

Committed to excellence

# Smart Highlights



 **RUTRONIK**  
**SMART**



V3.0

Discover the Internet of Things  
Design SMART Products



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## Our Product Portfolio

 Semiconductors	 Boards & Systems
 Passive Components	 Storage Technologies
 Electromechanical Components	 Wireless Technologies
 Displays & Monitors	

## Our Initiatives

			
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## Committed to Excellence

### Consult – Know-how. Built-in.

**The Technical Competence from RUTRONIK**

Worldwide and individual consulting on the spot: by competent sales staff, application engineers and product specialists.

### Components – Variety. Built-in.

**The Product Portfolio from RUTRONIK**

Wide product range of semiconductors, passive and electro-mechanical components, displays & monitors, boards & systems, storage and wireless technologies for optimum coverage of your needs.

### Logistics – Reliability. Built-in.

**The Delivery Service from RUTRONIK**

Innovative and flexible solutions: from supply chain management to individual logistics systems.

### Quality – Security. Built-in.

**Quality Management without Compromise**

The integrated management system (IMS) encompasses quality control, information security, environmental protection, occupational health and safety.





# RUTRONIK SMART

## What Does SMART Mean?

Today, many things are apparently “smart” – a search for the word SMART yields around two billion hits. Whether talking about a factory, the home, a television, or many other things – hardly any other word is used in a more inflationary way nowadays. Usually, the term SMART refers to the increasing interconnection of different end devices. This also leads us to the next terms used to describe our “new” world: Internet of Things, cloud computing, artificial intelligence, neural networks, big data. The Internet of Things will transform our lives in a profound way. We have made it our mission to play an active role in creating this “new” world. Through the selection of innovative sensors, the right wireless protocols, suitable security chips, and cloud services, Rutronik SMART helps its customers bring their applications online. The focus here is on four areas that will profoundly change our lives:



### SMART HEALTH

My smartphone vibrates and sends me bad news: my grandmother fell at home and needs urgent help. The emergency dispatch center is automatically informed and is on the scene within a few minutes. Grandma is taken to the hospital for observation. Apart from the doctors and nurses, Grandma is also monitored by innovative sensors that permanently record and relay her vital signs. After my visit to the hospital, my cell phone sends me the next message: “time for another jog,” says my wearable, which is connected to my smartphone via Bluetooth®. I overcome my inner laziness and pull on my jogging suit.



### SMART HOME

“Welcome home, Nick,” my house greets me after my run. It recognized me and allowed me to enter the house after it analyzed my face’s characteristic features. Meanwhile, the coffee machine is preparing an espresso exactly to my taste. It knows from the front door that I look pretty tired and need caffeine.

The windows open automatically because my body odor after my daily run seems to have significantly diminished the air quality in the room. Even before I can put my sweaty jogging gear into the washing machine, it tells me that I’m out of detergent. Off to the supermarket.



### SMART RETAIL

At the supermarket, the shopping cart leads me straight to the personal hygiene products. The specific ad for body wash is exactly what I’m looking for right now. On the way there, my gaze lingers on the running shoes I’ve wanted to buy for a long time. My pulse increases as I weigh the pros and cons in my mind. A salesperson smells prey and eventually convinces me to buy the shoes. Before I reach the checkout, I make a short stop at a candy machine: “Hello, Nick, would you like to buy your favorite protein bar?” the machine asks me. I agree and walk with the cart to the exit. The items are automatically scanned and the amount due is debited directly from my account.



### SMART TRACKING

Back home, I add the detergent and stuff my sweaty jogging suit into the washing machine. The drum starts to move – and at the same time, my smartphone vibrates, letting me know that the washing machine is about to break down. My phone then shows me how to get in touch with a technician who’s nearby. The technician orders the required spare part. I track the shipment. My smartphone sends me another notification, telling me it’s time to take my dog for a walk and simultaneously letting me know that my four-legged friend is already waiting outside in the yard. My day ends with a relaxed walk, and my fitness tracker lets me know that I have reached my daily goal of 10,000 steps today – so I celebrate with a protein bar!



# Suppliers at a Glance

Seminal applications require innovative capacity of leading manufacturers to satisfy extended demands of our end customers. Rutronik SMART contributes to this development by selecting leading Sensor and Wireless manufacturers. Beyond the below mentioned manufacturers, further suppliers out of the category groups Power, Microcontroller, Batteries and Displays support this one stop shop approach.



## Bosch Sensortec

Bosch Sensortec has developed from a start-up to an established company and nowadays is a market leader in MEMS.



## Infineon

Infineon is a world leading Manufacturer of semiconductors with the focus on Automotive, Industrial Power Control, Power Management / Multimarket and Chip Card / Security Solutions.



## Melexis

Melexis is global supplier of micro-electronic semiconductor solutions with an outstanding portfolio for contactless temperature measurement and hall sensors



## NJRC

NJRC is one of the most successful manufacturers of semiconductors offering a wide range of distance measurement products for commercial and consumer applications



## Nordic Semiconductors

Nordic is a market leader in Bluetooth low energy with driving technology in short-range low power IoT and Cellular IoT and offers a first class technical support to customers, highly integrated RF ICs, development tools and reference designs.



## Panasonic

Panasonic is an expert for a wide range of Wireless Connectivity solutions which covers all of today's latest communication protocols with ready-to-use modules for NFC, Bluetooth® BR/EDR, Wi-Fi and Bluetooth & Wi-Fi Combo, with a focus on helping design engineers increase their product's speed-to-market.





## Redpine Signals

Redpine Signals, Inc., is a wireless semiconductor and system solutions company focusing on innovative, ultra-low power and high-performance products for next-generation wireless Wi-Fi, Bluetooth 5 and 802.15.4 applications.



## Sensirion

Sensirion is World's leading manufacturer of digital micro-sensors and -systems including gas (VOC, CO<sub>2</sub>, PM2.5) and liquid flow sensors, differential pressure and RH/T sensors



## STMicroelectronics

STMicroelectronics is an international semiconductor Manufacturer with the business areas Automotive and Discrete Group (ADG), Analog and MEMS Group (AMG) and Microcontrollers and Digital ICs Group (MDG). STMicroelectronics offers one of the industry's broadest product portfolios for MEMS with 10 years longevity.



## Yageo

Yageo produces a wide range of wireless components, including metal/PCB/FPCB antenna, patch antenna (ceramic bulk), active antenna (LNA circuit), chip antenna, and RF components (filter/balancer).



## Telit

With nearly twenty years as a pioneer and leader in enterprise-grade IoT products and software, Telit has earned a reputation for solving the toughest challenges in the Internet of Things (IoT) offering next to hardware solutions also sim cards, embedded sims and cloud solutions.



# RUTRONIK SMART



Sensors



Wireless



Security



Cloud



# Smart Health

Health is the most important thing in life. This is the first thought that crossed my mind when my smartphone told me about my grandmother's fall. Good thing there are smart health devices, because my grandmother is 85 years old and lives in a different city than my family. If the sensors in her clothing hadn't registered the fall and made a call to the emergency dispatch center, it would have been days before anyone would have found her. Worst-case scenario, she would have died of thirst. But even apart from this scenario, smart health offers major advantages, from electronic patient files and connected ambulances to video consultations in regions with an acute shortage of medical professionals. In any case, I'm happy to know that my grandmother is in good hands thanks to smart health.

## Definition

Smart health means that innovative technology is used to permanently improve health-care processes and procedures. On the one hand, this includes the use of state-of-the-art diagnostic and therapeutic methods and, on the other hand, the use of networking and data-sharing options. Individual treatment steps are no longer isolated from one another. Instead, all of the necessary measures are organized as an integrated process.

## Why Smart Health?

Our health-care system faces three main challenges, the first of which is demographic change. Low birth rates and higher life expectancy have been placing an increasing burden on the health-care system for years. The second challenge is intergenerational fairness. In our insurance systems, fewer and fewer younger workers are expected to finance more and more older retired people. And third, we must prepare for a steadily increasing shortage of skilled workers in the medical and nursing professions. A decreasing number of health-care professionals have to care for an ever-growing number of patients. We are already seeing the effects of this today, like in the increasing decline in the availability of specialist care in rural areas, for example. Forward-looking health care must foster innovations and deliver them to patients quickly.

Digitization – in particular – offers an enormous potential for innovation. Smart digital technologies open up groundbreaking care and treatment options which allow processes, for example in practices, hospitals, and laboratories, to be structured more efficiently. Quality of treatment can be improved across the board and administrative procedures simplified.

The role of self-determined patients in the health-care system can be strengthened.

Innovative technology ensures that there is no time wasted and no data is lost. Rapid diagnoses, the selection of the right treatment, and the elimination of repeat examinations doesn't just save money – patients also benefit when less stressful procedures are available, experts contribute to the diagnosis, or visits to the doctor become unnecessary thanks to telemedicine. [Source: ZVEI]

This both reduces costs and increases customer satisfaction in the health-care system. According to a study by the management consulting firm McKinsey, the introduction of the electronic patient file alone – which has been a subject of debate for many years – together with supplementary applications would save around ten billion euros a year. In this context, the electronic patient file is only a small part of potential innovations – sensors in patients' clothing could monitor key health indicators.

Irregularities would be reported to the physician or the patient through an app on their smartphone. In rural areas with few specialists, treatment could be provided via video chat, which is already part of everyday life in many European countries. Even if the physician is not physically present, qualified personnel would take care of the patient at their location.

In the opinion of many experts, the use of digital technologies even has the potential to prevent or completely eliminate serious diseases such as cancer or diabetes over the medium term. The key to success is the ability to collect, transfer, and process large amounts of data.





## Patient Surveillance



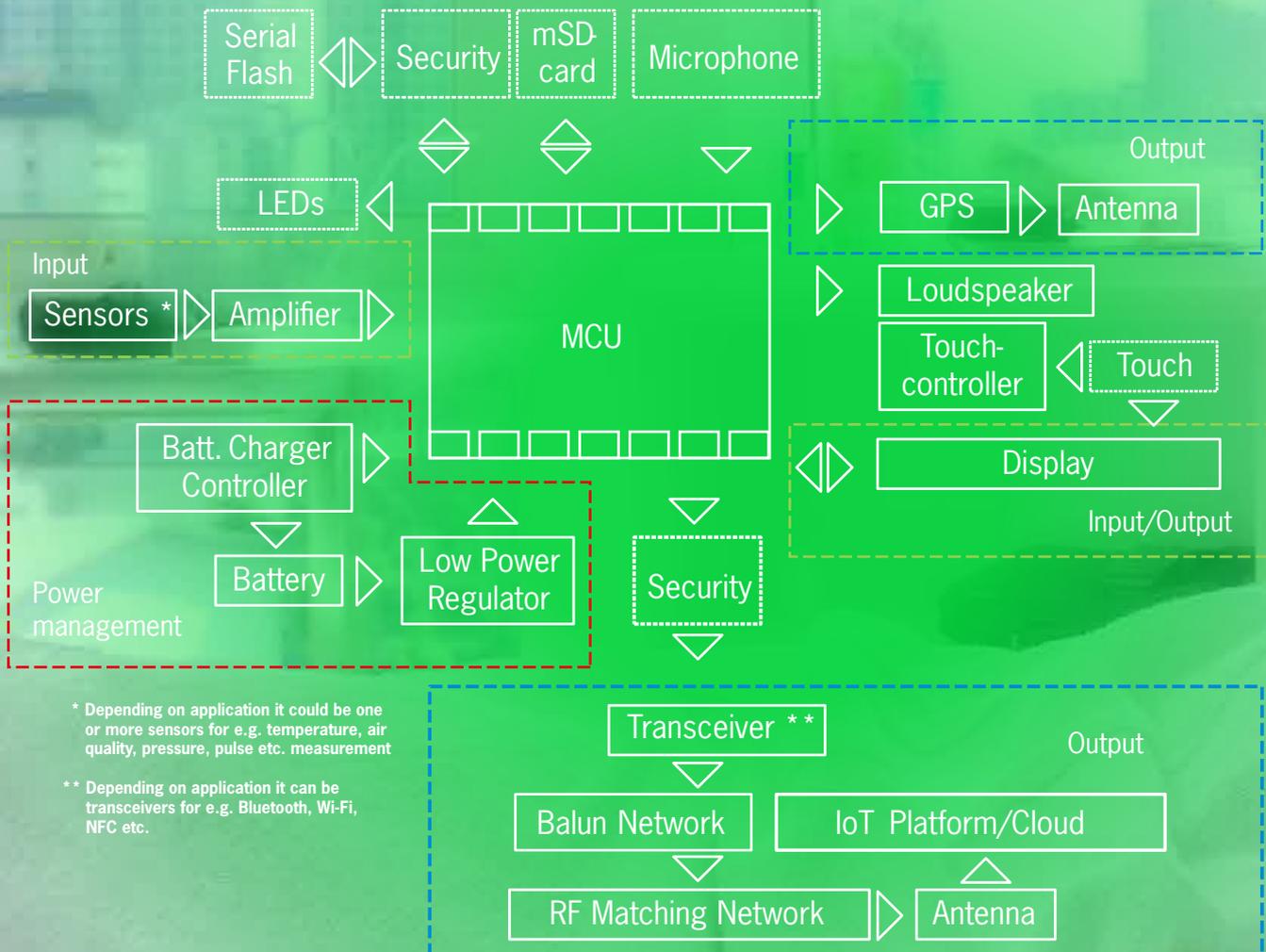
## Body Cardio & Wearables



## Fall Detection



# PATIENT SURVEILLANCE





We engineer the best imaginable future



## Patient Surveillance

### Miniature Infrared (IR) Thermometer IC



## MLX90632 – Robust Temperature Sensing when Size Really Matters

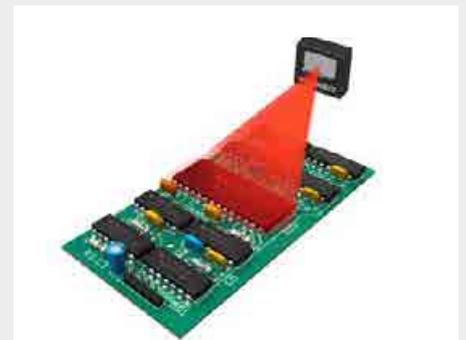
MLX90632 is a miniature SMD thermometer IC for accurate non-contact temperature measurement, especially in thermally dynamic environments and when available space is limited. Primary applications for this device can be found in server rooms, white and gray goods, room temperature monitoring in smart thermostats or integration into portable electronics devices such as tablets and smartphones.

#### Features & Benefits

- Accurate and stable operation in thermally challenging environments
- 3 x 3 x 1 mm QFN package, eliminating the need for bulky TO-can packages
- Factory calibrated with I<sup>2</sup>C digital interface, 50° field of view
- Object temperatures between -20 °C and 200 °C within -20 °C to 85 °C operational temperature range can be measured
- Typical target object temperature accuracy of  $\pm 1$  °C can be obtained
- LGA-12 package (2 x 2 x 0.7 mm)

#### Key Applications

- Non-contact temperature measurements
- Temperature sensing element for residential, commercial and industrial building air conditioning
- Industrial temperature control of moving parts
- Home appliances with temperature control



Detection of feeling of unwellness



Detection for moving objects save lives and lighting energy

## Microwave 24GHz Doppler Module



### NJR4262 – Microwave Vital Sensor for Measuring the Heart Rate and Breath Rate

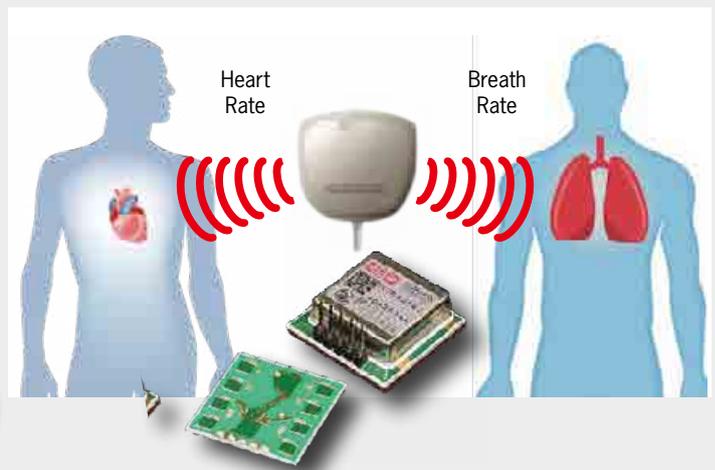
Microwave Vital Sensor can detect breast action (Breath Rate) and Micro-vibration of cutaneous surface (Heart Rate) by reflecting radio wave of microwave band with human body. Heart rate and breath rate can be detected with analyzing the output signal of microwave doppler module

#### Principle of Operation for Microwave Doppler Module

Module detects a moving action of human and object by Doppler effect of microwave.

When microwave is transmitted from the sensor, the frequency change occur by the reflection from the moving object, which is proportional to the moving speed of the object, is called "Doppler Effect".

Doppler module detects a moving object by using the frequency difference between the transmission wave and the reflection wave. By inputting the reflection wave and the radiation wave into the mixer, it outputs a frequency difference (Doppler Frequency) in the voltage waveform



#### Features & Benefits

- Analog signal output
- Miniaturized RF circuit with MMIC technology
- High accurate I-Q mixer
- High reliability and low deviation
- Built-in low noise voltage regulator
- Long-term frequency stability
- Built-in patch antenna
- EU certification & FCC part 15.245

Model No.	Frequency	Operating Voltage	Region	Compliance
NJR4262F1P5	24.05-24.25 GHz	Vcc 3.3V/5V	EU except specific regions	EU / RED Directive 2014/53/EU
NJR4262F2P5	24.15-24.25 GHz		All of EU regions	
NJR4262F3P5	24.075-24.175 GHz		US	FCC Part 15.245





# Patient Surveillance

## BLE Solutions

### BlueMod+S50

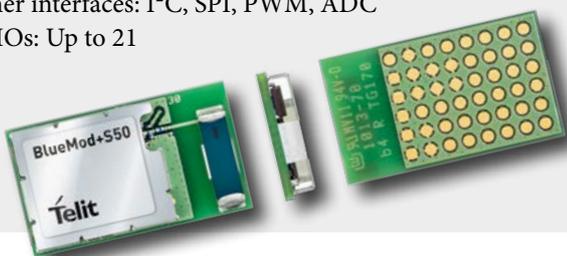


The BlueMod+S50 is Telit's next generation Bluetooth 5 module based on the nRF52 Nordic chipset. It is designed for smartphone connectivity and cable replacement applications with low energy consumption.

The BlueMod+S50 supports the Terminal I/O profile as well as most GATT based profiles.

#### Key Features

- Bluetooth v5 qualified module
- CE, FCC, IC certified
- Generic GATT Client and server
- Concurrent central and peripheral operations
- Terminal I/O for fast and easy transparent data transfer
- Sample code for iOS and Android
- NFC support for simple pairing
- LGA pads
- Available with integrated ceramic antenna or with antenna pin
- Size: 17 x 10 x 2.6 mm
- UART: 9600 bps – 921600 bps (asynchronous)
- Other interfaces: I<sup>2</sup>C, SPI, PWM, ADC
- GPIOs: Up to 21



### nRF52840



The latest version of Nordic Semiconductor's nRF52 Series is the nRF52840. As such it has full hardware support for all the Bluetooth 5 features including long range, high throughput, advertising extensions and improved coexistence. The nRF52840 is built around an Arm® Cortex®-M4F and with 1 MB flash and 256 kB RAM it is able to support complex and demanding applications.

#### Key Features

- Bluetooth 5, IEEE 802.15.4-2006, ANT, 2.4 GHz
- Arm® Cortex®-M4 32-bit processor with FPU, 64 MHz
- 1.7 V to 5.5 V operation
- Arm® TrustZone® Cryptocell 310 cryptographic and security module
- Automated power management system with automatic power management of each peripheral
- Advanced on-chip interfaces: USB, QSPI, SPI, NFC-A tag, PPI, 48 GPIO
- Nordic SoftDevice ready with support for concurrent multiprotocol
- Software development kits ready for Thread & Zigbee, Mesh and more
- Audio peripherals: I<sup>2</sup>S, PDM
- On-air compatible with nRF52, nRF51 and nRF24 series





## Single & Dual Band Wi-Fi Modules

### PAN9026

**Panasonic**

The PAN9026 is a dual band 2.4/5 GHz Wi-Fi 802.11 a/b/g/n Bluetooth v4.2 BR/EDR Combo module and supports simultaneous and independent WLAN and Bluetooth operation. This enables high data rates and low-power consumption.

#### Key Features

- Surface Mount Type (SMT) 17.5 x 10.0 x 2.6 mm
- Wide temperature range of -30 °C up to +85 °C
- Tx power (max.): +17 dBm @ 802.11b
- Rx sensitivity: -98 dBm @ 802.11b DSSS 1 Mbps
- Current consumption  
Wi-Fi typical 400 mA @ TX and 70 mA @ RX

#### Key Benefits

- Supports 802.11i security standards through AES, CCMP, etc.
- For multimedia appl. 802.11e Quality of Service is supported
- IEEE 802.11n compliant, 1x1 spatial stream data rates up to 150 Mbps
- Indoor location and navigation with IEEE 802.11mc
- Generic interfaces include SDIO 3.0 and high-speed UART for host processor connection
- Software Linux driver
- Marvell® 88W8977  
WLAN 2.4/5 GHz and Bluetooth single-chip solution inside
- Quick Starter Kit with Cortex-A9 board -  
Freescale i.MX6 for easy Prototyping available



### GS2101M

**Telit**

The GS2101M modules provide a quick, easy and cost effective way for device and appliance manufacturers to add Wi-Fi connectivity to their products. The module runs the SEP 2.0 Smart Energy Profile stack and has 3 high bit-rate sigma-delta ADCs for high resolution sensor and measurement devices, making it ideally suited for smart energy and sensor applications.

#### Key Features

- IEEE 802.11 b/g/n, 2.4 GHz single band
- 25 x 18 x 2.7 mm
- High resolution sensing and energy measurement
- Ultra-low power through dynamic power management modes
- Interfaces:  
SPI, UART, SDIO, I<sup>2</sup>C, I<sup>2</sup>S, GPIO
- GS2101MIP – integrated PCB antenna
- GS2101MIE – U.FL connector
- FCC, IC, CE, TELEC certified

#### Application Fields

- Smart energy and measurement
- Smart home
- Healthcare
- Fitness
- Industrial controls
- Commercial building automation
- Audio/video consumer electronics





# Patient Surveillance

## Dual Band Wi-Fi & RFID Solutions

### RS9116



Redpine Signals' RS9116 family of SoCs and modules provides a comprehensive multi-protocol wireless connectivity solution including 802.11 a/b/g/n (2.4 GHz and 5 GHz), 802.11j, dual-mode Bluetooth 5 and 802.15.4 (capable of running Thread or ZigBee®).

#### Solution Highlights

- Co-existence of multiple wireless protocols managed by an internal protocol arbitration manager
- Ultra-low power consumption with multiple power modes to reduce the system energy consumption
- Multiple levels of security including FIPS 140-2 and PUF (Physically Unclonable Function) to create a highly secure system
- Fully integrated and wireless certified modules with multiple sizes as small as 4.63 mm x 7.90 mm
- Multiple software architectures (hosted and embedded) and host interfaces (SDIO, USB, SPI, UART) for easy integration with different processor families and operating systems
- Footprint compatible single band and dual band modules as well as hosted and embedded modules for easy migration within the product family
- Leading edge RF performance providing long range and higher throughputs



### ST25DV



The ST25DV series of dynamic NFC/RFID tags offers a 13.56 MHz long-range interface compatible with NFC phones and readers. Based on an ISO/IEC 15693 and NFC Forum Type 5 tag, ST25DV tag ICs can be operated from an RFID reader or an NFC phone. They also include an I<sup>2</sup>C interface that lets them connect to a host (MCU, MPU, etc.). These tags feature an innovative fast transfer mode between an embedded host and an NFC phone or reader thanks to their half-duplex 256-byte buffer. ST25DV dynamic NFC/RFID tags can be used in a wide variety of applications including consumer electronics, industrial, metering, electronic shelf labels, IoT objects and more.

#### Feature

- ISO/IEC 15693 and NFC Forum Type 5 tag contactless interface
- 1-MHz I<sup>2</sup>C serial interface operating from 1.8 to 5.5 V
- EEPROM memory density from 4 to 64 Kbits
- Fast Transfer mode thanks to 256-byte buffer
- Energy harvesting feature
- 64-bit password protection
- GPO interruption pin configurable on multiple RF events
- Temperature range
- Range 6: -40 to 85 °C
- Range 8: -40 to 105 °C (UDFPN8 only)  
-40 to 125 °C (SO8N and TSSOP8 only,  
105 °C max on RF interface)
- Simple antenna design, backward compatible with M24LR series



## Antennas

### Recommended for Patient Surveillance

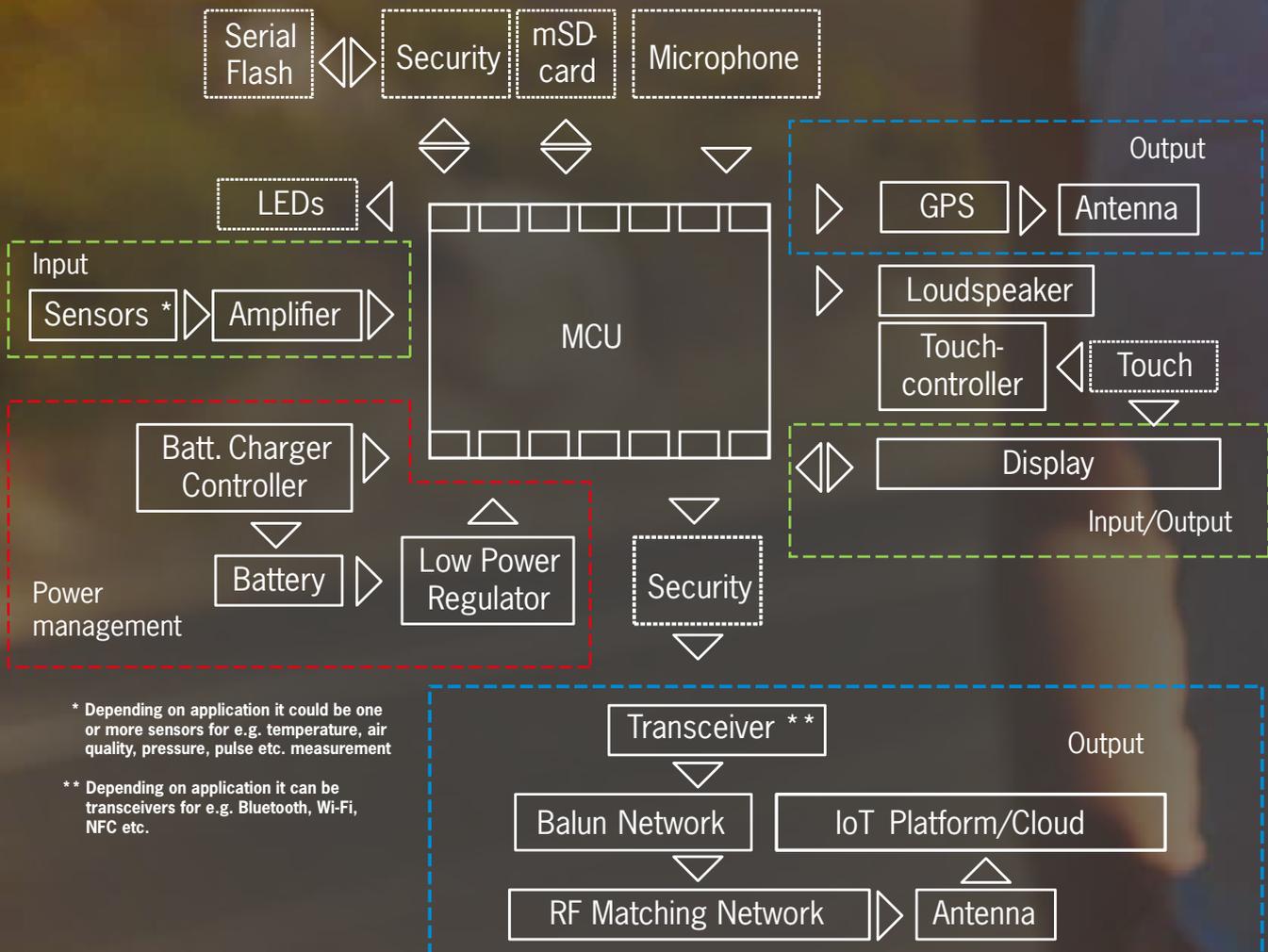
Type	ANTX100P001B24003	YAGEO®
Standard	Bluetooth / Wlan / ZigBee	
Frequency	2.4 GHz	
Gain	4.4 dBi	
Polarization	Linear	
Max. Power	1 W	

Type	ANT1003LL15R2455A	YAGEO®
Standard	Wlan / ISM	
Frequency	2.4 & 5 GHz	
Gain	2.45 / 1.55 dBi	
Polarization	Linear	
Max. Power	1 W	

Type	W7001	Pulse Electronics
Standard	NFC	
Frequency	13.56 MHz	
Antenna Type	Flex Stamp Antenna	
Size	25 x 25 x 0.12 mm	
Impedance	50 / 80 Ω	

Type	W5100	Pulse Electronics
Standard	Bluetooth / NFC	
Frequency	13.56 / 2400 MHz	
Antenna Type	Adhesive Type	
Size	40 x 40 x 1.2 mm	
VSWR	<3:1	

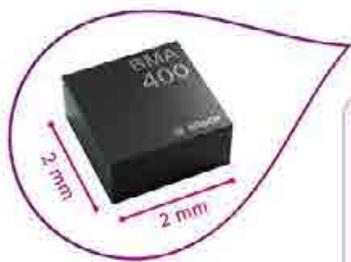
# BODY CARDIO & WEARABLES







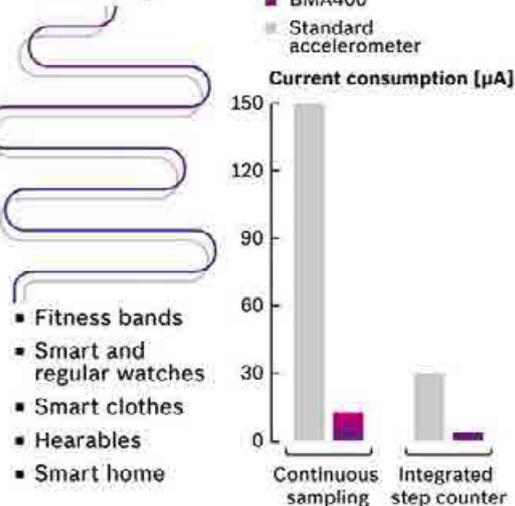
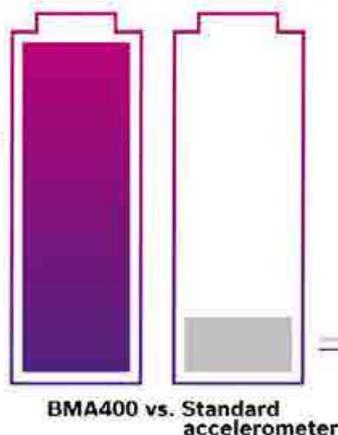
- Ten times lower power consumption as standard accelerometers without compromising on performance
- Integrated ultra-low power step counter
- Significant battery lifetime enhancement



## BMA400

- Step counting
- Activity recognition and change: walking, running, standing still
- Motion detection
- Auto wake-up
- Auto sleep

After several weeks



- Fitness bands
- Smart and regular watches
- Smart clothes
- Hearables
- Smart home



# Body Cardio & Wearables

## Ultra-low Power, Triaxial Accelerometer for Wearable Devices and IoT Applications

### BMA400

The BMA400 is the first real ultra-low power acceleration sensor without compromising on performance. Featuring 12-bit digital resolution, continuous measurement and a defined selectable bandwidth combined with ultra-low power the BMA400 allows low-noise measurement of accelerations in three perpendicular axes.

The BMA400 thus senses tilt, orientation, tap/double tap, and enables plug 'n' play step counting with activity recognition especially suited for wearable devices, which need a long-lasting battery lifetime. Thanks to the continuous measurement principle and always-defined bandwidth, the BMA400 is the ideal solution for smart home applications such as smart indoor climate systems and smart home security systems. In the latter, the BMA400 can distinguish between real alarm situations like broken glass and false signals coming from random vibrations. Thereby, the new acceleration sensor avoids false alarms.

#### Applications

- IoT and smart home applications (e.g. indoor climate systems, security systems)
- Activity tracking and step counting in wearable devices (e.g. fitness bands, smart and regular watches, hearables)
- Industrial applications (e.g. predictive maintenance, package tracking)
- Power management of consumer end-devices based on motion



Parameter	Technical data
Measurement range	±2 g, ±4 g, ±8 g, ±16 g
Digital resolution	12 bit
Output Data Rate (ODR)	12.5 Hz to 800 Hz
Low path filter bandwidth	Selectable 0.48xODR or 0.24xODR
Current consumption *	Max. performance: 14.5 µA Typical use case: 5.8 µA Low power use case: 3.5µA
Noise density	Max. performance: 180 µg/√Hz (Z: x 1.45) Typical use case: 300 µg/√Hz (Z: x 1.45) Low power: 415 µg/√Hz (Z: x 1.45)
Ultra low power / Auto-wake-up mode	800 nA @ 25 Hz ODR
Embedded features	<ul style="list-style-type: none"> <li>▪ Step counter (&lt; 4 µA overall)</li> <li>▪ Activity recognition (walking, running, standing still)</li> <li>▪ Activity change</li> <li>▪ Orientation</li> <li>▪ Tap/Double tap (&lt; 8 µA overall)</li> <li>▪ General interrupt 1 and 2 (programmable via thresholds, timer, logical AND/OR operations)</li> <li>▪ 1 kB FIFO</li> </ul>
Offset	±80 mg
TCO	±1 mg/K
Interface	SPI & I <sup>2</sup> C & 2 Interrupt pins
Supply voltage	1.71 V up to 3.6 V
Package	12 pin LGA 2x2x0.95 mm <sup>3</sup> Bosch



\* (independent from ODR due to continuous measurement)





# Body Cardio & Wearables

## Digital Pressure Sensor



### DPS310

DPS310 provides ultra-high precision up to  $\pm 5$  cm and  $\pm 0.06$  hPa relative accuracy. The pressure sensing element is based on a unique capacitive principle, which is totally different from piezoelectric technology employed in most of the pressure sensors available in today's market. The capacitive technology enables high accuracy during temperature changes, which is important for smartphones, wearable and personal navigation devices.

#### Target Applications

- Internet of Things
- Wearable electronics e.g. health and sports gadgets
- Indoor navigation floor detection e.g. in shopping malls and parking garages
- Outdoor navigation in personal navigation devices
- Dead-reckoning e.g. in tunnels
- Local weather station

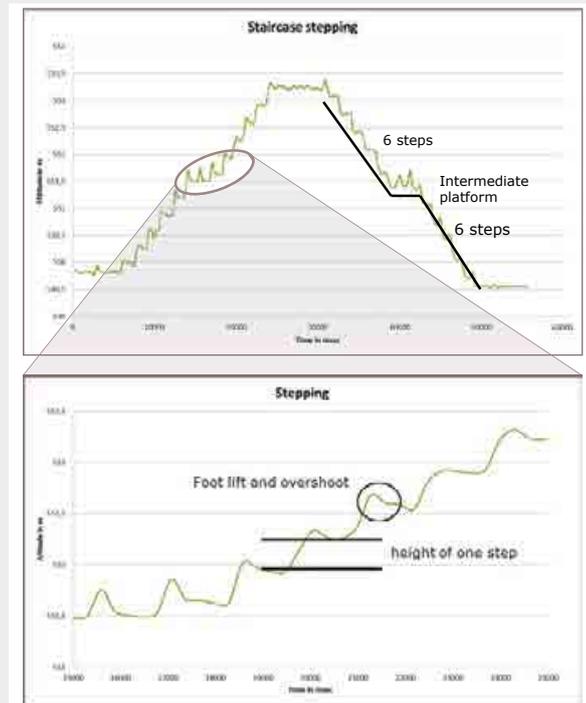
#### Application Benefits

- Ultra-high precision
- High measurement accuracy over wide pressure and temperature range
- Easy implementation due to compact size
- Low system level energy consumption due to FIFO



#### Use Cases Examples

- Motion and Activity monitoring: Sitting / standing / walking / running
- Transient states detection: Enter the building / the car
- Enhanced indoor navigation experience: Detect even single steps
- Mobile weather stations





# Body Cardio & Wearables

## Flexible Ultra-low-power 3-Axis Smart Accelerometer in a 2x2x0.7 mm Package

ST has shipped more than 13 billion micro-electromechanical sensors and has one of the industry's most extensive sensor portfolio including proximity and MEMS accelerometers, gyroscopes, digital compasses, inertial modules, microphones, and environmental sensors such as pressure, temperature and humidity sensors.

### LIS2DW12



#### Key Features

- Acceleration range:  $\pm 2/\pm 4/\pm 8/\pm 16$  g
- Multiple operating modes with multiple bandwidths
- 32-level FIFO
- Noise density (accel.):  $90 \mu\text{g}/\sqrt{\text{Hz}}$
- Very low noise down to 1.3 mg RMS in low power mode
- 16-bit output resolution
- Ultra-low power consumption:
  - Power-down mode: 50 nA
  - Low-power mode:  $< 1 \mu\text{A}$  @ ODR = 12.5 Hz
- Supply voltage range: 1.62 to 3.6 V
- Temperature range: -40 to +85 °C
- I<sup>2</sup>C/SPI digital interfaces

#### Key Applications

- Motion detection for wearables
- Gesture recognition and gaming
- Motion-activated functions and user interfaces
- Display orientation
- Tap/double-tap recognition
- Free-fall detection
- Smart power saving for handheld devices
- Impact recognition and logging
- Hearing aids
- Portable healthcare devices
- Wireless sensor nodes
- Motion-enabled

#### Advanced Applications

##### Enhanced Flexibility with Embedded FIFO

32-level first-in, first-out (FIFO) buffer allowing the user to store data in order to limit intervention by the host processor.

##### Higher Thermal Stability

Over the entire operating temperature range from -40 to +85 °C

##### Ultra-low Power Consumption

- High-performance mode:  $90 \mu\text{A}$  @ ODR = 12.5 to 1600 Hz
- Low-power mode:
  - $5 \mu\text{A}$  @ ODR = 100 Hz
  - $3 \mu\text{A}$  @ ODR = 50 Hz
  - $1 \mu\text{A}$  @ ODR = 12.5 Hz
  - $0.38 \mu\text{A}$  @ ODR = 1.6 Hz
- Power-down mode: 50 nA



Operating Modes		Parameter	High-perf. Mode	Low-power Mode 4	Low-power Mode 3	Low-power Mode 2	Low-power Mode 1
			Low-noise Mode >Disabled<	Resolution	14-bit	14-bit	14-bit
	Noise density ( $\mu\text{g}/\sqrt{\text{Hz}}$ )	110	160	210	300	550	
Low-noise Mode >Enabled<	Resolution	14-bit	14-bit	14-bit	14-bit	12-bit	
	Noise density ( $\mu\text{g}/\sqrt{\text{Hz}}$ )	90	130	180	240	450	

##### Advanced Digital Features

Dedicated internal engine to process motion and acceleration detection:

- Free-fall wakeup
- 6D/4D orientation
- Tap and double-tap recognition
- Activity/inactivity recognition
- Portrait/landscape detection





## BLE & GNSS Solutions

Body Cardio Devices and Wearables are mostly small and moving applications and gadgets, which require RF solutions with a very small form factor. Simultaneously they handle only very little amounts of data. Therefore the BLE IC nRF52810 from Nordic with only 192 kB of Flash and 24 kB of RAM and the GNSS module SL876Q5-A with an integrated Chip antenna, fit perfectly to this kind of applications.

### nRF52810



The nRF52810 from Nordic Semiconductor is a high performance multiprotocol SoC supporting Bluetooth 5, ANT and 2.4 GHz proprietary applications. It has been designed to offer advanced features such as Bluetooth 5 and an Arm® Cortex®-M4 CPU at a level that makes it compelling for even the lowest cost Bluetooth Low Energy applications. Together with the nRF52840 and nRF52832, the nRF52810 completes the nRF52 Series SoC range, giving developers a broad selection of features, memory variants and small-footprint package options.

#### Key Features

- Single chip, highly flexible, 2.4 GHz multiprotocol SoC
- 32-bit Arm® Cortex®-M4 Processor, 64 MHz
- 1.7 V to 3.6 V operation
- 192 kB flash and 24 kB RAM
- Supports concurrent Bluetooth Low Energy / ANT protocol operation
- Nordic Soft Devices ready
- On air compatible with nRF24L and nRF24AP series
- 2 data rates (2Mbps/1Mbps)
- Automated power management system with automatic power management of each peripheral
- Interfaces: SPI, I<sup>2</sup>C, UART, PWM, PDM
- Up to 32 GPIOs
- Available in 6 x 6mm QFN-48, 5 x 5mm QFN-32 and 2.48 x 2.46 mm WLCSP32 packages



### SL876Q5-A Family



The full-featured SL876Q5-A smart antenna module simplifies the development process for designers with little or no RF design experience. Superior performance with very low power consumption makes the SL876Q5-A ideal for battery-dependent devices that demand reliable accuracy. The ultra-slim SL876Q5-A is equipped with features, such as an omnidirectional antenna and an internal RF switch and an internal RF switch, which make the SL876Q5-A the ideal choice for projects with time, cost, and size constraints.

#### Key Benefits

- Full-GNSS: GPS/QZSS and GLONASS or BeiDou; Galileo ready
- Omnidirectional antenna
- MEMS wakeup feature offers lowest power consumption
- Built in LNA for improved sensitivity
- Embedded RF switch allows easy integration with external antennas
- Ultra-slim design
- Flash memory enables firmware upgrades, customization, and AGPS file storage, which is ideal for battery-dependent devices
- Ultra-Slim: 11 x 11.9 x 2.3 mm
- 24-pad LCC package
- Acquisition sensitivity: -148 dBm
- Tracking sensitivity: -165 dBm
- Multiple Interfaces: UART, I2C and SPI





# Body Cardio & Wearables

## BLE Solutions

### PAN1760A

**Panasonic**

Bluetooth® Low-Energy v4.2 Module

#### Key Benefits

- Panasonic's next generation BLE module offers the lowest power consumption for BLE modules on the market (Tx/Rx 3.3 mA)
- Bluetooth Low Energy (BLE) 4.2 compliant
- Supports not only mandatory, but also all optional BLE 4.2 features
- AT command mode, Host mode, Stand-Alone mode
- Standard SIG BLE profiles as well as SPPoverBLE profile
- Support for Over-the-Air update
- Support for Scatternet/Mesh network
- ECDH Cryptography (supports FIPS-recommended curve)
- AES-128 hardware encryption (FIPS-approved)
- Frequent changing of device address (improved privacy, reduced tracking ability)
- Larger packet sizes (more efficient application and network layer security)

#### Key Features

- Small 15.6 x 8.7 x 1.9 mm SMD package
- Embedded 256 kB flash memory and 192 kB internal RAM
- 83 kB RAM available for user application
- Power Consumption (max.): 3.3 mA (Tx/Rx)
- Operating temperature range -40 °C to +85 °C
- Receiver sensitivity -93 dBm typ.
- Output power 0 dBm maximum setting
- Same footprint as PAN1026, PAN1760 and PAN1761 USB-Dongle Evaluation Kit with Application Note for easy prototyping available



### BlueNRG-2

Ultra-Low-Power, High-Performance BLE SoC



The BlueNRG-2 is a very low power Bluetooth low energy (BLE) single-mode system-on-chip that enables the usage of the embedded Cortex M0 for running the user application code. BlueNRG-2 includes 256 KB of programming Flash memory, 24 KB of static RAM memory with retention (two 12 KB banks) and SPI, UART, I<sup>2</sup>C standard communication interface peripherals. It also features multifunction timers, watchdog, RTC and DMA controller.

#### Key Features

- Bluetooth low energy single mode system-on-chip compliant with Bluetooth 4.2
- Operating supply voltage: from 1.7 to 3.6 V
- Operating temperature range: -40 °C to 105 °C
- High performance, ultra-low power Cortex-M0 32-bit based architecture core
- Battery voltage monitor and temperature sensor
- Up to +8 dBm available output power (at antenna connector)
- Excellent RF link budget (up to 96 dB)
- 8.3 mA TX current (@ -2 dBm, 3.0 V)
- Down to 1 µA current consumption with active BLE stack (sleep mode)
- Pre-programmed bootloader via UART
- QFN32, QFN48 and WCSP34 package options





## LTE-M/NB-IoT Combo Modules & NFC Tags

### M24SR Series

#### Dynamic NFC Tags

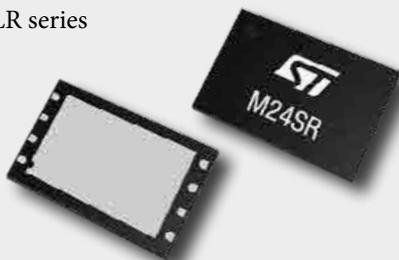


The M24SR series provides an NFC forum tag type 4 RF interface and supports the NFC data exchange format (NDEF).

This enables NFC use cases such as simple Bluetooth pairing and other connection handovers, automatic links to URLs, storage of Vcard and other types of information. It can be used in a wide variety of applications, including consumer electronics, computer peripherals, home appliances, industrial automation and healthcare products.

#### Features

- NFC forum tag type 4 based on ISO 14443 RF interface
- 1 MHz I<sup>2</sup>C serial interface operating from 2.7 to 5.5 V
- EEPROM memory density from 2 Kbits to 64 Kbits with built-in NDEF message support
- RF disable pin allowing the application to control RF access from NFC phones
- 128-bit password protection
- General-purpose output pin allowing flexibility for the applications (wake up on several types of events)
- Simple antenna design, backward compatible with M24LR series



### ME910C1

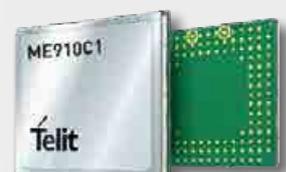
#### LTE-M / NB-IoT Combo Solution

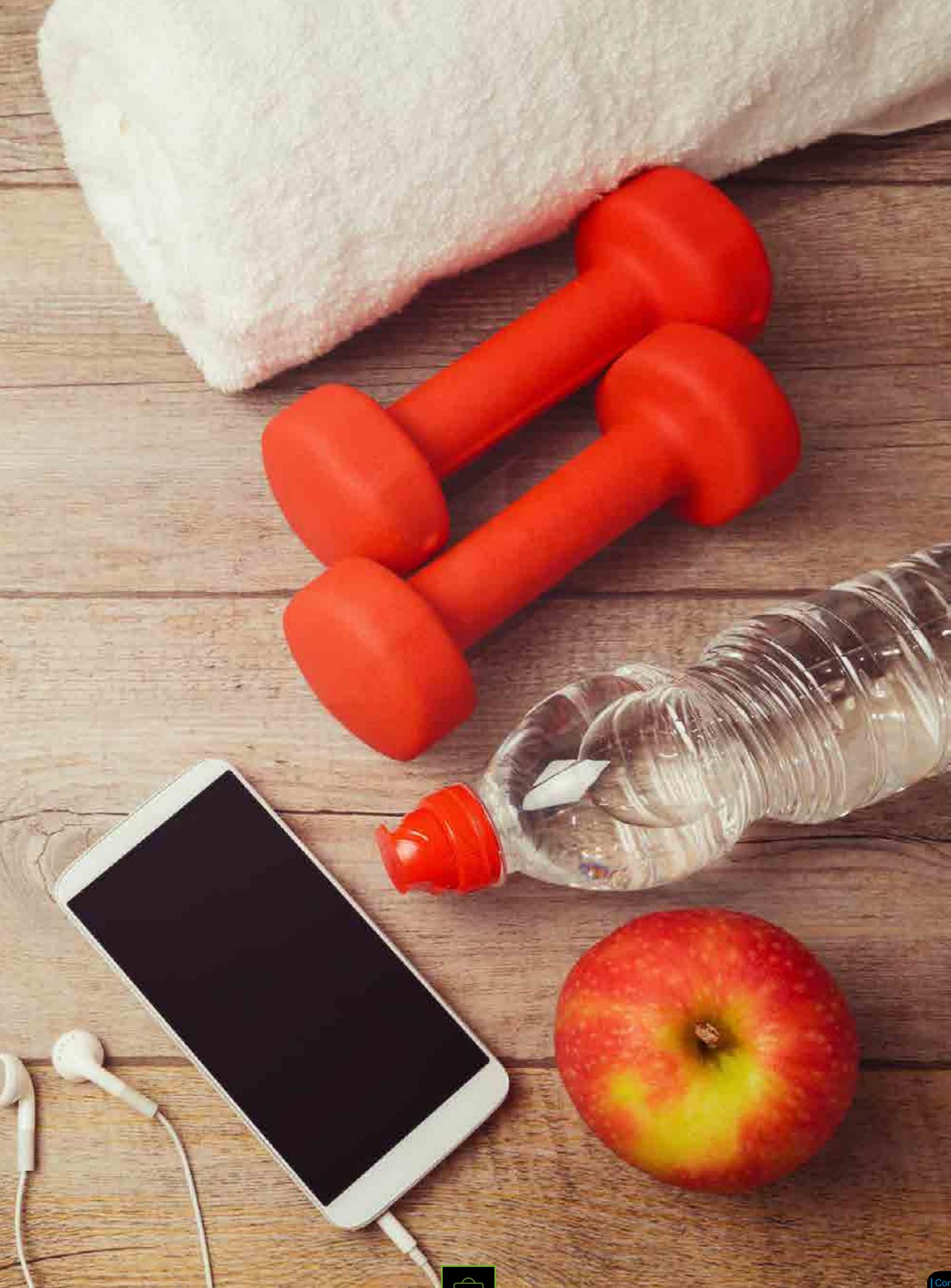


The ME910C1 is the category LTE-M (M1) and Narrow-band-IoT (NB1) evolution of the Telit xE910 Series of LTE modules. This next generation of products supports the new features specified by 3GPP to boost IoT applications, such as the Power Saving Mode (PSM) and the extended Discontinuous Reception (eDRX), which allow the devices to wake up periodically to deliver only very small amounts of data to the network and then go back to sleep for most of the time, thus allowing longer battery operation.

#### Product Features

- LTE UE Category M1/NB1
- 3GPP release 13 compliant
- Control via AT commands
- IPv4/IPv6 stack with TCP and UDP protocol
- Optional embedded GNSS (GPS, GLONASS, Beidou, Galileo)
- LTE Category M1
  - Uplink up to 375 kbps / Downlink up to 300 kbps
- LTE Category NB1
  - Uplink up to 20 kbps (single-tone), 250 kbps (multi-tone)
  - Downlink up to 250 kbps
- Dimensions 28.2 x 28.2 x 2.2 mm
- Extended temperature range: -40 to +85°C
- Interfaces: 10 I/O ports, USB, UART, SPI, I<sup>2</sup>C







## Antennas

Antennas – Recommended for Body Cardio & Wearables

Type	ANT2012LL13R2400A	YAGEO®
Standard	Bluetooth / Wlan / ISM / ZigBee	
Frequency	2.4 GHz	
Gain	2.72 dBi	
Polarization	Linear	
Max. Power	1 W	

Type	ANT2012LL00R2400A	YAGEO®
Standard	Bluetooth / Wlan / ISM / ZigBee	
Frequency	2.4 GHz	
Gain	3.77 dBi	
Polarization	Linear	
Max. Power	1 W	

Type	W3544B	Pulse Electronics
Standard	GSM/3G	
Frequency	824-960 / 1710-2170 MHz	
Antenna Type	Hybrid PCB Antenna	
Size	7.65 x 26 x 3 mm	
Impedance	50 Ω	

Type	W3095	Pulse Electronics
Standard	Wlan / GPS/Glonass / DSRC	
Frequency	1.575-1.610 / 2.4 / 5 GHz	
Antenna Type	Ceramic Chip Antenna	
Size	10 x 3.2 x 1.5 mm	
VSWR	<2.5:1	



# Smart Home

Our home is the most important place in our lives. This is where we create our own little kingdom, where our family lives, where we celebrate with friends, and where we watch our children grow up. Our home offers us exactly the creature comforts we need – this is what I think of when I walk through my door tired and weary after jogging, and the buzzing of the espresso machine announces that it was just waiting to greet me with a hot, caffeinated drink. But the connected house can do much more than that – from the refrigerator that reminds me when food is running low, to an automatic sprinkler system in the yard that waters the lawn based on how dry it is, to smart burglary prevention technologies.

## Definition

The term “smart home” describes the use of digital technology and connectivity in private homes and covers a wide variety of different aspects. On the one hand, smart home refers to automating traditional home-related functions such as lighting, shade, and heating. On the other hand, smart home describes connecting multimedia devices, household appliances, and other convenience devices found in the home with both smartphones and

one another. Current trends indicate that the boundaries between the two definitions are becoming increasingly blurred – the previously separate industries are increasingly discovering and developing interfaces between each other. The smart home is evolving into a consumer-driven market with a focus on convenience and lifestyle. [Source: ZVEI]

## Why a Smart Home?

While on the way to work or going on vacation, you might ask yourself: Did I turn off the stove? Did I lock the door? Is the window open? With a smart home, these worrying questions are a thing of the past. Using your smartphone, you can answer all of these questions with the touch of a finger. This is not only extremely practical, but also safe. If your smart home controls and monitors the windows and doors, burglars don't stand a chance. In addition, smart thermostats measure and adjust the temperature in the house and in doing so, help save energy.

But there are also many arguments against the technology. Until now, smart homes have been considered a luxury, since devices that can be seamlessly integrated into a networked home usually cost considerably more than their offline counterparts. In addition, integrating all the devices into one and the same network can be time-consuming or even impossible depending on the standards used, and is completely confusing for the layperson. From Zigbee, Z-Wave, EnOcean, Thread, AllJoyn, or Dect ULE, there is almost no end to the number of different smart home wireless standards. One possible solution would be for manufacturers to include intermediary translators between the standards.

In addition, the plug-and-play installation promised by many manufacturers is still far from reality. Challenges for smart home technology include liability, warranties, compatibility, IT security, data security, and data privacy. Networked products receive instructions not only from the owner as a user, but also from third parties. Products can develop their features independently or interact with other products. The problem is that after a certain degree of autonomization, it is no longer possible to say with certainty whether the information generated by the digital product originates from the user of the system or from third parties or was created by the product itself. The same applies to the question of who is liable for serious security vulnerabilities. So far there is no legal basis for holding manufacturers or suppliers accountable. The background is that European product liability law only applies to physical objects, which means that it only applies on the Internet of Things if the hardware manufacturer can also be held responsible for the software error. This is where Rutronik's comprehensive security expertise comes into play. Our experts keep an eye on all of the relevant security aspects and help customers take the proper protective measures – and of course advise them on all other aspects of a smart home.



# SMART HOME

Smart Access



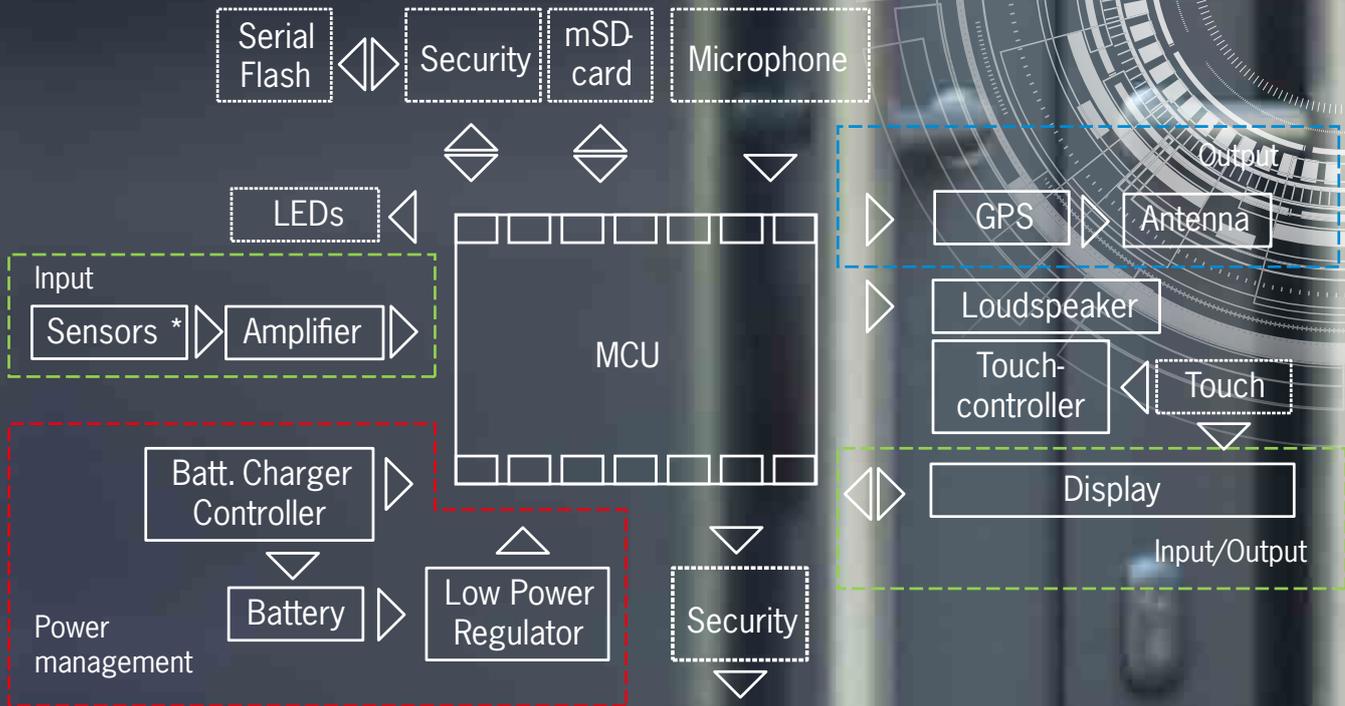
Smart Comfort



Smart HVAC

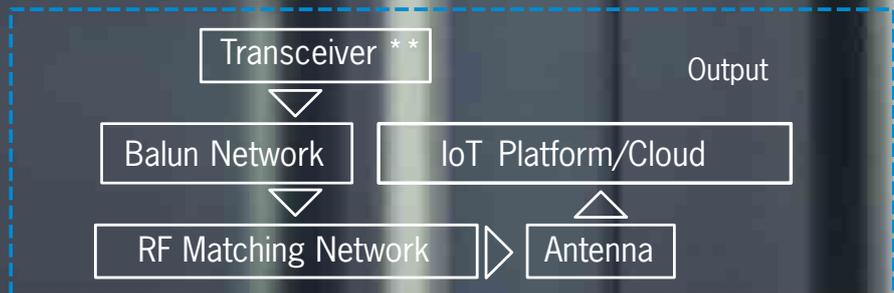


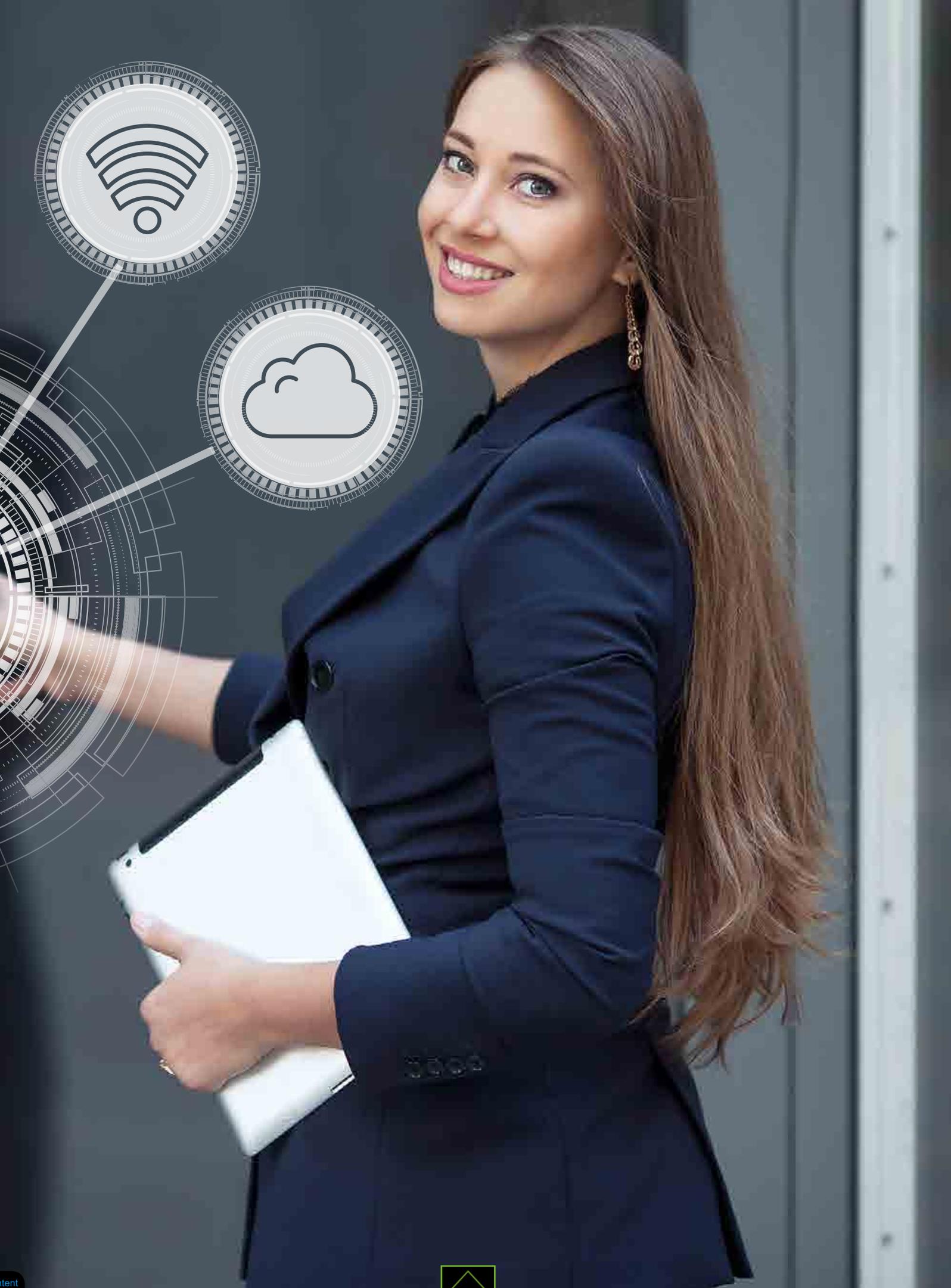
# SMART ACCESS



\* Depending on application it could be one or more sensors for e.g. temperature, air quality, pressure, pulse etc. measurement

\*\* Depending on application it can be transceivers for e.g. Bluetooth, Wi-Fi, NFC etc.







# 32X24 Pixel Thermal Imager

## MLX90640 Infrared (IR) Array

Addresses growing demands seen across numerous applications for thermal analysis. The sensor provides enhanced resolution while still occupying an attractive price point. Primary applications for this device include people detection, fire prevention, building automation, lighting control, surveillance and air conditioning systems.

### Features & Benefits

- -40 °C to 85 °C operational temperature range, allows deployment in difficult industrial environments
- Can measure object temperatures between -40 °C and 300 °C
- A typical target object temperature accuracy of  $\pm 1$  °C, precision across its full measurement scale
- Noise equivalent temperature difference (NETD) of just 0.1K RMS at a 1Hz refresh rate, offers superior noise performance
- Unlike microbolometer solutions, this sensor does not need re-calibration to specific temperature requirements ensuring greater convenience and lowering operational expense
- Two different field of view (FoV) options - standard 55° x 35° version and a 110° x 75° wide angle version
- Supplied in a 4-pin TO39 package, with the compact dimensions lowering the overall cost of the thermal imaging system
- I<sup>2</sup>C compatible digital interface, simplifying integration

### Applications

- Home Appliances & Smart Building  
MLX90640's ability to detect, count and localize people and provide a detailed temperature map of the room makes it ideal for smart & green HVAC (Heat-Ventilation-AirCo) systems. It can also detect food temperature in (microwave) ovens.
- Fire Fighting & Fire Detection  
With its wide temperature range MLX90640 can help firefighters detecting hot spots and victims in very difficult conditions
- Automotive  
Enables passenger/driver detection and acts as input sensor for the HVAC control system





# Microwave Distance Measurement Modules & Sensors



## NJR4265

### 24 GHz Microwave Motion Sensors

#### Features & Benefits

- Digital output
- All-in-one solution: Antenna, RF circuit, IF amp, MCU and voltage regulator are integrated in a small package (14 x 20.4 x 8.8 mm)
- Identification of movement direction (approaching and leaving)
- Low voltage & low power consumption
- Communication with PC/MCU is available by UART interface, but stand alone operation is also possible
- EU Certification & FCC Part 15.245



#### Applications

- Energy saving management
- Room access control
- Human detection sensor for various instruments

## NJR4266

### 24 GHz Microwave Motion Sensors

#### Features & Benefits

- Digital output
- All-in-one solution: Antenna, Microwave RF circuit, IF amp, MCU and voltage regulator are integrated in low-profile package (17.2 x 27.3 x 5.2 mm)
- Low power consumption: 1.9 mA min. @ 3.3 V
- Sleep mode for power reduction
- Identification of direction for moving objects (approaching and leaving)
- Interface selectable from UART and digital output / analog sensitivity setting
- EU Certification & FCC Part 15.245



#### Applications

- Lighting equipment
- Entrance and exit management
- Safety and security systems
- Energy saving management

## NJR4234

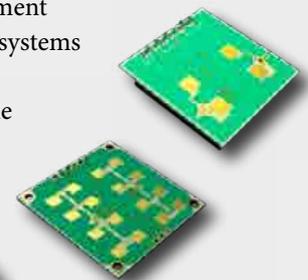
### 24GHz Microwave Distance Measurement Sensor

#### Features

- Digital output
- Measures distances up to 30 m
- All-in-one solution: Antenna, Microwave RF circuit, Base-band IF circuit, MCU and signal processing are integrated in a low-profile package
- Low power consumption: 37 mA @ 3.3 V power supply
- Unique signal processing / algorithm installation
- Distance measurement signal processing
- High sensitivity for mobile object detection (Patented technology)
- Automatic calibration and gain control
- Radio interference prevention
- Adopted UART and digital CMOS output for interface
- Usable for indoor and outdoor applications
- Versions with additional stationary object detection available
- EU Certification & FCC Part 15.245

#### Applications

- Various equipment controlled by moving objects detection and distance measurement
- Security equipment
- Traffic control systems
- FA robot
- Industrial drone
- Parking management system





# Smart Access

## NFC Tags with Built-in FeRAM



### MN63Y12xx NFC Tag ICs & MN63Y32xx NFC Tag Modules

#### Features & Benefits

- Global interoperability  
=> Compliant with ISO14443A, ISO14443B and FeliCa
- High Security  
=> AES-128 encryption / 128 bit password protection
- Long life time  
=> Built-in FeRAM guarantees 100 million write cycles
- Advanced host interface  
=> I<sup>2</sup>C or UART/SPI interface with host wake-up function
- Energy harvesting  
=> Host can be powered by the NFC magnetic field energy

#### Application Examples

- Wireless connectivity  
=> Cost effective and reliable HMI, also for sealed devices
- Bluetooth / Wi-Fi pairing  
=> Pair devices by an easy one touch operation
- Access control  
=> Identification by NFC cards / NFC smart phones
- Setup & diagnostics  
=> Data can be read / written even without power supply
- Digital signage  
=> NFC user interaction opens new marketing approaches

### NFC Product Portfolio

Type	NFC Tag ICs				NFC Tag Modules				
Parts No	MN63Y 1210AF	MN63Y 1212-E1	MN63Y 1213-E1	MN63Y 1221-E1	MN63Y 3214N1	MN63Y 3213N1	MN63Y 3212N1	MN63Y 3212N4	MN63Y 3212N5
Picture									
Operation Voltage	1.8V to 3.6V 4.5V to 5.5V	-	1.7V to 3.6V				-		
Operating Temperature	-20 to 85°C				-20 to 75°C		-20 to 55°C		
Storage Temperature	-40 to 85°C				-40 to 85°C		-25 to 80°C		
Non-volatile Memory	Total Storage: 512 Byte User Data Area: 432 Byte			Total Storage: 1024 Byte User Data Area: 960 Byte		Total Storage: 512 Byte User Data Area: 432 Byte			
	Endurance : 100 000 000 times								
RF Interface	Type-A			✓	✓				
	Type-B	✓	✓	✓	✓	✓	✓	✓	✓
	Type-F	✓	✓	✓	✓	✓	✓	✓	✓
NFC Forum Tag	Type3	Type4B, Type3		Type4A, Type4B, Type3		Type4B, Type3			
Security Function	N/A	AES128 Encryption		Password Protection		AES128 Encryption			
Serial Interface	UART Sync Serial	N/A (only IRQ)	I <sup>2</sup> C (100kbps)	I <sup>2</sup> C (400kbps)		I <sup>2</sup> C (100kbps)	N/A (only IRQ)	N/A	
Package Size	SSOP 16pin 5.0x6.4x1.3 mm	SON 8pin 2x2x0.45 mm			40x30x1.35 mm	9x30x1.4 mm	11.5x25x0.85 mm	Ø30x3 mm PC molded	30x15x2.4 mm PC molded





## NFC/RFID Reader



### ST25 NFC / RFID Readers

The ST25R HF reader series provides multiprotocol support for 13.56 MHz NFC / RFID communications as ISO / IEC 14443 Type A or B, ISO / IEC 15693, ISO / IEC 18092, FeliCa and NFC Forum protocols. They integrate an SPI interface for interface to a host microcontroller.

#### ST95HF Reader

- ST95HF products are suitable for a wide spectrum of applications including identification, authentication, product configuration, access control, door locks and industrial tag readers.

#### ST25R39 Reader

- ST25R39 devices provide a complete solution for payment and point of sale terminals (POS) with the ST25R3911B/12/13 boasting EMVCo & PBOC certifications while the ST25R3914/15 are full AEC-Q100 grade 1 automotive grade making them ideal for keyless entry and immobilizer applications. They are also ideal applications like access control, door locks and gaming.

#### ST25RU39 Reader Series

- The ST25RU39 UHF reader series provides multiprotocol support for the 840-960 MHz. UHF band compliant with ISO 18000 6c & b, ISO 29143 and UHF EPC GEN2 RAIN standards.
- The ST25RU39 devices are optimized for solutions for supply chain and logistics applications, asset tracking, cold chain management and a variety of IoT based applications.

### ECO-System





# Smart Access

## BLE & Mesh Solutions

### nRF52832

Bluetooth® 5 SoC



Nordic Semiconductor's nRF52832 SoC is a powerful, highly flexible ultra-low power multiprotocol SoC ideally suited for Bluetooth Low-Energy, ANT and 2.4 GHz ultra-low-power wireless applications. The SoC has hardware support on-chip for Bluetooth 5 which includes high throughput, advertising extensions and improved coexistence. The nRF52832 incorporates a powerful Cortex-M4F processor enabling the most demanding applications with complex arithmetic requirements to be realized in a single chip solution.

#### Key Features

- Bluetooth 5 compliant (without long range)
- 32-bit Arm® Cortex®-M4F CPU, 64 MHz
- 512 kB Flash / 64 kB RAM or 256 kB Flash / 32 kB RAM
- 1.7 V to 3.6 V supply voltage range
- Interfaces: SPI, I<sup>2</sup>C, UART, PWM, PDM, NFC-A tag, PPI,
- Supports concurrent Bluetooth low energy / ANT protocol operation
- Nordic SoftDevice ready
- Software Development Kits ready for Mesh, AirFuel, HomeKit and more
- On-air compatible with nRF51 and nRF24L and nRF24AP Series
- Available in 6 x 6 mm 48-pin QFN packages and 3.0 x 3.2 mm WL-CSP



### BlueMod+W42

Embedded Bluetooth® & Wirepas Module



The BlueMod+W42 is Telit's first Bluetooth module with embedded Wirepas connectivity Technology, an automated multi-hop, wide-area mesh network. It's an ideal solution for large-scale industrial and infrastructure IoT applications such as smart meters and smart cities.

The BlueMod+W42 is pin to pin compatible with Bluetooth Low-Energy modules, BlueMod+S42 and the BlueMod+S50.

#### Key Features

- Integrates the nRF52832 SoC from Nordic Semiconductors
- Form factor: 10 x 17 x 2.5 mm
- Temperature range: -40 to +85 °C
- Integrated ceramic antenna
- Interfaces: UART, I<sup>2</sup>C, SPI, PWM, ADC
- Power supply: 1.8 – 3.6 V
- Transmit power: up to +5 dBm
- Receiver sensitivity: -94 dBm
- RED certification





## Dual Band Wi-Fi Modules

### WE866 Wi-Fi Family

Dual Band Wi-Fi & Bluetooth® Combo Solutions



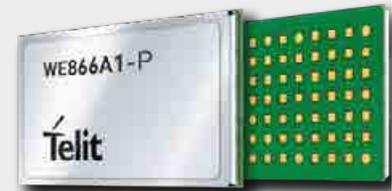
This new and upcoming WE866 variants offer a rich feature set while packed in a small footprint. See what low energy Wi-Fi and Wi-Fi + Bluetooth combo solutions can do by integrating Telit's line of fully certified modules.

#### Key Features

- Single band (2.4 GHz) & dual band (2.4 GHz / 5 GHz) Wi-Fi modules for high bandwidth IoT applications
- International regulatory certifications
- Industrial grade temperature range
- Proprietary technology delivers power consumption savings of up to 97% when compared to the IEEE standard and competitors

#### Applications

- Connected home
- Wearables
- Healthcare
- Automobiles
- Audio/Video
- Smart Home/Smart Energy
- Industrial controls, monitoring



Specifications	WE866E2	WE866E4	WE866C3 (LE910 companion solution)	WE866A1 (LE910 companion solution)
Frequency	2.4 & 5 GHz	2.4 & 5 GHz	2.4 & 5 GHz	2.4 GHz
IEEE 802.11	802.11 a/b/g/n	802.11 a/b/g/n	802.11 a/b/g/n/ac	802.11 b/g/n
Bluetooth	-	Bluetooth 5	Bluetooth v4.2 + HS	-
IEEE 802.15.4	-	Yes (Thread)	-	-
ANT	-	-	ANT+	-
TCP/IP	Yes	Yes	-	Yes
Drivers	Linux	Linux	Linux, Android OS	-
MCU	Cortex M4-F	Cortex M4-F	-	-
Internal Flash	4MB	4MB	-	-
Security	<ul style="list-style-type: none"> <li>Secured Boot</li> <li>Flash encryption</li> <li>Copy Protection</li> <li>WPA2 Personal and Enterprise</li> <li>TLS-1.2/SSL-3.0, HTTPS</li> </ul>	<ul style="list-style-type: none"> <li>Secured Boot</li> <li>Flash encryption</li> <li>Copy Protection</li> <li>WPA2 Personal and Enterprise</li> <li>TLS-1.2/SSL-3.0, HTTPS</li> </ul>		<ul style="list-style-type: none"> <li>Powerful Crypto Engine</li> <li>256-Bit AES</li> <li>WPA2 Personal and Enterprise</li> <li>TLS-1.2/SSL-3.0, HTTPS</li> </ul>
Operating Temp.	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C
Operating Voltage	3.3 V	1.8 – 3.3 V	3.3 V	3.1 - 4.5 V
Peripherals	SPI, UART, I <sup>2</sup> C, I <sup>2</sup> S, GPIO, ADC (12 bit), PWM, JTAG, SDIO	SPI, UART, I <sup>2</sup> C, I <sup>2</sup> S, GPIO, ADC (12 bit), PWM, JTAG, SDIO	SDIO 3.0, UART, PCM	4-wire UART, SPI
Antenna Options	External (RF Pad) / Internal Antenna	Dual Antenna Pin	External (RF Pad) / Internal Antenna	External (RF Pad)
Certifications	FCC, IC, CE, TELEC	FCC, IC, CE, TELEC	FCC, IC, CE	FCC, IC, CE
Dimensions	15 x 19 mm (Ant. pin) 15 x 25 mm (Int. Ant.)	15 x 19 mm	15 x 13 mm (Ant. pin) 15 x 19 mm (Int. Ant.)	15 x 19 mm





# Smart Access

## Dual Band Wi-Fi Modules

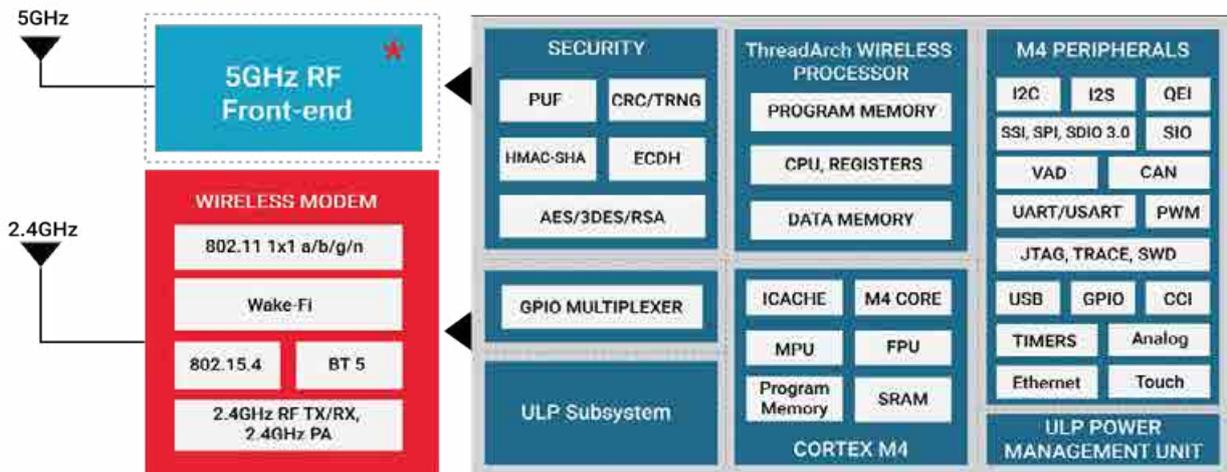


### RS14100 Wireless MCU SoCs & Modules

Redpine Signals RS14100 WiSeMCU™ family of SoCs and modules are the industry's first Wireless Secure MCU family with a comprehensive multi-protocol wireless sub-system. It has an integrated ultra-low-power microcontroller, a built-in wireless subsystem, advanced security, high performance mixed-signal peripherals and integrated power-management.

#### Features & Benefits

- Efficient on-chip application processor based on Arm® Cortex®-M4F with up to 180 MHz performance, up to 4 MB dedicated flash
- Co-existence of multiple wireless protocols including 802.11 a/b/g/n (2.4 GHz and 5 GHz), dual-mode Bluetooth 5 and 802.15.4 (capable of running Thread or ZigBee®)
- Ultra-low power consumption with multiple power modes to reduce the system energy consumption
- Leading edge RF performance providing long range and higher throughputs
- Multiple levels of security including PUF (Physically Unclonable Function), Crypto HW accelerators, Secure Bootloader and Secure Zone to create a highly secure system
- Fully integrated and wireless certified modules with multiple sizes as small as 4.63 mm x 7.90 mm
- Integrated networking and wireless stacks for ease of integration
- Unique peripherals like ULP sub-system, voice activity detection (VAD) and up to 8 capacitive touch sensor inputs



\*: This block applies only for Dualband chipset/Modules

# Antennas

Recommended for Smart Access



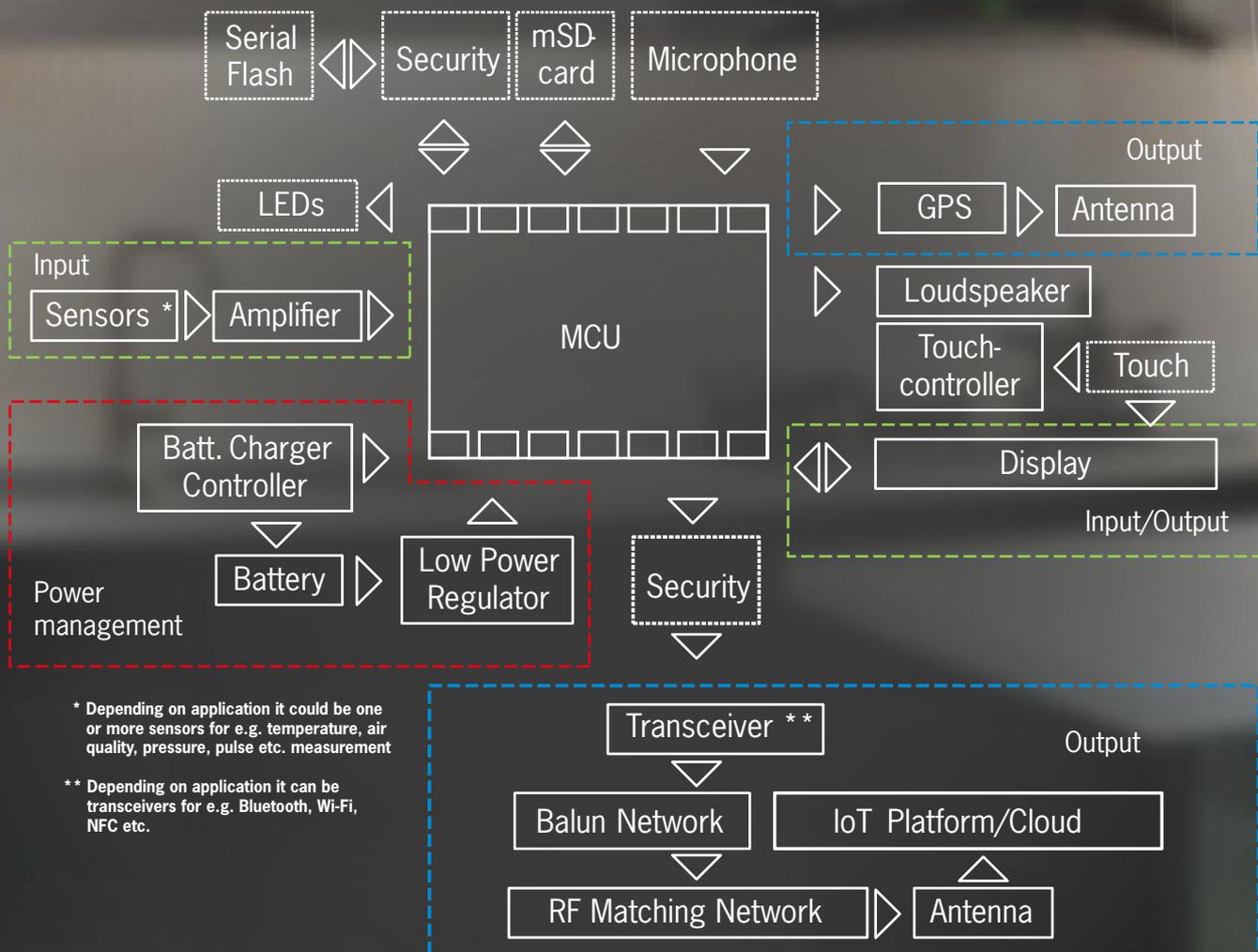
Type	ANT1003LL15R2455A	YAGEO®
Standard	Wlan / ISM	
Frequency	2.4 & 5 GHz	
Gain	2.45 / 1.55 dBi	
Polarization	Linear	
Max. Power	1 W	

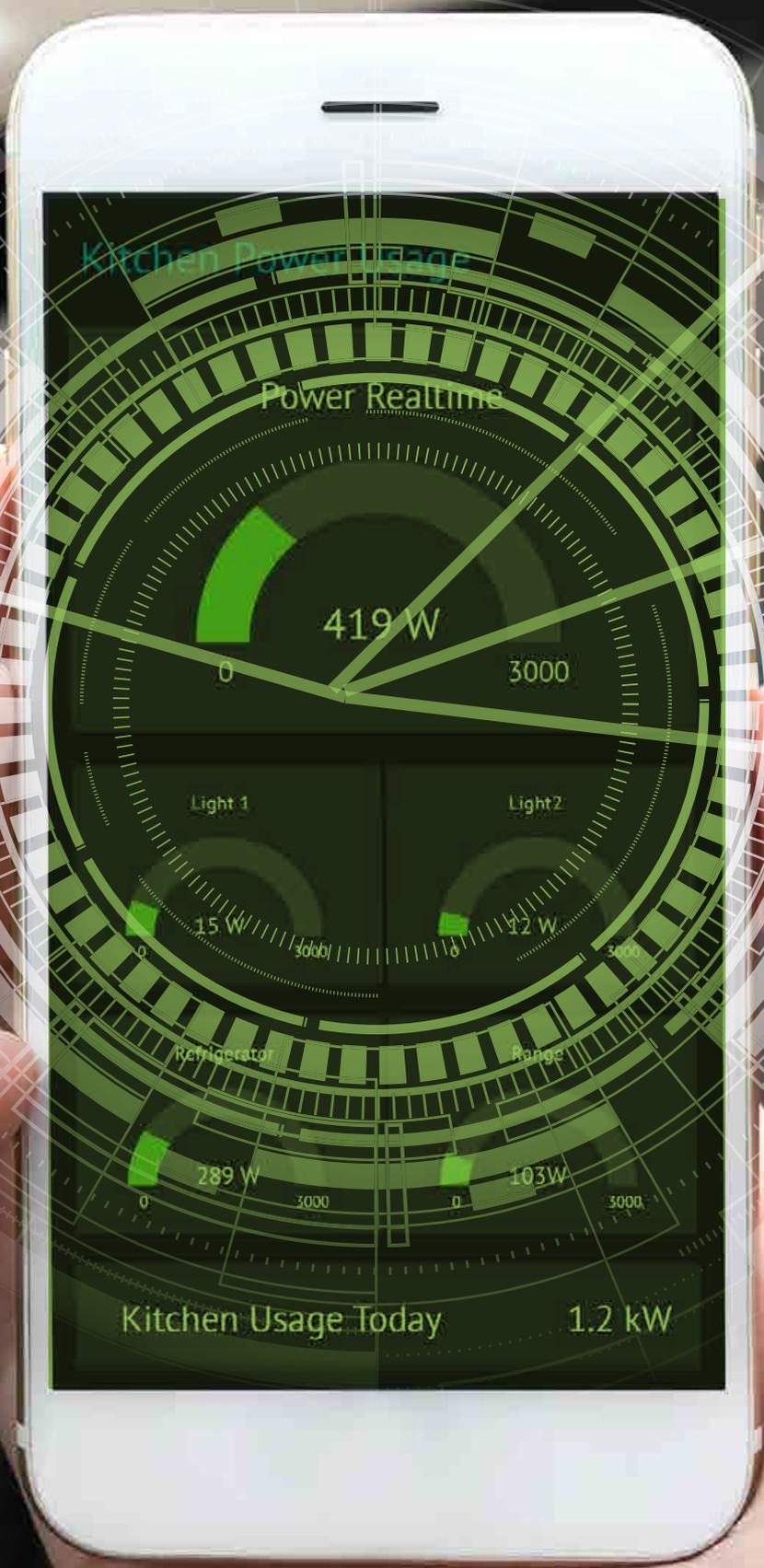
Type	ANT4005B000RWHEXS	YAGEO®
Standard	Cellular (LTE)	
Frequency	698~960 / 1710~2690 MHz	
Gain	3.2 / 4.0 dBi	
Max. Power	1 W	
VSWR	3.0 dB max.	

Type	W7013	Pulse Electronics
Standard	NFC	
Frequency	13.56 MHz	
Antenna Type	Small Planar NFC Antenna	
Size	30 x 25 x 0.36 mm	
Impedance	50 / 80 Ω	

Type	W5101	Pulse Electronics
Standard	Bluetooth / ISM / NFC / ZigBee	
Frequency	2.4 GHz / 13.56 MHz	
Antenna Type	Embedded Antenna	
Size	45 x 45 x 1.2 mm	
VSWR	<3:1	

# SMART COMFORT







# Smart Comfort

## Sensors for HVAC and Indoor Air Quality Applications



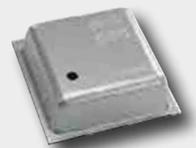
### BME 680 Integrated Environmental Unit

BME680 is an integrated environmental sensor developed specifically for mobile applications and wearables where size and low power consumption are key requirements. BME680 integrates gas, pressure, humidity and temperature sensors. BME680 consists of an 8-pin metal-lid 3.0 x 3.0 x 0.93 mm<sup>3</sup> LGA package which is designed for optimized consumption depending on the specific operating mode, long term stability and high EMC robustness.

The gas sensor within the BME680 can detect a broad range of gases to measure air quality for personal wellbeing. Gases that can be detected by the BME680 include Volatile Organic Compounds (VOC) from paints (such as formaldehyde), lacquers, paint strippers, cleaning supplies, furnishings, office equipment, glues, adhesives and alcohol.

#### Applications

- Air quality measurement
- Personalized weather station
- Context awareness, e.g. skin moisture detection, room change detection
- Fitness monitoring / well-being
- Warning regarding dryness or high temperatures
- Measurement of volume and air flow
- Home automation control (e.g. HVAC)
- GPS enhancement (e.g. time-to-first-fix improvement, dead reckoning, slope detection)
- Indoor navigation (change of floor detection, elevator detection)
- Altitude tracking and calories expenditure for sports activities



Product	Gas			Humidity			Pressure		Temp.	Interface	Power	Package Dimensions (mm <sup>3</sup> )
	Range	Response Time (t33-63 %)	Power Consumption	Range	Response Time (t0-63 %)	Accuracy Tolerance	Range	Relative Accuracy	Absolute accuracy			
BME680	0.2 ... 100 g/m <sup>3</sup>	<1 s for new sensors	Ultra-low power mode (ULP): <0.1 mA Low-power mode (LP): <1 mA	0 ... 100 % rH	8 s	±3 % relative humidity	300 ... 1100 hPa	±0.12 hPa (±1m)	± 0.5 °C	I <sup>2</sup> C and SPI	Sleep mode 0.1 µA 1.8 µA @ 1 Hz (H, T); 3.7 µA @ 1 Hz (H, P, T) 0.1 ... 16 mA (Gas, H, P, T) depending on operation mode	3.0 x 3.0 x 0.93



## Sensors for HVAC and Indoor Air Quality Applications

**SENSIRION**  
THE SENSOR COMPANY

### SPS30 – Particulate Matter Sensor

The SPS30 particulate matter (PM) sensor represents a new technological breakthrough in optical PM sensors. Its measurement principle is based on laser scattering and makes use of Sensirion's innovative contamination-resistance technology. This technology, together with high-quality and long-lasting components, enables accurate measurements from the device's first operation and throughout its lifetime of more than eight years.

PM2.5 and PM10 refer to particulate matter with particle diameter up to 2.5 microns and 10 microns, respectively, and are among the most dangerous air pollutants. Due to their small size, PM2.5 particles can travel deep into the human lung and cause a variety of health issues such as asthma attacks and several cardiovascular diseases. The SPS30 will enable the implementation of innovative air quality monitoring devices that prevent air pollution damage.



### SCD30 – CO<sub>2</sub> Sensor

Carbon dioxide is a key indicator of indoor air quality. Thanks to new energy standards and better insulation, houses have become increasingly energy efficient, but the air quality can deteriorate rapidly. Active ventilation is needed to maintain a comfortable and healthy indoor environment, and to improve the well-being and productivity of the inhabitants. Sensirion's SCD30 offers accurate and stable CO<sub>2</sub>, temperature and humidity monitoring. This enables customers to develop new solutions that increase energy efficiency and simultaneously support well-being. The evaluation kit-SCD30 is also available for a fast and easy evaluation of Sensirion's CO<sub>2</sub> Sensor.





## SMART Comfort

### Bluetooth Dual Mode Modules

#### BlueMod+SR

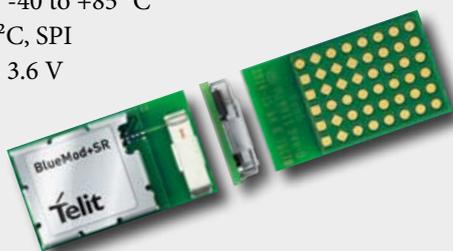
Embedded Bluetooth® Dual Mode v4.0 Module



The BlueMod+SR, part of the BlueMod+S form factor family, is a dual mode Bluetooth 4.0 compliant module. This Class 1 dual mode module supports the classic Bluetooth basic rate (BR) and enhanced data rate (EDR) operations as well as Bluetooth low energy (LE). Integration is easy and cost-effective. It is an ideal solution for cable replacement applications and smartphone connectivity, especially where connectivity to older Bluetooth devices is required.

#### Key Features

- Bluetooth v4.0 qualified
- Master and slave mode support
- Simultaneous BR/EDR and BLE connectivity
- Available with integrated antenna (AI) or external antenna (AP)
- SPP, Terminal I/O and GATT server
- NFC Support
- Source Code for iOS and Android available
- RF-Power (max) -23 to +8 dBm (software adjustable)
- Form factor: 10 x 17 x 2.5 mm
- Temperature range: -40 to +85 °C
- Interfaces: UART, I<sup>2</sup>C, SPI
- Power supply: 2.5 – 3.6 V
- CE, FCC, IC, KCC, MIC and Anatel certified



#### PAN1026A

Bluetooth® Dual Mode v4.2 Basic Data Rate Module



The PAN1026A module is based on Toshiba's single chip TC35661 with an embedded Bluetooth SIG certified stack. Through extended GATT functionality there are more complex BLE profiles possible and it has an improved packet-error-rate (PER). The PAN1026A has fast SPP classic connection and disconnection times for both Bluetooth Classic and Bluetooth Low-Energy. The module is manufactured in a small package with a shielded case. FCC, IC, and CE approvals are available.

#### Key Features & Benefits

- Successor of the PAN1026
- Bluetooth v4.2 Basic Data Rate and Low Energy Module
- Embedded SPP profile
- Bluetooth v4.2 combines the data rate of Bluetooth Classic and ultra-fast connection time of Bluetooth Low Energy
- Increased (2.5 x) BLE data transfer rates through extended MTU size (64 Bytes to 160 Bytes)
- USB-Dongle Evaluation Kit with Application Note for quick testing available
- Small SMD package: 15.6 x 8.7 x 1.8 mm
- High temperature range: -40 °C to +85 °C
- Tx Power (max.): +4 dBm
- Integrated high speed crystal oscillator (26 MHz)
- UART, GPIO (10 input/output pins), wake-up control
- Same footprint as PAN1026, PAN1760A and PAN1761





## BLE/ANT & Single Band Wi-Fi Solutions

### D52

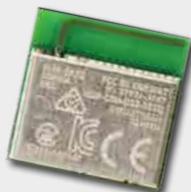
#### ANT SOC Module Series



The D52 series of ANT SoC Modules, based on Nordic Semiconductor's nRF52832 SoC (with 64 kB RAM and 512 kB Flash and a 32-bit Arm® Cortex®-M4F CPU) supporting ANT, Bluetooth® low energy and extended features such as NFC.

#### Key Features

- The D52 series can be flashed with all available soft devices from Nordic Semiconductor
  - S212-ANT only SoftDevice from Dynastream Innovations (preloaded)
  - S332-concurrent ANT and Bluetooth low-energy SoftDevice from Dynastream Innovations
  - S132-Bluetooth low energy only SoftDevice from Nordic Semiconductor
- Integrated printed antenna
  - Up to 30 GPIOs (D52QD2M4IA, D52QPMM4IA-A)
  - Up to 24 GPIOs (D52QD2M4IA-A, D52MD2M8IA, D52QPMM4IA-A, D52MPMM8IA)
- Interfaces: SPI, I<sup>2</sup>C, UART
- 14 x 9.8 x 2 mm (D52MD2M8IA, D52MPMM8IA)
- 20 x 20 mm (D52QD2M4IA, D52QD2M4IA-A, D52QPMM4IA, D52QPMM4IA-A)
- Onboard 3-axis MEMS accelerometer (D52QD2M4IA-A, D52QPMM4IA-A)



### PAN90x0

## Panasonic

#### Non-Embedded Wi-Fi IEEE 802.11 b/g/n Modules

The PAN9010 (without antenna) and PAN9020 (integrated ceramic chip-antenna) are low-power operation and SoC 2.4 GHz ISM band wireless radio modules for implementing WLAN IEEE 802.11 b/g/n functionality into various electronic devices. The PAN90x0 series enables wireless network adapters and cards to be built with low total bill-of-material costs. Both versions can be ordered either with USB or SDIO HOST interface.

#### Key Features

- Surface Mount Type 22.75 x 13.5 x 2.4 mm
- Operating in the 2.4 GHz ISM band
- Operating temperature: 0 – 70 °C
- Supply Voltage 3.0 – 3.6 V
- Supports IEEE 802.11 b/g/n/i/e
- Coexistence Interface for external co-located 2.4GHz radios (e.g. Bluetooth)
- Tx power up to +18 dBm (IEEE 802.11b CCK) and +14dBm (IEEE 802.11g OFDM)
- High Rx sensitivity:
  - -98dBm (IEEE 802.11b DSSS 1Mbps)
  - -76dBm (IEEE 802.11g OFDM 54Mbps)
  - -74dBm (IEEE 802.11n MCS7 HT20 65Mbps)
  - -71dBm (IEEE 802.11n MCS7 HT40 135Mbps)
- Marvell® 88W8782 WLAN System-on-Chip solution inside
- 0 or SDIO interface
- Integrated shielding to resist EMI
- Manufactured in conformance with RoHS



# SMART Comfort

## Cellular Data Cards



### LTE Cat 11 Mini PCIe & M.2 Data Cards

The Telit LN940 and LM940 LTE Cat 11 data cards deliver high speed data rates via Advanced LTE and offer a cellular connection for products in network appliance environments. They are well-suited for products that demand high throughput such as routers, mobile gateways and access points.

#### LN940

Telit M.2 LN940 family supports the latest LTE-Advanced networks with 3G fallback worldwide. The industrial-grade M.2 form factor allows for easy integration into mobile computing, networking, and industrial IoT device platforms that command a smaller and thinner footprint. Optimized for low power consumption, the Telit M.2 family delivers unprecedentedly high-speeds of Advanced LTE with the addition of up to 3CC Downlink Carrier Aggregation and up to 256 QAM modulation for the most robust cellular performance possible.

Models within the LN940 M.2 family support 3GPP releases Cat 9, 10, 11, and 12, achieving 450 Mbps (Cat 9) and up to 600 Mbps downlink speeds (Cat 11).

#### Key Features

- LTE Bands for LN940A11/LN940A9: 1, 2, 3, 4, 5, 7, 8, 12, 13, 17, 18, 19, 20, 21, 25, 26, 28, 29, 30, 38, 39, 40, 41, 66
- Data Throughput:
  - LN940A11: Up to 600 Mbps Downlink & 50 Mbps Uplink
  - LN940A9: Up to 450 Mbps Downlink & 50 Mbps Uplink
- Operating Temperature: -40 °C to +85 °C
- Inter processor communication interface: USB 3.0 SS, USB 2.0 HS
- 2 x 2 MIMO
- Operating system support: Win 10, Linux, Android
- GNSS: GPS, Glonass, BEIDOU
- Certifications: FCC/CE/PTCRB/GCF/NCC/CCC/JATE/TELEC
- Targeted MNO IOT: AT&T, VZW, Docomo, KDDI, Telstra, Optus, Deutsche Telekom, Swisscom, Orange, Vodafone, Telefonica
- Dimension: 42 x 30 x 2.3 mm

#### LM940

The LM940 Mini PCIe (mPCIe) data card delivers high speed data rates via Advanced LTE.

Based on LTE Category 11, the LM940 mPCIe data card achieves download rates up to 600 Mbps supported by the 3GPP release 11 with MIMO and LTE Carrier Aggregation. The product supports multiple RF frequency bands and band combinations to accommodate global deployments.

Furthermore the LM940 offers full GNSS support with GPS, GLONASS, Galileo and Beidou.

#### Key Features

- LTE Bands for LM940: 1-5, 7, 8, 12, 13, 17, 20, 25, 26, 28, 29, 30, 38, 40, 41, 66
- Data Throughput: Up to 600 Mbps Downlink & 75 Mbps Uplink
- Operating Temperature: -40 °C to +85 °C
- Interfaces: mPCIe, USB 2.0/3.0, Dual SIM, GPIOs, DVI
- 32 bit Arm® Cortex®-A7 up to 1.19 GHz running the Linux operating system
- GNSS: GPS, Glonass, BEIDOU, Galileo
- Certifications: FCC/IC/PTCRB/GCF/RED/RCM
- Dimension: 50.95 x 30 x 2.8 mm

#### Application Fields

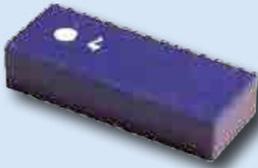
- Battery powered, wearable devices
- Automated Meter Reading (AMR)
- Security alarms and non-video surveillance



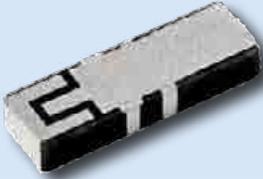


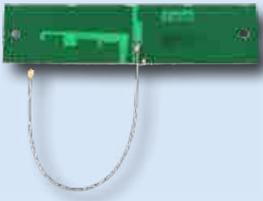
## Antennas

### Recommended for Smart Comfort

Type	ANT5320LL24R2455A	YAGEO®
Standard	Wlan / ISM	
Frequency	2.4 & 5 GHz	
Gain	2.17 / 3.5 dBi	
Polarization	Linear	
Max. Power	1 W	

Type	ANT8010LL04R2400A	YAGEO®
Standard	Bluetooth / Wlan / ISM / ZigBee	
Frequency	2.4 GHz	
Gain	5.46 dBi	
Polarization	Linear	
Max. Power	1 W	

Type	W3056	Pulse Electronics
Standard	Bluetooth / GPS	
Frequency	1.575 / 2.4 GHz	
Antenna Type	Ceramic Single Feed Antenna	
Size	10 x 3.2 x 1.5 mm	
Impedance	50 Ω	

Type	W3554B0140	Pulse Electronics
Standard	LTE / GSM	
Frequency	698-960 / 1710-2690 MHz	
Antenna Type	Wideband LTE Dipole	
Size	30 x 120 x 0.2 mm	
Polarization	Vertical	

# Smart Retail

“Seek, and ye shall find” is a popular proverb that comes to mind when thinking back to the time when I used to roam the shelves of the supermarket like a Stone Age hunter-gatherer, usually on the hunt for a yeast cube. Today, the smart shopping cart guides me through the aisles and helps me work through my shopping list. At the same time, I receive targeted offers that are tailored to my needs and interests – so I can complement my shopping with products that I can actually use. The fact that the store evaluates a profile of both my movements and my purchases to do so is something I am aware of. Thanks to the high privacy barriers that now exist, however, I’m not concerned – the benefits far outweigh the drawbacks..

## Definition

In order to respond to the changing demands of consumers in the digital age and to counter this strong competitive pressure, retailers must upgrade their stores technologically with retail solutions. Customers want a smart store where they can enjoy a fully connected shopping experience. A place where real-life products are integrated into a digital world for them

to experience and where they receive individual and high-quality advice. Connected technologies and big data applications are the basis for smart retail. On the one hand, they make it possible to offer products that are tailored to the individual needs of customers and, on the other hand, to effectively and efficiently speak to customers and create loyalty. [Source: Telekom]

## Why a Tracking

Communicating with and keeping customers informed in the best way possible is the duty of the sales staff. Electronic devices such as computers, telephones, cash registers, advertising displays, and electronic price labels all assist them in this regard. If stores are equipped with these technologies, they benefit immensely from the connectivity. Whether via local area networks (LAN) or WLAN networks – those who connect their systems to each other in a centralized manner can achieve a completely new level of control. Scalable managed LAN services outsource the planning, deployment, and management of the network to service providers such as T-Systems. This means that the infrastructure can be adapted to the needs of the user at any time; simultaneously, they don’t need to spend time or obtain expertise on installing and operating the network.

The result is that smart retailers are primed for growth and can focus on their core business.

WLAN and hot spots go one step further – the network is now accessible throughout the store. This facilitates better communication, the integration of new store services, and more efficient logistics. Customer interest increases when they can

surf the Web for free, while at the same time customers receive targeted information and can be shown promotional offers; logging on to the network also makes it possible to interact with customers.

In order to display the most suitable advertising and offers, retailers first need to know exactly what their customers want. They can find this out using special data analytics applications for smart retail. Collecting, managing, and analyzing customer data and making it available to all of a store’s employees becomes child’s play.

Outdoor retail analytics measure the movement of customers outside the store, showing from where, when, and how many customers visit. The analysis then continues in the store with indoor retail analytics, tracking visitors’ paths and exactly what they are interested in.

All of the pertinent information, combined with individual value-added services, is available to retailers and employees; they can access it via a dashboard and as such, have a complete control center for smart retail in this location at their disposal.





Beacons & Price Tags



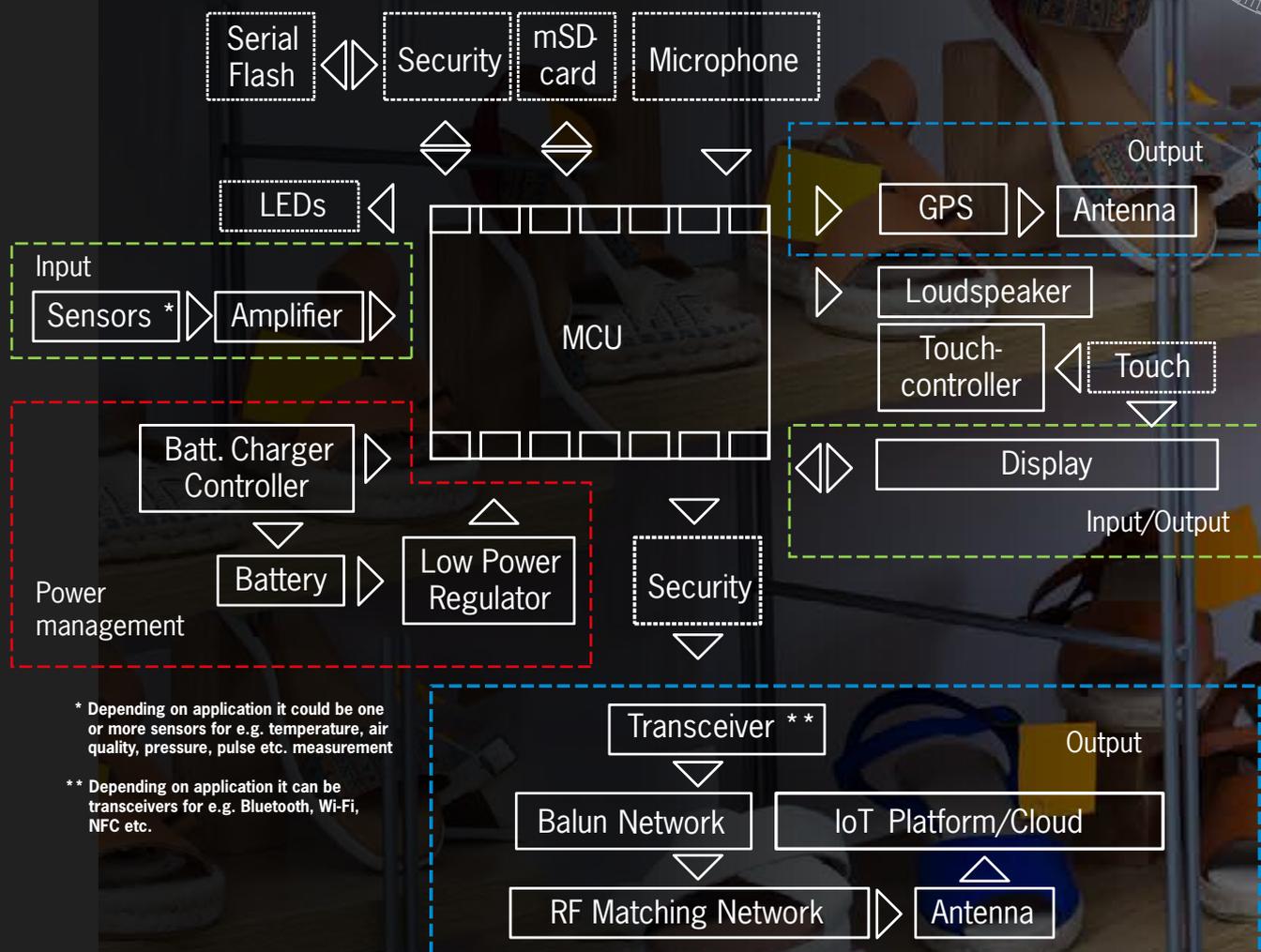
Vending Machines



Intelligent Trolley



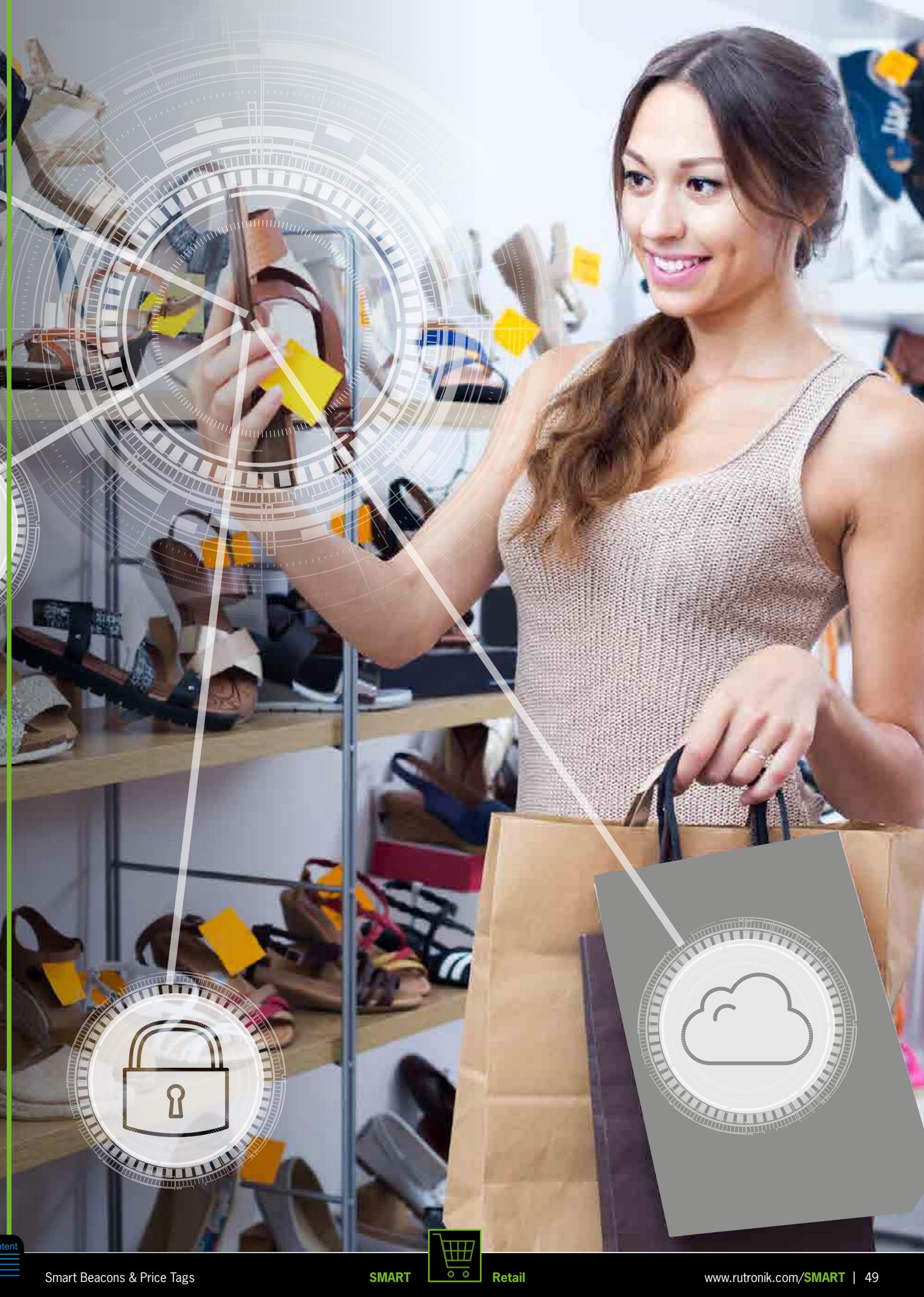
# SMART BEACONS & PRICE TAGS



\* Depending on application it could be one or more sensors for e.g. temperature, air quality, pressure, pulse etc. measurement

\*\* Depending on application it can be transceivers for e.g. Bluetooth, Wi-Fi, NFC etc.







# Smart Beacons & Price Tags

## Multi-Pixel Gas Sensors SGP

### SGP Series

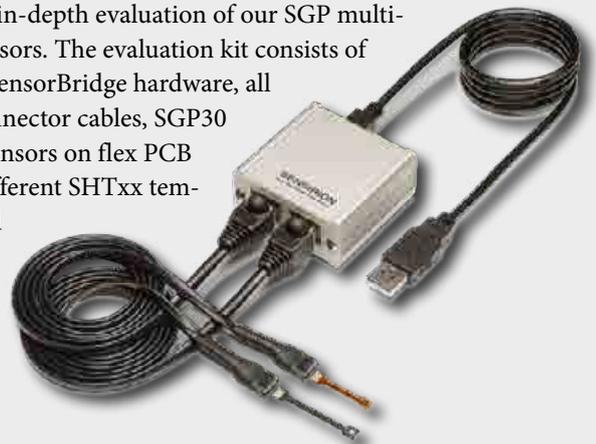
People spend 90% of their time indoors where concentrations of gaseous pollutants are significantly higher than outdoors. The widespread use of new products and building materials, as well as improved insulation for energy efficiency, has resulted in increased concentrations of volatile organic compounds (VOCs). These VOCs originate mainly from paints and solvents, carpets and furniture, and cleaning agents, and are also emitted by humans. Elevated VOC levels can have a negative impact on wellbeing, comfort, and cognitive abilities. Exposure to high levels of VOCs can be avoided or significantly reduced by regular ventilation, air purification and removal of strong VOC sources. The Total VOC (TVOC) concept has been established as a practical time and cost-effective method of surveying indoor environments for contamination. Sensirion's multi-pixel gas sensor SGP enables measurement of TVOC levels and thus helps to increase the efficiency of ventilation and air purification, and increases awareness of VOC sources and indoor air pollution.

#### Features

- Outstanding long-term stability
- I<sup>2</sup>C interface with TVOC and CO<sub>2</sub>eq output signals
- Very small 6-pin DFN package:  
2.45 x 2.45 x 0.9 mm
- Low power consumption: 48 mA at 1.8 V
- Tape and reel packaged, reflow solderable

#### Evaluation Kit SEK-SGP

The evaluation kits SEK-SGP30 and SEK-SGPC3 are designed for an easy and cost-efficient evaluation of Sensirion's SGP multi-pixel gas sensors. The SEK combines plug-and-play hardware with easy-to-use viewer software, the ControlCenter, enabling an in-depth evaluation of our SGP multi-pixel gas sensors. The evaluation kit consists of Sensirion's SensorBridge hardware, all required connector cables, SGP30 or SGPC3 sensors on flex PCB as well as different SHTxx temperature and humidity sensors on flex PCB..





## Long Distance Ranging Time-of-Flight Sensor Based on ST's FlightSense™

### VL53L1X

The VL53L1X is a state-of-the-art, Time-of-Flight (ToF), laser-ranging sensor, enhancing the ST FlightSense™ product family. It is the fastest miniature ToF sensor on the market with accurate ranging up to 4 m and fast ranging frequency up to 50 Hz. Housed in a miniature and reflowable package, it integrates a SPAD receiving array, a 940 nm invisible Class1 laser emitter, physical infrared filters, and optics to achieve the best ranging performance in various ambient lighting conditions with a range of cover window options.

Unlike conventional IR sensors, the VL53L1X uses ST's latest generation ToF technology which allows absolute distance measurement whatever the target color and reflectance. It is also possible to program the size of the ROI on the receiving array, allowing the sensor FoV to be reduced.

#### Key Features

- Fully integrated miniature module
- Size: 4.9x2.5x1.56 mm
- Emitter: 940 nm invisible laser (Class1)
- SPAD (single photon avalanche diode) receiving array with integrated lens
- Low-power microcontroller running advanced digital firmware
- Pin-to-pin compatible with the VL53L0X FlightSense™ ranging sensor
- Fast and accurate long distance ranging
- Up to 400 cm distance measurement
- Up to 50 Hz ranging frequency
- Typical full field-of-view (FoV): 27 °
- Programmable region-of-interest (ROI) size on the receiving array, allowing the sensor FoV to be reduced
- Programmable ROI position on the receiving array, providing multizone operation control from the host



#### Easy Integration

- Single reflowable component
- Can be hidden behind many cover window materials
- Software driver and code examples for turnkey ranging
- Single power supply (2v8)
- I<sup>2</sup>C interface (up to 1 MHz)
- Shutdown and interrupt pins

#### Applications

- Advanced user detection for power-saving and improved security in personal computers and IoT devices
- Long distance and rapid obstacle detection for robotics and smart buildings
- Hovering and landing assistance for drones
- Gesture recognition
- Camera and video assist (ultra-fast autofocus)





# Smart Beacons & Price Tags

## BLE Beacons

### ISP1580



This miniature BLE beacon from Insight SiP, is based on the ultra-low power nRF52832 Chip from Nordic Semiconductor.

Insight SiP engineered the best in class hardware and software optimized solution to provide up to several years beacon advertising in a very inexpensive design.

#### Key Features

- 2.4 GHz Ultra Low Power RF transceiver
- Bluetooth 5 Ready stack
- Fully integrated RF matching and antenna
- Integrated 32 MHz & 32 kHz clock
- DC/DC converter with loading circuit
- 32-bit Arm® Cortex®-M4F CPU
- Coin cell battery CR2032
- Very small size: 24 x 35 x 0.8 mm
- Temperature -40 °C to +85 °C
- Certification: Bluetooth SIG, CE, FCC, IC, IMOC, TELEC
- Application available to set the different parameters of the beacon

#### Applikation

- Marketing or retail applications
- Location system
- Private network information
- Find me devices
- Healthcare
- Beacon technologies in education



### PAN1740 Beacon

## Panasonic

The PAN1740 beacon is based on the PAN1740 module and has a power consumption of less than 5 mA in TX mode. That makes the beacon suitable for applications running on a coin cell battery for many months. The battery holder fits a standard CR2032 coin cell battery. Customer application can be put in the onboard flash memory.

#### Key Features

- Based on Dialog 14580 Bluetooth smart System-on-Chip
- Arm® Cortex®-M0 with internal 32 kB OTP
- Small size (26 x 24 mm) with antenna
- FCC, IC and CE certified
- Battery holder for CR2032 coin cell
- Available reference design for plastic housing
- Estimated battery life of 18 months (700 ms advertising interval)
- Available sample code and application note
- Operating temperature range: -40 °C to +85 °C
- Power supply: 2.35 to 3.3 V
- Receiver sensitivity: -93 dBm
- Low power consumption: 5mA in TX mode





## M24SR series easier NFC connectivity

Dynamic NFC/RFID tags with I<sup>2</sup>C EEPROM



## Dynamic NFC Tags

### ST25DV

The ST25DV series of dynamic NFC/RFID tags offers a 13.56 MHz long-range interface compatible with NFC phones and readers. Based on an ISO/IEC 15693 and NFC forum type 5 tag, ST25DV tag ICs can be operated from an RFID reader or an NFC phone. They also include an I<sup>2</sup>C interface that lets them connect to a host (MCU, MPU, etc.). These tags feature an innovative fast transfer mode between an embedded host and an NFC phone or reader thanks to their half-duplex 256-byte buffer. ST25DV dynamic NFC/RFID tags can be used in a wide variety of applications including consumer electronics, industrial, metering, electronic shelf labels, IoT objects and more.



#### Features

- ISO/IEC 15693 and NFC forum type 5 tag contactless interface
- 1-MHz I<sup>2</sup>C serial interface operating from 1.8 to 5.5 V
- EEPROM memory density from 4 to 64 Kbits
- Fast Transfer mode thanks to 256-byte buffer
- Energy harvesting feature
- 64-bit password protection
- GPO interruption pin configurable on multiple RF events
- Temperature range
  - Range 6: -40 to 85 °C
  - Range 8: -40 to 105 °C (UDFPN8 only)  
-40 to 125 °C (SO8N and TSSOP8 only,  
105 °C max on RF interface)
- Simple antenna design, backward compatible with M24LR series

### M24LR Series

The M24LR series offers a long-range RFID interface compatible with ISO 15693-capable NFC phones. It features an energy harvesting function that enables batteryless designs. It can be used in a wide variety of applications, including consumer electronics, computer peripherals, home appliances, industrial automation and healthcare products.

- ISO 15693 tag RF interface
- 400 kHz I<sup>2</sup>C serial interface operating from 1.8 to 5.5 V
- EEPROM memory density from 4 Kbits to 64 Kbits
- Energy harvesting
- 32-bit password protection
- RF WIP/busy output pin
- Simple antenna design, backward compatible with M24SR series

### M24SR

The M24SR series provides an NFC forum tag type 4 RF interface and supports the NFC data exchange format (NDEF). This enables NFC use cases such as simple Bluetooth pairing and other connection handovers, automatic links to URLs, storage of Vcard and other types of information. It can be used in a wide variety of applications, including consumer electronics, computer peripherals, home appliances, industrial automation and healthcare products.



- NFC forum tag type 4 based on ISO 14443 RF interface
- 1 MHz I<sup>2</sup>C serial interface operating from 2.7 to 5.5 V
- EEPROM memory density from 2 Kbits to 64 Kbits with built-in NDEF message support
- RF disable pin allowing the application to control RF access from NFC phones
- 128-bit password protection
- General-purpose output pin allowing flexibility for the applications (wake up on several types of events)
- Simple antenna design, backward compatible with M24LR series





# Smart Beacons & Price Tags NFC Tags

# Panasonic

## MN63Y12xx NFC Tag ICs & MN63Y32xx NFC Tag Modules

### Features & Benefits

- Global interoperability  
=> Compliant with ISO14443A, ISO14443B and FeliCa
- High Security  
=> AES-128 encryption / 128 bit password protection
- Long life time  
=> Built-in FeRAM guarantees 100 million write cycles
- Advanced host interface  
=> I<sup>2</sup>C or UART/SPI interface with host wake-up function
- Energy harvesting  
=> Host can be powered by the NFC magnetic field energy

### Application Examples

- Wireless connectivity  
=> Cost effective and reliable HMI, also for sealed devices
- Bluetooth / Wi-Fi pairing  
=> Pair devices by an easy one touch operation
- Access control  
=> Identification by NFC cards / NFC smart phones
- Setup & diagnostics  
=> Data can be read / written even without power supply
- Digital signage  
=> NFC user interaction opens new marketing approaches

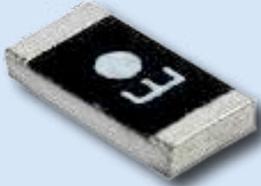
### NFC Product Portfolio

Type	NFC Tag ICs				NFC Tag Modules				
Parts No	MN63Y 1210AF	MN63Y 1212-E1	MN63Y 1213-E1	MN63Y 1221-E1	MN63Y 3214N1	MN63Y 3213N1	MN63Y 3212N1	MN63Y 3212N4	MN63Y 3212N5
Picture									
Operation Voltage	1.8V to 3.6V 4.5V to 5.5V	-	1.7V to 3.6V			-		-	
Operating Temperature	-20 to 85°C				-20 to 75°C			-20 to 55°C	
Storage Temperature	-40 to 85°C				-40 to 85°C			-25 to 80°C	
Non-volatile Memory	Total Storage: 512 Byte User Data Area: 432 Byte			Total Storage: 1024 Byte User Data Area: 960 Byte		Total Storage: 512 Byte User Data Area: 432 Byte			
	Endurance : 100 000 000 times								
RF Interface	Type-A			✓	✓				
	Type-B	✓	✓	✓	✓	✓	✓	✓	✓
	Type-F	✓	✓	✓	✓	✓	✓	✓	✓
NFC Forum Tag	Type3	Type4B, Type3		Type4A, Type4B, Type3		Type4B, Type3			
Security Function	N/A	AES128 Encryption		Password Protection		AES128 Encryption			
Serial Interface	UART Sync Serial	N/A (only IRQ)	I <sup>2</sup> C (100kbps)	I <sup>2</sup> C (400kbps)		I <sup>2</sup> C (100kbps)	N/A (only IRQ)	N/A	
Package Size	SSOP 16pin 5.0x6.4x1.3 mm	SON 8pin 2x2x0.45 mm			40x30x1.35 mm	9x30x1.4 mm	11.5x25x0.85 mm	Ø30x3 mm PC molded	30x15x2.4 mm PC molded

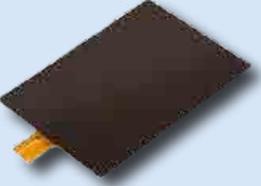


# Antennas

Recommended for Smart Beacons & Price Tags

Type	ANT3216A063R2455A	YAGEO®
Standard	Wlan / ISM	
Frequency	2.4 & 5 GHz	
Gain	1.59 / 2.23 dBi	
Polarization	Linear	
Max. Power	1 W	

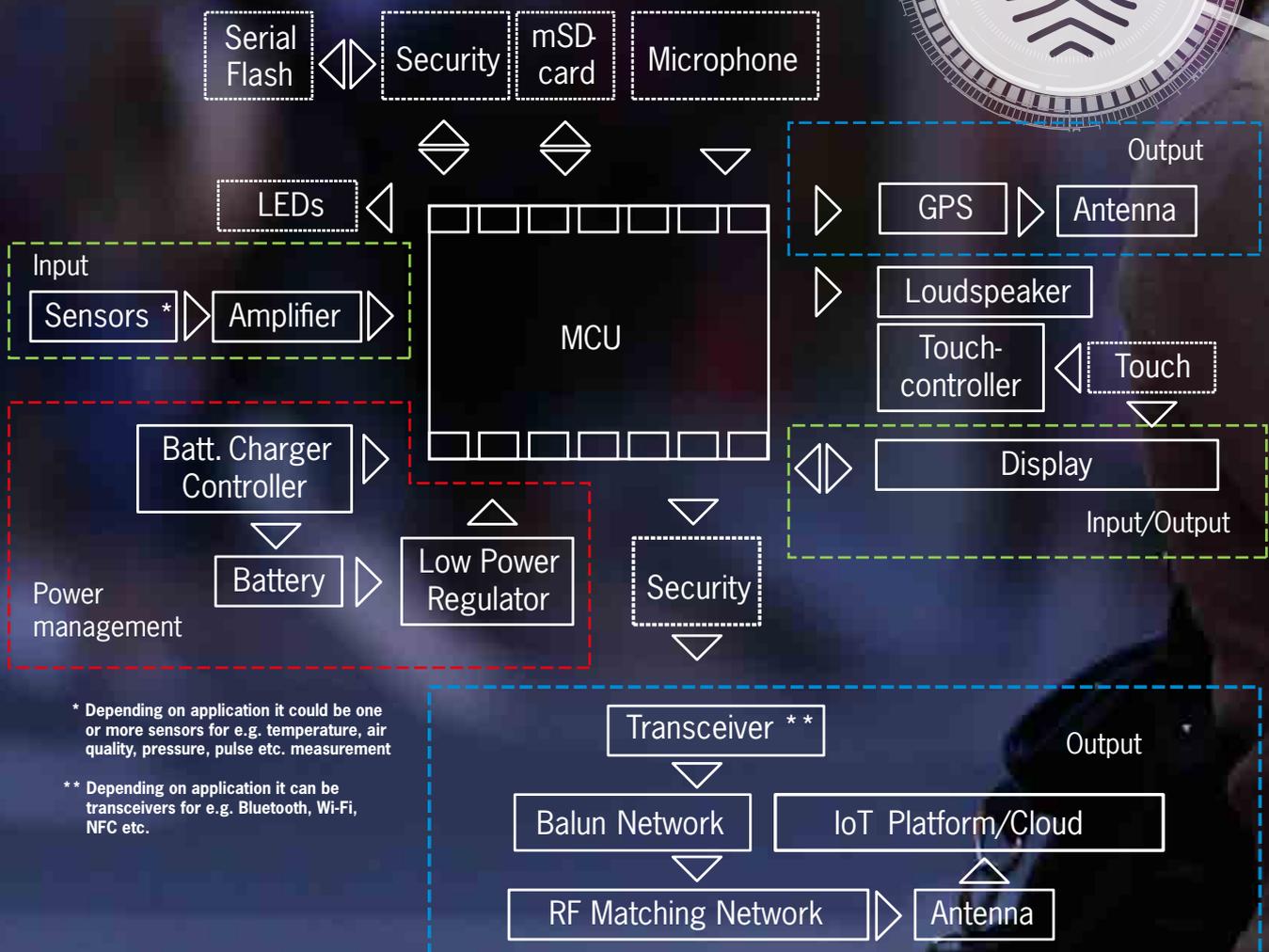
Type	ANT1608LL14R2455A	YAGEO®
Standard	Wlan / ISM	
Frequency	2.4 / 5 GHz	
Gain	3.11 / 3.43 dBi	
Polarization	Linear	
Max. Power	1 W	

Type	W3579	Pulse Electronics
Standard	NFC	
Frequency	13.56 MHz	
Antenna Type	Ferrite-backed NFC Antenna	
Size	35 x 50 x 0.30 mm	
Impedance	50 / 80 Ω	

Type	W3334B0150	Pulse Electronics
Standard	Bluetooth / Wlan / ZigBee	
Frequency	2.4 & 5 GHz	
Antenna Type	FPC Antenna	
Size	4.3 x 15.3 x 0.1 mm	
Peak Gain	4/5.5 dBi	



# SMART VENDING MACHINES



\* Depending on application it could be one or more sensors for e.g. temperature, air quality, pressure, pulse etc. measurement

\*\* Depending on application it can be transceivers for e.g. Bluetooth, Wi-Fi, NFC etc.







# HVC-P2 (Human Vision Components)

## Benefits

- People's conditions recognizable simply by mounting an HVC on equipment, regardless of the CPU performance of a customer's equipment, simply mounting an HVC on the equipment enables the customer to obtain the results of advanced image processing as a sensor output.
- Full range of functions, ten different sensing functions are incorporated to recognise the intentions and conditions of people from a variety of perspectives.
- High precision: accurate recognition of people's conditions and intentions is enabled under a variety of situations in which a customer's equipment is used

## Specifications

<b>Part Number</b>	<b>B5T-007001-010</b>
Horizontal Detection Area (angle of view)	50 deg: 54°±3°; 90 deg: 94°±5°
Vertical Detection Area (angle of view)	50 deg: 41°±3°, 90 deg: 76°±5°
Detection Distance (differs per function)	3.2-16.7 m (HVC-P2 50 deg), 1.6-8.6 m (HVC-P2 90 deg)
Dimensions (WxLxH)	45 x 45 x 8.2 mm (main board for both types), 25 x 25 x 8.7 mm (camera board 50deg type), 25 x 25 x 15.7 mm (camera board 90deg type)

## Outdoors

- Estimate interest and purchase behaviour of people to store goods of interest
- Vending machines recommending drinks to people

## Home

- Home appliances matching movement of people
- AC units targeting people
- Robots matching people
- Lights targeting only people

## Workplace

- AC units targeting people
- Lights targeting only people
- Hands free machine operation
- Doors opening to registered people



## Main Features

- Camera module angle of view: 2 models (50deg. and 90deg.) available
- Multiple functions (10 functions): Body Detection, Face Detection, Hand Detection, Face Direction Estimation, Gaze Estimation, Blink Estimation, Age Estimation, Gender Estimation, Expression Estimation and Face Recognition
- User friendly: Easy implementation through UART or USB



Face Detection	Face Recognition	Gender Estimation	Age Estimation	Expression Estimation
Facial Pose Estimation	Gaze Estimation	Blink Estimation	Hand Detection	Human Body Detection

Function	Result
Face Detection, Body Detection, Hand Detection	Result count (max:35), Center coordinates (X & Y), Detection size (pixel), Degree of confidence
Face Direction Estimation	Yaw degree, Pitch degree, Roll degree, Degree of confidence
Gaze Estimation	Yaw degree, Pitch degree
Blink Estimation	Blink degree (left-side eye/right-side eye)
Age Estimation	Age, degree of confidence
Gender Estimation	Gender, degree of confidence
Expression Estimation	5 expressions: "neutral", "happiness", "surprise", "anger", "sadness" and their respective score, Expression degree (positive/negative)
Face Recognition	Individual recognition result, score
Image output	Choose one: none, 160 x 120 pixels, 320 x 240 pixels Image format: 8-bit Y data



## Transmissive Optical Sensors

The new TCUT transmissive sensors in a compact transmissive sensor include two infrared emitters and three or four phototransistor detectors, located face-to-face in a surface mount package.

### 3-Channel Transmissive Optical Sensor for „Turn and Push“ Encoding

#### TCUT1630X01

##### Features

- Combines infrared emitter and 3 phototransistors
- Dimensions (L x W x H in mm): 5.5 x 5.85 x 7
- AEC-Q101 qualified
- Gap (in mm): 3
- Aperture (in mm): 0.3
- Typical output current under test: IC = 1.3 mA
- Emitter wavelength: 950 nm
- Operating temp.: -40 to +105 °C
- Moisture sensitivity level (MSL): 1

##### Applications

- Sensors for motion, speed, and direction
- Steering Angle detection (ESP)
- Sensors for “turn and push” encoding
- Position sensors in climate control panels



### 4-Channel Transmissive Optical Sensor for Absolute and Incremental Encoding

#### TCUT1800X01

##### Features

- Combines 2 infrared emitters and 4 phototransistors
- Dimensions (L x W x H in mm): 5.5 x 5.85 x 7
- AEC-Q101 qualified
- Gap (in mm): 3
- Aperture (in mm): 0.3
- Typical output current under test: IC = 1.3 mA
- Emitter wavelength: 950 nm
- Operating temp.: -40 to +105 °C
- Moisture sensitivity level (MSL): 1

##### Applications

- Optical encoders that requires high resolution (can detect upto 16 positions)
- Ignition locks and adaptive headlights
- Encoder for interior turn knobs (climate panel, e-shifter, iDrive)
- Control system valve or vane feedback position sensing



## Fully Integrated Proximity & Ambient Light Sensors

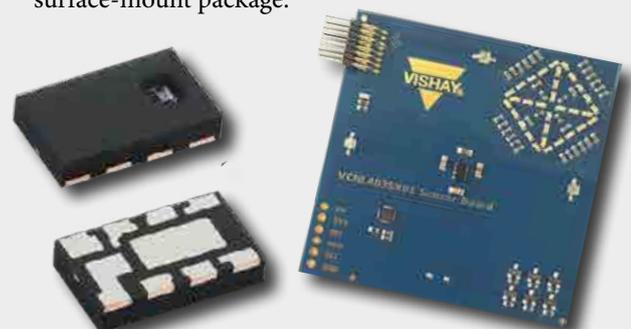
Featuring Filtron technology, the sensor combines photo detectors for proximity and ambient light, a signal conditioning IC.

### New Fully Integrated Automotive Grade Proximity and Ambient Light Sensor for Gesture Recognition

#### VCNL4035X01

##### Features

- Offers excellent background light cancellation capabilities
- AEC-Q101 qualified
- Supports I<sup>2</sup>C bus communication interface
- High object detection distances up to 500 mm
- Ambient light photo diode offers detection from 0.004 lx to 4.2 klx
- High accuracy of ± 10 %
- Excellent temperature compensation: -40 to +105 °C
- Proximity function uses intelligent cancellation to eliminate cross-talk
- Supply voltage range of 2.5 V to 3.6 V
- I<sup>2</sup>C bus voltage range from 1.8 V to 5 V
- A 16-bit ADC, and a driver for up to three external IREDs in one compact 4 mm by 2.36 mm by 0.75 mm surface-mount package.



VCNL4035 Board

Demo Boards available



# Smart Vending Machines

## Dual Band Wi-Fi Modules



### WE866 Wi-Fi Family

#### Dual Band Wi-Fi & Bluetooth Combo Solutions

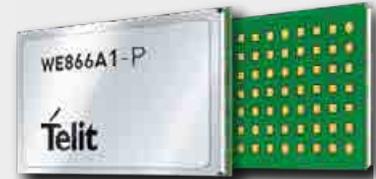
Integrating Wi-Fi™ to your IoT solution is simplified with the use of Telit's pre-certified Wi-Fi modules. This new & upcoming WE866 variants offer a rich feature set while packed in a small footprint. See what low energy Wi-Fi and Wi-Fi + Bluetooth combo solutions can do by integrating Telit's line of fully certified modules.

#### Key Features

- Single band (2.4 GHz) & dual band (2.4 GHz / 5 GHz) Wi-Fi modules for high bandwidth IoT applications
- International regulatory certifications
- Industrial grade temperature range
- Proprietary technology delivers power consumption savings of up to 97% when compared to the IEEE standard and competitors

#### Applications

- Connected home
- Wearables
- Healthcare
- Automobiles
- Audio/Video
- Smart Home/Smart Energy
- Industrial controls, monitoring



Specifications	WE866E2	WE866E4	WE866C3 (LE910 companion solution)	WE866A1 (LE910 companion solution)
Frequency	2.4 & 5 GHz	2.4 & 5 GHz	2.4 & 5 GHz	2.4 GHz
IEEE 802.11	802.11 a/b/g/n	802.11 a/b/g/n	802.11 a/b/g/n/ac	802.11 b/g/n
Bluetooth	-	Bluetooth 5	Bluetooth v4.2 + HS	-
IEEE 802.15.4	-	Yes (Thread)	-	-
ANT	-	-	ANT+	-
TCP/IP	Yes	Yes	-	Yes
Drivers	Linux	Linux	Linux, Android OS	-
MCU	Cortex M4-F	Cortex M4-F	-	-
Internal Flash	4MB	4MB	-	-
Security	<ul style="list-style-type: none"> <li>Secured Boot</li> <li>Flash encryption</li> <li>Copy Protection</li> <li>WPA2 Personal and Enterprise</li> <li>TLS-1.2/SSL-3.0, HTTPS</li> </ul>	<ul style="list-style-type: none"> <li>Secured Boot</li> <li>Flash encryption</li> <li>Copy Protection</li> <li>WPA2 Personal and Enterprise</li> <li>TLS-1.2/SSL-3.0, HTTPS</li> </ul>		<ul style="list-style-type: none"> <li>Powerful Crypto Engine</li> <li>256-Bit AES</li> <li>WPA2 Personal and Enterprise</li> <li>TLS-1.2/SSL-3.0, HTTPS</li> </ul>
Operating Temp.	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C	-40°C to +85°C
Operating Voltage	3.3 V	1.8 – 3.3 V	3.3 V	3.1 - 4.5 V
Peripherals	SPI, UART, I <sup>2</sup> C, I <sup>2</sup> S, GPIO, ADC (12 bit), PWM, JTAG, SDIO	SPI, UART, I <sup>2</sup> C, I <sup>2</sup> S, GPIO, ADC (12 bit), PWM, JTAG, SDIO	SDIO 3.0, UART, PCM	4-wire UART, SPI
Antenna Options	External (RF Pad) / Internal Antenna	Dual Antenna Pin	External (RF Pad) / Internal Antenna	External (RF Pad)
Certifications	FCC, IC, CE, TELEC	FCC, IC, CE, TELEC	FCC, IC, CE	FCC, IC, CE
Dimensions	15 x 19 mm (Ant. pin) 15 x 25 mm (Int. Ant.)	15 x 19 mm	15 x 13 mm (Ant. pin) 15 x 19 mm (Int. Ant.)	15 x 19 mm





## Sub-GHz & Single Band Wi-Fi Modules

### S2-LP



Ultra-low Power, High Performance, Sub-1GHz Transceiver

The S2-LP is a high performance ultra-low power RF transceiver, intended for RF wireless applications in the sub-1 GHz band. It is designed to operate in both the license-free ISM and SRD frequency bands at 433, 512, 868 and 920 MHz, but can also be programmed to operate at other additional frequencies in the 413-479 MHz, 452-527 MHz, 826-958 MHz, 904-1055 MHz bands.

#### Key Features

- Modulation schemes:  
2(G)FSK, 4(G)FSK / OOK, ASK
- Air data rate from 0.1 to 500 kbps
- Ultra-low power consumption:  
7 mA RX / 10 mA TX @ +10 dBm
- Excellent performance of receiver sensitivity:  
down to -130 dBm
- Programmable RF output power up to +16 dBm
- Programmable channel spacing
- Battery indicator and low battery detector
- 4-wire SPI interface
- Wake-up driven by internal timer or external event
- IEEE 802.15.4g hardware packet support with whitening,  
FEC, CRC and dual SYNC word detection
- Wireless M-BUS supported
- Enables operations in the SIGFOX™ networks
- Operating temperature range: -40 °C to +105 °C
- Suitable to build systems targeting:
  - Europe: ETSI EN 300 220,  
category 1.5 natively  
compliant, ETSI EN 303 131
  - US: FCC part 15 and part 90
  - Japan: ARIB STD T67, T108
  - China: SRRC



### PAN9420

## Panasonic

Wi-Fi 2.4 GHz Module

The PAN9420 is a fully embedded stand-alone 2.4 GHz 802.11 b/g/n module. Simultaneous Wi-Fi connections are supported via parallel use of access point and infrastructure mode. In Transparent Mode all data is sent unmodified to e.g. smart devices, web server or PC applications via the UART interface of the modules. With its integrated stack and API that minimizes firmware development, the PAN9420 works well for highly integrated and cost-effective applications.

#### Key Features

- Supports IEEE 802.11 b/g/n
- Fully embedded: integrated full-featured network stack
- Contains all necessary IoT functionality (Place & Play)
- No stack or software implementation needed on a host MCU
- Simultaneous support of access point & infrastructure mode
- Fully automatically IP configuration
- DHCP server offers IP configuration in AP mode
- Access by names (<http://yourdevice>)
- Integrated TCP/IP network stack: IPv4, ARP, and AutoIP
- Supports TLS/SSL, https, and Wi-Fi security (WPA2) for secure data connection
- Over-the-Air firmware update
- Two UART interfaces (command and transparent data)
- Integr. QSPI flash for customer web contents and configuration file
- Programming via standard JTAG
- Evaluation kit with pre-installed web application for quick prototyping available
- Evaluation and development tool WiFigurator for Windows
- Getting starter tutorials, PC tool, quick start guide





# Smart Vending Machines

## LTE Cat. M1 & NB-IoT Combo Modules



### ML865C1 Series

The ML865C1 is the Category M1/NB1 evolution in the widely deployed Telit xL865 product family. It's specifically tailored for IoT applications, offering optimized power consumption and enhanced coverage. In addition, with its square 24.4 x 24.4 mm VQFN footprint, the ML865C1 is designed for size sensitive applications. This next generation of products supports the new features specified by 3GPP to boost IoT applications, such as the Power Saving Mode (PSM) and the extended Discontinuous Reception (eDRX), which allow the devices to wake up periodically to deliver only very small amounts of data to the network and then go back to sleep for most of the time, thus allowing longer battery operation.

#### Key Features

- LTE UE Category M1/NB1
- 3GPP release 13 compliant
- Half Duplex FDD
- Single Rx, single antenna
- 3GPP Rel. 12 Power Saving Mode (PSM)
- 3GPP Rel. 13 Extended Discontinuous Reception (eDRX)
- 3GPP Rel. 13 Extended coverage
- Control via AT commands according to 3GPP TS27.005, 27.007 and customized AT commands
- SMS
- IPv4/IPv6 stack with TCP and UDP protocol
- OMA Lightweight M2M (LWM2M)
- Over-the-Air firmware update

- Telit Application Development Environment: AppZone C
- TLS 1.2
- Optional embedded GNSS (GPS, GLONASS, Beidou, Galileo)
- Dimensions 24.4 x 24.4 x 2.6 mm
- Temperature Range: -40 °C to +85 °C
- Interfaces: USB 2.0 HS, UART, SPI, I<sup>2</sup>C, GPIO, ADC

#### Application Fields

- Smart meters
- Industrial sensors
- Healthcare monitors
- Home automation
- Asset tracker

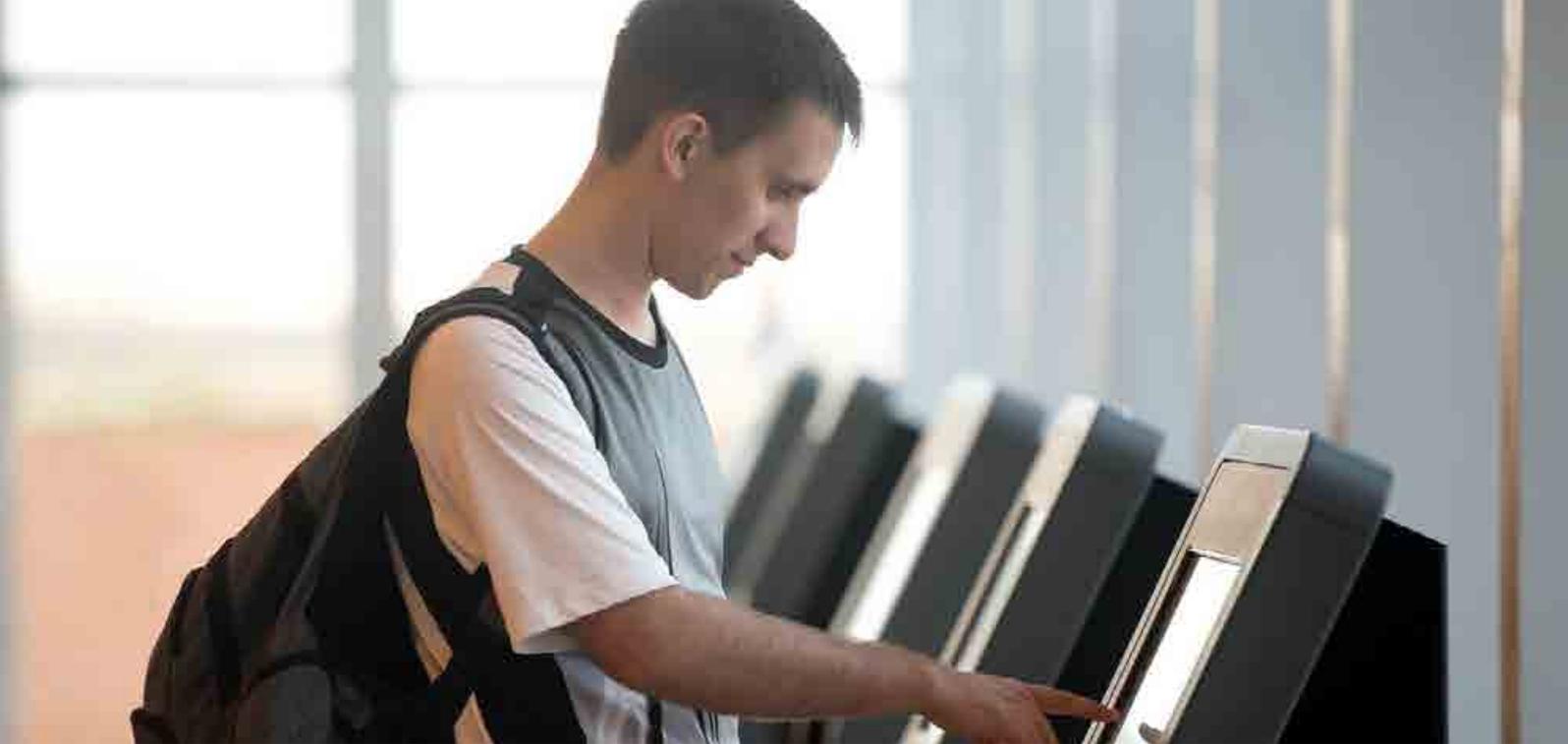


#### Please Note:

There is also a single LTE NB-IoT / LTE NB1 solution available within the xL865 Family: NL865B1

Model	ML865C1-EA	ML865C1-NA
M1/NB1	M1 & NB1	M1
Market	Europe, APAC, Latin America	North America
4G	B1, B3, B5, B8, B18, B19, B20, B26, B28	B2, B4, B12, B13
2G	B2, B3, B5, B8	-
Approvals	RED, GCF	FCC/IC, GCF, PTCRB, Verizon, AT&T





## LTE Cat. M1 & NB-IoT Combo Modules



### nRF9160 SiP Series – Low-Power MCU with Integrated LTE-M and NB-IoT

The nRF9160 from Nordic Semiconductor is making the latest LTE technology accessible for a wide range of applications and developers. Through the high integration and pre-certification for global operation, it solves the complex wireless design challenges as well as comprehensive set of qualifications needed to utilize cellular technology. By integrating an application MCU, full LTE modem, RF front end and power management in a 10x16x1.2 mm package, it also offers the most compact solution for cellular IoT (cIoT) on the market. Targeting asset tracking applications, the nRF91 SiP Series includes a variant with built-in GPS support. It combines location data from the cellular network with GPS satellite trilateration to allow remote monitoring of the device position.

#### Key Features

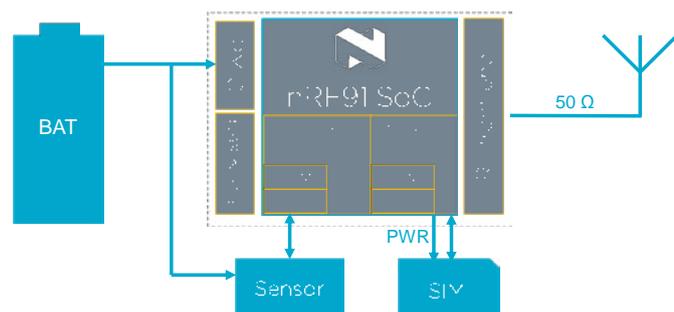
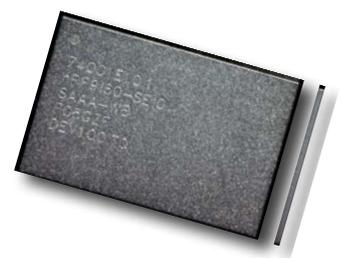
- LTE-M and NB-IoT support in bands from 700 MHz to 2.2 GHz
- Worldwide operation
- Arm® Cortex®-M33 processor with on-chip flash and RAM exclusively for application use
- TrustZone for trusted execution
- Crypto cell co-processor
- Low power peripherals
- 32 GPIO with flexible mapping
- Single 3.1 V – 5.5 V supply
- Single-ended 50 Ω RF
- Ultra-compact form factor 10 x 16 x 1.2 mm
- Built-in assisted GPS for positioning

#### Application Fields

- Smart meters
- Industrial sensors
- Healthcare monitors
- Home automation
- Asset tracker

#### Application Circuitry

- High integration single chip
- Direct supply from Li-ion
- Single 50 Ohm connection to antenna
- SIM or eSIM
- Application circuit: Sensors, actuators, user interface





# Smart Vending Machines

## NFC Tags



### ST25TA Series NFC Tags

The ST25TA series (formerly known as SRTAG series) provides an NFC Forum tag type 4 RF interface and supports the NFC data exchange format (NDEF). This enables NFC use cases such as NFC tag, NFC token, NFC smart poster, NFC business card (Virtual card). It can be used in a wide variety of applications, including consumer electronics, computer peripherals, gaming, home appliances, industrial automation and healthcare products.

#### Features & Benefits

- NFC forum tag type 4 based on ISO14443-A RF interface
- EEPROM memory density from 512-bit to 64-Kbit with built-in NDEF message support
- 20-bit events counter with anti-tearing
- Data protection with 128-bit password in Read and Write access
- Optional user-programmable digital output (Field detect, Write In Progress, RF busy,...)

### ST25TB Series NFC Tags

The ST25TB series of RFID tags are compatible with the ISO14443 standard, so support applications such as public transport and event ticketing. They provide state-of-the-art RF performance and include a counter able to count more than 4 billion events.

#### Features & Benefits

- ISO14443-2 Type B with proprietary protocol
- 512-, 2K-, and 4K-bit EEPROM with write protect
- Two 32-bit counters with anti-tearing feature
- OTP bytes with conditional erased features

### ST25TV Series NFC Tags

The ST25TV series supports NFC forum type 5 tags and complies with industrial ISO/IEC 15693 RFID specifications. It enables all NFC tag use cases such as smart poster (URL), wireless pairing, NFC business card (vCard) and all other NDEF formats (email, SMS, phone call, geo-localization, etc.)

#### Features & Benefits

##### Contactless Interface

- Supports all ISO/IEC 15693 modulations, coding, subcarrier modes and data rates
- Custom fast read access up to 53 Kbit/s
- Internal tuning capacitance: 28.5 pF
- Kill capability for privacy protection

##### Memory

- 16 KB or 64 Kbits of EEPROM
- Data retention: 40 years
- Write cycles endurance:  
Minimum endurance: 100 k write cycles

##### Data Protection

- User memory: one to four configurable areas, protectable in read and/or write by three 64-bit passwords
- System configuration: protected in write by a 64-bit password

##### Temperature Range

- From -40 to 85 °C



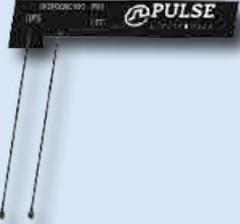
# Antennas

Recommended for Smart Vending Machines

Type	ANT4005B000RWHEXS	<b>YAGEO®</b>
Standard	Cellular (LTE)	
Frequency	698~960 / 1710~2690 MHz	
Gain	3.2 / 4.0 dBi	
Max. Power	1 W	
VSWR	3.0 dB max.	

Type	ANTX100P112B24553	<b>YAGEO®</b>
Standard	Bluetooth / Wlan / Zig-Bee	
Frequency	2.4 & 5 GHz	
Gain	2.2 / 2.9 dBi	
Max. Power	1 W	
VSWR	< 2.5:1	

Type	W3320	<b>Pulse Electronics</b>
Standard	ISM	
Frequency	868 / 915 / 2400 MHz	
Antenna Type	Ceramic Antenna	
Size	3.2 x 10 x 2 mm	
Polarization	Vertical	

Type	W3906B0100	<b>Pulse Electronics</b>
Standard	LTE / GNSS	
Frequency	698-3600 MHz	
Antenna Type	FPC Antenna	
Size	120.4 x 26.80 mm	
Polarization	Linear	



# Smart Tracking

The technician who repaired my washing machine leaves with a friendly “Take care!” The door slams shut and I am relieved that predictive maintenance has prevented the appliance from breaking down completely and I don’t have to buy a new washing machine. Predictive maintenance is becoming increasingly common in the home and, in combination with smart home applications, is increasing both convenience and quality of life. And this doesn’t only benefit me as a consumer – the industry also benefits from being able to anticipate and thereby prevent imminent breakdowns in a timely manner. This increases safety and cuts costs.

## Definition

“Predictive maintenance” is a typical Industry 4.0 application. It is already a common application in the digitization of systems and mechanical engineering and is based on condition monitoring, which is already common in many industries and which recognizes and monitors the wear condition of components. Predictive maintenance uses the data collected by condition monitoring to predict the expected state of the machine in the future and to assist in scheduling maintenance measures.

The process uses measurement and production data from machines and systems to calculate maintenance information. The purpose is to proactively maintain the machines and systems and minimize downtime. Ideally, malfunctions can be predicted before they have an impact or a breakdown occurs. By proactively initiating maintenance measures at an early stage, it is possible to prevent the malfunction from actually occurring. The ultimate goal is to avoid high costs due to machine downtime and repairs.

## Why a Tracking?

With its proactive approach, predictive maintenance differs significantly from conventional maintenance concepts. Traditional reactive maintenance is easy to perform, but involves a high risk. In contrast to predictive maintenance, reactive maintenance cannot proactively prevent machine failures and results in considerable downtime. In some cases, required spare parts can only be ordered after a malfunction has occurred and an analysis has been carried out.

In order to make reliable predictions about the condition of machines and systems and any expected malfunctions, you need to collect large amounts of data. This data must be stored, processed, and analyzed using intelligent algorithms. In addition to data from the machines themselves, information from peripheral equipment and environmental conditions such as temperature or humidity are also collected. The data must be collected at regular intervals in order to be able to identify trends and developments from the changes. To analyze the data, you need to quickly access the information you are looking for and process it with a high level of performance. Applications and database systems from the big data environment meet all these requirements. The larger the pool of data and the more intelligent and sophisticated the analysis algorithms are, the more reliable the findings that can be obtained.

Predictive maintenance offers a number of advantages over conventional maintenance approaches such as preventive or reactive maintenance. By knowing the current condition of the machine or system, you can avoid unplanned machine breakdowns and optimize field service employees’ assignments. Maintenance and service intervals as well as spare parts management are much easier to plan. In addition, by analyzing the data collected, you can improve machine performance and increase productivity.

Predictive maintenance is already being used in many sectors. For example, the speed, sound, and temperature of engines are recorded and unusual vibrations or imbalances are detected at an early stage. In this way, it is possible to anticipate the failure of a bearing at an early stage, for example. Machines and systems that are monitored and maintained by predictive maintenance include wind turbines, motor vehicles, and turbines. Predictive maintenance is also playing an increasingly important role in vehicles. Large amounts of data collected from many different sensors in the engine and chassis help prevent expensive repairs or vehicle breakdowns and make it possible to initiate preventive activities in a timely manner. This means that vehicle parts can be replaced on the next visit to the repair shop before they malfunction.





## Predictive Maintenance



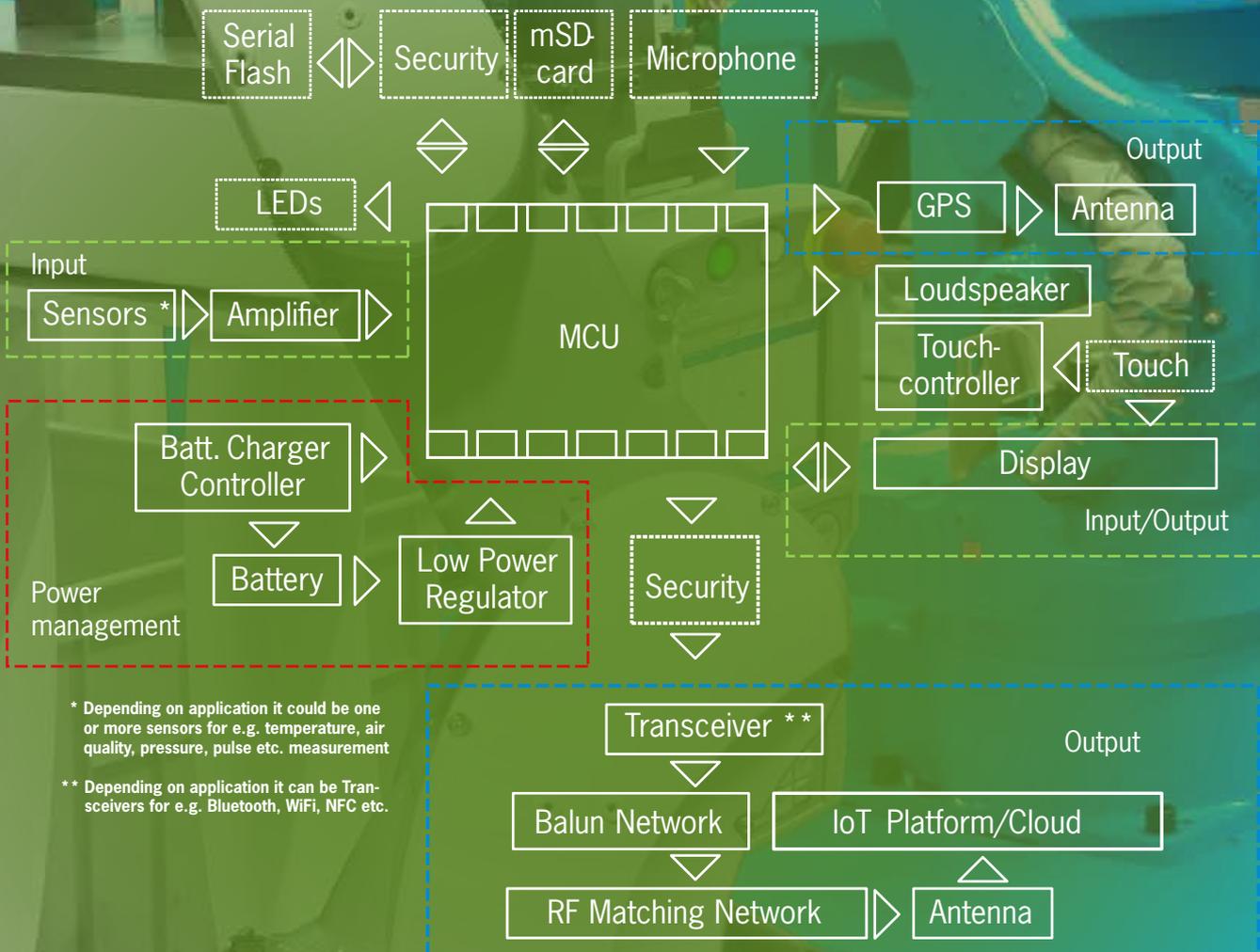
## Position Tracking



## Condition Tracking



# PREDICTIVE MAINTENANCE







# IM69D130

## High Performance Digital XENSIV™ MEMS Microphone

The IM69D130 is designed for applications where low self-noise (high SNR), wide dynamic range, low distortions and a high acoustic overload point is required. Infineon's Dual Backplate MEMS technology is based on a miniaturized symmetrical microphone design, similar as utilized in studio condenser microphones, and results in high linearity of the output signal within a dynamic range of 105dB. The microphone distortion does not exceed 1% even at sound pressure levels of 128dB SPL. The flat frequency response (28Hz low-frequency roll-off) and tight manufacturing tolerance result in close phase matching of the microphones, which is important for multi-microphone (array) applications. With its low equivalent noise floor of 25dB SPL the microphone is no longer the limiting factor in the audio signal chain and enables higher performance of voice recognition algorithms. The digital microphone ASIC contains an extremely low-noise preamplifier and a high-performance sigma-delta ADC. Different power modes can be selected in order to suit specific current consumption requirements. Each IM69D130 microphone is calibrated with an advanced Infineon calibration algorithm, resulting in small sensitivity tolerances. The phase response is tightly matched between microphones, in order to support beamforming applications.

### Key Features

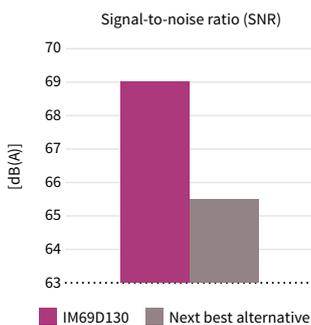
- 69 dB(A) signal-to-noise ratio
- Below 1 percent distortion
- at 128 dB SPL (130 dB SPL AOP)
- Digital (PDM) interface with 6 μs group delay at 1 kHz
- Tight sensitivity (-36 ±1 dB) and phase (±2°) tolerances
- 28 Hz low-frequency roll-off
- 980 μA current consumption
- (300 μA in low-power mode)

### Key Benefits

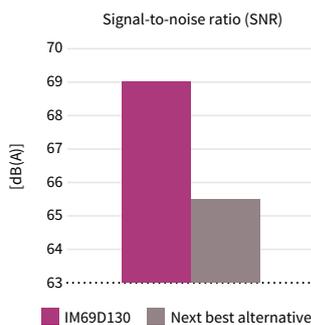
- Far field and soft audio signal pick-up
- Clear audio signals even at high sound pressure levels
- Enabling precise steering of audio beams for advanced audio algorithms

### Typical Applications

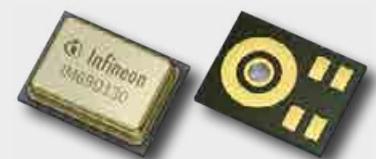
- Devices with Voice User Interface (VUI)
  - Smart speakers
  - Home automation
  - IOT devices
- Active Noise Cancellation (ANC) headphones and earphones
- High quality audio capturing
  - Conference systems
  - Cameras and camcorders
- Industrial or home monitoring with audio pattern

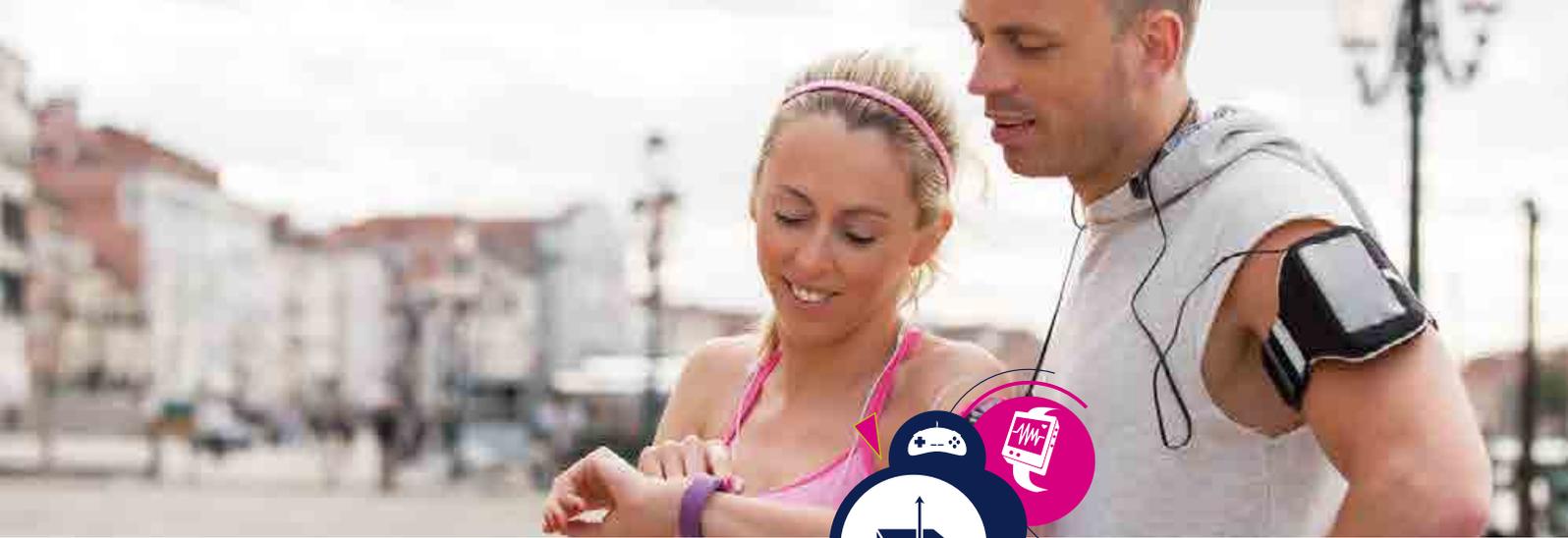


Clear far field and low volume audio pick-up



Below 1 percent distortion even if exposed to loud audio signals





# LIS2DW12

## Flexible Ultra-low-power 3-axis Smart Accelerometer in a 2x2x0.7 mm Package

ST has shipped more than 13 billion micro-electromechanical sensors and has one of the industry's most extensive sensor portfolio including proximity and MEMS accelerometers, gyroscopes, digital compasses, inertial modules, microphones, and environmental sensors such as pressure, temperature and humidity sensors.

### Key Features

- Acceleration range:  $\pm 2/\pm 4/\pm 8/\pm 16$  g
- Multiple operating modes with multiple bandwidths
- 32-level FIFO
- Noise density (accel.):  $90 \mu\text{g}/\sqrt{\text{Hz}}$
- Very low noise down to 1.3 mg RMS in low power mode
- 16-bit output resolution
- Ultra-low power consumption:
  - Power-down mode: 50 nA
  - Low-power mode:  $< 1 \mu\text{A}$  @ ODR = 12.5 Hz
- Supply voltage range: 1.62 to 3.6 V
- Temperature range: -40 to +85 °C
- I<sup>2</sup>C/SPI digital interfaces
- LGA-12 package (2 x 2 x 0.7 mm)

### Key Applications

- Motion detection for wearables
- Gesture recognition and gaming
- Motion-activated functions and user interfaces
- Display orientation
- Tap/double-tap recognition
- Free-fall detection
- Smart power saving for handheld devices
- Impact recognition and logging
- Hearing aids
- Portable healthcare devices
- Wireless sensor nodes
- Motion-enabled metering devices

### Advanced Applications

- Enhanced Flexibility with Embedded FIFO**  
32-level first-in, first-out (FIFO) buffer allowing the user to store data in order to limit intervention by the host processor.
- Higher Thermal Stability**  
Over the entire operating temperature range from -40 to +85 °C
- Ultra-low Power Consumption**
  - High-performance mode:
    - 90  $\mu\text{A}$  @ ODR = 12.5 to 1600 Hz
  - Low-power mode:
    - 5  $\mu\text{A}$  @ ODR = 100 Hz
    - 3  $\mu\text{A}$  @ ODR = 50 Hz
    - 1  $\mu\text{A}$  @ ODR = 12.5 Hz
    - 0.38  $\mu\text{A}$  @ ODR = 1.6 Hz
  - Power-down mode: 50 nA



Operating Modes		Parameter	High-perf. Mode	Low-power Mode 4	Low-power Mode 3	Low-power Mode 2	Low-power Mode 1
			Low-noise Mode >Disabled<	Resolution	14-bit	14-bit	14-bit
	Noise density ( $\mu\text{g}/\sqrt{\text{Hz}}$ )	110	160	210	300	550	
Low-noise Mode >Enabled<	Resolution	14-bit	14-bit	14-bit	14-bit	12-bit	
	Noise density ( $\mu\text{g}/\sqrt{\text{Hz}}$ )	90	130	180	240	450	

- Advanced Digital Features**  
Dedicated internal engine to process motion and acceleration detection:
  - Free-fall wakeup
  - 6D/4D orientation
  - Tap and double-tap recognition
  - Activity/inactivity recognition
  - Portrait/landscape detection



# Predictive Maintenance

## BLE & LoRa Modules

### PAN1740 **Panasonic**

Bluetooth® Low Energy v4.2 SoC Module

The PAN1740 Bluetooth v4.2 module is manufactured in a very small 9.0 x 9.5 mm SMD package with shielded case and chip antenna. The power consumption of only 4.9 mA in Tx and Rx mode makes the use of coin cell batteries possible or reduces the needed battery capacity and cost of existing solution by at least 50%.

#### Key Features

- Single-mode Bluetooth Smart System-on-Chip
- Arm® Cortex®-M0
- Small 9.0 x 9.5 x 1.8 mm SMD package with antenna
- Includes 16MHz and 32.768kHz crystal
- Temperature Range from -40°C to +85°C
- Power consumption 4.9mA Rx and Tx
- Link budget 93dBm (Rx Sensitivity -93, Tx 0 dBm)
- Interfaces: GPIO, UART, SPI, I<sup>2</sup>C, 3-axis QD, ADC
- 42k SRAM, 84k ROM for LE Host and Boot ROM
- 32k OTP Memory for Profiles and Apps (delivered blank)
- OTP (One Time Programmable)
- FCC, IC, CE



### RE866A1-EU – 3-in-1 **Telit**

Bluetooth® Low Energy®, NFC and LoRa®

The RE866 uses an open protocol and offers a unique combination of long range (LoRa) with Bluetooth Low Energy (BLE) and NFC for simple pairing. The enormously long range and ultra-low power consumption make the RE866A1-EU an ideal choice for battery-operated devices, supporting battery life of up to 10 years. The RE866 enables remote management and configuration via PC or mobile or the module can even act as a LoRa gateway for a subnetwork of connected BLE sensors.

#### Key Features

- LoRa Alliance certified module
- LoRaWan compliant
- Frequency: 863-870 MHz (optional channels)
- Bluetooth v4.2 qualified module
- Integrated antenna for BLE, External antenna for Sub-GHz
- Firmware update over the air
- LoRa®: Max Tx power: +14 dBm or up to +19 dBm in PA boost mode
- Receiver sensitivity: Up to -138 dBm
- Other interfaces: I<sup>2</sup>C, SPI, PWM, ADC, up to 16 GPIOs
- Temp.: -40 °C to +85 °C
- Power supply: 1.8 V to 3.6 V
- Dimensions: 19x15x2.2 mm
- RED certification





## BLE & Single Band Wi-Fi Modules

### SPBTLE-1S

Module with integrated BlueNRG-1



The SPBTLE-1S is a Bluetooth® Low Energy System-on-Chip application processor certified module, compliant with BT specifications v4.2 and BQE qualified.

#### Key Benefits

- Bluetooth v4.2 compliant
- High performance, ultra-low power Cortex-M0 32-bit based architecture core
- Programmable embedded 160 KB Flash
- Max Tx power: +5 dBm
- On-board chip antenna
- Small form factor: 11.5 mm x 13.5 mm
- AES security co-processor
- Operating supply voltage: from 1.7 to 3.6 V
- Operating temperature range: -40 °C to 85 °C



### GS2200M

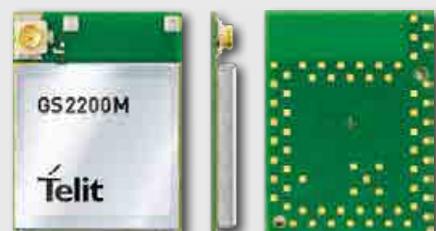
Single Band Wi-Fi Modules



The GS2200M-series comes with an extremely small footprint of only 17.85 x 13.5 x 2.1 mm. It is intended for both line-powered and battery-powered applications.

#### Key Features

- IEEE 802.11 b/g/n, 2.4 GHz single band
- 17.85 x 13.5 x 2.1 mm
- Extremely compact for size-constrained applications
- Ultra-low power through dynamic power management modes and optional off module DC to DC components
- Interfaces: SPI, UART, SDIO, I<sup>2</sup>C, I<sup>2</sup>S, GPIO
- GS2200MIZ – integrated chip antenna
- GS2200MIE – U.FL connector
- FCC, IC, CE, TELEC certified





## Predictive Maintenance – LTE NB-IoT & Dual Band Wi-Fi Combo Modules

### RS13100 Wireless MCU

Ultra-Low Power Dual-mode Bluetooth® 5,  
802.15.4 and Arm® Cortex®-M4F SoCs



The RS13100 provides the necessary wireless connectivity options and processing power for audio, data transfer, locationing and control/monitoring applications for wearable, home automation, industrial automation, lighting and home appliance markets.

#### Features & Benefits

- Highly integrated and secure solution with dual-mode Bluetooth 5 and 802.15.4 (capable of running ZigBee or Thread)
- Efficient on-chip application processor based on Arm® Cortex®-M4F with up to 180 MHz performance, up to 4 MB dedicated flash and up to 400 kB of RAM
- Support for BLE 5 long range (125 kbps), high data rate (2 Mbps) and advertising extensions
- Multiple levels of security including PUF (Physically Unclonable Function), Crypto HW accelerators, Secure Bootloader and Secure Zone, to create a highly secure system
- Ultra-small size SoC (3.51 mm x 3.6 mm) and module (4.63 mm x 7.90 mm) options (additional package options are also available)
- Integrated wireless stacks and profiles for easy evaluation and integration
- Leading edge RF performance (up to 20 dBm output power for BLE and 802.15.4) providing long range up and higher throughputs
- Unique peripherals like ULP sub-system, Voice Activity Detection (VAD) and up to 8 capacitive touch sensor inputs

### NE866B1 Series

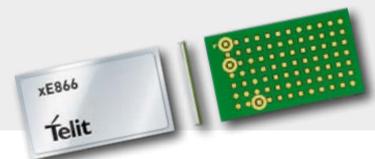
LTE NB-IoT / LTE NB1 Modules



The NE866B1 is the first Category NB1 product in the Telit portfolio. Specified in the approved Release 13 of the 3GPP standard, Cat NB1 devices are specifically tailored for IoT applications, offering optimized power consumption and enhanced coverage with up to +20 dB in maximum coupling loss (MCL). In addition, with its ultra compact 15 x 19 mm LGA footprint, the NE866B1 is designed for size sensitive applications. The NE866B1 is offered in a dual-band configuration for deployment in the European and Chinese NB-IoT networks, either in in-band, guard-band or standalone mode. Additional regional variants will follow.

#### Key Features

- NE866B1-E1
- Dual band LTE B8/B20
- Single Rx
- Half Duplex FDD
- LTE UE Category NB1
- 3GPP release 13 compliant
- 3GPP Rel. 12 Power Saving Mode (PSM)
- 3GPP Rel. 13 Extended Discontinuous Reception (eDRX)
- Control via AT commands according to 3GPP TS27.005, 27.007 and customized AT commands
- Embedded UDP/IP stack
- 3GPP Rel. 13 Extended coverage
- Data LTE NB-IoT:
  - Uplink up to 20 kbps (single-tone)
  - Downlink up to 250 kbps
- Dimensions 15 x 19 x 2.2 mm
- Temp. Range: -40 to +85 °C
- Interfaces: UART, SPI, I<sup>2</sup>C, GPIO, ADC
- Optional embedded SIM chip
- Approvals: RED, CCC, GCF



# Antennas

## Recommended for Predictive Maintenance

Type	ANTX100P002B24553	<b>YAGEO</b> <sup>®</sup>
Standard	Bluetooth / Wlan / ZigBee	
Frequency	2.4 & 5 GHz	
Gain	0.7 / 1.9 dBi	
Max. Power	1 W	
VSWR	< 2.5:1	

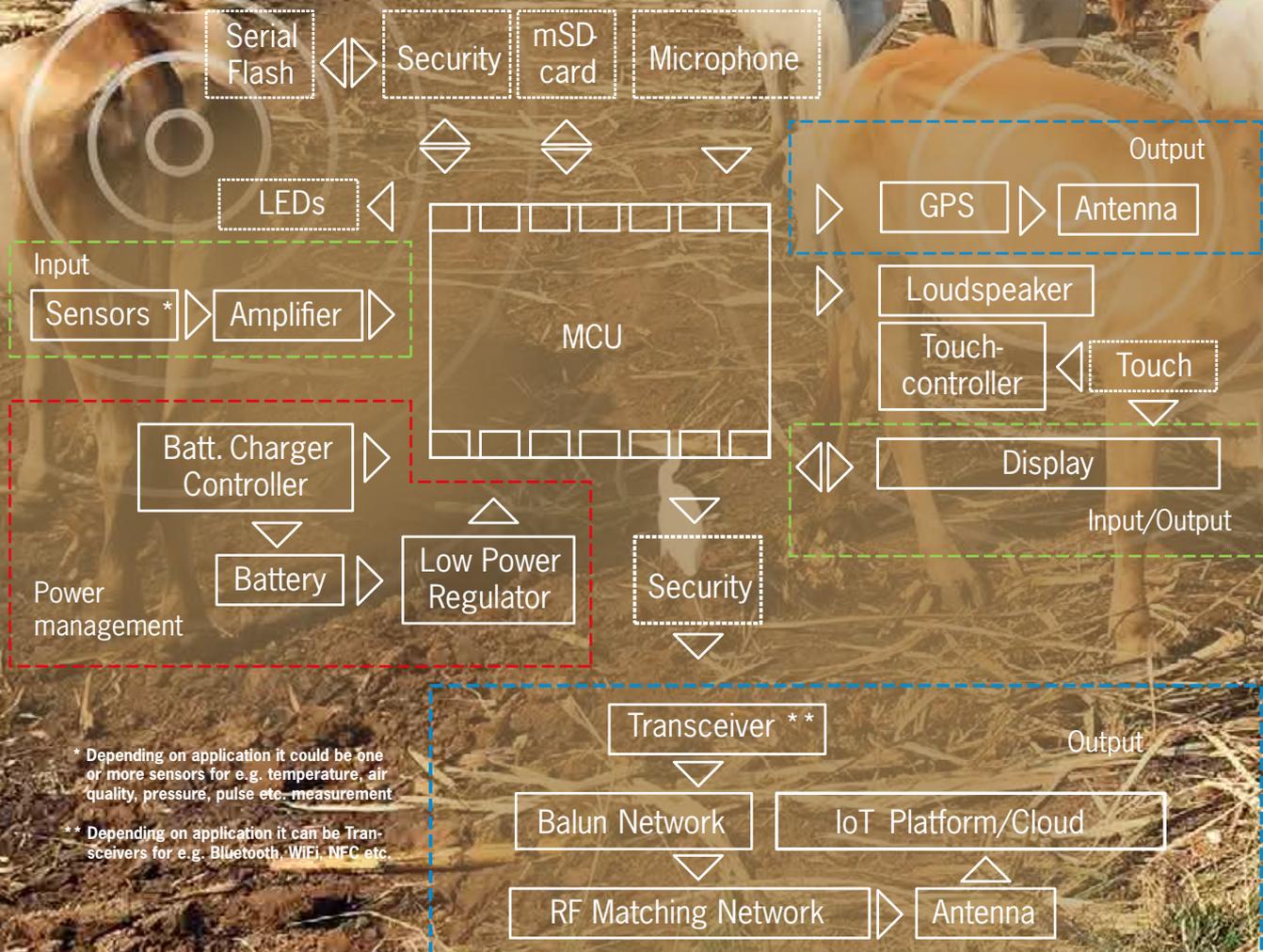
Type	ANT7020LL05R2400A	<b>YAGEO</b> <sup>®</sup>
Standard	Bluetooth / Wlan / ISM / ZigBee	
Frequency	2.4 GHz	
Gain	2.62 dBi	
Polarization	Linear	
Max. Power	1 W	

Type	W3332B0150	<b>Pulse Electronics</b>
Standard	Bluetooth / Wlan / ISM / ZigBee	
Frequency	815 / 915 / 2400 MHz	
Antenna Type	PCB Antenna	
Size	15.5 x 82.5 x 0.5 mm	
Peak Gain	4.1 dBi	

Type	W3917B0050	<b>Pulse Electronics</b>
Standard	Bluetooth / Wlan / ISM / ZigBee	
Frequency	2.4 & 5 GHz	
Antenna Type	FPC Antenna	
Size	42.6 x 8.6 x 0.15 mm	
Max. Power	2 W	



# POSITION TRACKING



\* Depending on application it could be one or more sensors for e.g. temperature, air quality, pressure, pulse etc. measurement

\*\* Depending on application it can be Transceivers for e.g. Bluetooth, WiFi, NFC etc.





# COW TRACKING



81 cows in range  
Range 100m

Map | List





# Digital Barometric Pressure Sensor



## BMP388

The BMP388 is a very small, low-power and low-noise 24 bit absolute barometric pressure sensor. It enables accurate altitude tracking and is specifically suited for drone applications. The best-in-class TCO of the BMP388 between 0-65°C for accurate altitude measurement over a wide temperature range greatly enhances the drone flying experience by making accurate steering easier. It is compatible for use with other Bosch sensors, including BMI088 for better performance, robustness and stability.

The BMP388 sensor offers outstanding design flexibility, providing a single package solution that is easy to integrate into other existing and upcoming devices such as smart homes, industrial products and wearables. It is more accurate than its predecessors, covering a wide measurement range from 300 hPa to 1250 hPa. BMP388 exhibits an attractive price-performance ratio coupled with low power consumption. It is available in a compact 10-pin 2.0 x 2.0 x 0.75 mm LGA package with metal lid.

### Applications

- Altitude stabilization in drones
- Improve calorie expenditure measurement accuracy in wearables for sports and health management
- Unprecedented precision to outdoor/indoor navigation and localization applications, e.g. in Smart Homes
- Enhancing GPS accuracy outdoors



Product	Operation Range	Relative Accuracy 700 ... 900 hPa (Temperature = +25 ... +40 °C)	Absolute Accuracy (-20 ... +65°C)	Power Consumption	Supply Voltage	Noise	Long Term Stability (1 yrs)	TCO	Interface	Package Dimensions (mm <sup>3</sup> )
BMP388	300... 1250 hPa	±0.06 hPa (equivalent to ±50 cm)	±0.50 hPa	2.0 µA @ 1 Hz	V <sub>DDIO</sub> : 1.2 V ... 3.6 V V <sub>DD</sub> : 1.65 V ... 3.6 V	0.03 Pa	±0.33 hPa	0.75 Pa/K (equivalent to ± 6.3 cm/K)	I <sup>2</sup> C and SPI	10-pin LGA with metal lid 2.0 x 2.0 x 0.75 mm <sup>3</sup>



# Motion Sensors



## Accelerometers

ST's state-of-the-art MEMS accelerometers include analog and digital sensors featuring up to  $\pm 400g$  acceleration full scale and from 1.71 to 3.6 V supply voltage. Accelerometers have advanced power-saving features that make them suitable for ultra-low-power applications. These features include low-power mode, auto wake-up function and a FIFO buffer that can be used to store data, thus reducing the host processor loading and system power consumption. The small size and embedded features of ST's accelerometers make them an ideal choice for wearable applications and where long battery life is required.

### Features

- Low power consumption and smart ultra-low-power operating modes including Always-on
- High resolution: accuracy and stability
- Smart embedded features for less power hungry systems
- Ultra compact devices in packages smaller than  $4\text{ mm}^3$
- Selectable full-scale up to 16g
- Advanced digital features
- Pin to pin compatible product family



Part Number	Description	Power cons. in PD Low Power Mode Normal Mode ( $\mu\text{A}$ )	Key Parameters	Package Size (mm)
LIS2DW12	3-axis accelerometer, 12 to 14 bit resolution	0.05 0.38 @1.6Hz, 3 / 16 @50Hz 120 in HPM @50Hz	32-level, FIFO, self test, temp sensor, high resolution very low power	LGA-12, 2 x 2 x 0.7
LIS2DH12	3-axis accelerometer, 8 to 12 bit resolution	0.5 2 @1Hz, 6 @ 50Hz, 11 @50Hz	32-level, FIFO, self test, temp sensor, 12-bit resolution, low power, cost effective	LGA-12, 2 x 2 x 1
LIS2DE12	3-axis accelerometer, 8 bit resolution	0.5 2 @1Hz, 6 @50Hz	32-level, FIFO, self test, temp sensor, 8 bit resolution, low power	LGA-12, 2 x 2 x 1

## Digital Compasses

ST's digital compasses include combo solutions, with an accelerometer and magnetic sensor integrated in a single LGA package and standalone magnetometer, to give the possibility of designing a solution locating the magnetic sensor in the best position on the board in order to minimize magnetic interference.

### Features

- Ultra-compact high-performance magnetometer module
- Wide magnetic sensor dynamic range and ultra low magnetic offset
- Pin to pin compatible product family
- Embedded self test and temp. compensated



Part Number	Full Scale	Noise Density (Typ.)	Package Size (mm)	Key Features
LSM303AGR	2, $\pm 4$ , $\pm 8$ , $\pm 16$ g $\pm 50$ gauss	220 $\mu\text{g}/\sqrt{\text{Hz}}$ 3 mgauss	LGA-12, 2 x 2 x 1	Ultra-low-power, high-performance, 3D digital accelerator sensor and 3D digital magnetic sensor
LSM303AH	$\pm 2$ , $\pm 4$ , $\pm 8$ , $\pm 16$ g $\pm 50$ gauss	120 $\mu\text{g}/\sqrt{\text{Hz}}$ 3 mgauss	LGA-12, 2 x 2 x 1	Ultra-compact, high-performance e-compass 3D accelerometer and 3D magnetometer module
LIS2MDL	$\pm 50$ gauss full scale	3 mgauss	LGA-12, 2 x 2 x 0.7	3-axis magnetometer standalone, power consumption (@ODR=20Hz): 200 $\mu\text{A}$ in high resolution, 50 $\mu\text{A}$ in low power & 2 $\mu\text{A}$ in power down

## iNEMO® Inertial Modules

iNEMO System-in-packages (SiP) combine accelerometer, gyroscope and magnetometer in a monolithic 6-axis or 9-axis solution. The integration of multiple sensor outputs bring motion sensing systems to the level of accuracy required for the most demanding applications, such as enhanced gesture recognition, gaming, augmented reality, indoor navigation and localization-based services.

### Features

- Always-on 3D accelerometer and 3D gyroscope
- Rate noise density 4mdps/ $\sqrt{\text{Hz}}$  (High Perf. Mode)
- Android M compliant
- Pedometer, step detector and step counter
- Embedded self test and temperature sensor



Part Number	Description	I <sub>DD</sub> (mA)	Key Parameters	Package
LSM6DSL	iNEMO inertial module: 3-axis accelerometer and 3-axis gyroscope	0.65 combo HP mode	Rate noise density in high-performance mode (HPM) Gyroscope: 4 mdps/ $\sqrt{\text{Hz}}$ Accelerometer: 90 $\mu\text{g}/\sqrt{\text{Hz}}$	LGA-14L 2.5 x 3 x 0.83 mm
LSM6DSM	iNEMO inertial module: 3-axis accelerometer and 3-axis gyroscope	0.65 combo HP mode	Optimized for Optical Image Stabilization Gyroscope: 3.8 mdps/ $\sqrt{\text{Hz}}$ Accelerometer: 90 $\mu\text{g}/\sqrt{\text{Hz}}$	LGA-14L 2.5 x 3 x 0.83 mm





## Position Tracking Cellular & GNSS Solutions

### LE910C1 – LTE Cat. 1 Module



The LE910C1 series of 4G LTE modules are compliant with the 3GPP Release 10 and are available with optional quad-constellation GNSS capability. This compact LGA form factor family is available in a variety of configurations, supporting both single-mode and fallback as needed for specific regions, carriers, and use cases.

#### Key Benefits

- 4G LTE Category 1 modules
- Uplink up to 5 Mbps
- Downlink up to 10 Mbps
- Compliant with the 3GPP release 10 platform
- Optional simultaneous GNSS capability: GPS, Glonass, BEIDOU, Galileo + QZSS
- 2G/3G fallback options
- Over-the-Air firmware update
- Integrated TCP/IP and UDP/IP stacks (IPv4/IPv6)
- Control via AT commands
- Dimensions:  
28.2 x 28.2 x 2.2 mm
- Temperature Range:  
-40 °C to +85 °C
- Supply voltage: 3.8 V



### TESEO LIV3F



The Teseo-LIV3F module is an easy to use Global Navigation Satellite System (GNSS) standalone module, embedding Teseo III single die standalone positioning receiver IC working simultaneously on multiple constellations (GPS/Galileo/Glonass/BeiDou/QZSS). Thanks to the embedded 16 Mbit flash Teseo-LIV3F offers many extra features such as data logging, 7 days autonomous assisted GNSS, FW reconfigurability as well as FW upgrades.

#### Key Features

- Simultaneously multiconstellation
- -163 dBm navigation sensitivity
- 1.5 m CEP accuracy positioning
- 16 Mbit embedded flash for data logging and FW upgrade
- 2.1 V to 4.3 V supply voltage range
- Tiny LCC 18 pin package (9.7 x 10.1)
- Operating temperature (-40 °C to 85 °C)
- Free FW configuration
- 17 µW standby current and 75 mW tracking power consumption





## UWB & BLE Solutions

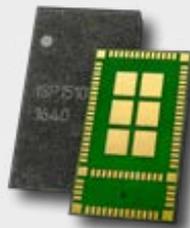
### ISP1510



The ISP1510 from Insight SiP is a smart Ultra-Wide Band and Bluetooth Low Energy module. It offers the perfect stand-alone ranging module solution for security bubble applications. It is ideally suited for applications like precision real time location systems (for healthcare, sport and wellness, consumer, industrial), security bubble, access control, indoor positioning.

#### Key Features

- Bluetooth v5, ANT, NFC Tag
- Built-in Arm® Cortex®-M4 core with 64KB RAM and 512KB flash (nRF52832)
- Dimension 7.4 x 7.0 x 0.9 mm
- Packaging: LGA
- Bluetooth/ANT Antenna Configuration:
  - On-board PCB antenna
  - Supports external antenna from pin pad
- Maximum transmit power: +4.0 dBm
- Receive sensitivity: -93 dBm @ 1 Mbps (LDO Mode)
- Power consumption
  - TX 7 mA @ 3.5 dBm (DCDC Mode)
  - RX 6 mA (DCDC Mode)
- Host interface: UART, SPI
- Operating temp. range: -40 °C to 85 °C
- Regulatory certificates: FCC, IC, ETSI, TELEC



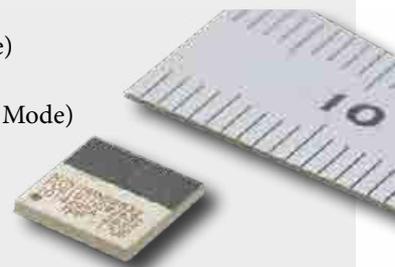
### MBN52832



MBN52832 is a Bluetooth Low Energy/NFC module. The module integrates Nordic Bluetooth Low Energy IC, RF front end, and crystal into a very small form factor. The built-in Arm® Cortex®-M4 core with 64KB RAM and 512KB flash provides a high performance engine and rich interfaces for variety of IoT applications such as sensor network, device control, etc. This RF certified module can significantly reduce the system designer's burden and help to reduce the time-to-market.

#### Key Features

- Bluetooth v5, ANT, NFC Tag
- Built-in Arm® Cortex®-M4 core with 64KB RAM and 512KB flash
- Dimension 7.4 x 7.0 x 0.9 mm
- On-board PCB antenna
- Supports external antenna from pin pad
- Maximum transmit power: +4.0dBm (@ antenna port LDO Mode)
- Receive sensitivity:
  - 93dBm @ 1Mbps (LDO Mode)
- Power consumption:
  - TX 7 mA @ 3.5dBm (DCDC Mode)
  - RX 6 mA (DCDC Mode)
- Host interface: UART, SPI
- Operating temperature range:
  - 40 °C to 85 °C
- RoHS compliant
- Regulatory certificates: FCC, IC, ETSI, TELEC





# Position Tracking

## BLE Modules

### BlueMod+S



Telit's Bluetooth® Low Energy  
Single Mode Modules based on nRF51822

The BlueMod+S is a Bluetooth 4.1 Low Energy solution designed to connect ultra low power wireless sensors and peripherals to Bluetooth v4.x equipped smartphones, tablets, and PCs with low energy consumption. The module offers several features such as terminal I/O and GATT peripheral, GATT central with terminal I/O peripheral and automation profile with ADC peripheral.

#### Key Benefits

- Bluetooth Low Energy module
- Bluetooth qualification 4.1
- CE, FCC, IC and KCC qualified
- Terminal I/O peripheral and GATT server
- Sample Code for iOS and Android
- GATT Central and Terminal I/O peripheral in parallel
- Automation I/O peripheral: cable replacement for Sensors
- LGA pads
- Ceramic antenna
- Length x Width x Height: 17 x 10 x 2.6 mm
- Temperature range: -25 °C to +75 °C
- UART: 9600 bps – 921600 bps (asynchronous)
- Other interfaces: I<sup>2</sup>C, SPI
- GPIOs: Up to 19



### PAN1761



Bluetooth® Low Energy v4.1  
+ NFC Forum Tag Type 3 Combo Module

The PAN1761 is a BLE v4.1 and NFC combo module based on Toshiba's Bluetooth chip TC35670. Integrated NFC allows the module to wake up from zero standby power consumption to full Bluetooth function.

#### Key Features

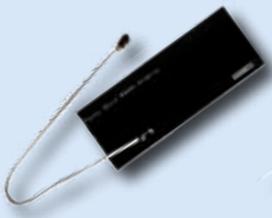
- Bluetooth wake-up function via NFC
- Read/Write data through NFC Tag
- BLE profiles including "SPP over BLE" available
- GAP central and peripheral mode
- Same form factor and footprint as PAN1026 and PAN1760
- Integrated 2.4 GHz antenna, NFC antenna external (antenna pin)
- Small 15.6 x 8.7 x 1.8 mm<sup>3</sup> SMD module
- Temperature range from -30°C to +85°C
- UART, I<sup>2</sup>C, SPI, PWM output (3x), ADC (3x), 10 programmable I/O
- Support for Over the Air Update (OTA) and Scatternet



# Antennas

## Recommended for Position Tracking

Type	ANT5320LL14R1516A	<b>YAGEO</b> <sup>®</sup>
Standard	GPS/Galileo/Glonass	
Frequency	1.575 / 1.602 GHz	
Gain	1.45 / 1.46 dBi	
Polarization	Linear	
Max. Power	1 W	

Type	ANT3505B002TWPENS	<b>YAGEO</b> <sup>®</sup>
Standard	Cellular (GSM/UMTS)	
Frequency	824~960 / 1710~2170 MHz / Penta Band	
Gain	2.91 dBi	
Max. Power	4 W	
VSWR	2.8 / 3.5 dB max.	

Type	W3064C	<b>Pulse Electronics</b>
Standard	Bluetooth / Wlan / ZigBee	
Frequency	1575.42 MHz / 2.4 GHz	
Antenna Type	Ceramic Chip Antenna	
Size	10 x 3.2 x 1.5 mm	
Max. Power	5 W	

Type	W3907B0100	<b>Pulse Electronics</b>
Standard	LTE / GNSS	
Frequency	698-3600 MHz	
Antenna Type	FPC Antenna	
Size	110.7 x 20.4 mm	
Max. Power	3 W	



# Security ICs



## Infineon OPTIGA™ Embedded Security Solutions

Infineon OPTIGA™ embedded security solutions are ..scalable and easy-to-integrate for your embedded project. The OPTIGA™ Trust family includes turnkey products for smaller platforms as well as programmable solutions, while OPTIGA™ TPM (Trusted Platform Module) products are ideal for embedded PC, mobile and computing applications. All OPTIGA™ TPM products comply with the Trusted Computing Group (TCG) standards.

The OPTIGA™ Trust product family offers a full range of security chips to address individual needs in the field of embedded authentication and brand protection and further security applications. Whether you are looking for a turnkey security chip enabling fast and easy integration or a feature-rich programmable solution, OPTIGA™ Trust has the perfect match for your business model.

OPTIGA™ TPM (Trusted Platform Module) offers a broad portfo-

lio of standardized security controllers to protect the integrity and authenticity of embedded devices and systems. With a secured key store and support for a variety of encryption algorithms, OPTIGA™ TPM security chips provide robust protection for critical data and processes through their rich functionality.

OPTIGA™ TPM security controllers are ideal for platforms running both Windows and Linux (and its derivatives). Based on Trusted Computing Group (TCG) standards, they support the TPM 1.2 or the latest innovative TPM 2.0 standard.

Rutronik can offer Infineon OPTIGA™ solutions as a chip to make your own embedded system build on your own PCB, as well as offering ready to use embedded boards and standard mainboards with already having Infineon OPTIGA™ technology on board.

Manufacturer	Part Name	Security Level	Functionality	NVM (Data)	Cryptography	Type of Host System	Interface	Package
Infineon	OPTIGA™ Trust B SLE95250	Basic	Authentication	512 Byte	ECC131	MCU without OS / proprietary OS / RTOS	SWI	PG-TSNP-6-9
	OPTIGA™ Trust X	CC EAL 6+	Connected device security	10 kByte	ECC384	MCU without OS / proprietary OS / RTOS, Embedded Linux	I2C	-
	OPTIGA™ Trust P SLJ 52ACA	CC EAL 5+	Programmable	150 kByte	ECC251 RSA2K	MCU without OS / proprietary OS / RTOS, Embedded Linux	UART	VQFN-32
	OPTIGA™ Trust E SLS 32AJA	CC EAL 6+	cost effective security for high value goods	3 kByte	ECC 256	MCU without OS / proprietary OS / RTOS	I2C	USON-10-2
	OPTIGA™ TPM SLB 9645	-	Security Cryptocontroller for Trusted Platform Modules	6 Kbyte	ECC256 RSA2K	Embedded Linux, Windows / Linux	I2C	TSSOP-28, VQFN-32
	OPTIGA™ TPM SLB 9660	CC EAL 4+	Security Cryptocontroller for Trusted Platform Modules	6 Kbyte	ECC256 RSA2K	Embedded Linux, Windows	LPC	TSSOP-28, VQFN-32
	OPTIGA™ TPM SLB 9665	CC EAL 4+	Security Cryptocontroller for Trusted Platform Modules	7206 Byte	ECC256 RSA2K	Embedded Linux, Windows	LPC	TSSOP-28, VQFN-32
	OPTIGA™ TPM SLB 9670	CC EAL 4+	Security Cryptocontroller for Trusted Platform Modules	6 kByte	ECC256 RSA2K	Embedded Linux / Windows / MCU without OS / proprietary OS	SPI	VQFN-32
STMicroelectronics	STSAFE-A1SX	CC EAL 5+	Authentication, data integrity, confidentiality	6 kByte	AES-128	Sigfox devices	I2C	SO8N 8, UDFPN 8
	STSAFE-A100	CC EAL 5+	Authentication	6 kByte	ECC256/384, ECHD, ECDSA256/384, AES-128/256	MCU without OS / proprietary OS	I2C	SO8N 8, UDFPN 8
	STSAFE-J100	CC EAL 5+	Authentication, secure data storage, cryptographic services	80 kByte	TRNG, DRNG, DES/3DES, ECC, AES	Java Card operating system / VGP 2.1.1	I2C	VFQFPN32

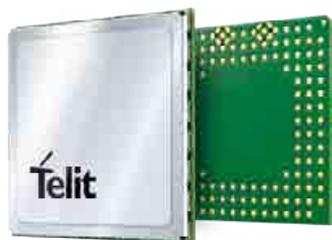
## STMicroelectronics STSAFE Embedded Security Solutions

Running on a Common Criteria EAL 5+ platform, STSAFE-A is a highly secure authentication solution which is certified by independent parties. Its command set is tailored to address strong authentication, establish a secure channel in the scope of a TLS session, verify signatures, and offer secure storage as well as decrement counters for usage monitoring. It is particularly well suited for applications heavily exposed to fraud and counterfeiting attacks, such as printers, game controllers, phone accessories, and Internet of Things net-

works and devices. By offering a complete solution ranging from an internally-developed secure operating system embedded in the security microcontroller, example code for integrating solutions in the applicative environment, and personalization services for storing confidential customer data in the secure microcontroller, ST offers seamless integration of security measures for customers who might not be experts in secure systems.



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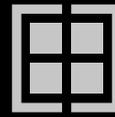
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