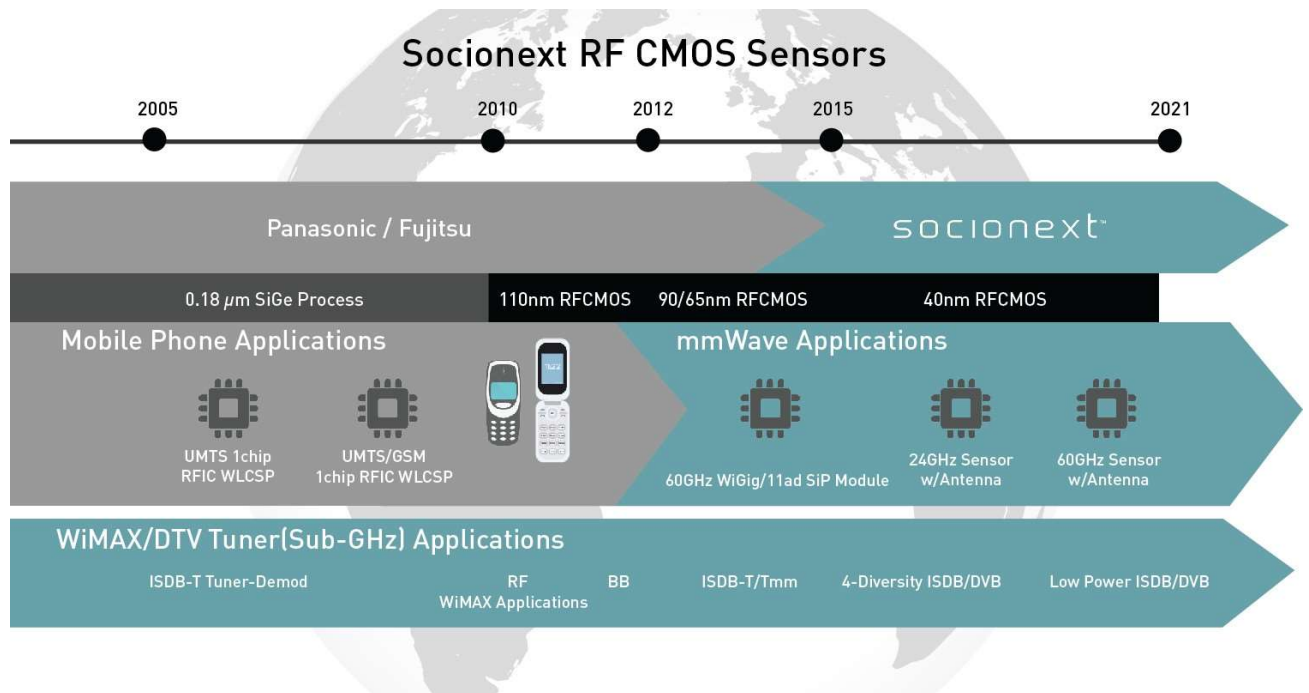
The Use of RADAR Sensors

Electromagnetic wave sensing, otherwise known as RADAR, uses Continuous Wave (CW), Frequency Modulated Continuous Wave (FMCW), Frequency Shift Keying Continuous Wave (FSKCW), and pulse radar by transforming microwave echo signals into electrical signals to detect moving or stationary targets. RADAR has progressed to a stage of micro miniaturization, enabling its use in a new generation of applications.

RADAR sensors provide a wider range of features and abilities than other kinds. Some of these capabilities include multi-sensing modes, wider area coverage, robust performance, and suitable for industrial product design.



**Multi-sensing Modes**
- Distance, velocity
- 2D location
- 3D location

**Wider Area Coverage**
- Range: 7-10m (or more)
- FOV: 120 degree

**Robust Performance**
- Unaffected by temperature, sunlight, weather conditions, micro movements, any color

**Broad Capabilities**
- Identify approach or leaving
- Specify targeted area

**Industrial Design Friendly**
- Easy to install without puncturing the case body

**Smart RADAR Sensor vs PIR**

VS

Transforming the Future of IoT with RADAR Sensing Technology

Since 2012, Socionext has been designing RF CMOS sensors. The company has expanded its product offerings with recent developments featuring 24GHz and 60GHz sensors.



The Socionext radio sensing chip employs a highly integrated mmWave front-end architecture and incorporates integrated packaged antennas, which reduce the physical product to a compact packaged device. Sizes range from 7 x 7 x 0.89mm to 9 x 9 x 1mm.

Along with compactness, certain sensor lines offer very low power consumption profiles (0.5 mW avg), which prolongs the application usage time, making them ideal for battery-operated devices and systems.

Example of a 60GHz sensor

The Socionext RADAR sensors are equipped with multiple antennas built inside a compact package, helping reduce BOM cost and shortening typical design cycles.

There are some issues, such as Interference of nearby antennas, that may hamper data transmission, reducing throughput and causing delays and performance degradation. Therefore, it is necessary when designing RF sensors to recognize and remove interference pulses.

Built-in design of multiple antennas requires very diverse and specialized engineering expertise for mitigating interferences between antennas and the negative effects of package resin.

Incorporating multiple antennas in a single chip can be beneficial for obtaining better azimuth resolution in a small form factor. This can also help to relieve the complicated design challenges for customers.

In addition to IC and package miniaturization, Socionext incorporates on-chip signal processing capabilities which eliminate the need to stream data off-chip to a separate MCU. The on-chip signal processing capabilities use a variety of sophisticated algorithms for detecting signal angle of arrival, distance to target, and movement of target. These integrated functions reduce overall system complexity, material cost, and power consumption in a product ideal for mass consumer markets.

Socionext RADAR Sensors Lineup

Socionext has designed a series of single chip 24GHz and 60GHz radio-controlled distance measurement sensors with ultra-low power consumption and positional detection functionalities to address the various needs of customers.
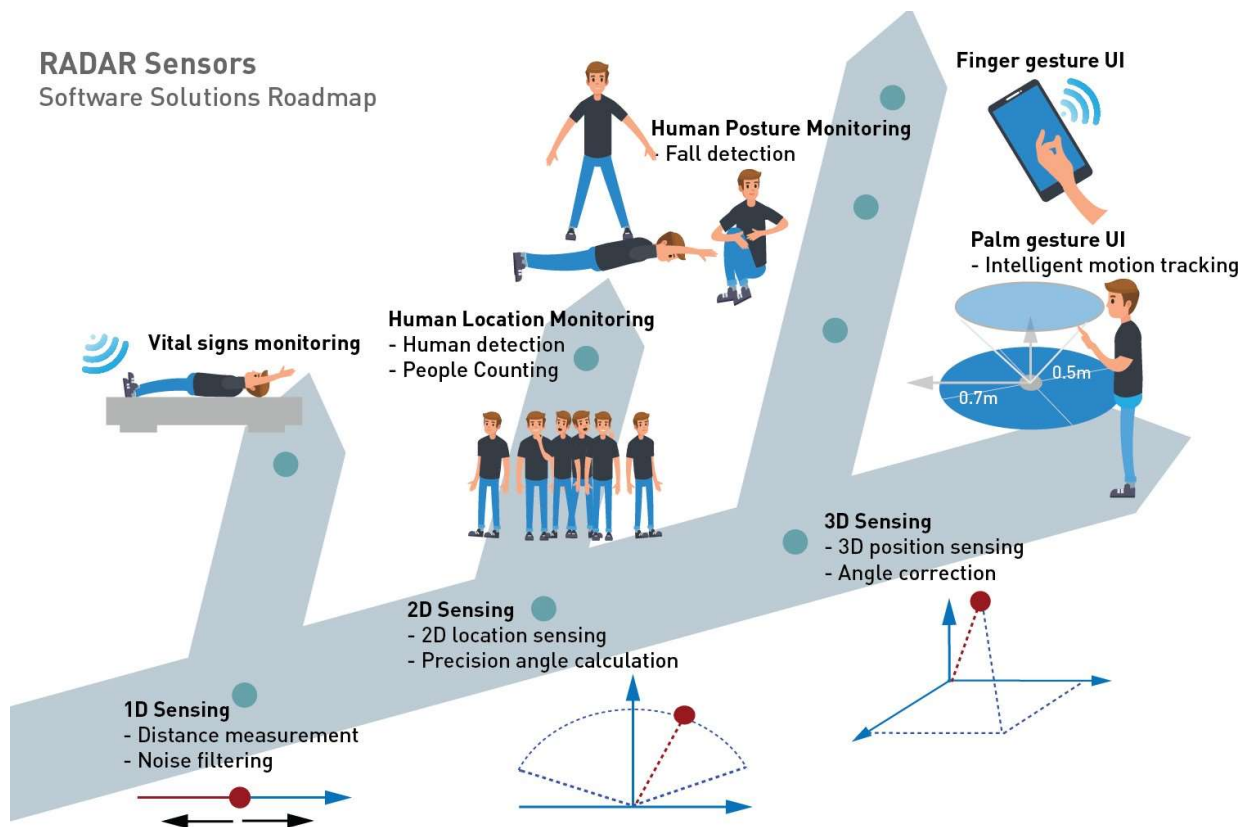
| | Motion Detection | | Distance | 2D Angle | 3D Motion (Gesture) | Status & Availability |
|---|---|---|---|---|---|---|
| | Entry | Presence | | | | |
| SC1239 | ✓ | ✓ | | | | MP-Ready |
| SC1232 | ✓ | ✓ | ✓ | | | MP-Available |
| SC1233 | ✓ | ✓ | ✓ | ✓ | | MP-Available |
| SC1220 | ✓ | ✓ | ✓ | ✓ | ✓ | MP-Available |
| SC1221 | ✓ | ✓ | ✓ | ✓ | | MP-Ready |

Software Solutions Roadmap

Combined with software, additional features can allow for more functions and gathering of more intelligence data. An example is the 3D sensing "angle correction" to automatically track a person entering into the sensor zone prior to the detection of hand movements or gesture. The following diagram illustrates the capabilities and additional applications Socionext can support.

**RADAR Sensors**
Software Solutions Roadmap

Finger gesture UI

Human Posture Monitoring
- Fall detection

Palm gesture UI
- Intelligent motion tracking

Vital signs monitoring

Human Location Monitoring
- Human detection
- People Counting

0.5m
0.7m

3D Sensing
- 3D position sensing
- Angle correction

2D Sensing
- 2D location sensing
- Precision angle calculation

1D Sensing
- Distance measurement
- Noise filtering

Below are the company's design capabilities and a video showcasing footage of different applications and use cases of Socionext RADAR sensors.

Areas of expertise:
- Integrating multiple antennas into an ultra-compact device size
- Mitigating adjacent inferences between antennas and reducing reflection noise from mold resin of the package.
- CMOS design for lower power consumption while enabling higher integration of digital circuits.
- Incorporation of signal processing engine into the device to reduce the processing workload of a separate MCU which fast-track development cycle.

Watch the Socionext RADAR Sensor Video featuring the different functionalities and use cases:

Socionext RF CMOS Sensors
Features and Capabilities

Click here or the image to watch the video.

With the number of similar products coming onto the market, the Socionext RADAR sensors offer many features and advantages by combining high level of integration into a single IC and package, and incorporating a full CMOS based semiconductor design to help reduce power consumption and lower manufacturing costs.

Design kits are now available. Contact Socionext for more details.
Below are the 24 & 60GHz products and deliverables.

### 24GHz Sensor Evaluation Kit
SC1232/1233/1239AR3-B-001



- Evaluation kit hardware with USB cable (A to micro-B)
- Sensor library / Evaluation software (GUI)
- Related documents
- Evaluation software (GUI) operation manual
- API specification of control API
- Application note (Sensor setting parameters / Sample C source for API)

### 60GHz Sensor Evaluation Kit
SC1220AT2-B-113/1221AR3-B-122



- Evaluation kit hardware with USB cable
- Sensor driver/ library and 3D location sensing valuation software (GUI)
- Evaluation software (GUI) operation manual
- API specification of control API
- Application note (MATLAB and Sample C source for API)

To learn more, visit socionext.com/radar

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