Smart Cities

APPLICATION GUIDE

muRata
INNOVATOR IN ELECTRONICS

Introduction

Exploring Emerging Smart City Opportunities

▪ Dynamics such as a growing population, an increasing elderly demographic, greater urbanization, plus rising pollution are all putting acute pressures on people's everyday lives. Society must look at what can be done to help enrich modern living conditions and make the world a better place for future generations to inhabit. This can be achieved by utilizing smart technology.

▪ Across the globe, a multitude of smart city projects are now under way. These are enabling air quality issues to be tackled and traffic congestion to be addressed. They are making public transport more efficient, augmenting industrial processes, boosting farming production, enhancing healthcare services and making homes more comfortable and secure.

▪ Through smart city initiatives, municipal governments and utility companies are improving the services that they provide, while also reducing their capital and operational expenditure.

▪ It must be acknowledged that every smart city implementation is distinct. Each will have different aspects that need to be considered and present its own specific problems to overcome. This means that having access to a broad range of different electronic components will be required in order to develop fully effective solutions.

▪ Murata has already built up a strong reputation in the various application areas that this guide discusses. There are a broad selection of Murata products that can be specified for smart city deployment, with details being given in the following pages.

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Overview

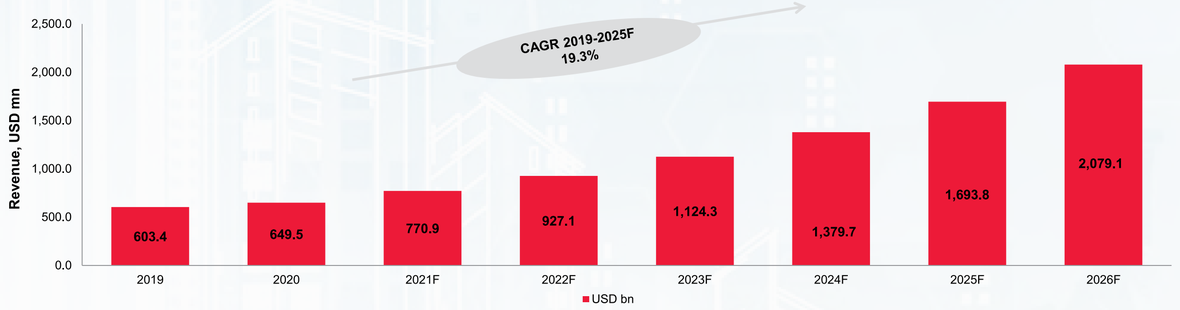
Global Smart Cities Market Expanding Rapidly

- Projections from industry analysts Frost & Sullivan estimate that the global smart cities market will experience a compound annual growth rate (CAGR) of approximately 19% over the coming years.

- There has already been widespread investment in smart city projects throughout Europe, and further projects are currently being planned. Among the cities where most activity has been seen are Barcelona, London and Amsterdam.

- Among the most important features of smart cities are environment monitoring, surveillance, resource management, more efficient farming, manufacturing with higher productivity levels and greater efficiency of healthcare systems. These will help to improve residents' quality of life, as well as enhancing the performance of public services.

FROST & SULLIVAN



Smart Cities Market, in USD Billion, Between 2019-2026F

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Rapid Urbanization

Emerging Mega Trends

62.5%

Urban Population

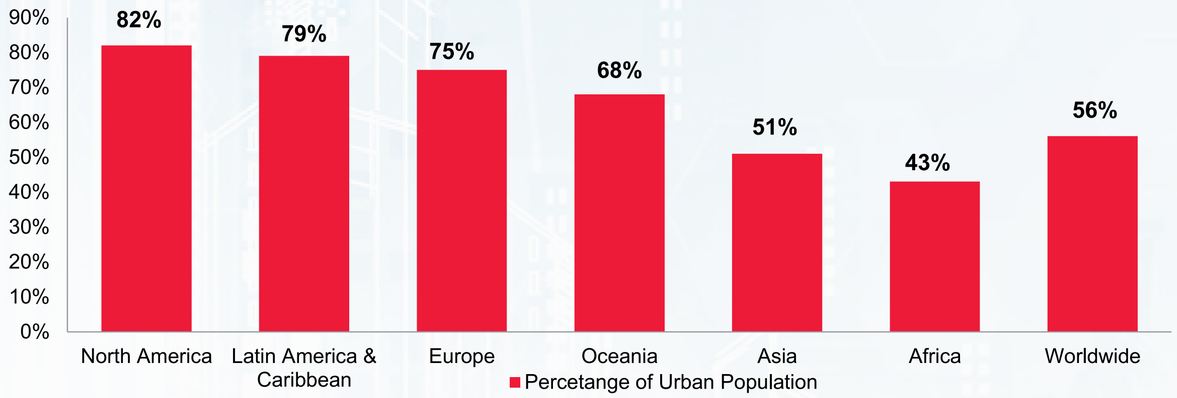
According to Statista, approximately 62.5% of the population will be living in the cities by 2050, as compared to 51% in 2010. Figures compiled by the World Health Organization (WHO) give very similar projections.

43 megacities

Megacities

A study published by the United Nations (UN) states that, by 2030, the world will have a total of 43 megacities (i.e. ones with more than 10 million inhabitants). Most of these will be situated in developing regions of the world.

- Statista states that North America is the most urbanized continent currently, with 82.0% of its population living in cities. Latin America and the Caribbean were also reported as having a high degree of urbanization - as about 79.0% of the population reside in cities.
- Europe is ranked third in terms of degree of urbanization. Here 75.0% of the population live in urban areas.
- Many countries in Asia and Africa will face challenges in meeting the needs of their rapidly growing urban populations. This will be most noticeable in relation to housing, transportation, energy systems and other infrastructure, as well as for employment and basic services (such as education and healthcare).



Degree of Urbanization by Continent, 2020

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Internet of Things

Emerging Mega Trends

10.0 bn

IoT Devices Today

In 2021, there were more than 10 billion active IoT devices.

25.4 bn

IoT Devices in the Future

It is expected that the number of IoT devices in operation will surpass 25.4 billion by 2025.

30%

IoT Hardware

The most-notable change to the IoT sector will be around the emergence of new software that allows for connection between devices. Hardware still accounts for 30.0% of the total value of IoT technology, although trends suggest its global market value is decreasing.

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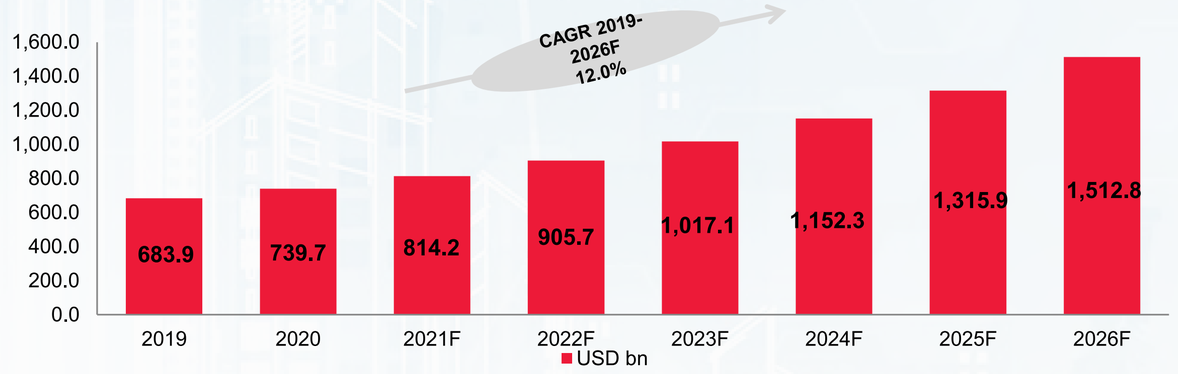
- The global IoT market is expected to reach a value of USD 1,512.8 billion by 2026 (from USD 683.9 billion in 2019). That represents a CAGR of 12.0%.
- With the development of new wireless networking technologies, the emergence of advanced data analytics, a reduction in the cost of connected devices and increased cloud platform adoption, the IoT market is expected to keep growing at a considerable rate.
- Based on forecasts of over 7.33 billion mobile users by 2023 and more than 1.1 billion connected wearable devices by 2022, show the IoT is destined to become one of the smartest collective and collaborative systems in human history.
- Transportation is getting smarter too. Insider Intelligence projects that in the US connected cars will constitute 97.0% of the total number of registered vehicles by 2035.



Global IoT Market, in USD Billion, Between 2019-2026F

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5G

Emerging Mega Trends

35 Gb

Phone Usage

The Ericsson Mobility Report states that the monthly global average data usage per smartphone now exceeds 10GB, and this is forecast to reach 35GB by the end of 2026.

USD 1.0 bn

Horizon Project

Governments are investing in 5G in a bid to make hyper connected public services. For example, China has allotted over USD 30 billion to 5G research and development for the next five years. The European Commission (EC) has earmarked USD 1 billion to 5G as part of its Horizon 2020 project.

350%

5G Coverage

In 2021, 5G coverage grew by a staggering 350.0% to cover 1,336 cities. As a result, 30.0% of the world's countries now have 5G coverage. A year earlier, there were only 378 cities that had 5G.

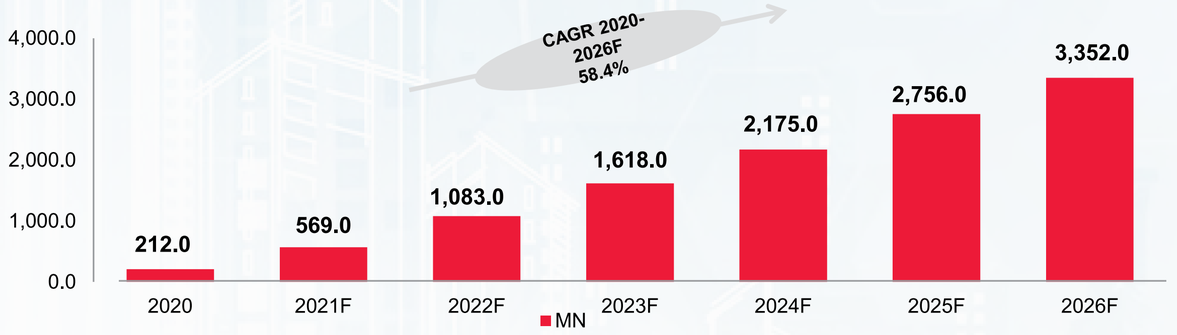
- According to estimates from Ericsson's latest edition of its Mobility Report, the number of 5G smartphone subscriptions worldwide passed 500 million in 2021, more than doubling the figure for 2020. In 2022, 5G subscriptions are on target to reach 1.1 billion and this is expected to climb to 3.4 billion during 2026.

- 5G-led ubiquitous sensor networks will be at the foundation of smart city development. The unique ability of 5G networks to meet differentiated smart city needs will be pivotal in enabling greater collaborative intelligence.

- 5G technology can address the needs of smart healthcare. Through this, it will be possible for fair, accessible and inclusive healthcare reform to be promoted.

- North America had an 89.3% share in LTE connections in Q4 of 2020. It was followed by Oceania, East and Southeast Asia at 78.4%, Western Europe at 69.73, then Latin America and the Caribbean at 57.59%.

- In Europe, the total benefit of a full 5G deployment for open innovation platforms will cost USD 53.2 billion. However, the benefit in doing so will amount to USD 240.0 billion.



Global 5G Subscription, in Millions, 2020-2026F

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Technological trends

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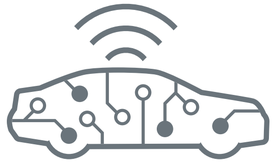

Autonomous Vehicle

These will include drones delivering packages to various locations, service machines doing cleaning and restoration services, plus automated 'personal assistants' helping employees get more done faster and with greater precision.

They will be driven by the improved capabilities from chip vendors (e.g. Qualcomm, Intel, MediaTek, Broadcom, etc.), advanced and more abundant sensors (e.g. visual-based sensors, ultrasonic, touch, smell, LiDAR, etc.), high bandwidth low latency connections (e.g. 5G, Wi-Fi 6), and enhanced AI capabilities/algorithms (e.g. navigation, point-to-point scheduling, visual interpretations, etc.).

Private 5G

5G private networks are isolated either physically or virtually from public networks, using different hardware, virtual machines or network-slices.

Additionally, 5G private networks will further transform the factory floor. The three main components of 5G - enhanced mobile broadband (eMBB), massive IoT and enhanced ultra-reliable low latency communications (eURLLC) - are utilized to connect a diverse set of devices in a factory. The 2020 3GPP Release 16 brought advanced support for 5G non-public networks (NPN), their defining characteristic being a network for private usage and not accessible to public users' navigation, point-to-point scheduling, visual interpretations, etc.)

DSA

Domain-specific architectures (DSAs) will represent the future of artificial intelligence (AI) inference. They will enable adaptable hardware which can be customized, so that workloads may run at the highest possible efficiency. In 2022, AI inferencing will continue to move away from fixed silicon approaches and towards DSAs, helping to eliminate AI productization challenges. With this new ease of programming, FPGAs and adaptable SoCs will continue to become more accessible for hundreds of thousands of software developers and AI scientists - making them the hardware solution of choice for next generation applications.

Cloud Computing

The smart cities that will be so central to our future society will be underpinned by 5G communication, but also reliant on a number of other technologies if they are to function effectively. This is where cloud computing comes in. Approximately 6 billion people are predicted to live in smart cities by 2045 - that will mean significant computing capacity will be necessary. Cloud technology will provide the digital infrastructure for smart cities, functioning as a storage and analysis system for the data used in everything from autonomous vehicles to farming.

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Addressing the Challenges

What is required and what Murata can offer

- At the foundation of any form of smart city deployment will be the ongoing collection of large amounts of data. Through the analysis of this data, the various different services involved can be planned in ways that are the most efficient, environmentally friendly, responsive and cost-effective. Compiling all of this data calls for mass distribution of IoT devices.

- With the IoT devices being placed in locations that are difficult to reach, there is little or no opportunity for technicians to return to them once they have been deployed - the logistical costs would simply be too high. It is therefore vital that such hardware is built from high reliability components that will support long-term trouble-free operation. This will mean that the need for replacement or maintenance work can be avoided.

- In addition, plug-and-play solutions should ideally be chosen. This will minimize the set-up period and the engineering effort involved in configuration, calibration, etc. Smart city services can then be brought on-line in a much shorter time frame, meaning that citizens will see the benefits sooner.

- Murata offers a broad selection of relevant components parts, enabling customers to choose the best fit for their specific application requirements without having to make compromises. These are straightforward to install and deliver prolonged working lifespans.

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Smart Agriculture

Using technology to solve future food shortage problems

- With a continuously increasing global populace, combined with diminishing land reserves available for farming and access to a limited workforce, food production is reaching a state of crisis. Efforts must be made to ensure that supply can keep up with demand.

- Smart agriculture will see data captured from numerous sensor nodes - enabling various different ambient parameters (relating to the air, soil, light levels, etc.) to be monitored, as well as updates on the local weather conditions.

- Because this hardware will be situated in an outdoor environment, it will need to be rugged enough to withstand extreme temperature variations, exposure to wind and rain, etc. Otherwise there will be a risk of malfunctions occurring.

- Crucial to the success of this monitoring work is 'barrier free' implementation. Use of wireless rather than wireline communication offers much greater convenience. It will be easier to add new nodes as they are required, or make changes to network arrangements.

- Murata wireless modules are highly robust and reliable. They represent a very lower total cost of ownership, as the need for repair and maintenance work is lessened considerably. These modules are also compact and lightweight, enabling them to attend to AGV/drone applications.

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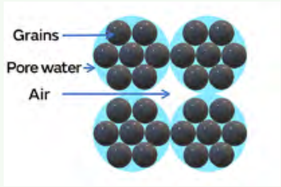
Soil sensor

Challenges in agricultural environments

The Murata soil sensor has been developed to continuously measure the conditions of many different agricultural environments.

The three-in-one package includes sensor elements for accurately determining electrical conductivity (EC), temperature, and moisture in terms of volumetric water content (VWC). As a result, this device is capable of measuring all three parameters simultaneously, eitherin soil or underwater. Specifically, the industry's first-ever nine-electrode EC sensor has multiple measuring patterns that help to eliminate uncertainty.

Measurement pattern example



FEATURES

- **EC sensor**
  - Electrical conductivity depends on contained anion/ cation amount. (NO3,NH4,H2PO4,K,Ca,Mg,Nacl etc..)
- **Temperature sensor**
  - Temp. in the soil and water environment.
- **Moisture sensor**
  - Measure the electric permittivity, translate to VWC.

PRODUCT SPECIFICATIONS

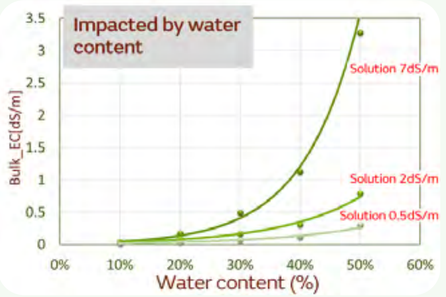
- **Supply Voltage:** 3.0-6.5 V
- **Active current:** 50 mA(max)
- **EC range:** 0-5.0 dS/m
- **EC accuracy:** ±3 - F.S.
- **Moisture range:** 0-60 %VWC
- **Moisture accuracy:** ±3 % F.S.
- **Temperature range:** -20ºC-70ºC
- **Temperature accuracy:** ±1.1 ºC
- **Waterproof:** IP68
- **Interface:** UART,RS232E,RS485,SDI-12
- **Cable length:**
  3m@UART, 10m@RS232E, 300m@RS485 (Verified cable length)

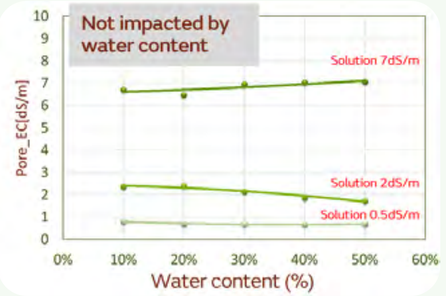
ADVANTAGES

- **Simple interface:**
  Three sensors in one package
- **High accuracy moisture measurement:**
  No effect of saline and temp
- **High accuracy EC:**
  Certainty and Ability for dry soil
- **Rugged and waterproof structure:**
  Hardness, IP68
- **Suitable for wireless transmission:**
  Low power consumption
- **Multi interface:**
  UART,RS232E,RS485,SDI-12
- **Wireless system:**
  2.4GHz original protocol, BLE

APPLICATIONS

- **Long term soil condition monitoring for Agriculture.**
- **Agriculture irrigation system control**
  - Long term river and pond water condition monitoring
  - Aquaculture pond water condition control
  - Powder dry monitoring and control
  - Soil and water environment research



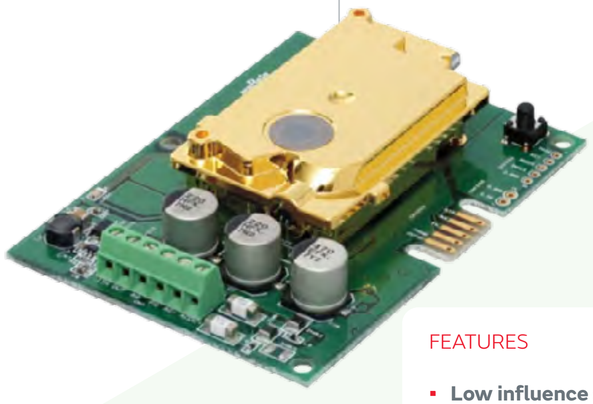


NDIR CO2 sensor

Long-term stability using auto-calibration

Murata's CO2 sensor is a product that exhibits long-term stability and high measurement accuracy. Its maintainability is improved through an automatic calibration feature incorporated. This is based on a unique calibration curve algorithm and a dual wavelength non-dispersive infrared (NDIR) system. One wavelength is for measurement and the other for reference.

IMG-CA0014-00
67 x 92 x 20mm



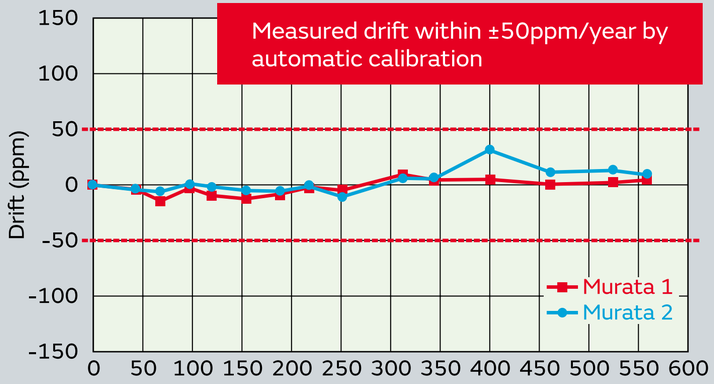
FEATURES

- **Low influence of other gases by NDIR principle**
- **Excellent temperature characteristics and high accuracy**
- **Excellent long-term stability and high reliability by automatic calibration**

PRODUCT SPECIFICATIONS

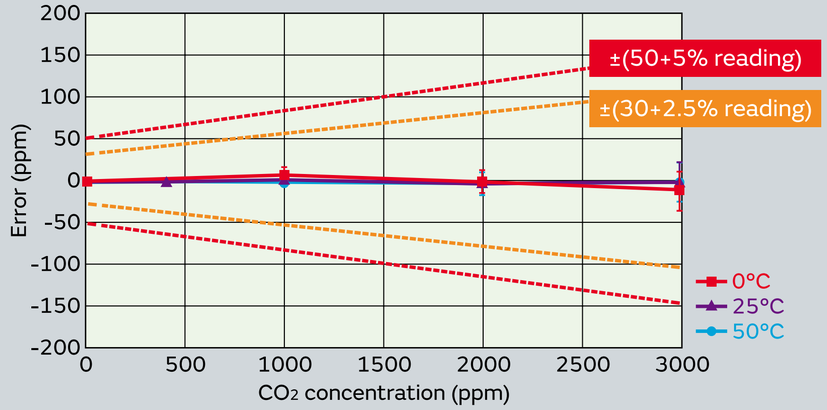
- **Operating temperature:** 0 to 50 °C
- **Storage temperature:** -20 to 50 °C
- **Measurement range:** 0 to 2000ppm, 0 to 3000ppm
- **Accuracy:** ± (50ppm+5% of reading) Typ. ± (30ppm+2.5% of reading)
- **Long-term stability (drift):** ±50ppm/Year @ 1000ppm
- **Power input:** AC/DC 24V, DC12V
- **Peak power consumption:** Avg. 0.5W/Max. 2.0W
- **Output interface:** Analog 0 to 5V
- **Measurement interval:** 5s
- **Dimensions:** 67x92x20mm

Long-term test in building



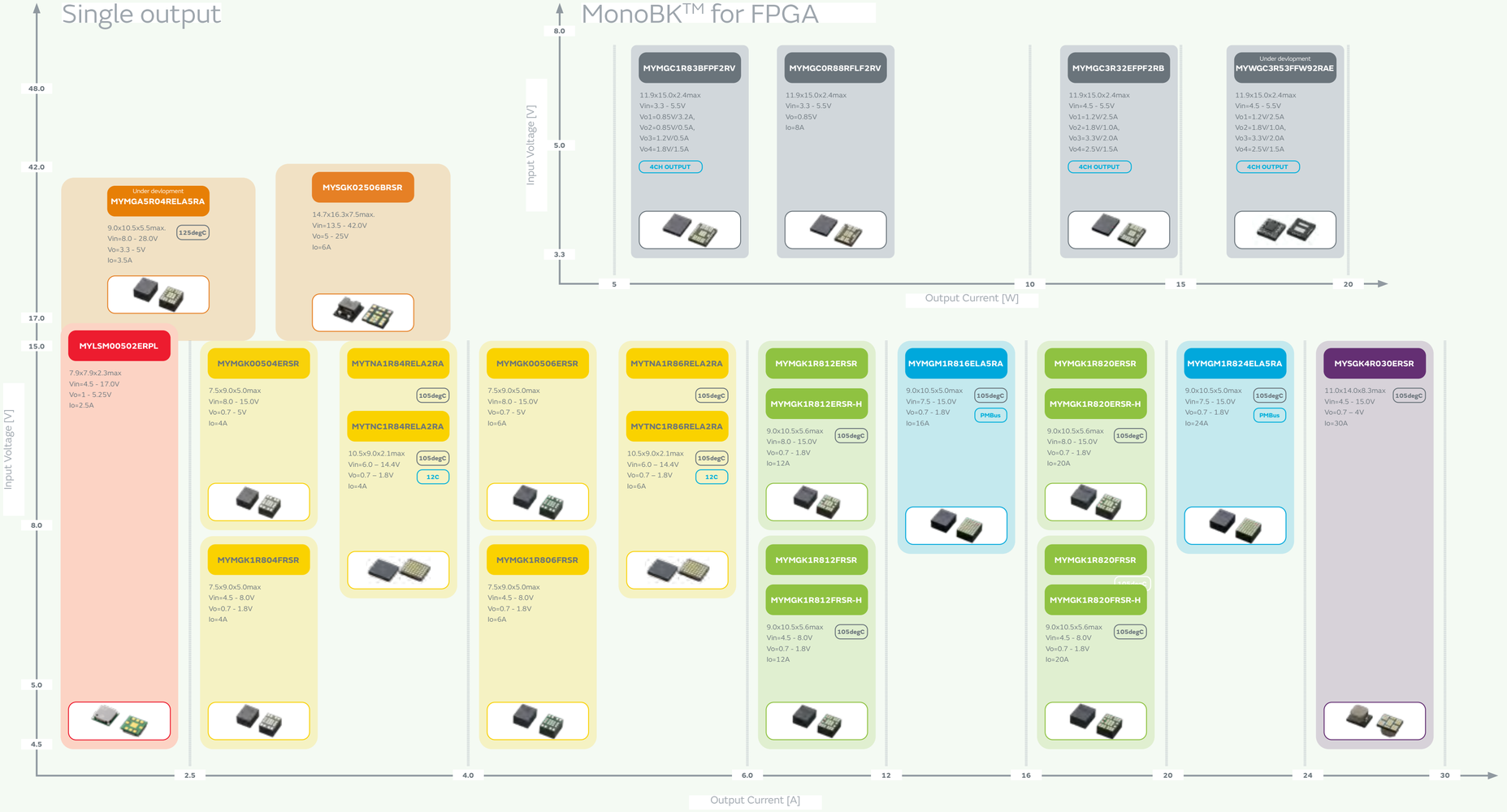
Tested by TODA Corp.
Tested by standard gas @ 1000ppm

Measurement accuracy



MonoBK™ and UltraBK™

Line-up | Small POL DC-DC converter



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Wi-Fi®
Smart Module

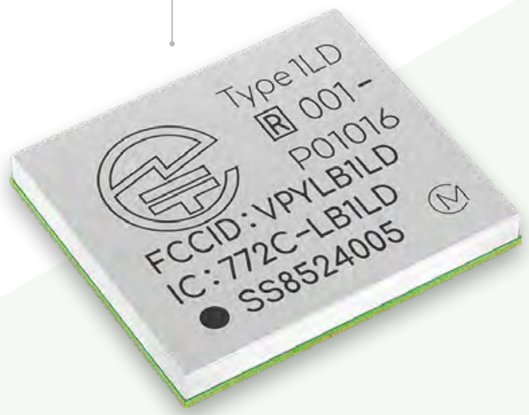
Wireless communications

Type 1LD

Murata is market leader in Wi-Fi® modules for embedded systems, providing superior quality, elevated performance modules for high volume production.

Murata's wireless modules will streamline your assembly operations, thus significantly reducing customer's design time. Additionally, we offer a variety of low-power products for sensor networks.

Type 1LD



Smart Agriculture
Connectivity

APPLICATIONS

- **Home and building automation**
  - Lighting control
  - Heating, Ventilation, Air-conditioning
- **Energy management system (EMS)**
- **Simple sensor network**
- **Home security**
- **Healthcare & fitness**

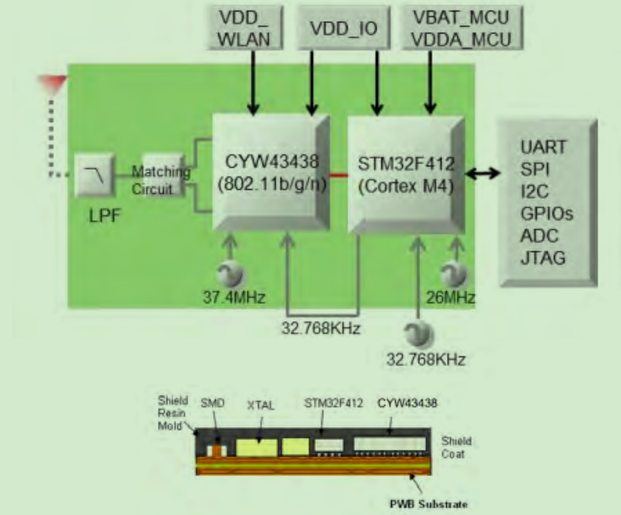
FEATURES

- **Highly integrated**
- **FCC/IC/CE/TELEC compliant**
- **Shielded Ultra Small Wi-Fi® 11b/g/n + Bluetooth® 5.2 + MCU Module**

PRODUCT SPECIFICATIONS

- **Chipset:**
  - Infineon (CYW43438)
  + STM32 (ARM Cortex-M4F)
- **Size:** 8.9 x 7.8 x 1.2 mm
- **Peripheral Interface:**
  GPIO/SPI/UART/I2C/ADC/PWM
- **Operating Temperature:**
  -40°C to 85°C
- **Package:** Shielded Resin
  Feature rich software hosted on module 802.11 b/g/n 65Mbps, Wi-fi® Stack runs inside, 1MB Flash, 256KB RAM
  Infineon WICED, SPP on Bluetooth® and GATT on Bluetooth® LE are supported by WICED Qualified for AWS IoT Core devices

BLOCK DIAGRAM



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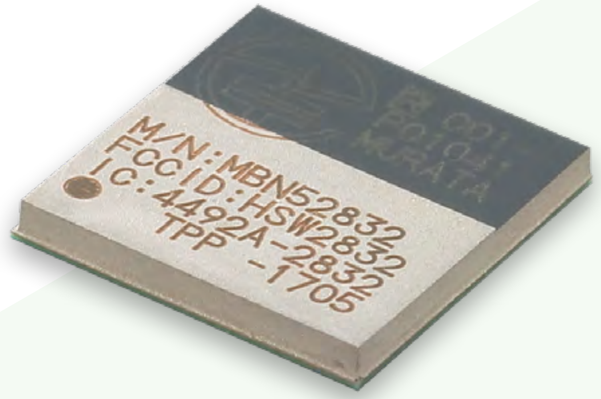
Bluetooth® Low Energy Module

Wireless communications

Type MBN52832

BLE is an ultra-low power communication technology that enables several years of operation off a button battery. Widespread adoption is being seen in fields like health management, fitness and home networks. BLE has also been adopted as a communication method by the Continua Health Alliance, a non-profit organization of healthcare and technology companies.

Type MBN52832



Smart Agriculture

Connectivity

APPLICATIONS

- **Proximity services**
- **Building automation**
- **Medical/healthcare**
- **Bluetooth beacons**

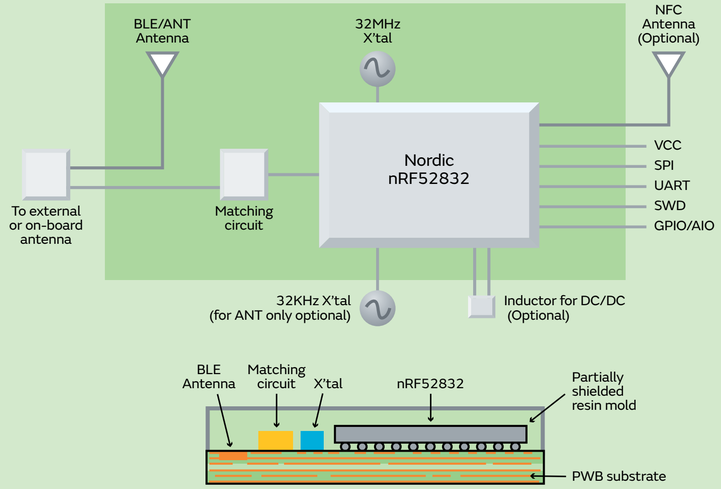
FEATURES

- **Powerful MCU core with large RAM and flash for user application**
  - ARM Cortex M4; 64K RAM; 512K flash
- **Low power consumption**
  - Tx 7mA @ 3.5dBm (DCDC mode)
  - Rx 6mA (DCDC mode)
- **Rich peripheral interface-20 GPIO ports**
- **Very small size:** 7.4x7.0x0.9mm (max.)
- **Fully certified**
  - FCC (US), IC (Canada), ETSI (EU), TELEC (Japan)
  - BT SIG Certificate
- **Support both on-board and external antenna version**
  - On-board PCB pattern antenna
  - External patch antenna
  - External dipole antenna
- **Bluetooth® 5.0**

PRODUCT SPECIFICATIONS

- **Chipset:** nRF52832 Bluetooth® LE IC
- **Dimension:** 7.4x7.0x0.9mm
- **Package:** LGA
- **Antenna:** on-board or external
- **Max output power:** +4dBm (LDO mode)
- **Interfaces:**
  UART, SPI, 20 GPIO, 5ADC, SWD, PWM, I2C
- **Operating voltage:** 1.7V to 3.6V
- **Operating temperature range:**
  -40 to 85°C
- **OTA firmware upgrade**
- **RoHS compliant**
- **Regulatory certificate:**
  FCC/IC/ETSI/TELEC
- **Bluetooth® SIG qualification**

BLOCK DIAGRAM



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UWB Modules

Wireless communications

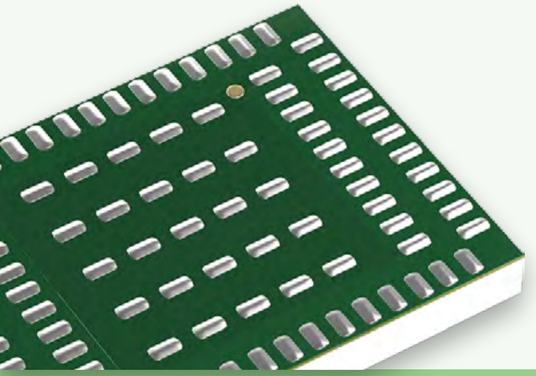
Ultra-wideband (UWB) technology provides a highly effective means for providing secure and precise distance measurement. This is based on determining the time-of-flight (ToF) of radio waves. Murata offers an extensive portfolio of UWB modules.

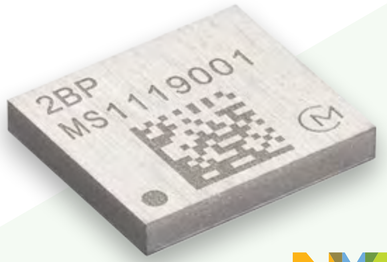
FEATURES

- **Ultra-small dimensions**
- **High quality**
- **Lower power consumption**

APPLICATIONS

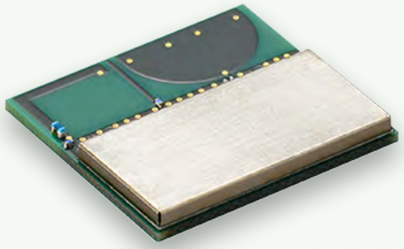
- **Indoor navigation**
- **Smart retail/point-of-sales**
- **Smart building**
- **Smart locks**
- **Tags/tracking**
- **Contactless presence detection**





TYPE 2BP

- **Ultra small UWB module which includes NXP's SR150 UWB chipset, clock, filters and peripheral components.**
- **3 Antenna support (3D AoA or 2D AoA support)**
- **UWB Chip set:** NXP Trimension SR150
- **Antenna:** External



TYPE 2DK

- **All-in-one UWB + Bluetooth LE combo module which integrates NXP Trimension™ SR040 UWB Chipset, NXP QN9090 Bluetooth LE + MCU chipset, On board antenna and peripheral components.**
- **Ideally suited for UWB Tag/Tracker which operates by coin-cell battery, and general IoT devices.**
- **UWB Chip set:** NXP Trimension™ SR040
- **Antenna:** Integrated

TYPE 2AB

- **UWB Chip set : Qorvo DW3110/3120**
- **FCC/IC/TELEC Reference Certified (Planed)**
- **Hostless module Integrated Nordic IC / nRF52840 which also have Blutooth Low Energy function for waking up UWB and updating FW.**
- **Integrated 3-Axis sensor for saving battery**
- **Reference clock for UWB and MCU are embedded**
- **UWB Chip set:** Qorvo DW3110/3120
- **Antenna:** External

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LPWA Modules

Wireless communications

Low power wide area (LPWA) networks provide a power efficient wireless communication technology for interconnecting devices together over a long range. LPWA is most suitable for applications such as IoT and machine-to-machine (M2M) communication, as well as various other situations where lower cost and lower power consumption are required. To respond to customers' needs, Murata has formed strategic partnerships with market leaders, and is accelerating the development of products using this highly appealing emerging technology.

Type 1SC

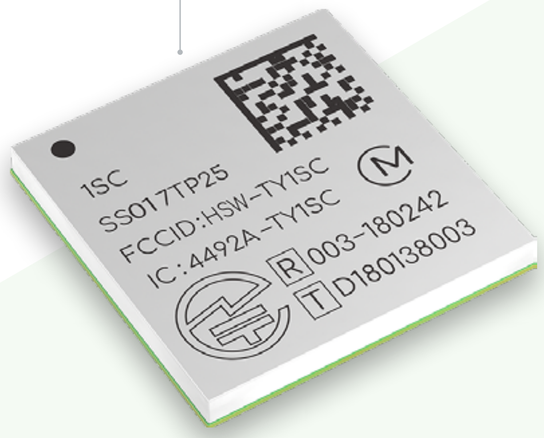
The Type 1SC (LBAD00XX1SC) module is the world's smallest **Cat. M1/NB-IoT module** with global certification. It supports GPS/GNSS, OpenMCU, Integrated SIM.

Murata has partnered with Truphone, making MVNO network communications possible through the use of eSIM.

FEATURES

- **Small size**
  Size attractive to wearables that previously had no means of cellular connectivity
- **Standardized**
  Through PTCRB/GCF certification improved global interoperability with global wireless networks operators for IoT applications
- **Low power**
  Protocol designed specifically for low current consumption extending battery lifetime up to 10+ years

Type 1SC
LBAD0XX1SC



Smart Agriculture
Connectivity

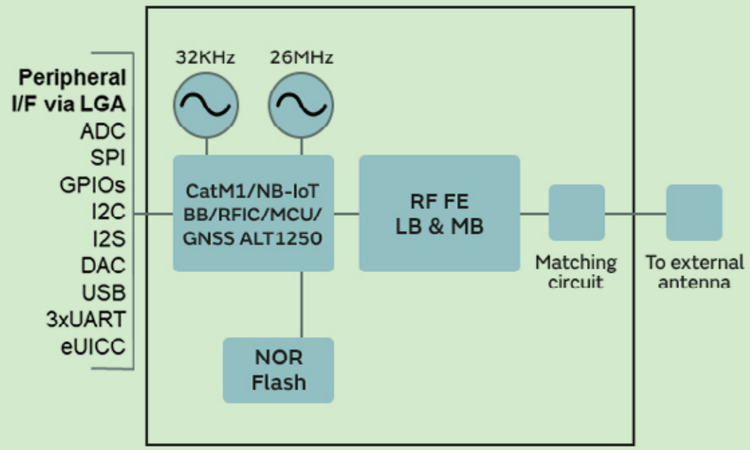
PRODUCT SPECIFICATIONS

- **Support LTE Band:**
  Low Bands 5,8,12,13,14 (CAT M1 Only), 17,18,19,20,26,28 - Mid Bands 1,2,3,4,25
- **Chipset**: Altair ALT1250
- **Modulation:** LTE Cat.M1/NB-IoT Release 13 (*Release 14 – SW Upgrade)
- **Antenna:** External
- **Type Package:** Resin Mold
- **Dimension**: 11.1 x 11.4 x 1.5 mm (max)
- **Transmit Power:** +23dBm max
- **Sleep Mode Current:**
  eDRX Current Consumption (avg)/LTE-M: 43 uA
  PSM Current Consumption (avg)/LTE-M: 1.4 uA
- **RoHS:** Yes
- **Software Features**: AT commands, IPv4/IPv6 stack with TCP and UDP protocol, SSL/TLS, MQTT, OpenMCU(Optional), GPS/GLONASS(Optional), iUICC(Optional)
- **Certified:**
  FCC/IC/RED/TELEC/KC/NCC GCF/PTCRB
- **Certified Carrier:**
  AT&T, KT, SKT, Pelion, Deutsch Telekom, Vodafone, Softbank, KDDI, Docomo, Soracom, Truphone

APPLICATIONS

- **Smart metering**
- **Smart parking**
- **Home security/home automation**
- **Vehicle fleet management**
- **Wearables/trackers**
- **Industrial M2M communication**
- **IoT edge nodes**

BLOCK DIAGRAM



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LPWA Modules

Wireless communications

Type 1SJ

The Type 1SJ (LBAA0QB1SJ) module is one of the smallest **LoRaWAN™** modules in the industry.

This module has a lower power consumption and higher output than previous products. Radio Law certification has already been obtained for major regions.

Open MCU design support is available.

Type 1SJ
LBAA0QB1SJ

APPLICATIONS

- **Smart metering**
- **Smart lighting**
- **Smart parking**
- **Smart agriculture**
- **Industrial M2M**
- **IoT edge nodes**

FEATURES

- **Compact and low cost**
- **Battery life**
  10 years
- **Low Range**
  10km
- **Pre-certified radio regulatory approvals**
  868 & 915 MHz spectrum

PRODUCT SPECIFICATIONS

- **RF/BB chipset:** SX1262
- **MCU chipset:** STM32L0 series
  CPU: Cortex M0+
  RAM: 20KB
  Flash: 192KB
- **Peripheral interfaces:**
  UART/SPI/I2C/GPIOs/ADC
- **Radio certification:**
  FCC, IC, CE
- **Module size:** 10.0x8.0x1.60mm
- **Package:** Shielded Resin Mold
- **Frequencies:** EU / US / India / Pacific
- **Operating temp:** -40 to +85 °C
- **Supply voltage:** 2.2V to 3.6V
- **RF transmit power:**
  +14dBm / +21.5dBm
- **RF sensitivity:** -135dBm
- **Frequency band:** 860MHz-930MHz

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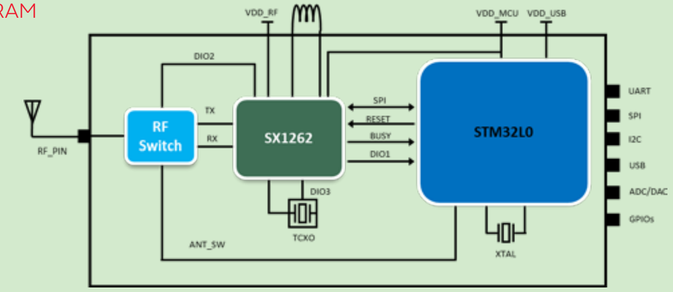

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Modular Solutions

Wireless communications

M.2 boards

Our M.2 modules, co-developed by Embedded Artists, are designed for evaluation, integration and ease-of-use. These professionally designed and proven M.2 modules provide easy evaluation of different Wi-Fi®/Bluetooth® solutions, lower your risk and shorten your time to market.

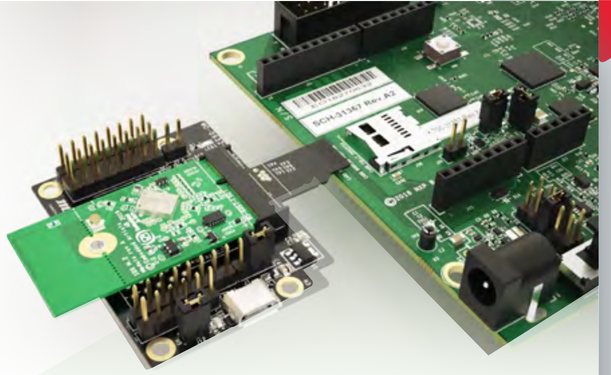
FEATURES

- **Standard M.2 form factor**
- **Reference-certified antennas & snap-off option**
- **UFL connectors for antenna or conducted testing**
- **Comprehensive interface support including SDIO, PCIe, UART, PCM, and radio control lines**

µSD adapter

Murata's µSD-M2 adapter board offers an out-of-the-box experience for NXP i.MX with Murata's M.2 module family. All WLAN/BT- necessary signals are included on M.2 connector pins (Key 'E') including:

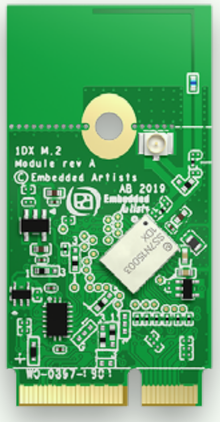
- **WLAN SDIO**
- **WLAN PCIe**
- **BT H4 UART**
- **BT PCM/I2S**
- **GPIOs**



Type 1XA
Dual band
Wi-Fi®11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (PCIe)

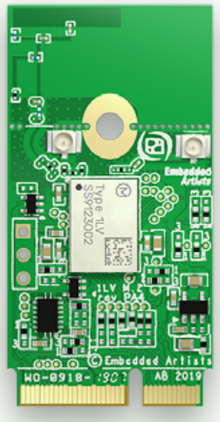
Type 1XZ
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (SDIO)

Type 1YM
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO
+ Bluetooth® 5.2



Type 1DX
Wi-Fi® 11b/g/n
+ Bluetooth® 5.1

Type 1MW
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0



Type 1LV
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0

Type 1ZM
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.1

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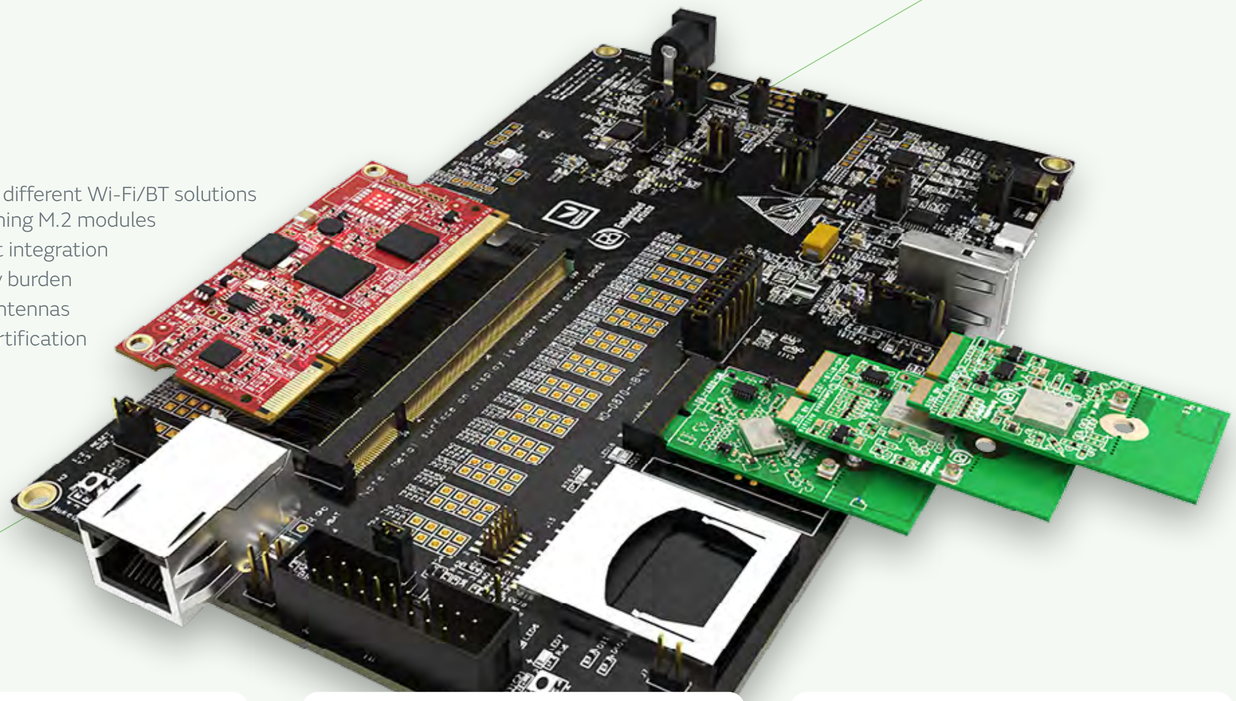
Fully Modular Systems

Wireless communications

Murata and Embedded Artists have developed a full modular system which offers IoT designers a quick, easy and cost-effective route to world-class connectivity.

Development kits are available for use as your evaluation/prototyping platform. The kits include the hardware and software components needed to get up-and-running with your software development on day 1.

- Easily evaluate different Wi-Fi/BT solutions – by just switching M.2 modules
- Fast-to-market integration
- Less regulatory burden
- Use certified antennas
- Re-use FCC certification



1. CHOOSE A COM/OEM BOARD

Embedded Artists have developed a suite of COM computer-on-module (COM) units and OEM boards, integrating all core components around a variety of NXP processors and microcontrollers:

- i.MX RT1062
- i.MX RT1052
- i.MX 8M Quad
- i.MX 8M Mini uCOM
- i.MX 8M Nano uCOM
- i.MX 6Quad
- i.MX 6DualLite
- i.MX 6Ultralite
- i.MX 6SoloX
- i.MX 7Dual
- i.MX 7Dual uCOM
- i.MX 7ULP uCOM

2. PLUG INTO COM CARRIER BOARD

There are two types of carrier boards: One for i.MXRT family boards (with a slot for the COM or OEM board) and one which is suitable for the MPU COM boards and offers...

- Support for i.MX8 designs
- Support for M.2 Key E interface (typically Wi-Fi®/BT), including advanced debug features developed in cooperation with Murata and Cypress
- Support for M.2 Key B interface (typically Cellular/SSD)
- Support for USB 3.0

3. PLUG IN YOUR CONNECTIVITY

Choose the Murata/Embedded Artists M.2 connectivity module appropriate for your application in terms of:

- Performance
- Power consumption
- Range
- Cost
- Temperature range
- Supported standards

4. START YOUR EVALUATION

- Pre-loaded software drivers
- Comprehensive user manuals
- Responsive support

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A Wide Range of Wireless

Communication Modules

Murata offers an extensive portfolio of wireless modules based on Cypress and NXP chipsets.

Modules with integrated MCUs are used in combination with Cypress WICED software. Wi-Fi® and Bluetooth® capabilities are also incorporated and the MCU can be used to run an application.

Other modules are radio-only and they can be used in combination with a MPU (Linux®) or MCU (RTOS).

These modules cover a wide array of different specifications - from single band Wi-Fi® 2.4GHz to dual band Wi-Fi® 11ac 2.4GHz and 5GHz with MIMO. Most of the options also include Bluetooth®.

With this variety of wireless modules Murata can cover a diverse breadth of applications - going all the way from small connected gadgets or sensor nodes to high data rate video streaming devices.

NXP GOLD PARTNER

Module with MCU

Type ABR

802.11 b/g/n WiFi
- *NXP 88MW320 chipset*
- *ARM Cortex-M4 200MHz*

Radio-only modules

Type 1ZM

Wi-Fi 11 a/b/g/n/ac Bluetooth 5.1
- *NXP 88W8987 chipset*

Infineon + CYPRESS EMBEDDED IN TOMORROW™

Modules with MCU

Type 1LD

Shielded ultra-small Wi-Fi 11b/g/n+Bluetooth 5.2 + MCU
- *Cypress CYW43438 chipset*
- *STM32 (ARM Cortex-M4F) MCU*

Type 1GC

Shielded ultra-small dual band Wi-Fi 11a/b/g/n + Ethernet + MCU
- *Cypress CYW43907 chipset*
- *Processor: ARM Cortex-R4*

Radio-only modules

Type 1FX

Shielded ultra-small Wi-Fi 11b/g/n
- *Cypress CYW43364 chipset*

Type 1DX

Shielded ultra-small Wi-Fi 11b/g/n + Bluetooth 5.1
- *Cypress CYW4343W chipset*

Type 1LV

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43012 chipset*

Type 1MW

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43455 chipset*

Soldered-down in major development platforms

Wireless communications

Many of Murata's extensive range of wireless modules are designed into leading development platforms. These include Linux®, FreeRTOS, etc.

- **NXP i.MX**
  - i.MX 8M Mini EVK - Type 1MW
  - i.MX 8M Nano EVK - Type 1MW
  - i.MX 7ULP EVK - Type 1DX
  - i.MX RT Alexa Voice Board - Type 1DX
- **Cypress WICED**
  - PSoC® 6 WiFi-BT Pioneer Board &
  - Prototyping Kit - Type 1DX/Type 1LV
  - CYW43907 Eval Kit - Type 1GC
- **ST Micro - Linux®**
  - STM32MPI Discovery Kit - Type 1DX
- **Micropython**
  - Arduino Portenta H7 - Type 1DX

Arduino Portenta H7

i.MX 8M Nano EVK

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CR Batteries

Micro Batteries

Murata offers a wide range of primary micro batteries with high performance and reliability, taking advantage of 40+ years technology development and manufacturing expertise.

FEATURES

- **40+ years technology development and manufacturing expertise.**
- **Acquisition of ISO 9001/14001 certification.**
- **Full automated assembling lines with high productivity.**

Smart Agriculture
Batteries

Coin Manganese Dioxide Lithium Batteries

- High voltage, high energy density
- Wide range; including heat-resistant models
- ISO/TS16949 certified

Lightweight, High Voltage and High Energy Density

The battery voltage is 3V, almost double that of normal alkaline or manganese batteries.

Excellent discharge characteristics

Voltage characteristics remain stable even for a long period of discharge.

Excellent long-term reliability

Murata's innovative sealing technology minimize battery self-discharge.

Battery	Type	Nominal Voltage	Capacity	Operating Temp.	Features
Coin Manganese Dioxide Lithium (CR)	Standard	3.0V	30-1000mAh	-30 to 70ºC	Lineup of 10 models from small size and thin models to high capacity models
	Extended Temp.	3.0V	220-2000mAh	-40 to 85ºC	Good balance between wide operating temperature and affordability
	Heat resistant	3.0V	210-1000mAh	-40 to 125ºC	Wide operating temperature
	High Drain	3.0V	200-500mAh	-30 to +70ºC	High peak 50mA pulse (x2 times) vs. Standard

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Smart Factory

Making industrial operations more efficient

- Within factory settings, there is now a shift away from outdated mechanical systems and increasing reliance on automation. This is resulting in industrial activities being run more efficiently - with reduced wastage, lower levels of pollution, less risk of downtime and substantial energy savings all being realized.

- Use of automated and robotic systems means that human operatives are not needed to carry out repetitive work, as such tasks can be offloaded. This is clearly advantageous, as it eliminates the possible threat of error through fatigue. It also means that staff can be assigned to other functions that will draw on their experience (thereby making their jobs more fulfilling).

- Through the use of high resolution magnetic sensor technology, control accuracy can be increased, with higher precision motion and position data being derived. This is enabling the performance of the actuators and motors in machinery to be improved - reducing energy consumption and extending lifecycles, as well as safeguarding against potential damage.

- Wireless technology will be pivotal in upgrading older items of legacy equipment, so that they can be connected to Ethernet-based industrial automation infrastructure. This will need to run off minimal power reserves, so as to extend operational life.

- Thanks to advanced sensors, wireless modules, batteries and DC-DC converters, Murata now plays an important role in making factories smarter.

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TMR Sensors

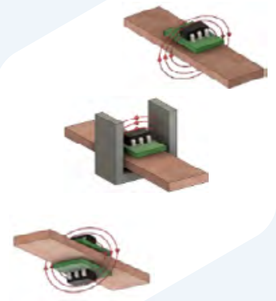
CT100: 1D Linear Sensor

High Linearity, High Resolution and Low Noise

The CT100 1D linear sensor is characterized by its wide dynamic range (covering ±50mT) and also exhibits industry-leading linearity (with a linear error of just ±0.5% at ±20mT).

These attributes enable improved measurement reproducibility and negate the need for compensation circuitry to address temperature fluctuations. The sensor supports a wide operating voltage range (1.0V to 5.5V). Among its main applications are linear measurements, proximity sensing and current sensing.

CT100

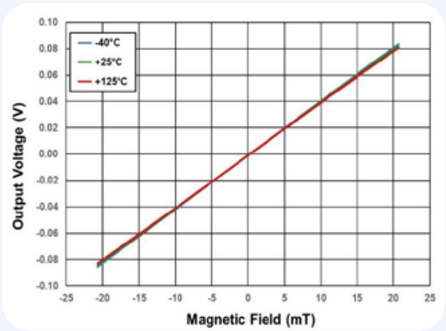


Contactless current sensor

Cylinder switch

Linear Encoders

Linear sensor
CT100 series (Analog)



FEATURES

- **Excellent Linearity, < ±0.5%**
  - Highly accurate linear measurements.
- **Stable Magnetic Performance over Temperature**
  - No compensation circuitry or software required to ensure consistent performance over temperature.
  - Reduces development time and cost.
- **Low Current Consumption**
  - Draws about 167 µA @ VDD = 5.0 V which is more than 12x lower current than other 1D linear sensors.
- **Wide Supply Voltage Range**
  - No need for regulator to operate CT100 since it operates over wide range.
  - Reduces cost, component count and solution footprint.
- **Small Form Factor**
  - DFN-6 package occupies only 2.25 mm2 of PCB area.
  - Ideal for mobile or wearable devices.

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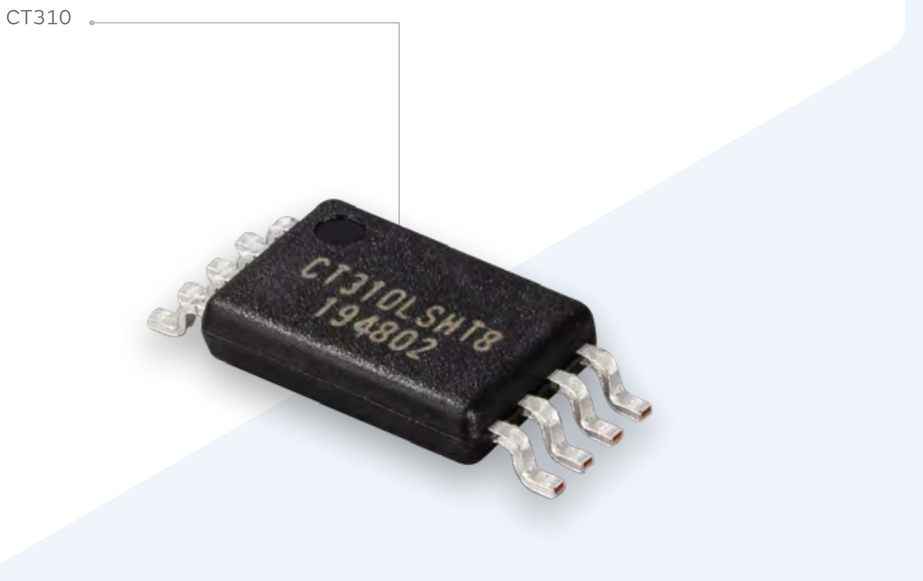
TMR Sensors

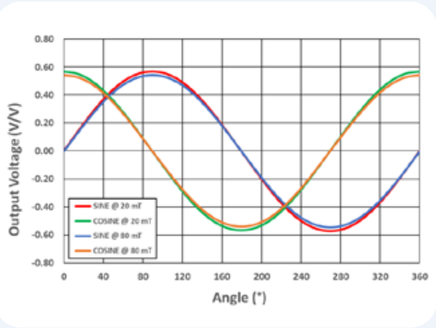
CT310: 2D Angular Sensor

High Linearity, High Resolution and Low Noise

The CT310 is a 2D angular sensor with an operating magnetic range from 25mT to 90mT, plus differential outputs for both sine (SIN) and cosine (COS) axes. It is intended for angular position measurement and BLDC motor control. This device has a very low angular error of <0.6°, once amplitude normalization and offset cancellation have both been applied.



2D Angle sensor
CT310 series (Analog)



FEATURES CT 310

- **Low Angular Error**
  - High precision angle measurements.
- **Stable Magnetic Performance over Temperature**
  - No compensation circuitry or software required to ensure consistent performance over temperature.
  - Reduces development time and cost.
- **Wide Supply Voltage Range**
  - No need for regulator to operate CT310 since it operates over wide range.
  - Reduces cost, component count and solution footprint.
- **Small Form Factor**
  - DFN-8 package almost 5x smaller in size than competing solutions.
  - Ideal for mobile or wearable devices.

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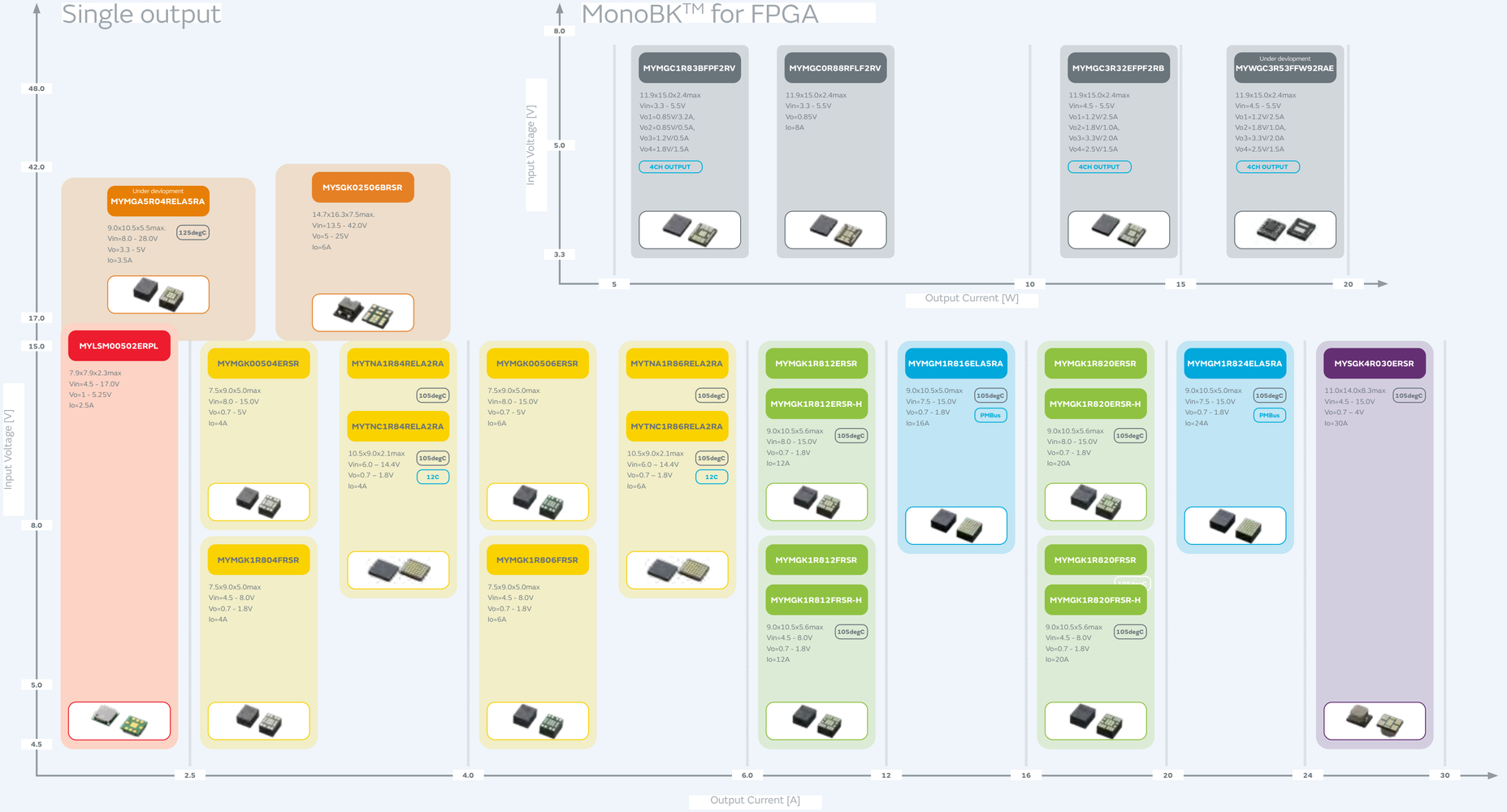
MonoBK™ and UltraBK™

Line-up | Small POL DC-DC converter



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Wi-Fi®
Smart Module

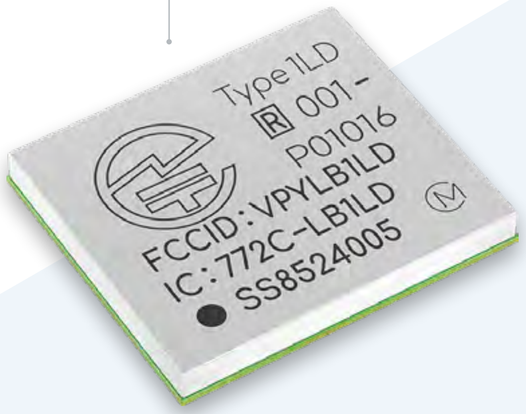
Wireless communications

Type 1LD

Murata is market leader in Wi-Fi® modules for embedded systems, providing superior quality, elevated performance modules for high volume production.

Murata's wireless modules will streamline your assembly operations, thus significantly reducing customer's design time. Additionally, we offer a variety of low-power products for sensor networks.

Type 1LD



APPLICATIONS

- **Home and building automation**
  - Lighting control
  - Heating, Ventilation, Air-conditioning
- **Energy management system (EMS)**
- **Simple sensor network**
- **Home security**
- **Healthcare & fitness**

FEATURES

- **Highly integrated**
- **FCC/IC/CE/TELEC compliant**
- **Shielded Ultra Small Wi-Fi® 11b/g/n + Bluetooth® 5.2 + MCU Module**

PRODUCT SPECIFICATIONS

- **Chipset:**
  - Infineon (CYW43438)
  + STM32 (ARM Cortex-M4F)
- **Size:** 8.9 x 7.8 x 1.2 mm
- **Peripheral Interface:**
  GPIO/SPI/UART/I2C/ADC/PWM
- **Operating Temperature:**
  -40°C to 85°C
- **Package:** Shielded Resin
  Feature rich software hosted on module
  802.11 b/g/n 65Mbps, Wi-fi® Stack runs inside, 1MB Flash, 256KB RAM
  Infineon WICED, SPP on Bluetooth® and GATT on Bluetooth® LE are supported by WICED Qualified for AWS IoT Core devices

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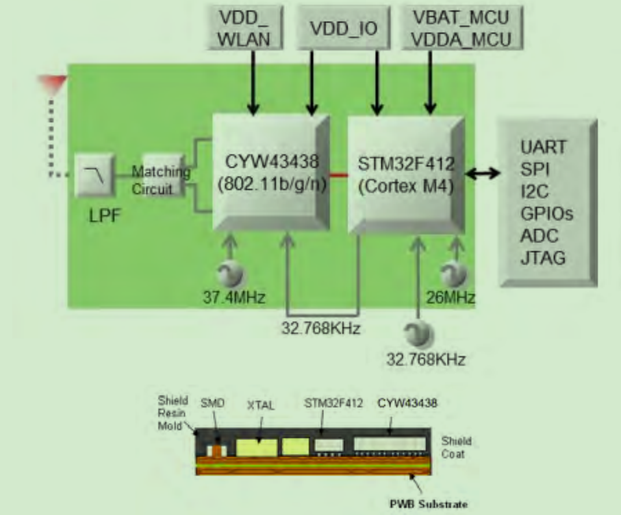

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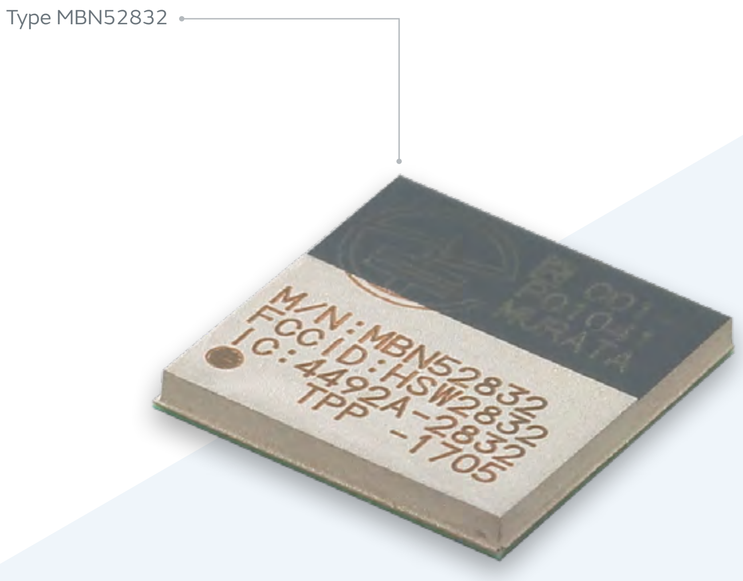
Bluetooth® Low Energy Module

Wireless communications

Type MBN52832

BLE is an ultra-low power communication technology that enables several years of operation off a button battery. Widespread adoption is being seen in fields like health management, fitness and home networks. BLE has also been adopted as a communication method by the Continua Health Alliance, a non-profit organization of healthcare and technology companies.



APPLICATIONS

- **Proximity services**
- **Building automation**
- **Medical/healthcare**
- **Bluetooth beacons**

FEATURES

- **Powerful MCU core with large RAM and flash for user application**
  - ARM Cortex M4; 64K RAM; 512K flash
- **Low power consumption**
  - Tx 7mA @ 3.5dBm (DCDC mode)
  - Rx 6mA (DCDC mode)
- **Rich peripheral interface-20 GPIO ports**
- **Very small size:** 7.4x7.0x0.9mm (max.)
- **Fully certified**
  - FCC (US), IC (Canada), ETSI (EU), TELEC (Japan)
  - BT SIG Certificate
- **Support both on-board and external antenna version**
  - On-board PCB pattern antenna
  - External patch antenna
  - External dipole antenna
- **Bluetooth® 5.0**

PRODUCT SPECIFICATIONS

- **Chipset:** nRF52832 Bluetooth® LE IC
- **Dimension:** 7.4x7.0x0.9mm
- **Package:** LGA
- **Antenna:** on-board or external
- **Max output power:** +4dBm (LDO mode)
- **Interfaces:**
  UART, SPI, 20 GPIO, 5ADC, SWD, PWM, I2C
- **Operating voltage:** 1.7V to 3.6V
- **Operating temperature range:**
  -40 to 85°C
- **OTA firmware upgrade**
- **RoHS compliant**
- **Regulatory certificate:**
  FCC/IC/ETSI/TELEC
- **Bluetooth® SIG qualification**

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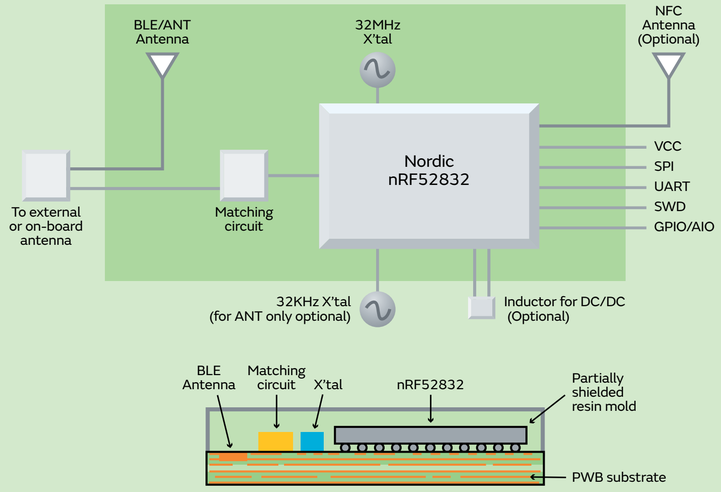

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UWB Modules

Wireless communications

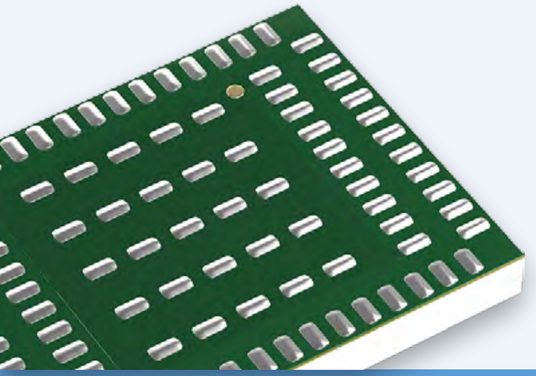
Ultra-wideband (UWB) technology provides a highly effective means for providing secure and precise distance measurement. This is based on determining the time-of-flight (ToF) of radio waves. Murata offers an extensive portfolio of UWB modules.

FEATURES

- **Ultra-small dimensions**
- **High quality**
- **Lower power consumption**

APPLICATIONS

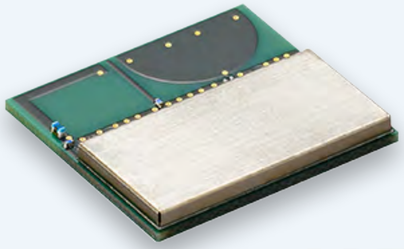
- **Indoor navigation**
- **Smart retail/point-of-sales**
- **Smart building**
- **Smart locks**
- **Tags/tracking**
- **Contactless presence detection**



NXP

TYPE 2BP

- **Ultra small UWB module which includes NXP's SR150 UWB chipset, clock, filters and peripheral components.**
- **3 Antenna support (3D AoA or 2D AoA support)**
- **UWB Chip set:** NXP Trimension SR150
- **Antenna:** External



NXP

TYPE 2DK

- **All-in-one UWB + Bluetooth LE combo module which integrates NXP Trimension™ SR040 UWB Chipset, NXP QN9090 Bluetooth LE + MCU chipset, On board antenna and peripheral components.**
- **Ideally suited for UWB Tag/Tracker which operates by coin-cell battery, and general IoT devices.**
- **UWB Chip set:** NXP Trimension™ SR040
- **Antenna:** Integrated

qorvo
all around you

TYPE 2AB

- **UWB Chip set : Qorvo DW3110/3120**
- **FCC/IC/TELEC Reference Certified (Planed)**
- **Hostless module Integrated Nordic IC / nRF52840 which also have Blutooth Low Energy function for waking up UWB and updating FW.**
- **Integrated 3-Axis sensor for saving battery**
- **Reference clock for UWB and MCU are embedded**
- **UWB Chip set:** Qorvo DW3110/3120
- **Antenna:** External

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INNOVATOR IN ELECTRONICS

LPWA Modules

Wireless communications

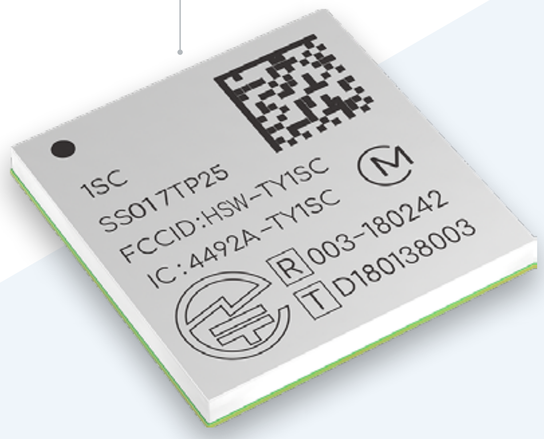
Low power wide area (LPWA) networks provide a power efficient wireless communication technology for interconnecting devices together over a long range. LPWA is most suitable for applications such as IoT and machine-to-machine (M2M) communication, as well as various other situations where lower cost and lower power consumption are required. To respond to customers' needs, Murata has formed strategic partnerships with market leaders, and is accelerating the development of products using this highly appealing emerging technology.

Type 1SC

The Type 1SC (LBAD00XX1SC) module is the world's smallest **Cat. M1/NB-IoT module** with global certification. It supports GPS/GNSS, OpenMCU, Integrated SIM.

Murata has partnered with Truphone, making MVNO network communications possible through the use of eSIM.

Type 1SC
LBAD0XX1SC



FEATURES

- **Small size**
  Size attractive to wearables that previously had no means of cellular connectivity
- **Standardized**
  Through PTCRB/GCF certification improved global interoperability with global wireless networks operators for IoT applications
- **Low power**
  Protocol designed specifically for low current consumption extending battery lifetime up to 10+ years

PRODUCT SPECIFICATIONS

- **Support LTE Band:**
  Low Bands 5,8,12,13,14 (CAT M1 Only), 17,18,19,20,26,28 - Mid Bands 1,2,3,4,25
- **Chipset**: Altair ALT1250
- **Modulation:** LTE Cat.M1/NB-IoT Release 13 (*Release 14 – SW Upgrade)
- **Antenna:** External
- **Type Package:** Resin Mold
- **Dimension**: 11.1 x 11.4 x 1.5 mm (max)
- **Transmit Power:** +23dBm max
- **Sleep Mode Current:**
  eDRX Current Consumption (avg)/LTE-M: 43 uA
  PSM Current Consumption (avg)/LTE-M: 1.4 uA
- **RoHS:** Yes
- **Software Features**: AT commands, IPv4/IPv6 stack with TCP and UDP protocol, SSL/TLS, MQTT, OpenMCU(Optional), GPS/GLONASS(Optional), iUICC(Optional)
- **Certified:**
  FCC/IC/RED/TELEC/KC/NCC GCF/PTCRB
- **Certified Carrier:**
  AT&T, KT, SKT, Pelion, Deutsch Telekom, Vodafone, Softbank, KDDI, Docomo, Soracom, Truphone

APPLICATIONS

- **Smart metering**
- **Smart parking**
- **Home security/home automation**
- **Vehicle fleet management**
- **Wearables/trackers**
- **Industrial M2M communication**
- **IoT edge nodes**

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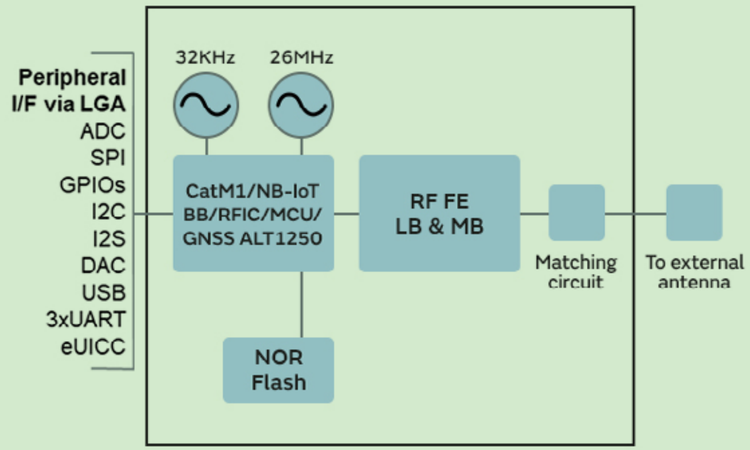

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LPWA Modules

Wireless communications

Type 1SJ

The Type 1SJ (LBAA0QB1SJ) module is one of the smallest **LoRaWAN™** modules in the industry.

This module has a lower power consumption and higher output than previous products. Radio Law certification has already been obtained for major regions.

Open MCU design support is available.

Type 1SJ
LBAA0QB1SJ

APPLICATIONS

- **Smart metering**
- **Smart lighting**
- **Smart parking**
- **Smart agriculture**
- **Industrial M2M**
- **IoT edge nodes**

FEATURES

- **Compact and low cost**
- **Battery life**
  10 years
- **Low Range**
  10km
- **Pre-certified radio regulatory approvals**
  868 & 915 MHz spectrum

PRODUCT SPECIFICATIONS

- **RF/BB chipset:** SX1262
- **MCU chipset:** STM32L0 series
  CPU: Cortex M0+
  RAM: 20KB
  Flash: 192KB
- **Peripheral interfaces:**
  UART/SPI/I2C/GPIOs/ADC
- **Radio certification:**
  FCC, IC, CE
- **Module size:** 10.0x8.0x1.60mm
- **Package:** Shielded Resin Mold
- **Frequencies:** EU / US / India / Pacific
- **Operating temp:** -40 to +85 °C
- **Supply voltage:** 2.2V to 3.6V
- **RF transmit power:**
  +14dBm / +21.5dBm
- **RF sensitivity:** -135dBm
- **Frequency band:** 860MHz-930MHz

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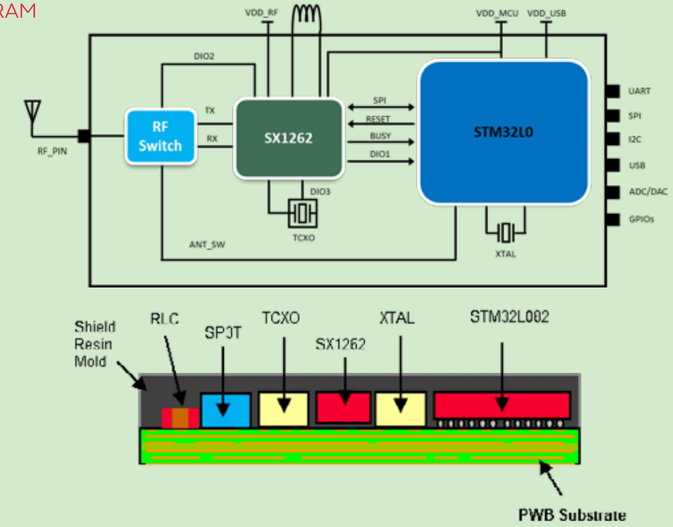

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Modular Solutions

Wireless communications

M.2 boards

Our M.2 modules, co-developed by Embedded Artists, are designed for evaluation, integration and ease-of-use. These professionally designed and proven M.2 modules provide easy evaluation of different Wi-Fi®/Bluetooth® solutions, lower your risk and shorten your time to market.

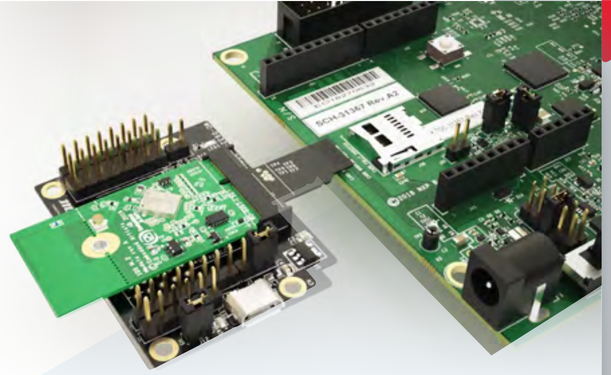
FEATURES

- **Standard M.2 form factor**
- **Reference-certified antennas & snap-off option**
- **UFL connectors for antenna or conducted testing**
- **Comprehensive interface support including SDIO, PCIe, UART, PCM, and radio control lines**

µSD adapter

Murata's µSD-M2 adapter board offers an out-of-the-box experience for NXP i.MX with Murata's M.2 module family. All WLAN/BT- necessary signals are included on M.2 connector pins (Key 'E') including:

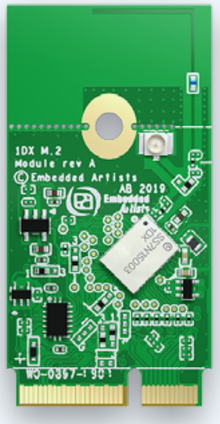
- **WLAN SDIO**
- **WLAN PCIe**
- **BT H4 UART**
- **BT PCM/I2S**
- **GPIOs**



Type 1XA
Dual band
Wi-Fi®11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (PCIe)

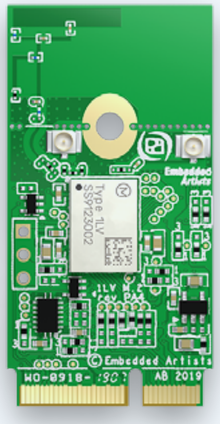
Type 1XZ
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (SDIO)

Type 1YM
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO
+ Bluetooth® 5.2



Type 1DX
Wi-Fi® 11b/g/n
+ Bluetooth® 5.1

Type 1MW
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0



Type 1LV
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0

Type 1ZM
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.1

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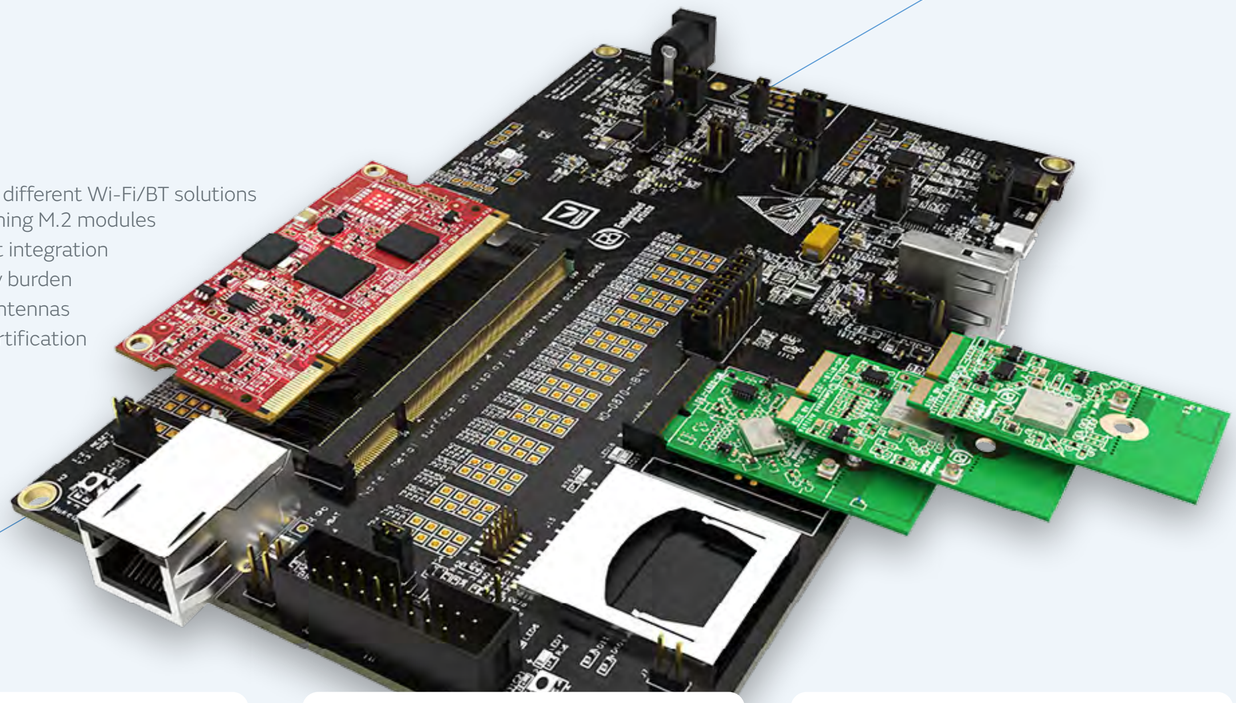
Fully Modular Systems

Wireless communications

Murata and Embedded Artists have developed a full modular system which offers IoT designers a quick, easy and cost-effective route to world-class connectivity.

Development kits are available for use as your evaluation/prototyping platform. The kits include the hardware and software components needed to get up-and-running with your software development on day 1.

- Easily evaluate different Wi-Fi/BT solutions – by just switching M.2 modules
- Fast-to-market integration
- Less regulatory burden
- Use certified antennas
- Re-use FCC certification



1. CHOOSE A COM/OEM BOARD

Embedded Artists have developed a suite of COM computer-on-module (COM) units and OEM boards, integrating all core components around a variety of NXP processors and microcontrollers:

- i.MX RT1062
- i.MX RT1052
- i.MX 8M Quad
- i.MX 8M Mini uCOM
- i.MX 8M Nano uCOM
- i.MX 6Quad
- i.MX 6DualLite
- i.MX 6Ultralite
- i.MX 6SoloX
- i.MX 7Dual
- i.MX 7Dual uCOM
- i.MX 7ULP uCOM

2. PLUG INTO COM CARRIER BOARD

There are two types of carrier boards: One for i.MXRT family boards (with a slot for the COM or OEM board) and one which is suitable for the MPU COM boards and offers...

- Support for i.MX8 designs
- Support for M.2 Key E interface (typically Wi-Fi®/BT), including advanced debug features developed in cooperation with Murata and Cypress
- Support for M.2 Key B interface (typically Cellular/SSD)
- Support for USB 3.0

3. PLUG IN YOUR CONNECTIVITY

Choose the Murata/Embedded Artists M.2 connectivity module appropriate for your application in terms of:

- Performance
- Power consumption
- Range
- Cost
- Temperature range
- Supported standards

4. START YOUR EVALUATION

- Pre-loaded software drivers
- Comprehensive user manuals
- Responsive support

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A Wide Range of Wireless

Communication Modules

Murata offers an extensive portfolio of wireless modules based on Cypress and NXP chipsets.

Modules with integrated MCUs are used in combination with Cypress WICED software. Wi-Fi® and Bluetooth® capabilities are also incorporated and the MCU can be used to run an application.

Other modules are radio-only and they can be used in combination with a MPU (Linux®) or MCU (RTOS).

These modules cover a wide array of different specifications - from single band Wi-Fi® 2.4GHz to dual band Wi-Fi® 11ac 2.4GHz and 5GHz with MIMO. Most of the options also include Bluetooth®.

With this variety of wireless modules Murata can cover a diverse breadth of applications - going all the way from small connected gadgets or sensor nodes to high data rate video streaming devices.

NXP GOLD PARTNER

Module with MCU

Type ABR

802.11 b/g/n WiFi
- *NXP 88MW320 chipset*
- *ARM Cortex-M4 200MHz*

Radio-only modules

Type 1ZM

Wi-Fi 11 a/b/g/n/ac Bluetooth 5.1
- *NXP 88W8987 chipset*

Infineon + CYPRESS

Modules with MCU

Type 1LD

Shielded ultra-small Wi-Fi 11b/g/n+Bluetooth 5.2 + MCU
- *Cypress CYW43438 chipset*
- *STM32 (ARM Cortex-M4F) MCU*

Type 1GC

Shielded ultra-small dual band Wi-Fi 11a/b/g/n + Ethernet + MCU
- *Cypress CYW43907 chipset*
- *Processor: ARM Cortex-R4*

Radio-only modules

Type 1FX

Shielded ultra-small Wi-Fi 11b/g/n
- *Cypress CYW43364 chipset*

Type 1DX

Shielded ultra-small Wi-Fi 11b/g/n + Bluetooth 5.1
- *Cypress CYW4343W chipset*

Type 1LV

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43012 chipset*

Type 1MW

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43455 chipset*

Soldered-down in major development platforms

Wireless communications

Many of Murata's extensive range of wireless modules are designed into leading development platforms. These include Linux®, FreeRTOS, etc.

- **NXP i.MX**
  - i.MX 8M Mini EVK - Type 1MW
  - i.MX 8M Nano EVK - Type 1MW
  - i.MX 7ULP EVK - Type 1DX
  - i.MX RT Alexa Voice Board - Type 1DX
- **Cypress WICED**
  - PSoC® 6 WiFi-BT Pioneer Board &
  - Prototyping Kit - Type 1DX/Type 1LV
  - CYW43907 Eval Kit - Type 1GC
- **ST Micro - Linux®**
  - STM32MPI Discovery Kit - Type 1DX
- **Micropython**
  - Arduino Portenta H7 - Type 1DX

Arduino Portenta H7

i.MX 8M Nano EVK

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CR Batteries

Micro Batteries

Murata offers a wide range of primary micro batteries with high performance and reliability, taking advantage of 40+ years technology development and manufacturing expertise.

FEATURES

- **40+ years technology development and manufacturing expertise.**
- **Acquisition of ISO 9001/14001 certification.**
- **Full automated assembling lines with high productivity.**

Coin Manganese Dioxide Lithium Batteries

- High voltage, high energy density
- Wide range; including heat-resistant models
- ISO/TS16949 certified

Lightweight, High Voltage and High Energy Density

The battery voltage is 3V, almost double that of normal alkaline or manganese batteries.

Excellent discharge characteristics

Voltage characteristics remain stable even for a long period of discharge.

Excellent long-term reliability

Murata's innovative sealing technology minimize battery self-discharge.

Battery	Type	Nominal Voltage	Capacity	Operating Temp.	Features
Coin Manganese Dioxide Lithium (CR)	Standard	3.0V	30-1000mAh	-30 to 70ºC	Lineup of 10 models from small size and thin models to high capacity models
	Extended Temp.	3.0V	220-2000mAh	-40 to 85ºC	Good balance between wide operating temperature and affordability
	Heat resistant	3.0V	210-1000mAh	-40 to 125ºC	Wide operating temperature
	High Drain	3.0V	200-500mAh	-30 to +70ºC	High peak 50mA pulse (x2 times) vs. Standard

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Smart Health

Improving the quality of life for patients and better utilizing medical resources

- The global smart health business is expanding rapidly. Precedence Research forecasts that it will be worth over $482 billion by 2027.
- Until now medical activities were almost exclusively undertaken within a clinical setting. Over the last decade, however, this has changed. Now it is possible for a large proportion of this work to be done without the need for patients to visit a hospital or clinic.
- The data required by medical professionals can be obtained by employing home-based monitoring. This can be through the regular use of portable equipment, or continuous data acquisition via body-worn technology. The latest figures from Research and Markets estimate that there are now more than 50 million patients worldwide being monitored from their homes.
- Smart health can be of value in the remote treatment of patients, as well as for diagnostic reasons. Data from sensors can be examined to help improve drug delivery and to make certain that patients are administering their treatments correctly (such as smart insulin pens, etc.).
- At the foundation of home-based monitoring and treatment are lower power wireless and advanced battery technologies. Murata has batteries supporting long-term monitoring implementations and wireless modules to construct gateways for transporting data to the cloud for analysis.

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Wi-Fi®
Smart Module

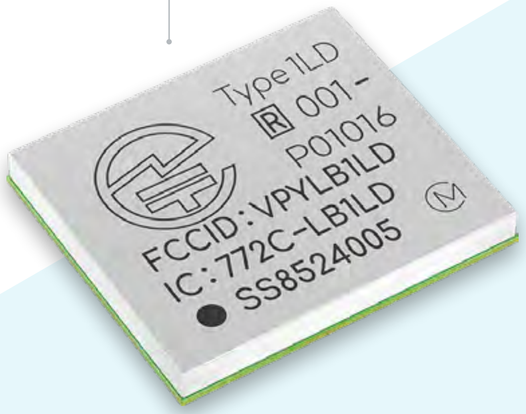
Wireless communications

Type 1LD

Murata is market leader in Wi-Fi® modules for embedded systems, providing superior quality, elevated performance modules for high volume production.

Murata's wireless modules will streamline your assembly operations, thus significantly reducing customer's design time. Additionally, we offer a variety of low-power products for sensor networks.

Type 1LD



Smart Health

Connectivity

APPLICATIONS

- **Home and building automation**
  - Lighting control
  - Heating, Ventilation, Air-conditioning
- **Energy management system (EMS)**
- **Simple sensor network**
- **Home security**
- **Healthcare & fitness**

FEATURES

- **Highly integrated**
- **FCC/IC/CE/TELEC compliant**
- **Shielded Ultra Small Wi-Fi® 11b/g/n + Bluetooth® 5.2 + MCU Module**

PRODUCT SPECIFICATIONS

- **Chipset:**
  - Infineon (CYW43438)
  + STM32 (ARM Cortex-M4F)
- **Size:** 8.9 x 7.8 x 1.2 mm
- **Peripheral Interface:**
  GPIO/SPI/UART/I2C/ADC/PWM
- **Operating Temperature:**
  -40°C to 85°C
- **Package:** Shielded Resin
  Feature rich software hosted on module
  802.11 b/g/n 65Mbps, Wi-fi® Stack runs inside, 1MB Flash, 256KB RAM
  Infineon WICED, SPP on Bluetooth® and GATT on Bluetooth® LE are supported by WICED Qualified for AWS IoT Core devices

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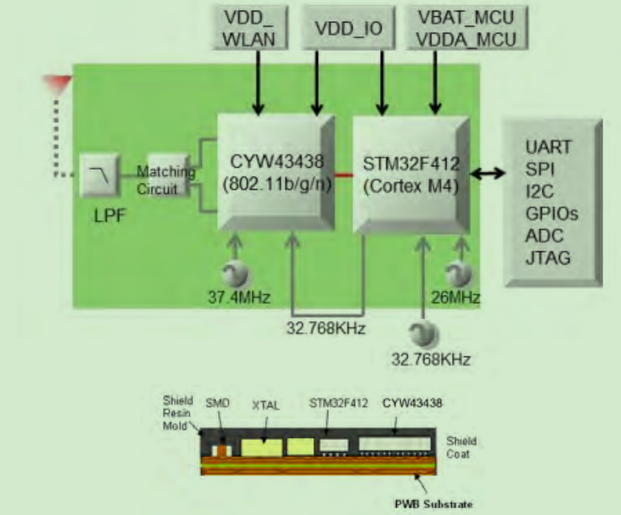

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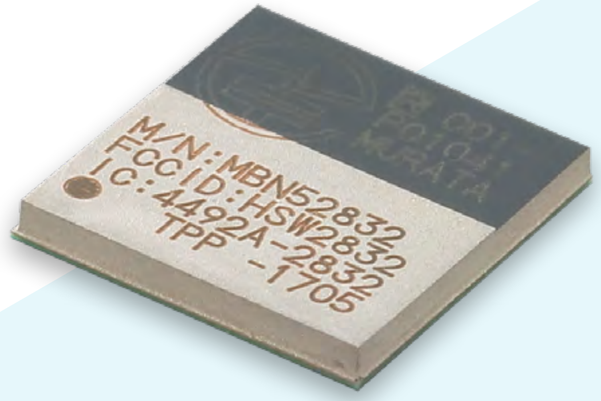
Bluetooth® Low Energy Module

Wireless communications

Type MBN52832

BLE is an ultra-low power communication technology that enables several years of operation off a button battery. Widespread adoption is being seen in fields like health management, fitness and home networks. BLE has also been adopted as a communication method by the Continua Health Alliance, a non-profit organization of healthcare and technology companies.

Type MBN52832



Smart Health

Connectivity

APPLICATIONS

- **Proximity services**
- **Building automation**
- **Medical/healthcare**
- **Bluetooth beacons**

FEATURES

- **Powerful MCU core with large RAM and flash for user application**
  - ARM Cortex M4; 64K RAM; 512K flash
- **Low power consumption**
  - Tx 7mA @ 3.5dBm (DCDC mode)
  - Rx 6mA (DCDC mode)
- **Rich peripheral interface-20 GPIO ports**
- **Very small size:** 7.4x7.0x0.9mm (max.)
- **Fully certified**
  - FCC (US), IC (Canada), ETSI (EU), TELEC (Japan)
  - BT SIG Certificate
- **Support both on-board and external antenna version**
  - On-board PCB pattern antenna
  - External patch antenna
  - External dipole antenna
- **Bluetooth® 5.0**

PRODUCT SPECIFICATIONS

- **Chipset:** nRF52832 Bluetooth® LE IC
- **Dimension:** 7.4x7.0x0.9mm
- **Package:** LGA
- **Antenna:** on-board or external
- **Max output power:** +4dBm (LDO mode)
- **Interfaces:**
  UART, SPI, 20 GPIO, 5ADC, SWD, PWM, I2C
- **Operating voltage:** 1.7V to 3.6V
- **Operating temperature range:**
  -40 to 85°C
- **OTA firmware upgrade**
- **RoHS compliant**
- **Regulatory certificate:**
  FCC/IC/ETSI/TELEC
- **Bluetooth® SIG qualification**

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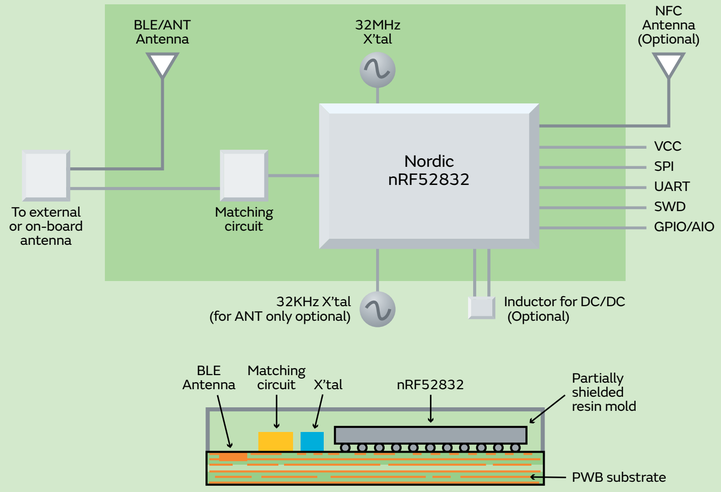

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UWB Modules

Wireless communications

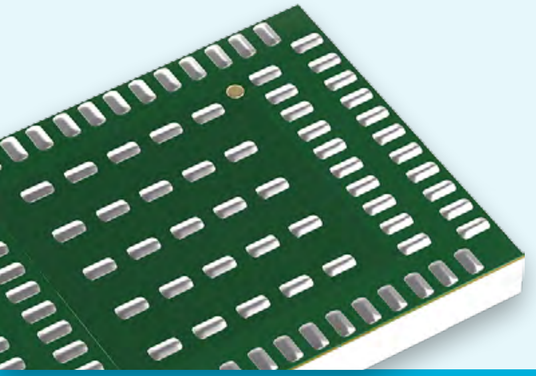
Ultra-wideband (UWB) technology provides a highly effective means for providing secure and precise distance measurement. This is based on determining the time-of-flight (ToF) of radio waves. Murata offers an extensive portfolio of UWB modules.

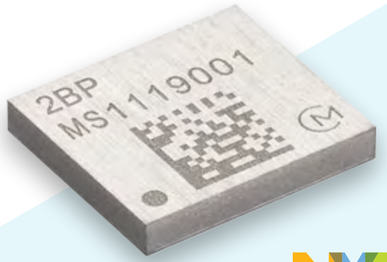
FEATURES

- **Ultra-small dimensions**
- **High quality**
- **Lower power consumption**

APPLICATIONS

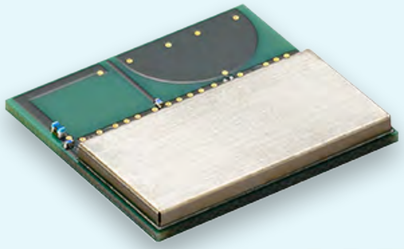
- **Indoor navigation**
- **Smart retail/point-of-sales**
- **Smart building**
- **Smart locks**
- **Tags/tracking**
- **Contactless presence detection**





TYPE 2BP

- **Ultra small UWB module which includes NXP's SR150 UWB chipset, clock, filters and peripheral components.**
- **3 Antenna support (3D AoA or 2D AoA support)**
- **UWB Chip set:** NXP Trimension SR150
- **Antenna:** External



TYPE 2DK

- **All-in-one UWB + Bluetooth LE combo module which integrates NXP Trimension™ SR040 UWB Chipset, NXP QN9090 Bluetooth LE + MCU chipset, On board antenna and peripheral components.**
- **Ideally suited for UWB Tag/Tracker which operates by coin-cell battery, and general IoT devices.**
- **UWB Chip set:** NXP Trimension™ SR040
- **Antenna:** Integrated

TYPE 2AB

- **UWB Chip set : Qorvo DW3110/3120**
- **FCC/IC/TELEC Reference Certified (Planed)**
- **Hostless module Integrated Nordic IC / nRF52840 which also have Blutooth Low Energy function for waking up UWB and updating FW.**
- **Integrated 3-Axis sensor for saving battery**
- **Reference clock for UWB and MCU are embedded**
- **UWB Chip set:** Qorvo DW3110/3120
- **Antenna:** External

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LPWA Modules

Wireless communications

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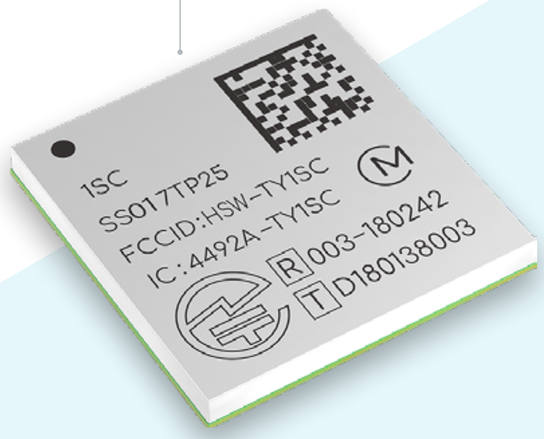

FEATURES

- **Small size**
  Size attractive to wearables that previously had no means of cellular connectivity
- **Standardized**
  Through PTCRB/GCF certification improved global interoperability with global wireless networks operators for IoT applications
- **Low power**
  Protocol designed specifically for low current consumption extending battery lifetime up to 10+ years

PRODUCT SPECIFICATIONS

- **Support LTE Band:**
  Low Bands 5,8,12,13,14 (CAT M1 Only), 17,18,19,20,26,28 - Mid Bands 1,2,3,4,25
- **Chipset**: Altair ALT1250
- **Modulation:** LTE Cat.M1/NB-IoT Release 13 (*Release 14 – SW Upgrade)
- **Antenna:** External
- **Type Package:** Resin Mold
- **Dimension**: 11.1 x 11.4 x 1.5 mm (max)
- **Transmit Power:** +23dBm max
- **Sleep Mode Current:**
  eDRX Current Consumption (avg)/LTE-M: 43 uA
  PSM Current Consumption (avg)/LTE-M: 1.4 uA
- **RoHS:** Yes
- **Software Features**: AT commands, IPv4/IPv6 stack with TCP and UDP protocol, SSL/TLS, MQTT, OpenMCU(Optional), GPS/GLONASS(Optional), iUICC(Optional)
- **Certified:**
  FCC/IC/RED/TELEC/KC/NCC GCF/PTCRB
- **Certified Carrier:**
  AT&T, KT, SKT, Pelion, Deutsch Telekom, Vodafone, Softbank, KDDI, Docomo, Soracom, Truphone

APPLICATIONS

- **Smart metering**
- **Smart parking**
- **Home security/home automation**
- **Vehicle fleet management**
- **Wearables/trackers**
- **Industrial M2M communication**
- **IoT edge nodes**

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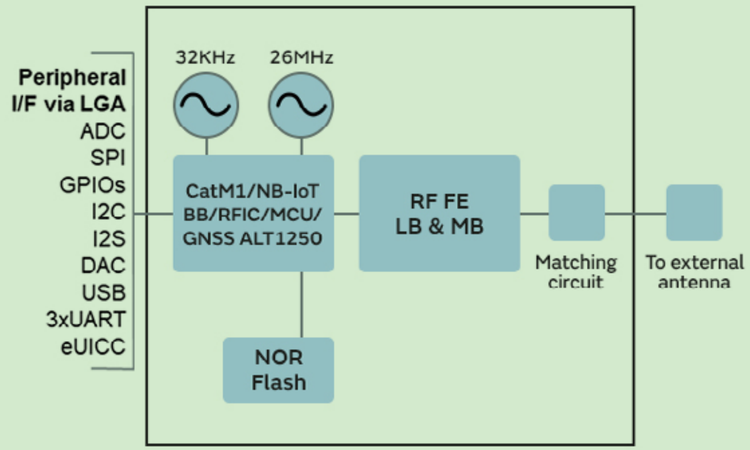

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LPWA Modules

Wireless communications

Type 1SJ

The Type 1SJ (LBAA0QB1SJ) module is one of the smallest **LoRaWAN™** modules in the industry.

This module has a lower power consumption and higher output than previous products. Radio Law certification has already been obtained for major regions.

Open MCU design support is available.

Type 1SJ
LBAA0QB1SJ

APPLICATIONS

- **Smart metering**
- **Smart lighting**
- **Smart parking**
- **Smart agriculture**
- **Industrial M2M**
- **IoT edge nodes**

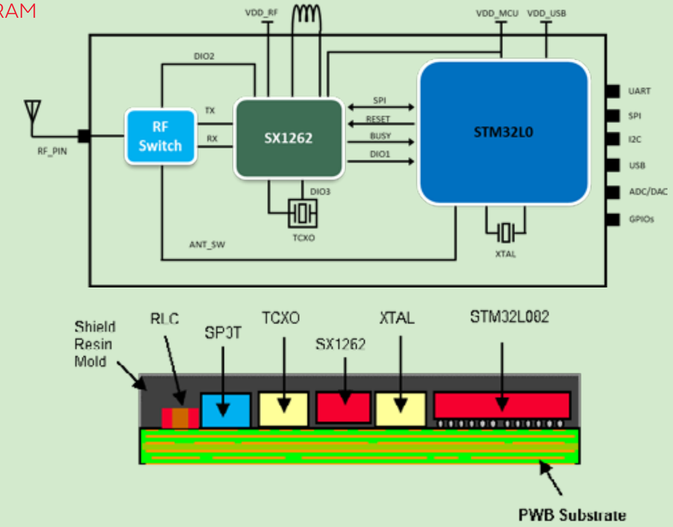
FEATURES

- **Compact and low cost**
- **Battery life**
  10 years
- **Low Range**
  10km
- **Pre-certified radio regulatory approvals**
  868 & 915 MHz spectrum

PRODUCT SPECIFICATIONS

- **RF/BB chipset:** SX1262
- **MCU chipset:** STM32L0 series
  CPU: Cortex M0+
  RAM: 20KB
  Flash: 192KB
- **Peripheral interfaces:**
  UART/SPI/I2C/GPIOs/ADC
- **Radio certification:**
  FCC, IC, CE
- **Module size:** 10.0x8.0x1.60mm
- **Package:** Shielded Resin Mold
- **Frequencies:** EU / US / India / Pacific
- **Operating temp:** -40 to +85 °C
- **Supply voltage:** 2.2V to 3.6V
- **RF transmit power:**
  +14dBm / +21.5dBm
- **RF sensitivity:** -135dBm
- **Frequency band:** 860MHz-930MHz

BLOCK DIAGRAM



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Modular Solutions

Wireless communications

M.2 boards

Our M.2 modules, co-developed by Embedded Artists, are designed for evaluation, integration and ease-of-use. These professionally designed and proven M.2 modules provide easy evaluation of different Wi-Fi®/Bluetooth® solutions, lower your risk and shorten your time to market.

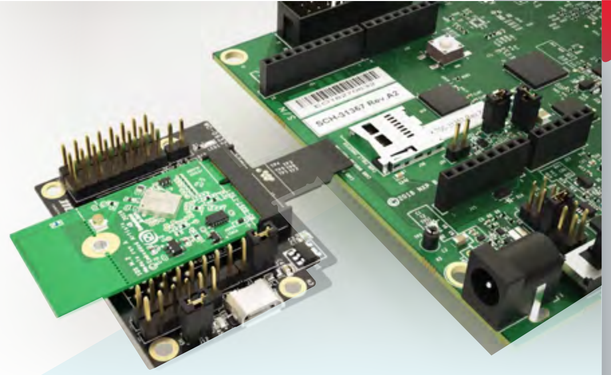
FEATURES

- **Standard M.2 form factor**
- **Reference-certified antennas & snap-off option**
- **UFL connectors for antenna or conducted testing**
- **Comprehensive interface support including SDIO, PCIe, UART, PCM, and radio control lines**

µSD adapter

Murata's µSD-M2 adapter board offers an out-of-the-box experience for NXP i.MX with Murata's M.2 module family. All WLAN/BT- necessary signals are included on M.2 connector pins (Key 'E') including:

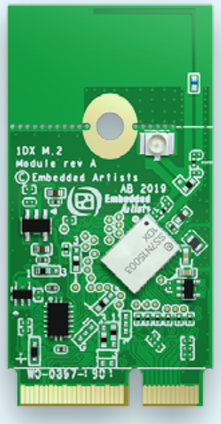
- **WLAN SDIO**
- **WLAN PCIe**
- **BT H4 UART**
- **BT PCM/I2S**
- **GPIOs**



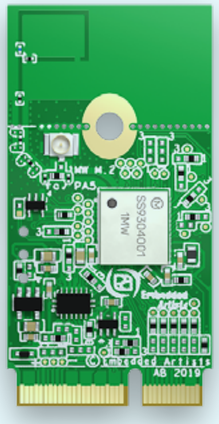
Type 1XA
Dual band
Wi-Fi®11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (PCIe)

Type 1XZ
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (SDIO)

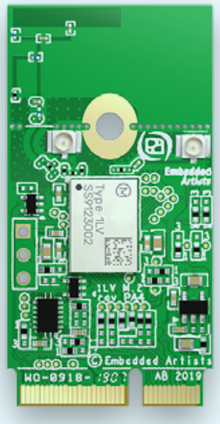
Type 1YM
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO
+ Bluetooth® 5.2



Type 1DX
Wi-Fi® 11b/g/n
+ Bluetooth® 5.1



Type 1MW
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0



Type 1LV
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0

Type 1ZM
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.1

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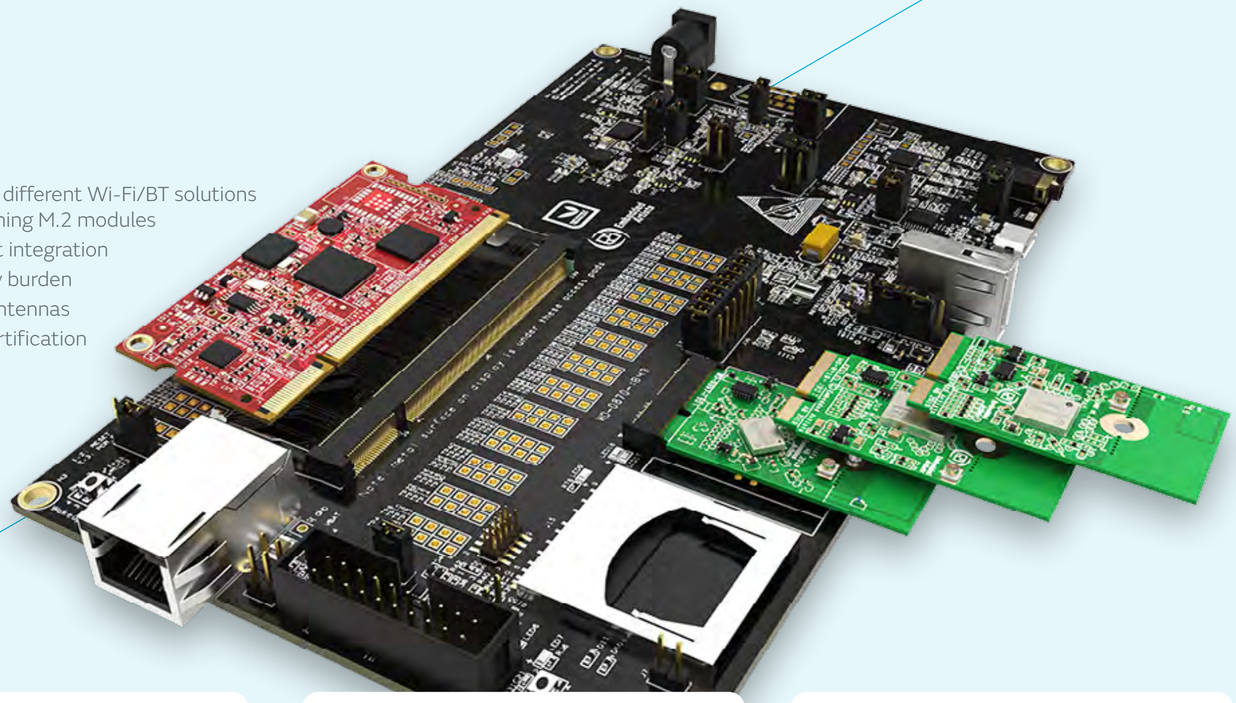
Fully Modular Systems

Wireless communications

Murata and Embedded Artists have developed a full modular system which offers IoT designers a quick, easy and cost-effective route to world-class connectivity.

Development kits are available for use as your evaluation/prototyping platform. The kits include the hardware and software components needed to get up-and-running with your software development on day 1.

- Easily evaluate different Wi-Fi/BT solutions – by just switching M.2 modules
- Fast-to-market integration
- Less regulatory burden
- Use certified antennas
- Re-use FCC certification



1. CHOOSE A COM/OEM BOARD

Embedded Artists have developed a suite of COM computer-on-module (COM) units and OEM boards, integrating all core components around a variety of NXP processors and microcontrollers:

- i.MX RT1062
- i.MX RT1052
- i.MX 8M Quad
- i.MX 8M Mini uCOM
- i.MX 8M Nano uCOM
- i.MX 6Quad
- i.MX 6DualLite
- i.MX 6Ultralite
- i.MX 6SoloX
- i.MX 7Dual
- i.MX 7Dual uCOM
- i.MX 7ULP uCOM

2. PLUG INTO COM CARRIER BOARD

There are two types of carrier boards: One for i.MXRT family boards (with a slot for the COM or OEM board) and one which is suitable for the MPU COM boards and offers...

- Support for i.MX8 designs
- Support for M.2 Key E interface (typically Wi-Fi®/BT), including advanced debug features developed in cooperation with Murata and Cypress
- Support for M.2 Key B interface (typically Cellular/SSD)
- Support for USB 3.0

3. PLUG IN YOUR CONNECTIVITY

Choose the Murata/Embedded Artists M.2 connectivity module appropriate for your application in terms of:

- Performance
- Power consumption
- Range
- Cost
- Temperature range
- Supported standards

4. START YOUR EVALUATION

- Pre-loaded software drivers
- Comprehensive user manuals
- Responsive support

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A Wide Range of Wireless

Communication Modules

Murata offers an extensive portfolio of wireless modules based on Cypress and NXP chipsets.

Modules with integrated MCUs are used in combination with Cypress WICED software. Wi-Fi® and Bluetooth® capabilities are also incorporated and the MCU can be used to run an application.

Other modules are radio-only and they can be used in combination with a MPU (Linux®) or MCU (RTOS).

These modules cover a wide array of different specifications - from single band Wi-Fi® 2.4GHz to dual band Wi-Fi® 11ac 2.4GHz and 5GHz with MIMO. Most of the options also include Bluetooth®.

With this variety of wireless modules Murata can cover a diverse breadth of applications - going all the way from small connected gadgets or sensor nodes to high data rate video streaming devices.

NXP GOLD PARTNER

Module with MCU

Type ABR

802.11 b/g/n WiFi
- *NXP 88MW320 chipset*
- *ARM Cortex-M4 200MHz*

Radio-only modules

Type 1ZM

Wi-Fi 11 a/b/g/n/ac Bluetooth 5.1
- *NXP 88W8987 chipset*

Infineon + CYPRESS

Modules with MCU

Type 1LD

Shielded ultra-small Wi-Fi 11b/g/n+Bluetooth 5.2 + MCU
- *Cypress CYW43438 chipset*
- *STM32 (ARM Cortex-M4F) MCU*

Type 1GC

Shielded ultra-small dual band Wi-Fi 11a/b/g/n + Ethernet + MCU
- *Cypress CYW43907 chipset*
- *Processor: ARM Cortex-R4*

Radio-only modules

Type 1FX

Shielded ultra-small Wi-Fi 11b/g/n
- *Cypress CYW43364 chipset*

Type 1DX

Shielded ultra-small Wi-Fi 11b/g/n + Bluetooth 5.1
- *Cypress CYW4343W chipset*

Type 1LV

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43012 chipset*

Type 1MW

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43455 chipset*

Soldered-down in major development platforms

Wireless communications

Many of Murata's extensive range of wireless modules are designed into leading development platforms. These include Linux®, FreeRTOS, etc.

- **NXP i.MX**
  - i.MX 8M Mini EVK - Type 1MW
  - i.MX 8M Nano EVK - Type 1MW
  - i.MX 7ULP EVK - Type 1DX
  - i.MX RT Alexa Voice Board - Type 1DX
- **Cypress WICED**
  - PSoC® 6 WiFi-BT Pioneer Board &
  - Prototyping Kit - Type 1DX/Type 1LV
  - CYW43907 Eval Kit - Type 1GC
- **ST Micro - Linux®**
  - STM32MPI Discovery Kit - Type 1DX
- **Micropython**
  - Arduino Portenta H7 - Type 1DX

Arduino Portenta H7

i.MX 8M Nano EVK

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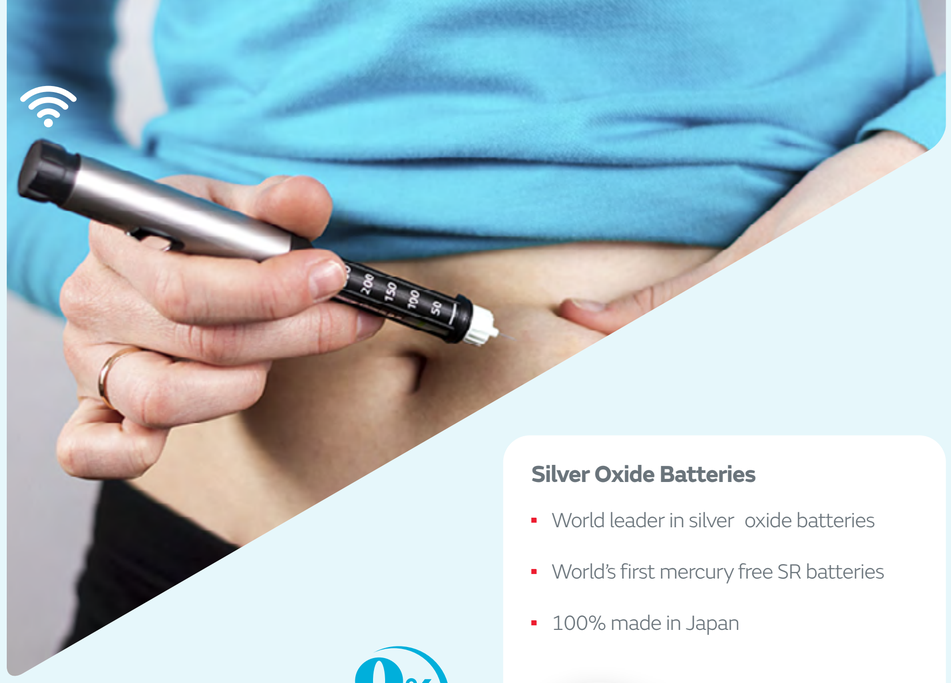
SR & LR Batteries

Micro Batteries

Ideal for high-performance medical devices that require large current loads for communication, lighting, camera, mechanical driving, etc.

FEATURES

- **40+ years technology development and manufacturing expertize.**
- **Acquisition of ISO 9001/14001 certification.**
- **Full automated assembling lines with high productivity.**



0% MERCURY

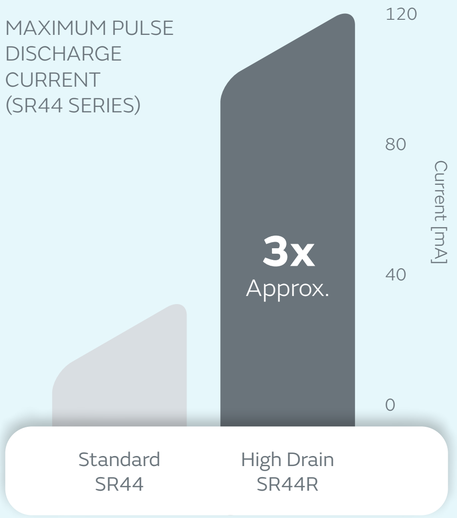
THE WORLD'S NO.1 SUPPLIER OF SILVER OXIDE BATTERIES

Silver Oxide Batteries

- World leader in silver oxide batteries
- World's first mercury free SR batteries
- 100% made in Japan

Smart Health Batteries

MAXIMUM PULSE DISCHARGE CURRENT (SR44 SERIES)



Alkaline Manganese Batteries

- Excellent high-drain pulse discharge characteristics
- High safety with unique Technology preventing leakage & swelling
- 100% made in Japan

Battery	Type	Nominal Voltage	Capacity	Operating Temp.	Features
Alkaline Manganese (LR)	Standard	1.5V	45-120mAh	-10 to 60ºC	Affordable, High drain
	High Drain	1.5V	150mAh	-10 to 60ºC	High peak 120mA pulse (x3 times) vs. Standard
Silver Oxide (SR)	Standard	1.55V	20-110mAh	-10 to 60ºC	Stable discharge performance
	High Drain	1.55V	45-150mAh	-10 to 60ºC	High peak 120mA pulse (x3 times) vs. Standard

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CR Batteries

Micro Batteries

Murata offers a wide range of primary micro batteries with high performance and reliability, taking advantage of 40+ years technology development and manufacturing expertise.

FEATURES

- **40+ years technology development and manufacturing expertise.**
- **Acquisition of ISO 9001/14001 certification.**
- **Full automated assembling lines with high productivity.**

Coin Manganese Dioxide Lithium Batteries

- High voltage, high energy density
- Wide range; including heat-resistant models
- ISO/TS16949 certified

Lightweight, High Voltage and High Energy Density

The battery voltage is 3V, almost double that of normal alkaline or manganese batteries.

Excellent discharge characteristics

Voltage characteristics remain stable even for a long period of discharge.

Excellent long-term reliability

Murata's innovative sealing technology minimize battery self-discharge.

Battery	Type	Nominal Voltage	Capacity	Operating Temp.	Features
Coin Manganese Dioxide Lithium (CR)	Standard	3.0V	30-1000mAh	-30 to 70ºC	Lineup of 10 models from small size and thin models to high capacity models
	Extended Temp.	3.0V	220-2000mAh	-40 to 85ºC	Good balance between wide operating temperature and affordability
	Heat resistant	3.0V	210-1000mAh	-40 to 125ºC	Wide operating temperature
	High Drain	3.0V	200-500mAh	-30 to +70ºC	High peak 50mA pulse (x2 times) vs. Standard

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Smart Mobility

Bringing us closer to an autonomous future

▪ One of the key elements of future smart cities is certain to be the automation of transportation networks and the removal of human involvement from driving. This will enable safer journeys for citizens, with there no longer being the prospect of accidents occurring. Rather than needing to worry about concentrating on the road, vehicle occupants will be able to simply relax and enjoy the ride.

▪ Industry analysts Statista has predicted that 1 in 10 vehicles will be fully autonomous by 2030. To support this shift away from human control, high accuracy movement predictions will be mandated. This will ensure that optimal distance between vehicles is kept to while they are travelling along highways.

▪ In addition, object detection will be critical - so that any potential danger on the road ahead can be rapidly reacted to (with evasive action being taken if necessary).

▪ Autonomous vehicles will need to communicate with nearby infrastructure and other vehicles. V2X will enable valuable information to be shared, with regard to congestion problems, speed restrictions, accidents, available parking spaces, etc.

▪ Murata's automotive-qualified sensor devices are being featured in many OEMs' smart mobility systems. MEMS-based inertial sensing devices provide accurate data on vehicle positioning and movement. Likewise, ultrasonic sensors are being employed for object detection purposes.

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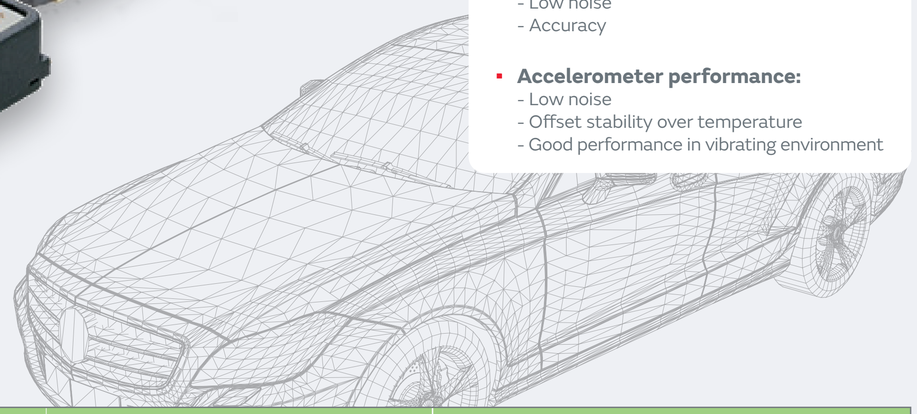
High accuracy MEMS sensor

3D MEMS technology enables higher performance at lower cost.

Murata offers high performance accelerometers, inclinometers, gyroscopes and combo sensors. Gyroscope components and combined sensors (including gyroscope and accelerometer) are based on our proven 3D MEMS technology and highly integrated electronics.
Industrial gyroscopes offer a performance level that has typically been available only for expensive module products.
All products are RoHS compatible and suitable for lead-free reflow soldering.

SCC2000
SCA3300



MURATA BENEFITS & ADVANTAGES:

- **Gyroscope performance:**
  - Bias stability
  - Low noise
  - Accuracy
- **Accelerometer performance:**
  - Low noise
  - Offset stability over temperature
  - Good performance in vibrating environment

FEATURES

- **Robust MEMS technology**
- **Field proven reliability & high performance in demanding applications**
- **Good offset stability over temperature and time**
- **High accuracy in demanding applications (eg, high temperature variation, high vibration environment, etc.)**
- **Excellent mechanical shock endurance**
- **Can withstand high impact/dropping**

ACCELEROMETERS & GYROS

Recommended product	Product description	Benefits	Features
SCA3300	Digital SPI 3 axis accelerometer for inclination measurement	Reliability	Good performance vibrating environment High offset accuracy over temperature and time High mechanical shock endurance Competitive price Self-diagnostic features
SCC2000	Digital SPI 1 axis gyro & 3 axis accelerometer (X or Z axis)	Combined sensor Reduced PCB size	
SCC3000	Digital SPI 2 axis gyro and 3 axis accelerometer	Combined sensor Small size	
SCHA600	Digital SPI 3 axis gyro and 3 axis accelerometer	Excellent bias stability and noise 6 DoF sensor	

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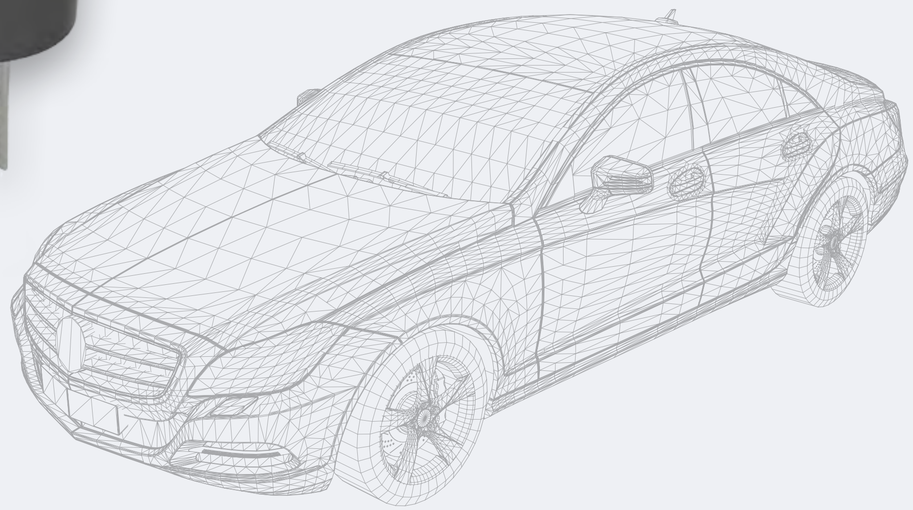
Ultrasonic sensor

Low-cost solution for distance detection

Small and lightweight, ideally suited for short-distance range detection and home security.

APPLICATIONS

- **Robotics (consumer use)**
- **Room layout scanning**



Type	Using method	Part number	Driving frequency (kHz)	Diameter (mm)	Capacitance (pF)	Directivity (degree, typ.)	Sound pressure level	Sensitivity	Max. Input voltage
Open type	Transmitter	**MA40S4S**	40	9.9±0.3	2550±20%	80	120dB typ. (0db=0.02mPa)	—	20Vp-p Continuous signal
	Receiver	**MA40S4R**		9.9±0.3	2550±20%		—	-63dB typ. (0db=10V/Pa)	—

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Smart Home Appliances

Making living spaces more responsive to people's needs

▪ The more widespread use of automation in the home is bringing greater comfort to occupants. It also means that they do not have to dedicate as much time to their daily household chores and gives them the freedom to operate domestic appliances without needing to actually be there.

▪ Key to home automation is the integration of wireless technology. Through this, an increasing proportion of appliances are now becoming connected to the network - rather than just being standalone items that can only be operated by pressing a button or flicking a switch. Instead, actuators can be wirelessly controlled, allowing remote operation of appliances. The cooking of food in microwaves can be initiated, so that it is ready to eat when people return home. Likewise, washing machines may be turned on during the day, to avoid electricity consumption during peak pricing periods. There is also scope for smart refrigerators to check if the use-by dates of products they are storing have passed and then reorder these products.

▪ Household electricity and water consumption may be monitored to check that there is no unwanted wastage. Also indoor air quality management is starting to be addressed.

▪ Murata's low power wireless modules are enabling domestic appliances to interface with home automation systems and smart speakers. Magnetic sensors from Murata allow accurate flow metering. Furthermore, the IonissimoTM family of ionizer products are helping improve air quality within the home environment.

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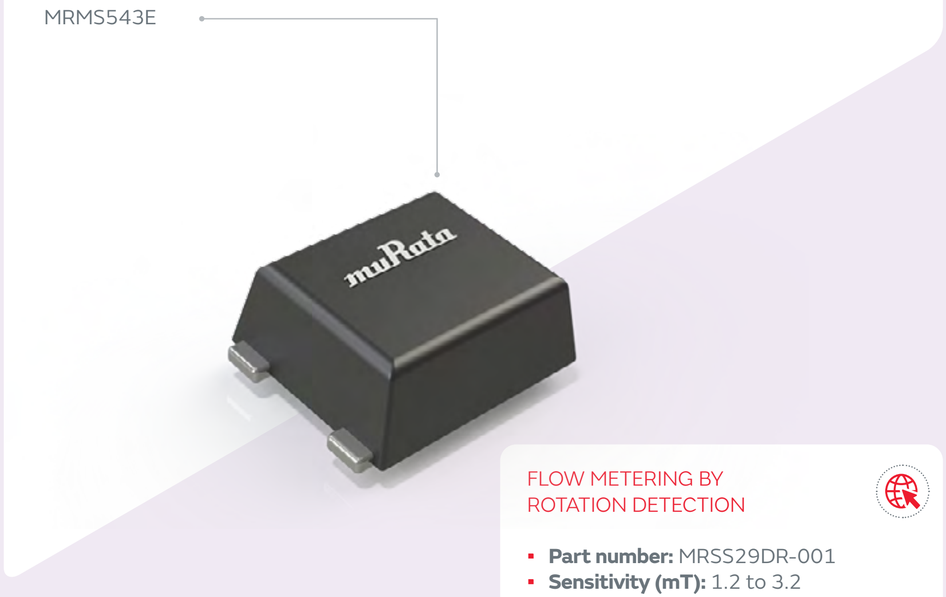
AMR magnetic sensor

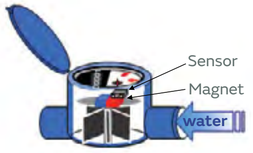
Design flexibility, narrower sensitivity range and higher reliability

The AMR series consists of sensors that include an IC to detect changes in the magnetic resistance of a magneto resistive element that is effected by an external magnetic field. This is achieved from a ferromagnetic NiFe alloy thin film that is deposited over the IC circuit.



OPEN-CLOSE DETECTION

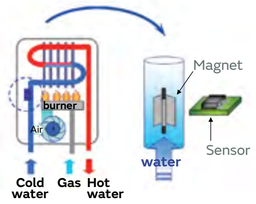
- **Part number:** MRMS20 series
- **Sensitivity (mT):** 0.5 to 2.5
- **Dimensions (mm):** 2.9x2.8x1.1
- **Features:**
  - Std. performance, compact package
- **Applications:**
  - Std. open-close, position detection
  - Low-speed rotation detection



Water meter

FLOW METERING BY ROTATION DETECTION

- **Part number:** MRSS29DR-001
- **Sensitivity (mT):** 1.2 to 3.2
- **Dimensions (mm):** 2.9x2.8x1.1
- **Features:**
  - High voltage operation (3.5 to 30V)
  - High speed detection (Typ. 5kHz)
  - Built-in voltage regulator
- **Applications:**
  - Flow metering for industrial equipment

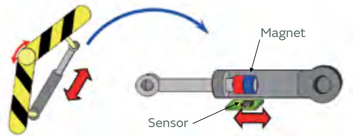


Water boiler

CYLINDER CONTROL BY POSITION DETECTION

- **Part number:** MRMS543E
- **Sensitivity (mT):** 0.5 to 3.1
- **Dimensions (mm):** 1.45x1.45x0.55
- **Features:**
  - High accuracy, high-speed detection (Typ. 500Hz (min.))
  - Built-in temp. compensation circuit
  - Low voltage, low power operation
- **Applications:**
  - Position, proximity detection
  - High-speed rotation detection for industrial equipment

- **Part number:** MRMS541E
- **Sensitivity (mT):** 0.9 to 2.7
- **Dimensions (mm):** 1.45x1.45x0.55
- **Features:**
  - Typ. 1kHz (min.)
  - Built-in temp. compensation circuit
- **Applications:**
  - Position, proximity detection
  - High-speed rotation detection for industrial equipment



Cylinder control

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Small, high efficiency ionizer

Ionissimo™ MHM5 series

This highly reliable and highly safe ionizer module uses Murata's exclusive high-voltage circuit, insulation technology and generator structure design to efficiently generate ions at lower voltages. The module structure featuring the drive power supply wired to the ion generator provides a high degree of design freedom when incorporating the module into the finished product.

In addition, you can select the model that best matches your application, controlling the amount of ozone generated without changing the volume of ions.

SMALL, LOW-VOLTAGE IONIZER

The Ionissimo can effectively generate ions for a comfortable environment

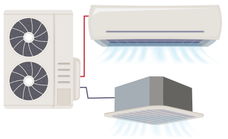
- **Ionizer's Ions clean the air dust (PM2.5) and keep moisture on the skin.**
- **Ionizer's Ions remove static charged from objects.**
- **Ionizer's ozone kill virus/bacteria, sterilize any surface and prevent odor.**
- **Ionizer's ozone keep vegetable/fruits stay for long life and increase Vitamin.**

Items	Parts number	Input voltage	Ion amount at 20cm	Ozone density
Ionizer	MHM305 series	12Vdc	-5Mpcs/cc	0.04mg/h
	MHM306 series	12Vdc	-5Mpcs/cc	0.6mg/h
	MHM314 series	12Vdc	-8Mpcs/cc	0.1mg/h
	MHM400 series (*1)	12Vdc	+5Mpcs/cc	0.1mg/h
	MHM402 series	230Vac	-4Mpcs/cc	0.4mg/h

*MHM400 series is for static eliminating application. If you would like to use other application, please contact us.

APPLICATIONS EXAMPLES

Air Conditioner
Clean air from dust and smell



Air Purifier

Refrigerator
Sterilize refrigerator and improve food freshness

Dishwasher

Washing Machine
Dryer Machine
Sterilize clothes and dish, preventing mold

Circulator and Electric fan

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INNOVATOR IN ELECTRONICS

Small, high efficiency ozonizer

Active Oxygen Module

This highly reliable and highly safe ozonizer module uses Murata's exclusive high-voltage circuit, insulation technology and generator structure design utilizing creepage discharge on the board surface to generate ozone more stably and efficiently.

The module structure featuring the drive power supply wired to the ion generator provides a high degree of design freedom when incorporating the module into the finished product.

ionissimo

SMALL, LOW-VOLTAGE OZONIZER

Active Oxygen module will help you to create clean space

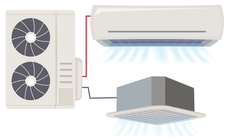
- **AO module's ozone kill virus/bacteria, sterilize any surface and prevent odor.**
- **AO module's ozone clean water and sterilize it.**
- **AO module's ozone keep vegetable/ fruits stay for long life and increase Vitamin.**

Reduce **90.5%** virus after 20min with very low ozone density **0.1ppm**

Items	Parts number	Input voltage	Ozone density
Active Oxygen (Ozonizer)	MHM500-00A	12Vdc	1.1mg/h
	MHM501-00 (High reliability)	12Vdc	1.0mg/h
	MHM502-01A (High density Ozone)	12Vdc	45mg/h

APPLICATIONS EXAMPLES

Air Conditioner
Clean air from dust and smell



Air Purifier

Refrigerator
Sterilize refrigerator and improve food freshness

Dishwasher

Washing Machine Dryer Machine
Sterilize clothes and dish, preventing mold

Circulator and Electric fan

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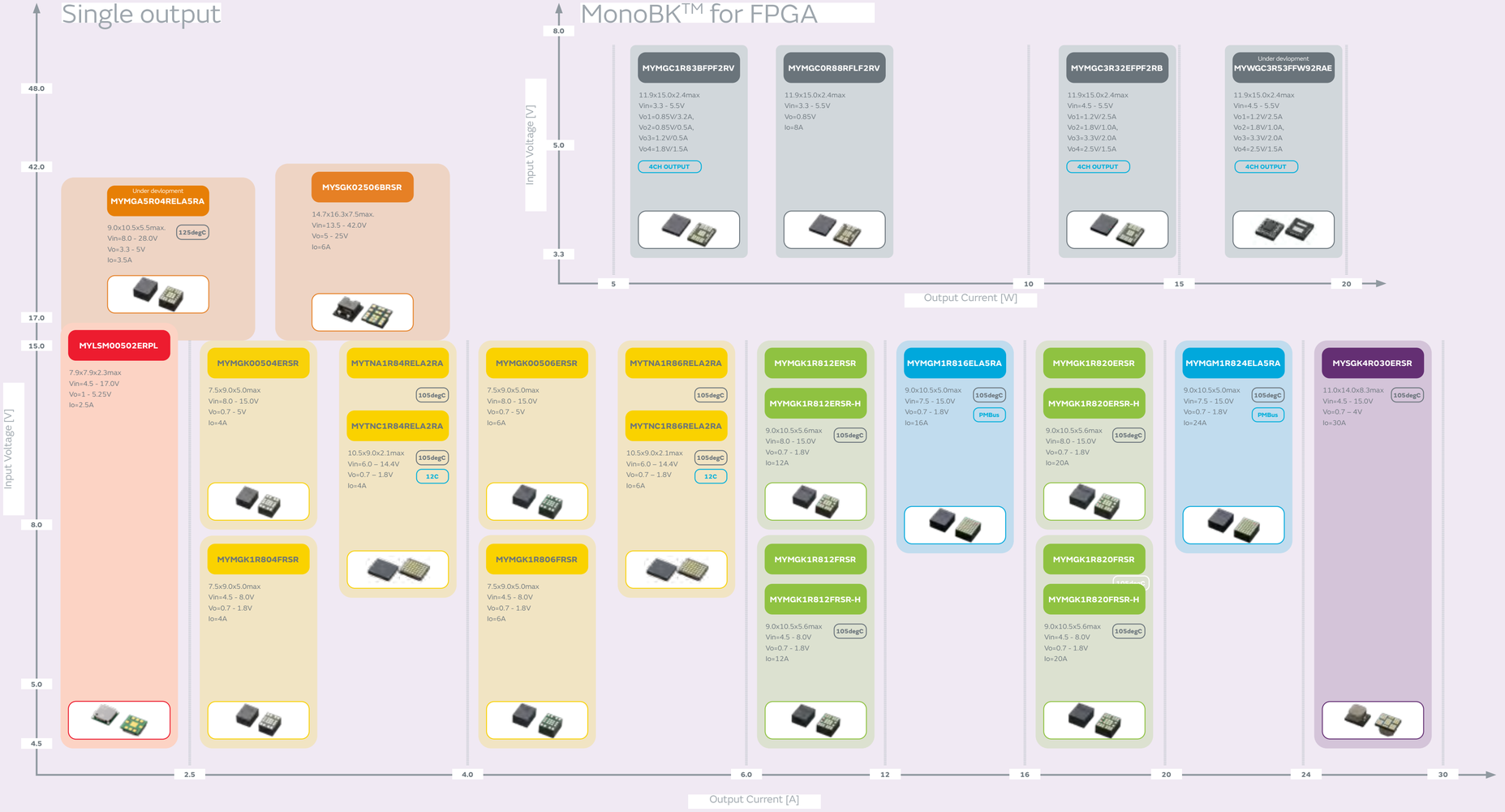
INNOVATOR IN ELECTRONICS

MonoBK™ and UltraBK™

Line-up | Small POL DC-DC converter



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INNOVATOR IN ELECTRONICS

Wi-Fi®
Smart Module

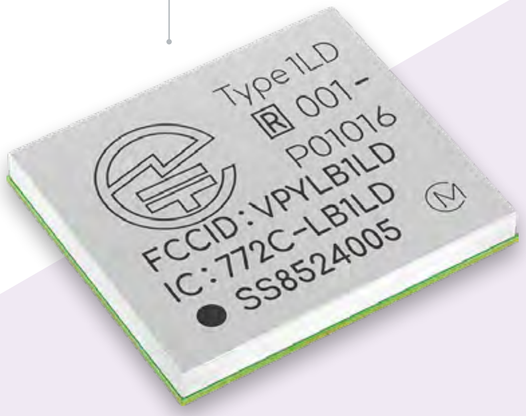
Wireless communications

Type 1LD

Murata is market leader in Wi-Fi® modules for embedded systems, providing superior quality, elevated performance modules for high volume production.

Murata's wireless modules will streamline your assembly operations, thus significantly reducing customer's design time. Additionally, we offer a variety of low-power products for sensor networks.

Type 1LD



APPLICATIONS

- **Home and building automation**
  - Lighting control
  - Heating, Ventilation, Air-conditioning
- **Energy management system (EMS)**
- **Simple sensor network**
- **Home security**
- **Healthcare & fitness**

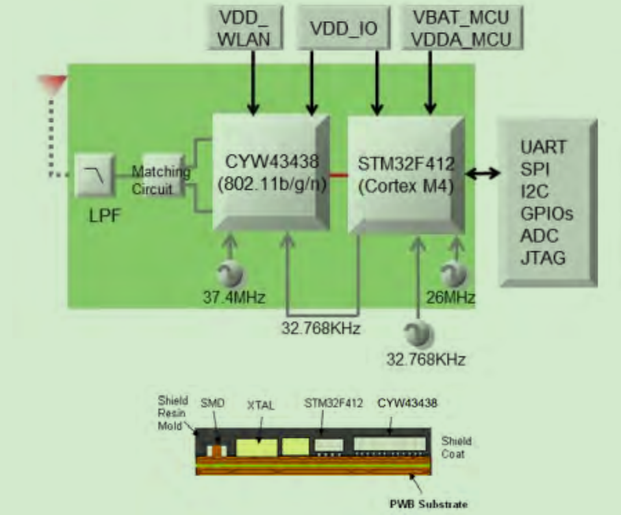
FEATURES

- **Highly integrated**
- **FCC/IC/CE/TELEC compliant**
- **Shielded Ultra Small Wi-Fi® 11b/g/n + Bluetooth® 5.2 + MCU Module**

PRODUCT SPECIFICATIONS

- **Chipset:**
  - Infineon (CYW43438)
  + STM32 (ARM Cortex-M4F)
- **Size:** 8.9 x 7.8 x 1.2 mm
- **Peripheral Interface:**
  GPIO/SPI/UART/I2C/ADC/PWM
- **Operating Temperature:**
  -40°C to 85°C
- **Package:** Shielded Resin
  Feature rich software hosted on module 802.11 b/g/n 65Mbps, Wi-fi® Stack runs inside, 1MB Flash, 256KB RAM
  Infineon WICED, SPP on Bluetooth® and GATT on Bluetooth® LE are supported by WICED Qualified for AWS IoT Core devices

BLOCK DIAGRAM



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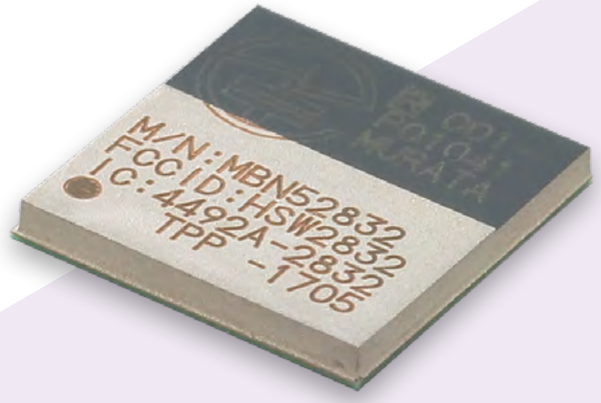
Bluetooth® Low Energy Module

Wireless communications

Type MBN52832

BLE is an ultra-low power communication technology that enables several years of operation off a button battery. Widespread adoption is being seen in fields like health management, fitness and home networks. BLE has also been adopted as a communication method by the Continua Health Alliance, a non-profit organization of healthcare and technology companies.

Type MBN52832



APPLICATIONS

- **Proximity services**
- **Building automation**
- **Medical/healthcare**
- **Bluetooth beacons**

FEATURES

- **Powerful MCU core with large RAM and flash for user application**
  - ARM Cortex M4; 64K RAM; 512K flash
- **Low power consumption**
  - Tx 7mA @ 3.5dBm (DCDC mode)
  - Rx 6mA (DCDC mode)
- **Rich peripheral interface-20 GPIO ports**
- **Very small size:** 7.4x7.0x0.9mm (max.)
- **Fully certified**
  - FCC (US), IC (Canada), ETSI (EU), TELEC (Japan)
  - BT SIG Certificate
- **Support both on-board and external antenna version**
  - On-board PCB pattern antenna
  - External patch antenna
  - External dipole antenna
- **Bluetooth® 5.0**

PRODUCT SPECIFICATIONS

- **Chipset:** nRF52832 Bluetooth® LE IC
- **Dimension:** 7.4x7.0x0.9mm
- **Package:** LGA
- **Antenna:** on-board or external
- **Max output power:** +4dBm (LDO mode)
- **Interfaces:**
  UART, SPI, 20 GPIO, 5ADC, SWD, PWM, I2C
- **Operating voltage:** 1.7V to 3.6V
- **Operating temperature range:**
  -40 to 85°C
- **OTA firmware upgrade**
- **RoHS compliant**
- **Regulatory certificate:**
  FCC/IC/ETSI/TELEC
- **Bluetooth® SIG qualification**

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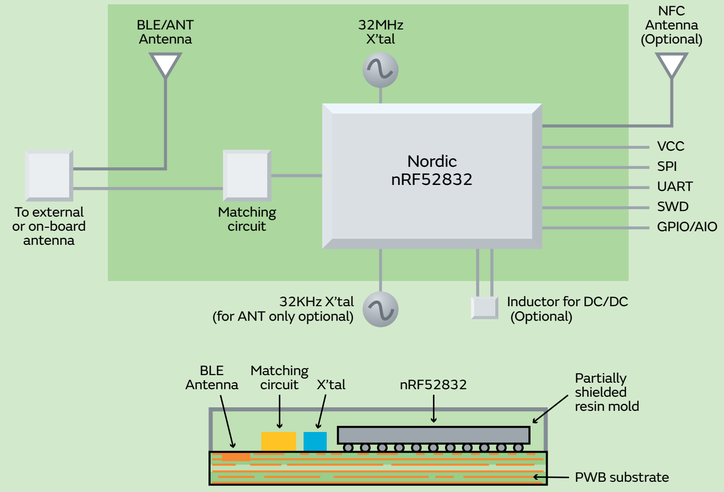

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UWB Modules

Wireless communications

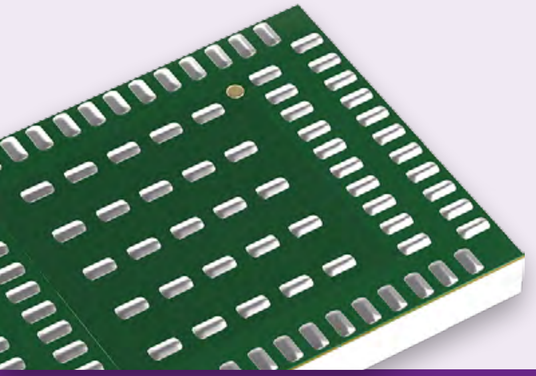
Ultra-wideband (UWB) technology provides a highly effective means for providing secure and precise distance measurement. This is based on determining the time-of-flight (ToF) of radio waves. Murata offers an extensive portfolio of UWB modules.

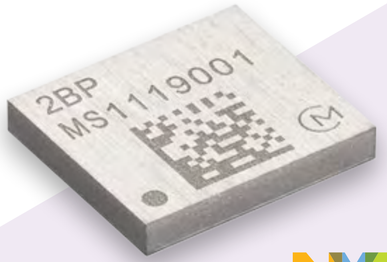
FEATURES

- **Ultra-small dimensions**
- **High quality**
- **Lower power consumption**

APPLICATIONS

- **Indoor navigation**
- **Smart retail/point-of-sales**
- **Smart building**
- **Smart locks**
- **Tags/tracking**
- **Contactless presence detection**

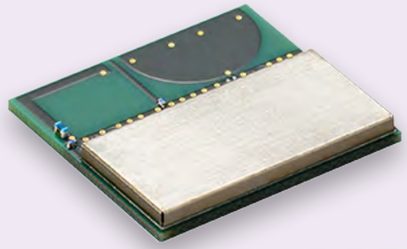




NXP

TYPE 2BP

- **Ultra small UWB module which includes NXP's SR150 UWB chipset, clock, filters and peripheral components.**
- **3 Antenna support (3D AoA or 2D AoA support)**
- **UWB Chip set:** NXP Trimension SR150
- **Antenna:** External



NXP

TYPE 2DK

- **All-in-one UWB + Bluetooth LE combo module which integrates NXP Trimension™ SR040 UWB Chipset, NXP QN9090 Bluetooth LE + MCU chipset, On board antenna and peripheral components.**
- **Ideally suited for UWB Tag/Tracker which operates by coin-cell battery, and general IoT devices.**
- **UWB Chip set:** NXP Trimension™ SR040
- **Antenna:** Integrated

qorvo
all around you

TYPE 2AB

- **UWB Chip set : Qorvo DW3110/3120**
- **FCC/IC/TELEC Reference Certified (Planed)**
- **Hostless module Integrated Nordic IC / nRF52840 which also have Blutooth Low Energy function for waking up UWB and updating FW.**
- **Integrated 3-Axis sensor for saving battery**
- **Reference clock for UWB and MCU are embedded**
- **UWB Chip set:** Qorvo DW3110/3120
- **Antenna:** External

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LPWA Modules

Wireless communications

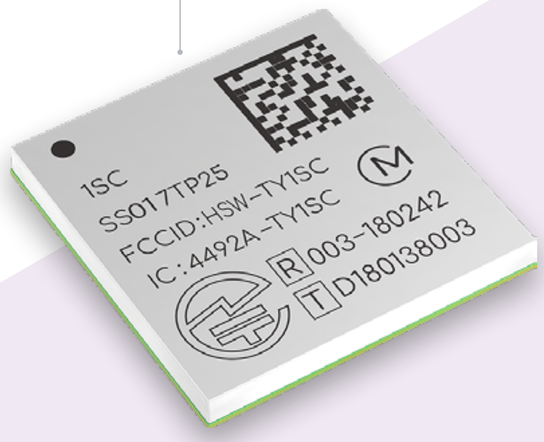
Low power wide area (LPWA) networks provide a power efficient wireless communication technology for interconnecting devices together over a long range. LPWA is most suitable for applications such as IoT and machine-to-machine (M2M) communication, as well as various other situations where lower cost and lower power consumption are required. To respond to customers' needs, Murata has formed strategic partnerships with market leaders, and is accelerating the development of products using this highly appealing emerging technology.

Type 1SC

The Type 1SC (LBAD00XX1SC) module is the world's smallest **Cat. M1/NB-IoT module** with global certification. It supports GPS/GNSS, OpenMCU, Integrated SIM.

Murata has partnered with Truphone, making MVNO network communications possible through the use of eSIM.

Type 1SC
LBAD0XX1SC



FEATURES

- **Small size**
  Size attractive to wearables that previously had no means of cellular connectivity
- **Standardized**
  Through PTCRB/GCF certification improved global interoperability with global wireless networks operators for IoT applications
- **Low power**
  Protocol designed specifically for low current consumption extending battery lifetime up to 10+ years

PRODUCT SPECIFICATIONS

- **Support LTE Band:**
  Low Bands 5,8,12,13,14 (CAT M1 Only), 17,18,19,20,26,28 - Mid Bands 1,2,3,4,25
- **Chipset**: Altair ALT1250
- **Modulation:** LTE Cat.M1/NB-IoT Release 13 (*Release 14 – SW Upgrade)
- **Antenna:** External
- **Type Package:** Resin Mold
- **Dimension**: 11.1 x 11.4 x 1.5 mm (max)
- **Transmit Power:** +23dBm max
- **Sleep Mode Current:**
  eDRX Current Consumption (avg)/LTE-M: 43 uA
  PSM Current Consumption (avg)/LTE-M: 1.4 uA
- **RoHS:** Yes
- **Software Features**: AT commands, IPv4/IPv6 stack with TCP and UDP protocol, SSL/TLS, MQTT, OpenMCU(Optional), GPS/GLONASS(Optional), iUICC(Optional)
- **Certified:**
  FCC/IC/RED/TELEC/KC/NCC GCF/PTCRB
- **Certified Carrier:**
  AT&T, KT, SKT, Pelion, Deutsch Telekom, Vodafone, Softbank, KDDI, Docomo, Soracom, Truphone

APPLICATIONS

- **Smart metering**
- **Smart parking**
- **Home security/home automation**
- **Vehicle fleet management**
- **Wearables/trackers**
- **Industrial M2M communication**
- **IoT edge nodes**

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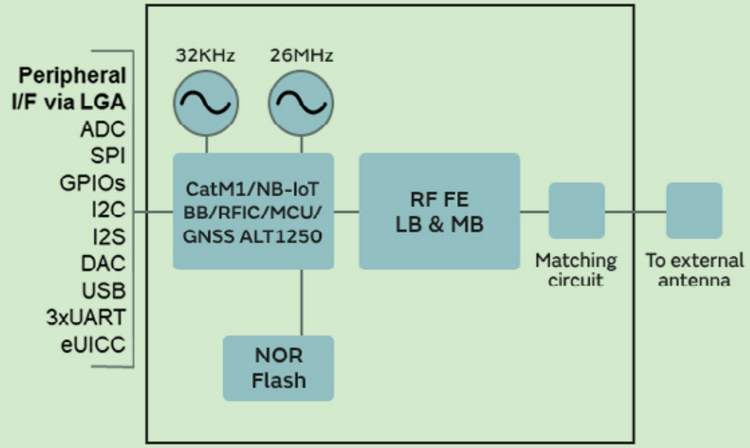

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LPWA Modules

Wireless communications

Type 1SJ

The Type 1SJ (LBAA0QB1SJ) module is one of the smallest **LoRaWAN™** modules in the industry.

This module has a lower power consumption and higher output than previous products. Radio Law certification has already been obtained for major regions.

Open MCU design support is available.

Type 1SJ
LBAA0QB1SJ

APPLICATIONS

- **Smart metering**
- **Smart lighting**
- **Smart parking**
- **Smart agriculture**
- **Industrial M2M**
- **IoT edge nodes**

FEATURES

- **Compact and low cost**
- **Battery life**
  10 years
- **Low Range**
  10km
- **Pre-certified radio regulatory approvals**
  868 & 915 MHz spectrum

PRODUCT SPECIFICATIONS

- **RF/BB chipset:** SX1262
- **MCU chipset:** STM32L0 series
  CPU: Cortex M0+
  RAM: 20KB
  Flash: 192KB
- **Peripheral interfaces:**
  UART/SPI/I2C/GPIOs/ADC
- **Radio certification:**
  FCC, IC, CE
- **Module size:** 10.0x8.0x1.60mm
- **Package:** Shielded Resin Mold
- **Frequencies:** EU / US / India / Pacific
- **Operating temp:** -40 to +85 °C
- **Supply voltage:** 2.2V to 3.6V
- **RF transmit power:**
  +14dBm / +21.5dBm
- **RF sensitivity:** -135dBm
- **Frequency band:** 860MHz-930MHz

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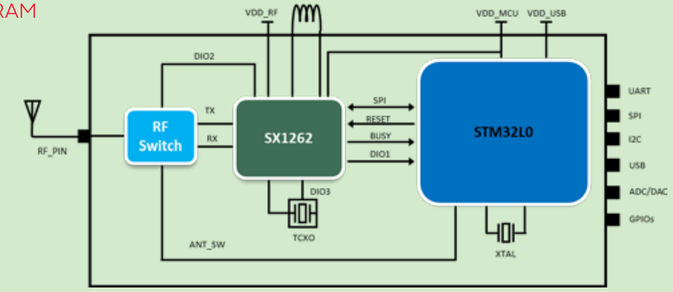

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Modular Solutions

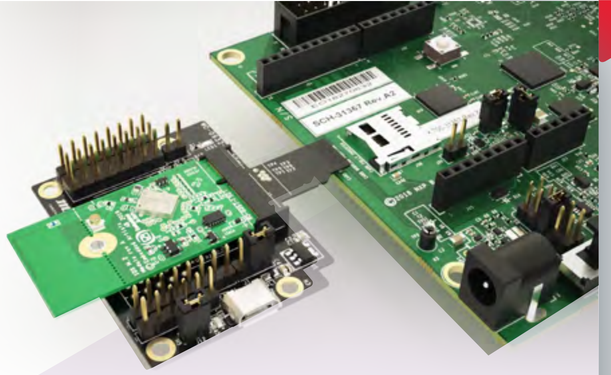
Wireless communications

M.2 boards

Our M.2 modules, co-developed by Embedded Artists, are designed for evaluation, integration and ease-of-use. These professionally designed and proven M.2 modules provide easy evaluation of different Wi-Fi®/Bluetooth® solutions, lower your risk and shorten your time to market.

FEATURES

- **Standard M.2 form factor**
- **Reference-certified antennas & snap-off option**
- **UFL connectors for antenna or conducted testing**
- **Comprehensive interface support including SDIO, PCIe, UART, PCM, and radio control lines**



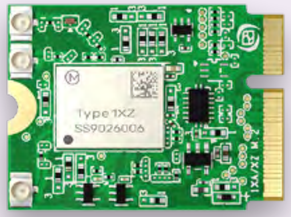
µSD adapter

Murata's µSD-M2 adapter board offers an out-of-the-box experience for NXP i.MX with Murata's M.2 module family. All WLAN/BT- necessary signals are included on M.2 connector pins (Key 'E') including:

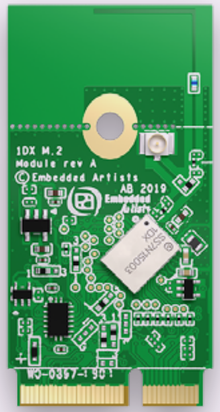
- **WLAN SDIO**
- **WLAN PCIe**
- **BT H4 UART**
- **BT PCM/I2S**
- **GPIOs**

Type 1XA
Dual band
Wi-Fi®11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (PCIe)

Type 1XZ
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (SDIO)



Type 1YM
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO
+ Bluetooth® 5.2



Type 1DX
Wi-Fi® 11b/g/n
+ Bluetooth® 5.1

Type 1MW
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0

Type 1LV
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0

Type 1ZM
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.1

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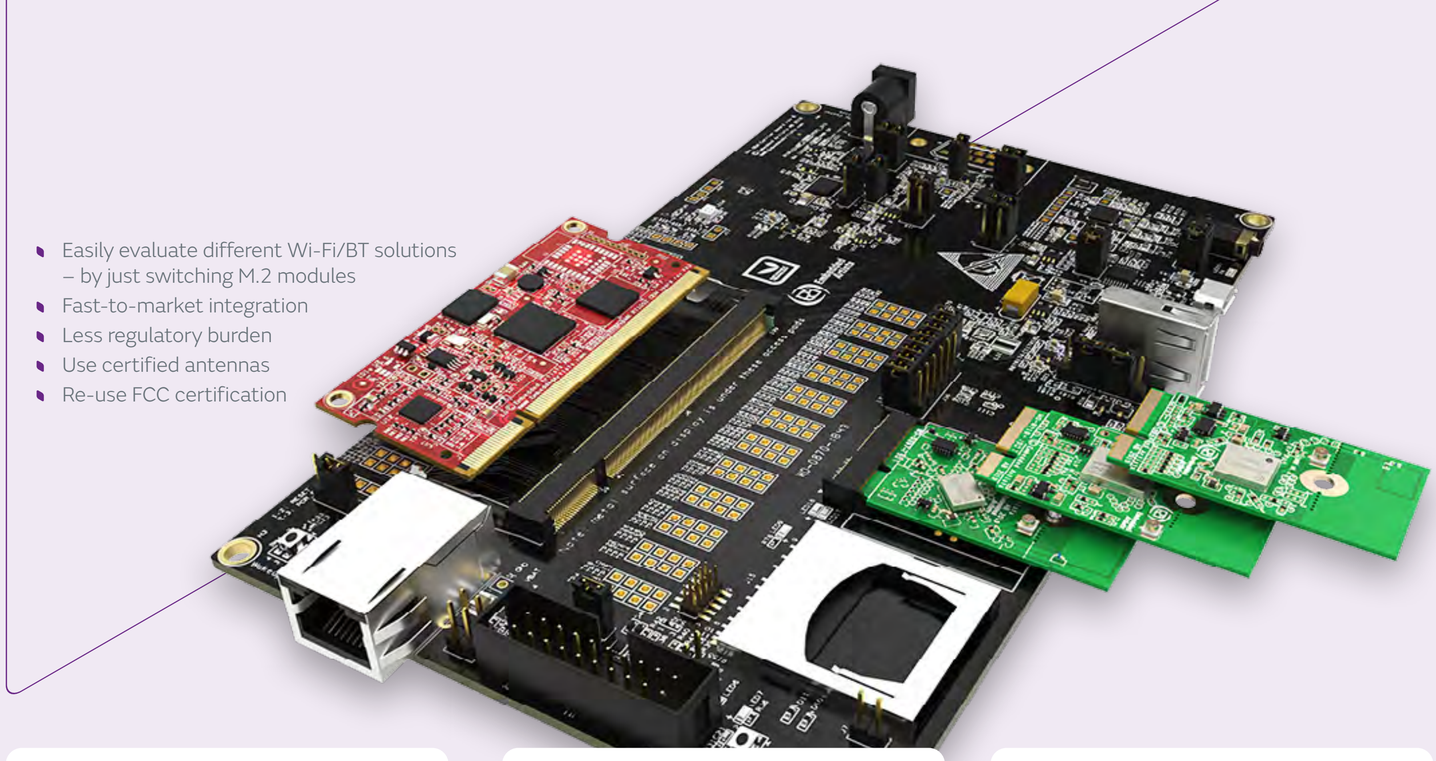
Fully Modular Systems

Wireless communications

Murata and Embedded Artists have developed a full modular system which offers IoT designers a quick, easy and cost-effective route to world-class connectivity.

Development kits are available for use as your evaluation/prototyping platform. The kits include the hardware and software components needed to get up-and-running with your software development on day 1.

- Easily evaluate different Wi-Fi/BT solutions – by just switching M.2 modules
- Fast-to-market integration
- Less regulatory burden
- Use certified antennas
- Re-use FCC certification



1. CHOOSE A COM/OEM BOARD

Embedded Artists have developed a suite of COM computer-on-module (COM) units and OEM boards, integrating all core components around a variety of NXP processors and microcontrollers:

- i.MX RT1062
- i.MX RT1052
- i.MX 8M Quad
- i.MX 8M Mini uCOM
- i.MX 8M Nano uCOM
- i.MX 6Quad
- i.MX 6DualLite
- i.MX 6Ultralite
- i.MX 6SoloX
- i.MX 7Dual
- i.MX 7Dual uCOM
- i.MX 7ULP uCOM

2. PLUG INTO COM CARRIER BOARD

There are two types of carrier boards: One for i.MXRT family boards (with a slot for the COM or OEM board) and one which is suitable for the MPU COM boards and offers...

- Support for i.MX8 designs
- Support for M.2 Key E interface (typically Wi-Fi®/BT), including advanced debug features developed in cooperation with Murata and Cypress
- Support for M.2 Key B interface (typically Cellular/SSD)
- Support for USB 3.0

3. PLUG IN YOUR CONNECTIVITY

Choose the Murata/Embedded Artists M.2 connectivity module appropriate for your application in terms of:

- Performance
- Power consumption
- Range
- Cost
- Temperature range
- Supported standards

4. START YOUR EVALUATION

- Pre-loaded software drivers
- Comprehensive user manuals
- Responsive support

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A Wide Range of Wireless

Communication Modules

Murata offers an extensive portfolio of wireless modules based on Cypress and NXP chipsets.

Modules with integrated MCUs are used in combination with Cypress WICED software. Wi-Fi® and Bluetooth® capabilities are also incorporated and the MCU can be used to run an application.

Other modules are radio-only and they can be used in combination with a MPU (Linux®) or MCU (RTOS).

These modules cover a wide array of different specifications - from single band Wi-Fi® 2.4GHz to dual band Wi-Fi® 11ac 2.4GHz and 5GHz with MIMO. Most of the options also include Bluetooth®.

With this variety of wireless modules Murata can cover a diverse breadth of applications - going all the way from small connected gadgets or sensor nodes to high data rate video streaming devices.

NXP GOLD PARTNER

Module with MCU

Type ABR

802.11 b/g/n WiFi
- *NXP 88MW320 chipset*
- *ARM Cortex-M4 200MHz*

Radio-only modules

Type 1ZM

Wi-Fi 11 a/b/g/n/ac Bluetooth 5.1
- *NXP 88W8987 chipset*

Infineon + CYPRESS EMBEDDED IN TOMORROW™

Modules with MCU

Type 1LD

Shielded ultra-small Wi-Fi 11b/g/n+Bluetooth 5.2 + MCU
- *Cypress CYW43438 chipset*
- *STM32 (ARM Cortex-M4F) MCU*

Type 1GC

Shielded ultra-small dual band Wi-Fi 11a/b/g/n + Ethernet + MCU
- *Cypress CYW43907 chipset*
- *Processor: ARM Cortex-R4*

Radio-only modules

Type 1FX

Shielded ultra-small Wi-Fi 11b/g/n
- *Cypress CYW43364 chipset*

Type 1DX

Shielded ultra-small Wi-Fi 11b/g/n + Bluetooth 5.1
- *Cypress CYW4343W chipset*

Type 1LV

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43012 chipset*

Type 1MW

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43455 chipset*

Soldered-down in major development platforms

Wireless communications

Many of Murata's extensive range of wireless modules are designed into leading development platforms. These include Linux®, FreeRTOS, etc.

- **NXP i.MX**
  - i.MX 8M Mini EVK - Type 1MW
  - i.MX 8M Nano EVK - Type 1MW
  - i.MX 7ULP EVK - Type 1DX
  - i.MX RT Alexa Voice Board - Type 1DX
- **Cypress WICED**
  - PSoC® 6 WiFi-BT Pioneer Board &
  - Prototyping Kit - Type 1DX/Type 1LV
  - CYW43907 Eval Kit - Type 1GC
- **ST Micro - Linux®**
  - STM32MPI Discovery Kit - Type 1DX
- **Micropython**
  - Arduino Portenta H7 - Type 1DX

Arduino Portenta H7

i.MX 8M Nano EVK

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CR Batteries

Micro Batteries

Murata offers a wide range of primary micro batteries with high performance and reliability, taking advantage of 40+ years technology development and manufacturing expertise.

FEATURES

- **40+ years technology development and manufacturing expertise.**
- **Acquisition of ISO 9001/14001 certification.**
- **Full automated assembling lines with high productivity.**

Coin Manganese Dioxide Lithium Batteries

- High voltage, high energy density
- Wide range; including heat-resistant models
- ISO/TS16949 certified

Lightweight, High Voltage and High Energy Density

The battery voltage is 3V, almost double that of normal alkaline or manganese batteries.

Excellent discharge characteristics

Voltage characteristics remain stable even for a long period of discharge.

Excellent long-term reliability

Murata's innovative sealing technology minimize battery self-discharge.

Battery	Type	Nominal Voltage	Capacity	Operating Temp.	Features
Coin Manganese Dioxide Lithium (CR)	Standard	3.0V	30-1000mAh	-30 to 70ºC	Lineup of 10 models from small size and thin models to high capacity models
	Extended Temp.	3.0V	220-2000mAh	-40 to 85ºC	Good balance between wide operating temperature and affordability
	Heat resistant	3.0V	210-1000mAh	-40 to 125ºC	Wide operating temperature
	High Drain	3.0V	200-500mAh	-30 to +70ºC	High peak 50mA pulse (x2 times) vs. Standard

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Smart Security

Assuring safety within the home

- The smart home security sector is currently experiencing a compound annual growth rate (CAGR) of almost 20%, according to Verified Market Research. The analyst firm expects this sector to generate annual revenues of over $8.5 billion by 2028.

- Previously, security systems tended to be mechanically based. Now ones that are electronically based are becoming more popular, better aligning with home automation systems. Flexible DIY platforms can be used to implement customized security systems.

- With increasing regularity, camera systems are being deployed around the exterior and interior of people's homes - enabling surveillance functions to be benefitted from. In addition, video doorbells are seeing widespread uptake.

- Sensors can be used for door/window positioning and motion detection. These must have strong immunity to the RF present around the home. They should also exhibit the ability to withstand exposure to intruders trying to use large magnets to trip locks.

- As well as the energy efficient wireless modules utilized for transferring data, Murata magnetic sensors are installed into window and door opening/closing mechanisms, plus anti-tampering mechanisms. High RF immunity pyroelectric-based PIR sensors are also being employed for motion detection, alerting occupants of intruders. Murata batteries and PoE DC-DC converters are enabling security systems to be powered.

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AMR magnetic sensor

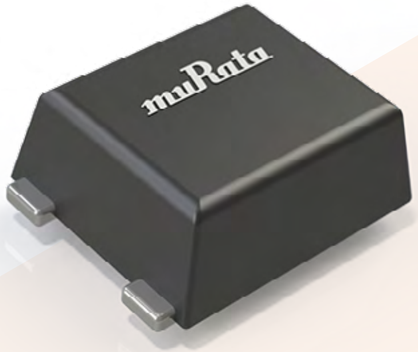
Design flexibility, narrower sensitivity range and higher reliability

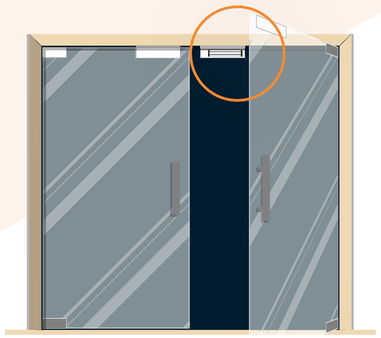
The AMR series consists of sensors that include an IC to detect changes in the magnetic resistance of a magneto resistive element that is effected by an external magnetic field. This is achieved from a ferromagnetic NiFe alloy thin film that is deposited over the IC circuit.

APPLICATIONS

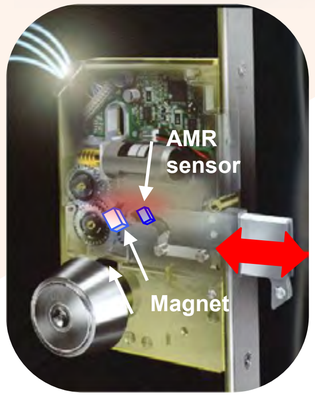
- **Door opening detector**
- **Smart lock**

MRMS581P





Open-Close detection in Door opening detectors



Position detection in Thumbturn

Anti-Tampering

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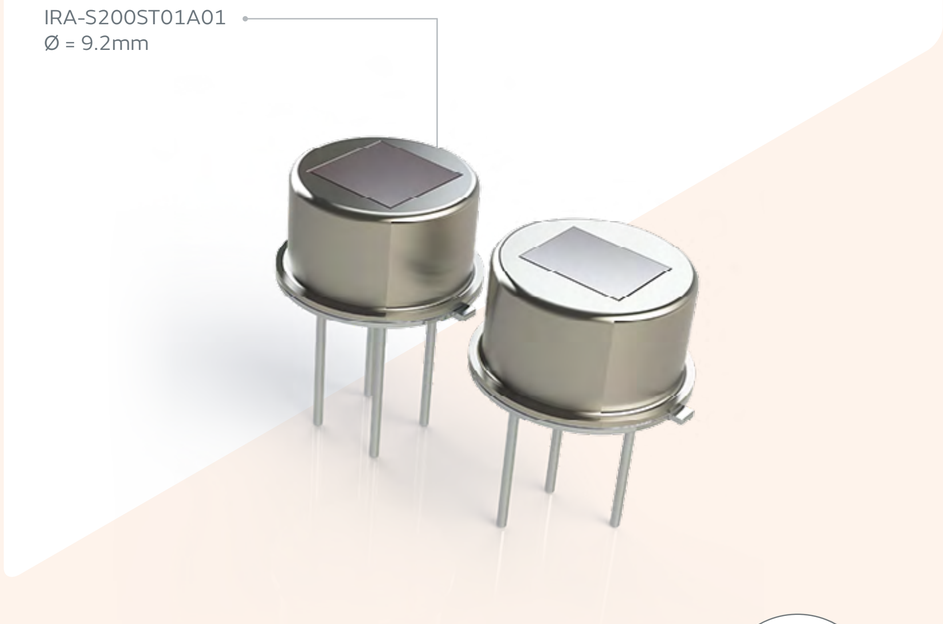
Pyroelectric infrared sensor

Extra high sensitivity, lead-type pyroelectric infrared sensor

Our newly developed low-cost, high-sensitivity, high-RFI (Radio Frequency Immunity) and high-WLI (White Light Immunity) characteristic lead-type infrared sensor.
The IRA-S series has an improved RFI characteristic for the security market to comply with EN regulation for detection levels, such as peripheral circuitry. Its high sensitivity and high reliability make a great contribution to ergonomics and energy conservation for a wide range of appliances.



FEATURES

- **Excellent immunity characteristic to electromagnetic waves**
- **Easy human movement detection**
- **Wide detection area using lens**

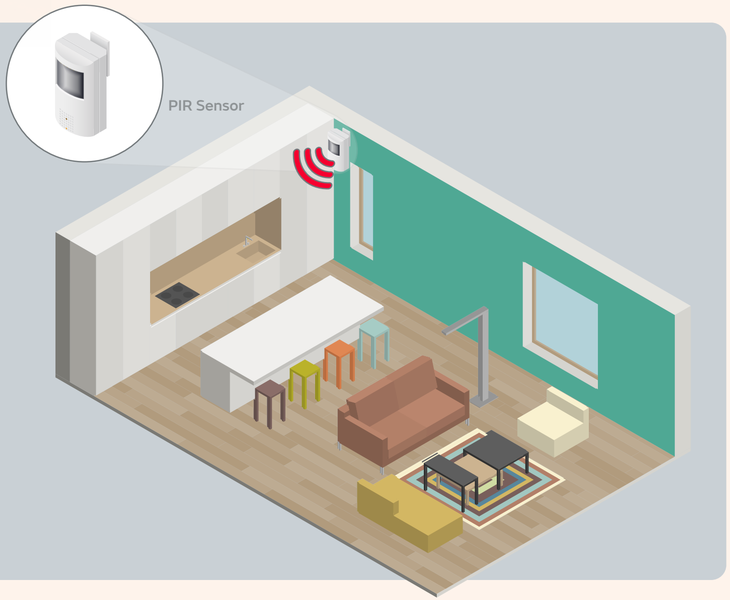
PRODUCT SPECIFICATIONS

- **Type:** Dual
- **Part number:** IRA-S200ST01A01
- **Sensitivity (500K, 1Hz, mVp-p):** 4.6
- **Dimensions (mm):** ø9.2x4.7

- **Type:** Serial quad
- **Part number:** IRA-S400ST01A01
- **Sensitivity (500K, 1Hz, mVp-p):** 7.0
- **Dimensions (mm):** ø9.2x4.7

- **Benefits**
  - New and cost effective model
  - High RFI (Radio Frequency Immunity)
  - For security, automatic ECO switch for display and other appliance

SECURITY SYSTEM APPLICATIONS



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INNOVATOR IN ELECTRONICS

Isolated DC-DC converters for PoE

PoE solution

An increasing number of network devices are utilizing PoE to eliminate the need for installing AC power supplies and in order to reduce wiring.

The expanding functionality and sophistication of these network devices is driving the need for miniaturization of the power supply section. The combination of these trends has led to Murata's development of the MYBSP series DC-DC converters. Incorporating hardware classification protocol functions that conform to the IEEE® 802.3af and at PoE communication standard, the product utilizes a sheet-type transformer resulting in a miniaturized design with high dielectric strength.

FEATURES

- **Compliant to IEEE® 802.3af or IEEE® 802.3at**
- **Small and low profile SMD type**
- **Available at Ta=+85°C**
- **Low EMI**
- **2250Vdc input-output isolation**
- **Fewer values of external capacitor**

PD module

PSE module

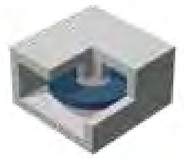
Lineup

		Power	Dimensions (mm)	Part number	Output	Adapter oring	T2P	Features
For PD	PoE / af	10W	 26x14.8x6	**MYBSP00502ABF**	5V/2A	N/A	N/A	Compliant to IEEE® 802.3af class 0 operation Low profile SMD type Operating temperature range -40 to +85°C Low EMI : compliant with CISPR class A 2250Vdc input-output isolation
		12W		**MYBSP01201ABF**	12V/1A	N/A	N/A	
	PoE+ / at	25.5W	 35.5x22.4x10.55	**MYBSP0055AABFT**	5V/5.1A	Available	Available	Compliant to IEEE® 802.3at class 4 operation Low profile SMD type Available continuous 25.5W at +85°C Low EMI : compliant with CISPR class B 2250Vdc input-output isolation Available T2P and adapter-oring No external capacitor operation
				MYBSP0122BABFT	12V/2.125A	Available	Available	
For PSE	Boost-up	30W	 35.5x22.4x8.9	**MYBSS054R6EBF**	54V/0.6A	N/A	N/A	Low profile SMD type Available from -40 to +85°C Operations input from 10.8V to 27V 2250Vdc input-output isolation

SMALL AND LOW PROFILE

Traditional transformer

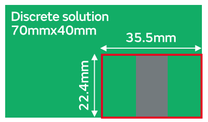
Sheet-type transformer



Murata PoE modules

High efficiency
Smaller and thinner size
Available at Ta=+85°C

Benefits
- Reduce PCB space
- Lower profile
- 72% down



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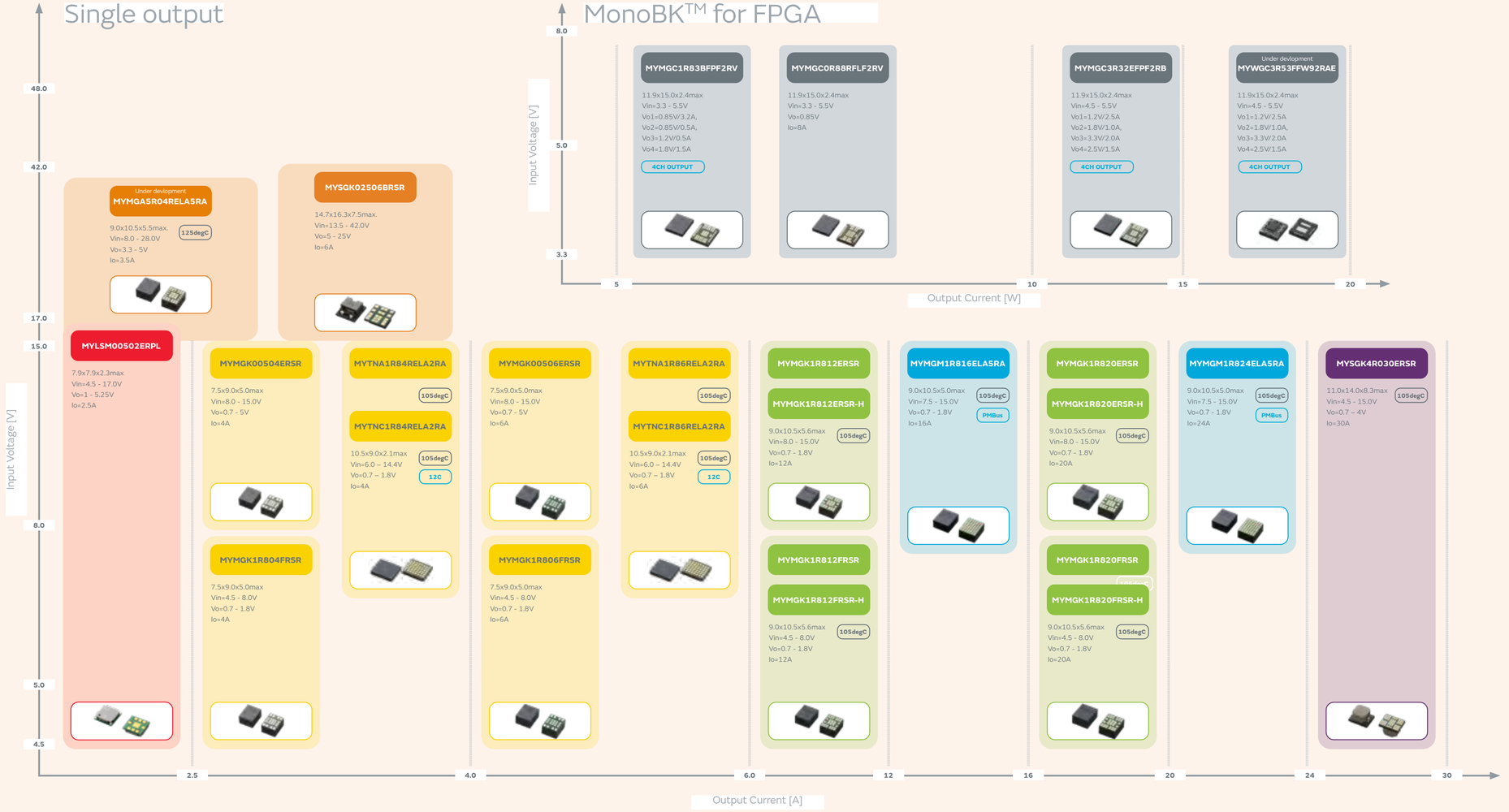
MonoBK™ and UltraBK™

Line-up | Small POL DC-DC converter



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Wi-Fi®
Smart Module

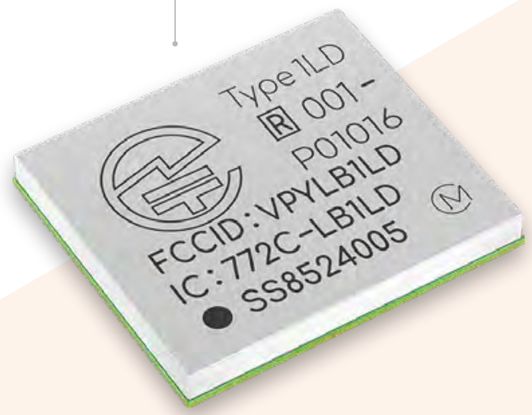
Wireless communications

Type 1LD

Murata is market leader in Wi-Fi® modules for embedded systems, providing superior quality, elevated performance modules for high volume production.

Murata's wireless modules will streamline your assembly operations, thus significantly reducing customer's design time. Additionally, we offer a variety of low-power products for sensor networks.

Type 1LD



APPLICATIONS

- **Home and building automation**
  - Lighting control
  - Heating, Ventilation, Air-conditioning
- **Energy management system (EMS)**
- **Simple sensor network**
- **Home security**
- **Healthcare & fitness**

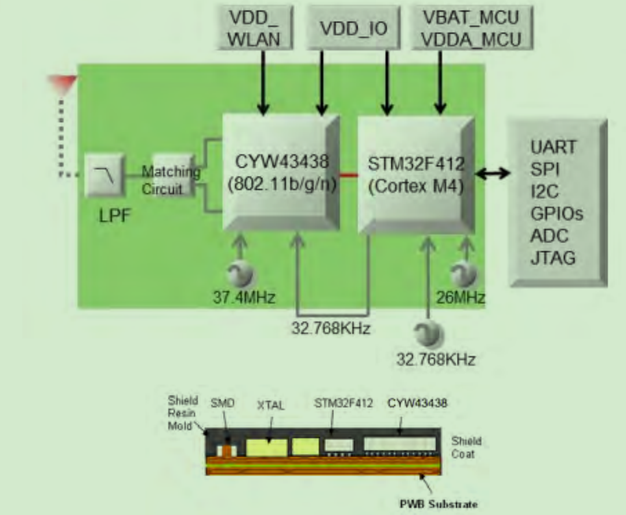
FEATURES

- **Highly integrated**
- **FCC/IC/CE/TELEC compliant**
- **Shielded Ultra Small Wi-Fi® 11b/g/n + Bluetooth® 5.2 + MCU Module**

PRODUCT SPECIFICATIONS

- **Chipset:**
  - Infineon (CYW43438)
  + STM32 (ARM Cortex-M4F)
- **Size:** 8.9 x 7.8 x 1.2 mm
- **Peripheral Interface:**
  GPIO/SPI/UART/I2C/ADC/PWM
- **Operating Temperature:**
  -40°C to 85°C
- **Package:** Shielded Resin
  Feature rich software hosted on module 802.11 b/g/n 65Mbps, Wi-fi® Stack runs inside, 1MB Flash, 256KB RAM
  Infineon WICED, SPP on Bluetooth® and GATT on Bluetooth® LE are supported by WICED Qualified for AWS IoT Core devices

BLOCK DIAGRAM



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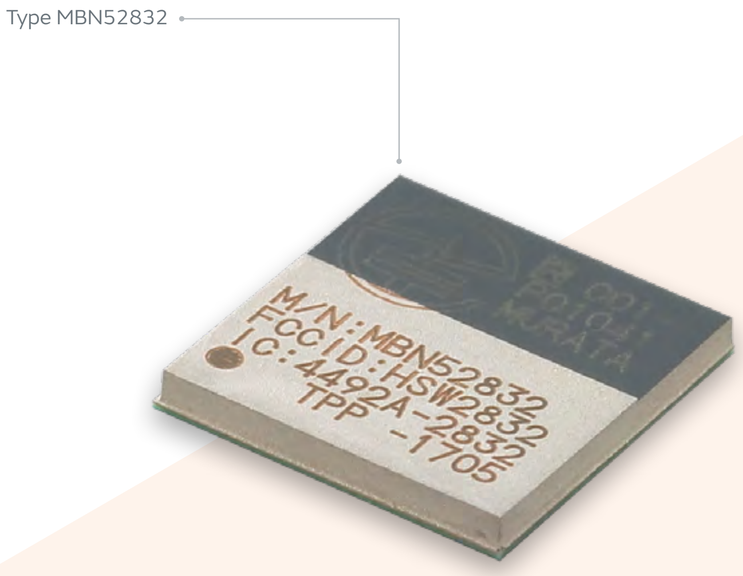
Bluetooth® Low Energy Module

Wireless communications

Type MBN52832

BLE is an ultra-low power communication technology that enables several years of operation off a button battery. Widespread adoption is being seen in fields like health management, fitness and home networks. BLE has also been adopted as a communication method by the Continua Health Alliance, a non-profit organization of healthcare and technology companies.



APPLICATIONS

- **Proximity services**
- **Building automation**
- **Medical/healthcare**
- **Bluetooth beacons**

FEATURES

- **Powerful MCU core with large RAM and flash for user application**
  - ARM Cortex M4; 64K RAM; 512K flash
- **Low power consumption**
  - Tx 7mA @ 3.5dBm (DCDC mode)
  - Rx 6mA (DCDC mode)
- **Rich peripheral interface-20 GPIO ports**
- **Very small size:** 7.4x7.0x0.9mm (max.)
- **Fully certified**
  - FCC (US), IC (Canada), ETSI (EU), TELEC (Japan)
  - BT SIG Certificate
- **Support both on-board and external antenna version**
  - On-board PCB pattern antenna
  - External patch antenna
  - External dipole antenna
- **Bluetooth® 5.0**

PRODUCT SPECIFICATIONS

- **Chipset:** nRF52832 Bluetooth® LE IC
- **Dimension:** 7.4x7.0x0.9mm
- **Package:** LGA
- **Antenna:** on-board or external
- **Max output power:** +4dBm (LDO mode)
- **Interfaces:** UART, SPI, 20 GPIO, 5ADC, SWD, PWM, I2C
- **Operating voltage:** 1.7V to 3.6V
- **Operating temperature range:** -40 to 85°C
- **OTA firmware upgrade**
- **RoHS compliant**
- **Regulatory certificate:** FCC/IC/ETSI/TELEC
- **Bluetooth® SIG qualification**

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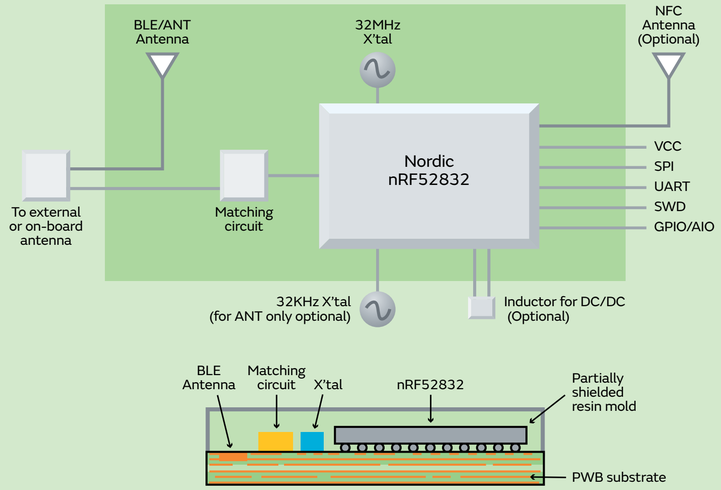

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UWB Modules

Wireless communications

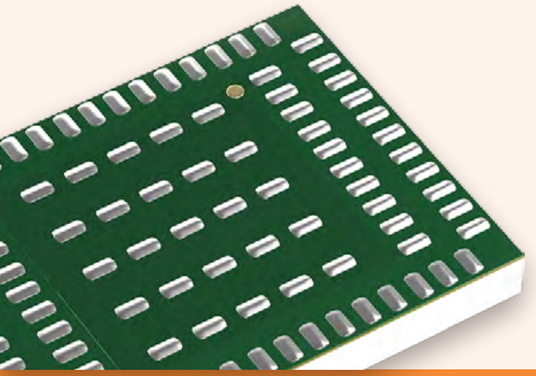
Ultra-wideband (UWB) technology provides a highly effective means for providing secure and precise distance measurement. This is based on determining the time-of-flight (ToF) of radio waves. Murata offers an extensive portfolio of UWB modules.

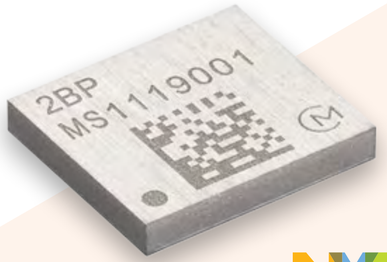
FEATURES

- **Ultra-small dimensions**
- **High quality**
- **Lower power consumption**

APPLICATIONS

- **Indoor navigation**
- **Smart retail/point-of-sales**
- **Smart building**
- **Smart locks**
- **Tags/tracking**
- **Contactless presence detection**

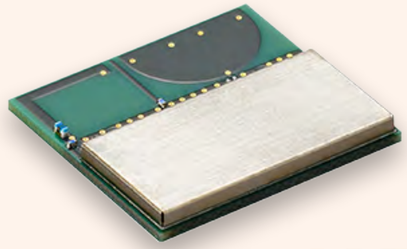




NXP

TYPE 2BP

- **Ultra small UWB module which includes NXP's SR150 UWB chipset, clock, filters and peripheral components.**
- **3 Antenna support (3D AoA or 2D AoA support)**
- **UWB Chip set:** NXP Trimension SR150
- **Antenna:** External



NXP

TYPE 2DK

- **All-in-one UWB + Bluetooth LE combo module which integrates NXP Trimension™ SR040 UWB Chipset, NXP QN9090 Bluetooth LE + MCU chipset, On board antenna and peripheral components.**
- **Ideally suited for UWB Tag/Tracker which operates by coin-cell battery, and general IoT devices.**
- **UWB Chip set:** NXP Trimension™ SR040
- **Antenna:** Integrated

qorvo
all around you

TYPE 2AB

- **UWB Chip set : Qorvo DW3110/3120**
- **FCC/IC/TELEC Reference Certified (Planed)**
- **Hostless module Integrated Nordic IC / nRF52840 which also have Blutooth Low Energy function for waking up UWB and updating FW.**
- **Integrated 3-Axis sensor for saving battery**
- **Reference clock for UWB and MCU are embedded**
- **UWB Chip set:** Qorvo DW3110/3120
- **Antenna:** External

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LPWA Modules

Wireless communications

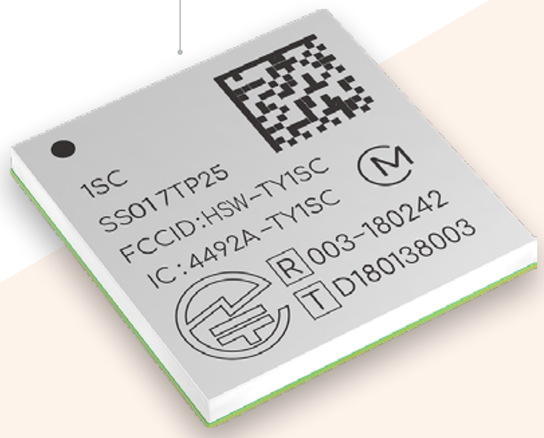
Low power wide area (LPWA) networks provide a power efficient wireless communication technology for interconnecting devices together over a long range. LPWA is most suitable for applications such as IoT and machine-to-machine (M2M) communication, as well as various other situations where lower cost and lower power consumption are required. To respond to customers' needs, Murata has formed strategic partnerships with market leaders, and is accelerating the development of products using this highly appealing emerging technology.

Type 1SC

The Type 1SC (LBAD00XX1SC) module is the world's smallest **Cat. M1/NB-IoT module** with global certification. It supports GPS/GNSS, OpenMCU, Integrated SIM.

Murata has partnered with Truphone, making MVNO network communications possible through the use of eSIM.

Type 1SC
LBAD0XX1SC



FEATURES

- **Small size**
  Size attractive to wearables that previously had no means of cellular connectivity
- **Standardized**
  Through PTCRB/GCF certification improved global interoperability with global wireless networks operators for IoT applications
- **Low power**
  Protocol designed specifically for low current consumption extending battery lifetime up to 10+ years

PRODUCT SPECIFICATIONS

- **Support LTE Band:**
  Low Bands 5,8,12,13,14 (CAT M1 Only), 17,18,19,20,26,28 - Mid Bands 1,2,3,4,25
- **Chipset**: Altair ALT1250
- **Modulation:** LTE Cat.M1/NB-IoT Release 13 (*Release 14 – SW Upgrade)
- **Antenna:** External
- **Type Package:** Resin Mold
- **Dimension**: 11.1 x 11.4 x 1.5 mm (max)
- **Transmit Power:** +23dBm max
- **Sleep Mode Current:**
  eDRX Current Consumption (avg)/LTE-M: 43 uA
  PSM Current Consumption (avg)/LTE-M: 1.4 uA
- **RoHS:** Yes
- **Software Features**: AT commands, IPv4/IPv6 stack with TCP and UDP protocol, SSL/TLS, MQTT, OpenMCU(Optional), GPS/GLONASS(Optional), iUICC(Optional)
- **Certified:**
  FCC/IC/RED/TELEC/KC/NCC GCF/PTCRB
- **Certified Carrier:**
  AT&T, KT, SKT, Pelion, Deutsch Telekom, Vodafone, Softbank, KDDI, Docomo, Soracom, Truphone

APPLICATIONS

- **Smart metering**
- **Smart parking**
- **Home security/home automation**
- **Vehicle fleet management**
- **Wearables/trackers**
- **Industrial M2M communication**
- **IoT edge nodes**

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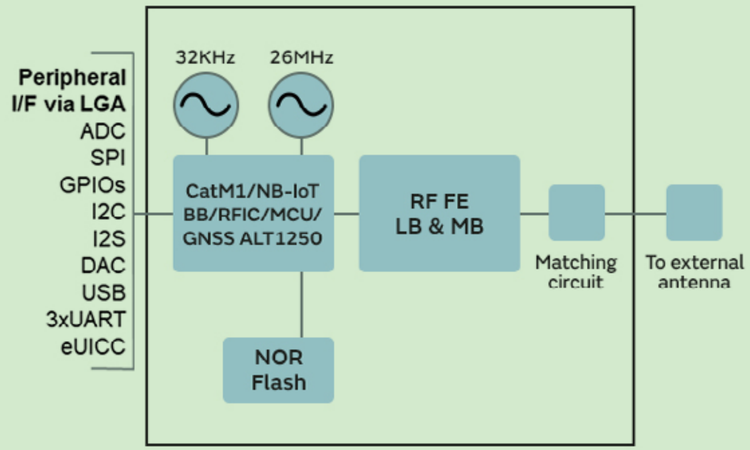

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LPWA Modules

Wireless communications

Type 1SJ

The Type 1SJ (LBAA0QB1SJ) module is one of the smallest **LoRaWAN™** modules in the industry.

This module has a lower power consumption and higher output than previous products. Radio Law certification has already been obtained for major regions.

Open MCU design support is available.

Type 1SJ
LBAA0QB1SJ

APPLICATIONS

- **Smart metering**
- **Smart lighting**
- **Smart parking**
- **Smart agriculture**
- **Industrial M2M**
- **IoT edge nodes**

FEATURES

- **Compact and low cost**
- **Battery life**
  10 years
- **Low Range**
  10km
- **Pre-certified radio regulatory approvals**
  868 & 915 MHz spectrum

PRODUCT SPECIFICATIONS

- **RF/BB chipset:** SX1262
- **MCU chipset:** STM32L0 series
  CPU: Cortex M0+
  RAM: 20KB
  Flash: 192KB
- **Peripheral interfaces:**
  UART/SPI/I2C/GPIOs/ADC
- **Radio certification:**
  FCC, IC, CE
- **Module size:** 10.0x8.0x1.60mm
- **Package:** Shielded Resin Mold
- **Frequencies:** EU / US / India / Pacific
- **Operating temp:** -40 to +85 °C
- **Supply voltage:** 2.2V to 3.6V
- **RF transmit power:**
  +14dBm / +21.5dBm
- **RF sensitivity:** -135dBm
- **Frequency band:** 860MHz-930MHz

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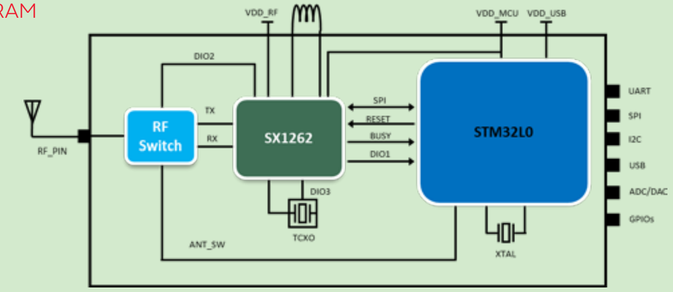

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Modular Solutions

Wireless communications

M.2 boards

Our M.2 modules, co-developed by Embedded Artists, are designed for evaluation, integration and ease-of-use. These professionally designed and proven M.2 modules provide easy evaluation of different Wi-Fi®/Bluetooth® solutions, lower your risk and shorten your time to market.

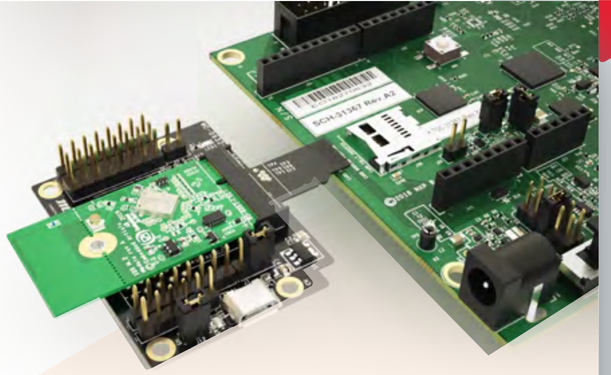
FEATURES

- **Standard M.2 form factor**
- **Reference-certified antennas & snap-off option**
- **UFL connectors for antenna or conducted testing**
- **Comprehensive interface support including SDIO, PCIe, UART, PCM, and radio control lines**

µSD adapter

Murata's µSD-M2 adapter board offers an out-of-the-box experience for NXP i.MX with Murata's M.2 module family. All WLAN/BT- necessary signals are included on M.2 connector pins (Key 'E') including:

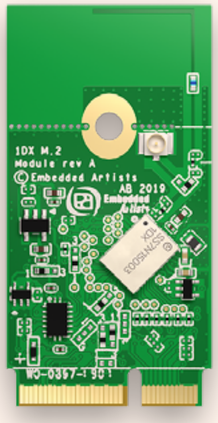
- **WLAN SDIO**
- **WLAN PCIe**
- **BT H4 UART**
- **BT PCM/I2S**
- **GPIOs**



Type 1XA
Dual band
Wi-Fi®11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (PCIe)

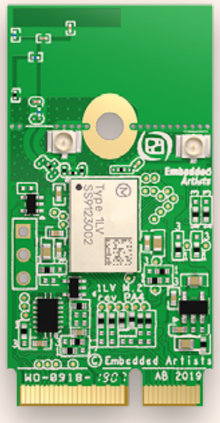
Type 1XZ
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (SDIO)

Type 1YM
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO
+ Bluetooth® 5.2



Type 1DX
Wi-Fi® 11b/g/n
+ Bluetooth® 5.1

Type 1MW
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0



Type 1LV
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0

Type 1ZM
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.1

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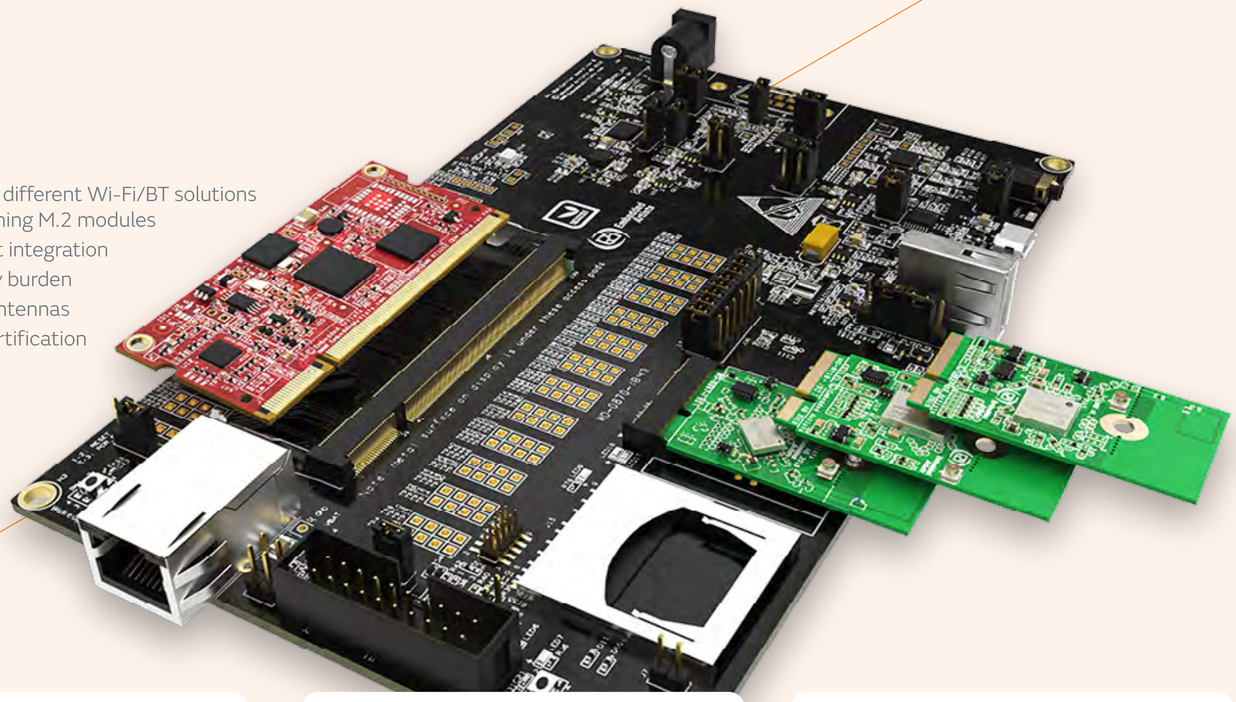
Fully Modular Systems

Wireless communications

Murata and Embedded Artists have developed a full modular system which offers IoT designers a quick, easy and cost-effective route to world-class connectivity.

Development kits are available for use as your evaluation/prototyping platform. The kits include the hardware and software components needed to get up-and-running with your software development on day 1.

- Easily evaluate different Wi-Fi/BT solutions – by just switching M.2 modules
- Fast-to-market integration
- Less regulatory burden
- Use certified antennas
- Re-use FCC certification



1. CHOOSE A COM/OEM BOARD

Embedded Artists have developed a suite of COM computer-on-module (COM) units and OEM boards, integrating all core components around a variety of NXP processors and microcontrollers:

- i.MX RT1062
- i.MX RT1052
- i.MX 8M Quad
- i.MX 8M Mini uCOM
- i.MX 8M Nano uCOM
- i.MX 6Quad
- i.MX 6DualLite
- i.MX 6Ultralite
- i.MX 6SoloX
- i.MX 7Dual
- i.MX 7Dual uCOM
- i.MX 7ULP uCOM

2. PLUG INTO COM CARRIER BOARD

There are two types of carrier boards: One for i.MXRT family boards (with a slot for the COM or OEM board) and one which is suitable for the MPU COM boards and offers...

- Support for i.MX8 designs
- Support for M.2 Key E interface (typically Wi-Fi®/BT), including advanced debug features developed in cooperation with Murata and Cypress
- Support for M.2 Key B interface (typically Cellular/SSD)
- Support for USB 3.0

3. PLUG IN YOUR CONNECTIVITY

Choose the Murata/Embedded Artists M.2 connectivity module appropriate for your application in terms of:

- Performance
- Power consumption
- Range
- Cost
- Temperature range
- Supported standards

4. START YOUR EVALUATION

- Pre-loaded software drivers
- Comprehensive user manuals
- Responsive support

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A Wide Range of Wireless

Communication Modules

Murata offers an extensive portfolio of wireless modules based on Cypress and NXP chipsets.

Modules with integrated MCUs are used in combination with Cypress WICED software. Wi-Fi® and Bluetooth® capabilities are also incorporated and the MCU can be used to run an application.

Other modules are radio-only and they can be used in combination with a MPU (Linux®) or MCU (RTOS).

These modules cover a wide array of different specifications - from single band Wi-Fi® 2.4GHz to dual band Wi-Fi® 11ac 2.4GHz and 5GHz with MIMO. Most of the options also include Bluetooth®.

With this variety of wireless modules Murata can cover a diverse breadth of applications - going all the way from small connected gadgets or sensor nodes to high data rate video streaming devices.

NXP GOLD PARTNER

Module with MCU

Type ABR

802.11 b/g/n WiFi
- *NXP 88MW320 chipset*
- *ARM Cortex-M4 200MHz*

Radio-only modules

Type 1ZM

Wi-Fi 11 a/b/g/n/ac
Bluetooth 5.1
- *NXP 88W8987 chipset*

Infineon + CYPRESS

Modules with MCU

Type 1LD

Shielded ultra-small Wi-Fi 11b/g/n+Bluetooth 5.2 + MCU
- *Cypress CYW43438 chipset*
- *STM32 (ARM Cortex-M4F) MCU*

Type 1GC

Shielded ultra-small dual band Wi-Fi 11a/b/g/n + Ethernet + MCU
- *Cypress CYW43907 chipset*
- *Processor: ARM Cortex-R4*

Radio-only modules

Type 1FX

Shielded ultra-small Wi-Fi 11b/g/n
- *Cypress CYW43364 chipset*

Type 1DX

Shielded ultra-small Wi-Fi 11b/g/n + Bluetooth 5.1
- *Cypress CYW4343W chipset*

Type 1LV

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43012 chipset*

Type 1MW

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43455 chipset*

Soldered-down in major development platforms

Wireless communications

Many of Murata's extensive range of wireless modules are designed into leading development platforms. These include Linux®, FreeRTOS, etc.

- **NXP i.MX**
  - i.MX 8M Mini EVK - Type 1MW
  - i.MX 8M Nano EVK - Type 1MW
  - i.MX 7ULP EVK - Type 1DX
  - i.MX RT Alexa Voice Board - Type 1DX
- **Cypress WICED**
  - PSoC® 6 WiFi-BT Pioneer Board &
  - Prototyping Kit - Type 1DX/Type 1LV
  - CYW43907 Eval Kit - Type 1GC
- **ST Micro - Linux®**
  - STM32MPI Discovery Kit - Type 1DX
- **Micropython**
  - Arduino Portenta H7 - Type 1DX

Arduino Portenta H7

i.MX 8M Nano EVK

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CR Batteries

Micro Batteries

Murata offers a wide range of primary micro batteries with high performance and reliability, taking advantage of 40+ years technology development and manufacturing expertise.

FEATURES

- **40+ years technology development and manufacturing expertise.**
- **Acquisition of ISO 9001/14001 certification.**
- **Full automated assembling lines with high productivity.**

Coin Manganese Dioxide Lithium Batteries

- High voltage, high energy density
- Wide range; including heat-resistant models
- ISO/TS16949 certified

Lightweight, High Voltage and High Energy Density

The battery voltage is 3V, almost double that of normal alkaline or manganese batteries.

Excellent discharge characteristics

Voltage characteristics remain stable even for a long period of discharge.

Excellent long-term reliability

Murata's innovative sealing technology minimize battery self-discharge.

Battery	Type	Nominal Voltage	Capacity	Operating Temp.	Features
Coin Manganese Dioxide Lithium (CR)	Standard	3.0V	30-1000mAh	-30 to 70ºC	Lineup of 10 models from small size and thin models to high capacity models
	Extended Temp.	3.0V	220-2000mAh	-40 to 85ºC	Good balance between wide operating temperature and affordability
	Heat resistant	3.0V	210-1000mAh	-40 to 125ºC	Wide operating temperature
	High Drain	3.0V	200-500mAh	-30 to +70ºC	High peak 50mA pulse (x2 times) vs. Standard

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INNOVATOR IN ELECTRONICS

Smart Building

IoT solutions for smart buildings

▪ As well as making homes smarter, there are huge opportunities for greater automation within offices and residential buildings too. This will help to reduce the operational expenses of these locations, while curbing their energy consumption and minimizing their ecological impact.

▪ Through data captured by wireless-enabled sensor devices, there is the prospect for heating, climate control and security functions to be attended to, plus energy control and occupancy management. Lighting and heating can be switched off in areas where there are no people present. Ventilation may be turned up in areas where the temperature is high (due to intense sunlight).

▪ Air quality management and occupancy gauging are becoming increasingly important to facilities managers.

▪ There is also a growing need for structural health monitoring of the buildings themselves - in order to make certain that there are no safety risks and to better schedule essential maintenance work.

▪ Murata is a key electronic component provider for smart building implementations - with a product portfolio that includes MEMS-based inertial sensors, PIR motion sensors and infra-red CO2 sensors. These are complemented by a wide array of different wireless modules and power solutions.

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High accuracy MEMS sensor

3D MEMS technology enables higher performance at lower cost.

Murata offers high performance accelerometers, inclinometers, gyroscopes and combo sensors. Gyroscope components and combined sensors (including gyroscope and accelerometer) are based on our proven 3D MEMS technology and highly integrated electronics.
Industrial gyroscopes offer a performance level that has typically been available only for expensive module products.
All products are RoHS compatible and suitable for lead-free reflow soldering.

SCA3300
SCL3300

INCLINOMETERS

Recommended product	Product description	Accuracy	Features
SCL3300-D01	Digital SPI output 3 axis inclinometer	Accuracy ± 0.5 degree over operating temperature	3-axis inclination sensor with digital true inclination angle output Four user selectable measurement modes for sensor performance optimization for different applications and their requirements Ultra-low noise density for high measurement resolution Mechanically damped sensing element design for excellent vibration robustness Extensive self-diagnostic features SPI digital interface -40 to +125 °C operating range Proven capacitive 3D-MEMS technology

ACCELEROMETERS & GYROS

Recommended product	Product description	Benefits	Features
SCA3300	Digital SPI 3 axis accelerometer for inclination measurement	Reliability	

Smart Building
Sensors

MURATA BENEFITS & ADVANTAGES:

- **Gyroscope performance:**
  - Bias stability
  - Low noise
  - Accuracy
- **Accelerometer performance:**
  - Low noise
  - Offset stability over temperature
  - Good performance in vibrating environment

FEATURES

- **Robust MEMS technology**
- **Field proven reliability & high performance in demanding applications**
- **Good offset stability over temperature and time**
- **High accuracy in demanding applications (eg, high temperature variation, high vibration environment, etc.)**
- **Excellent mechanical shock endurance**
- **Can withstand high impact/dropping**

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Pyroelectric infrared sensor

Extra high sensitivity, lead-type pyroelectric infrared sensor

Our newly developed low-cost, high-sensitivity, high-RFI (Radio Frequency Immunity) and high-WLI (White Light Immunity) characteristic lead-type infrared sensor.
The IRA-S series has an improved RFI characteristic for the security market to comply with EN regulation for detection levels, such as peripheral circuitry. Its high sensitivity and high reliability make a great contribution to ergonomics and energy conservation for a wide range of appliances.

FEATURES

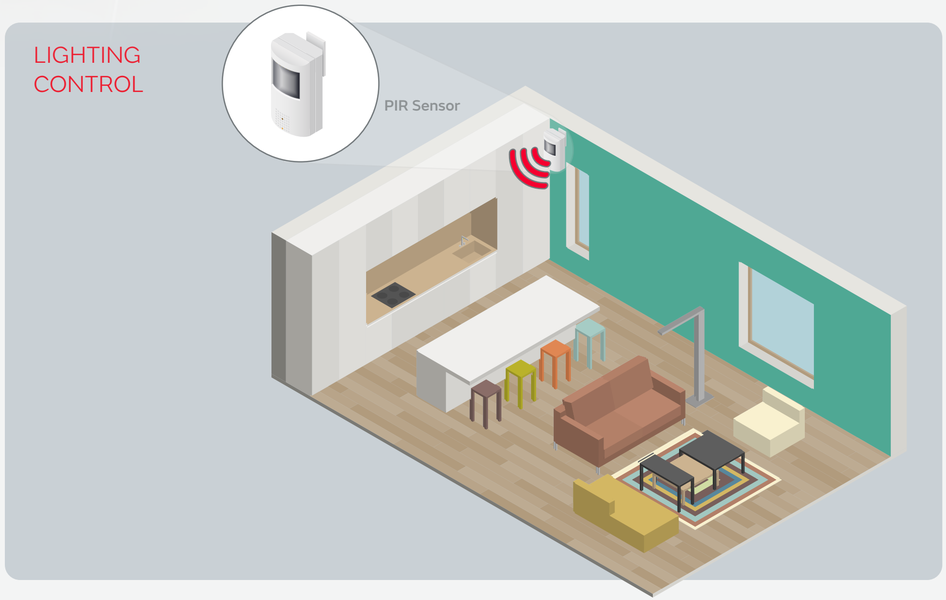
- **Excellent immunity characteristic to electromagnetic waves**
- **Easy human movement detection**
- **Wide detection area using lens**

PRODUCT SPECIFICATIONS

- **Type:** Dual
- **Part number:** IRA-S200ST01A01
- **Sensitivity (500K, 1Hz, mVp-p):** 4.6
- **Dimensions (mm):** ø9.2x4.7

- **Type:** Serial quad
- **Part number:** IRA-S400ST01A01
- **Sensitivity (500K, 1Hz, mVp-p):** 7.0
- **Dimensions (mm):** ø9.2x4.7

- **Benefits**
  - New and cost effective model
  - High RFI (Radio Frequency Immunity)
  - For security, automatic ECO switch for display and other appliance



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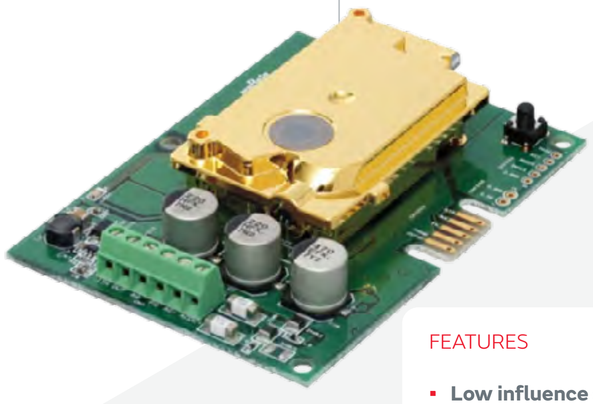
NDIR CO2 sensor

Long-term stability using auto-calibration

Murata's CO2 sensor is a product that exhibits long-term stability and high measurement accuracy. Its maintainability is improved through an automatic calibration feature incorporated. This is based on a unique calibration curve algorithm and a dual wavelength non-dispersive infrared (NDIR) system. One wavelength is for measurement and the other for reference.

IMG-CA0014-00
67 x 92 x 20mm



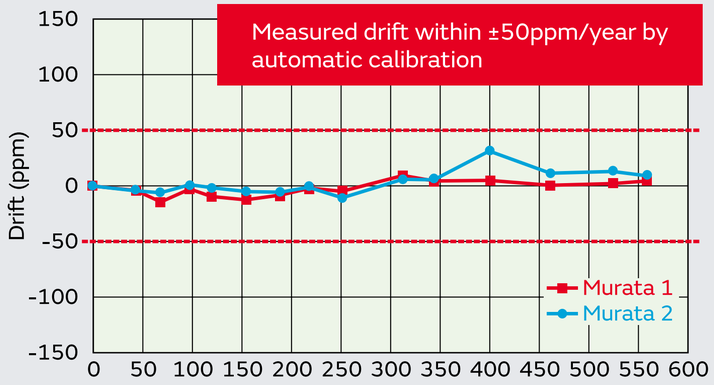
FEATURES

- **Low influence of other gases by NDIR principle**
- **Excellent temperature characteristics and high accuracy**
- **Excellent long-term stability and high reliability by automatic calibration**

PRODUCT SPECIFICATIONS

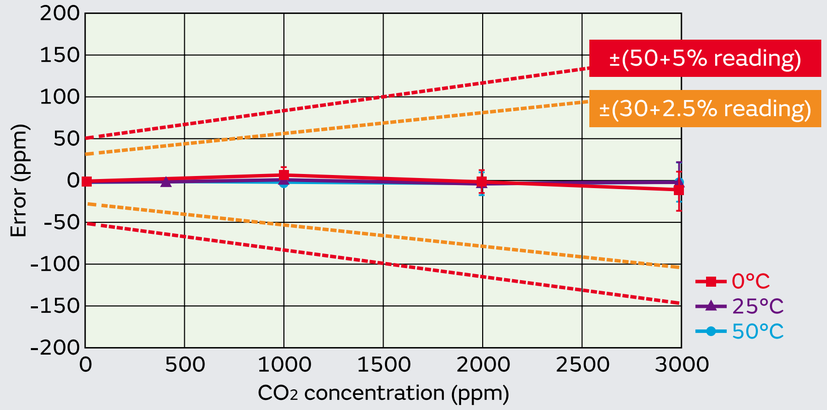
- **Operating temperature:** 0 to 50 °C
- **Storage temperature:** -20 to 50 °C
- **Measurement range:** 0 to 2000ppm, 0 to 3000ppm
- **Accuracy:** ± (50ppm+5% of reading) Typ. ± (30ppm+2.5% of reading)
- **Long-term stability (drift):** ±50ppm/Year @ 1000ppm
- **Power input:** AC/DC 24V, DC12V
- **Peak power consumption:** Avg. 0.5W/Max. 2.0W
- **Output interface:** Analog 0 to 5V
- **Measurement interval:** 5s
- **Dimensions:** 67x92x20mm

Long-term test in building



Tested by TODA Corp.
Tested by standard gas @ 1000ppm

Measurement accuracy



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Wi-Fi®
Smart Module

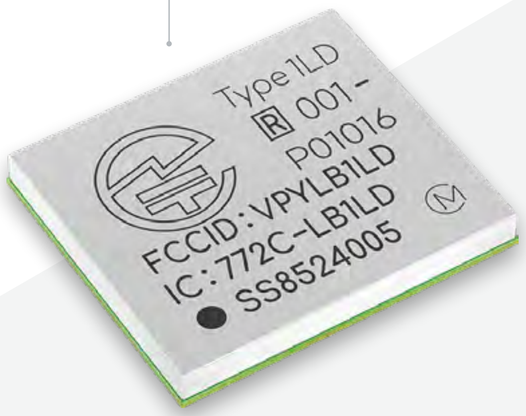
Wireless communications

Type 1LD

Murata is market leader in Wi-Fi® modules for embedded systems, providing superior quality, elevated performance modules for high volume production.

Murata's wireless modules will streamline your assembly operations, thus significantly reducing customer's design time. Additionally, we offer a variety of low-power products for sensor networks.

Type 1LD



APPLICATIONS

- **Home and building automation**
  - Lighting control
  - Heating, Ventilation, Air-conditioning
- **Energy management system (EMS)**
- **Simple sensor network**
- **Home security**
- **Healthcare & fitness**

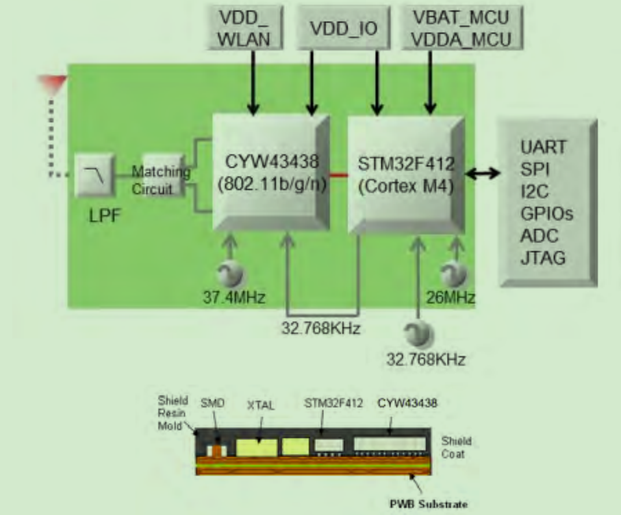
FEATURES

- **Highly integrated**
- **FCC/IC/CE/TELEC compliant**
- **Shielded Ultra Small Wi-Fi® 11b/g/n + Bluetooth® 5.2 + MCU Module**

PRODUCT SPECIFICATIONS

- **Chipset:**
  - Infineon (CYW43438)
  + STM32 (ARM Cortex-M4F)
- **Size:** 8.9 x 7.8 x 1.2 mm
- **Peripheral Interface:**
  GPIO/SPI/UART/I2C/ADC/PWM
- **Operating Temperature:**
  -40°C to 85°C
- **Package:** Shielded Resin
  Feature rich software hosted on module 802.11 b/g/n 65Mbps, Wi-fi® Stack runs inside, 1MB Flash, 256KB RAM
  Infineon WICED, SPP on Bluetooth® and GATT on Bluetooth® LE are supported by WICED Qualified for AWS IoT Core devices

BLOCK DIAGRAM



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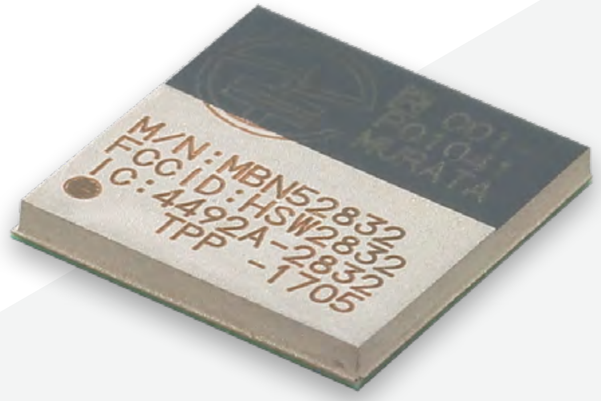
Bluetooth® Low Energy Module

Wireless communications

Type MBN52832

BLE is an ultra-low power communication technology that enables several years of operation off a button battery. Widespread adoption is being seen in fields like health management, fitness and home networks. BLE has also been adopted as a communication method by the Continua Health Alliance, a non-profit organization of healthcare and technology companies.

Type MBN52832



Smart Building

Connectivity

APPLICATIONS

- **Proximity services**
- **Building automation**
- **Medical/healthcare**
- **Bluetooth beacons**

FEATURES

- **Powerful MCU core with large RAM and flash for user application**
  - ARM Cortex M4; 64K RAM; 512K flash
- **Low power consumption**
  - Tx 7mA @ 3.5dBm (DCDC mode)
  - Rx 6mA (DCDC mode)
- **Rich peripheral interface-20 GPIO ports**
- **Very small size:** 7.4x7.0x0.9mm (max.)
- **Fully certified**
  - FCC (US), IC (Canada), ETSI (EU), TELEC (Japan)
  - BT SIG Certificate
- **Support both on-board and external antenna version**
  - On-board PCB pattern antenna
  - External patch antenna
  - External dipole antenna
- **Bluetooth® 5.0**

PRODUCT SPECIFICATIONS

- **Chipset:** nRF52832 Bluetooth® LE IC
- **Dimension:** 7.4x7.0x0.9mm
- **Package:** LGA
- **Antenna:** on-board or external
- **Max output power:** +4dBm (LDO mode)
- **Interfaces:** UART, SPI, 20 GPIO, 5ADC, SWD, PWM, I2C
- **Operating voltage:** 1.7V to 3.6V
- **Operating temperature range:** -40 to 85°C
- **OTA firmware upgrade**
- **RoHS compliant**
- **Regulatory certificate:** FCC/IC/ETSI/TELEC
- **Bluetooth® SIG qualification**

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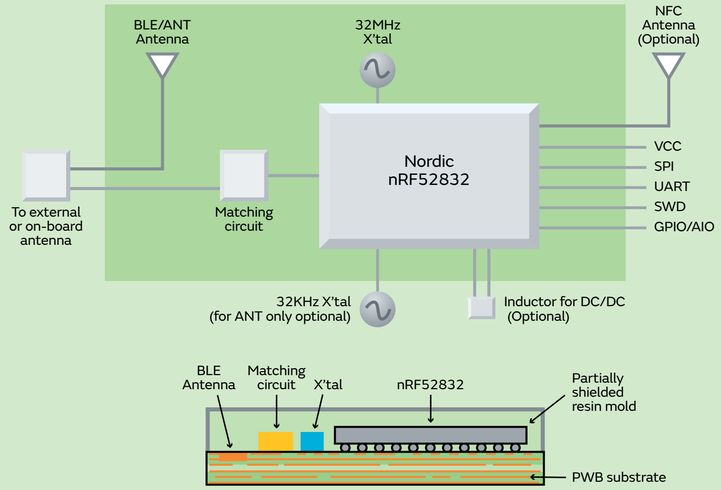

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UWB Modules

Wireless communications

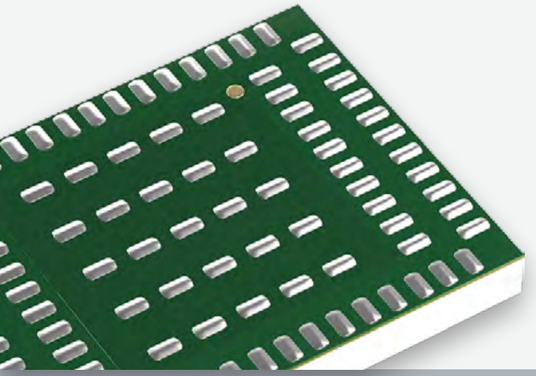
Ultra-wideband (UWB) technology provides a highly effective means for providing secure and precise distance measurement. This is based on determining the time-of-flight (ToF) of radio waves. Murata offers an extensive portfolio of UWB modules.

FEATURES

- **Ultra-small dimensions**
- **High quality**
- **Lower power consumption**

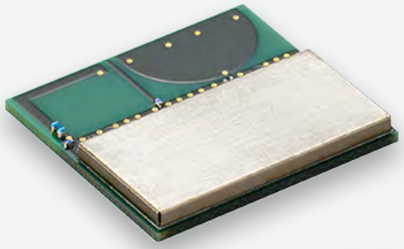
APPLICATIONS

- **Indoor navigation**
- **Smart retail/point-of-sales**
- **Smart building**
- **Smart locks**
- **Tags/tracking**
- **Contactless presence detection**



TYPE 2BP

- **Ultra small UWB module which includes NXP's SR150 UWB chipset, clock, filters and peripheral components.**
- **3 Antenna support (3D AoA or 2D AoA support)**
- **UWB Chip set:** NXP Trimension SR150
- **Antenna:** External



TYPE 2DK

- **All-in-one UWB + Bluetooth LE combo module which integrates NXP Trimension™ SR040 UWB Chipset, NXP QN9090 Bluetooth LE + MCU chipset, On board antenna and peripheral components.**
- **Ideally suited for UWB Tag/Tracker which operates by coin-cell battery, and general IoT devices.**
- **UWB Chip set:** NXP Trimension™ SR040
- **Antenna:** Integrated

TYPE 2AB

- **UWB Chip set : Qorvo DW3110/3120**
- **FCC/IC/TELEC Reference Certified (Planed)**
- **Hostless module Integrated Nordic IC / nRF52840 which also have Blutooth Low Energy function for waking up UWB and updating FW.**
- **Integrated 3-Axis sensor for saving battery**
- **Reference clock for UWB and MCU are embedded**
- **UWB Chip set:** Qorvo DW3110/3120
- **Antenna:** External

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LPWA Modules

Wireless communications

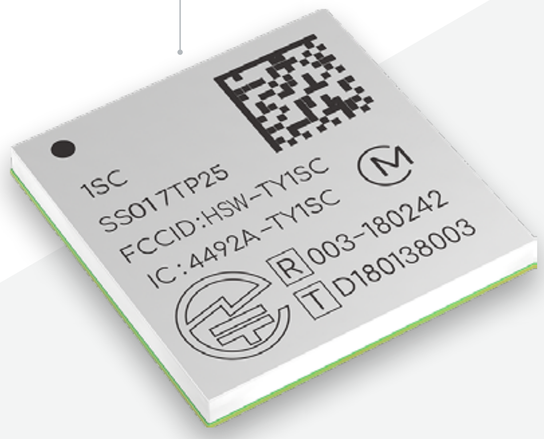
Low power wide area (LPWA) networks provide a power efficient wireless communication technology for interconnecting devices together over a long range. LPWA is most suitable for applications such as IoT and machine-to-machine (M2M) communication, as well as various other situations where lower cost and lower power consumption are required. To respond to customers' needs, Murata has formed strategic partnerships with market leaders, and is accelerating the development of products using this highly appealing emerging technology.

Type 1SC

The Type 1SC (LBAD00XX1SC) module is the world's smallest **Cat. M1/NB-IoT module** with global certification. It supports GPS/GNSS, OpenMCU, Integrated SIM.

Murata has partnered with Truphone, making MVNO network communications possible through the use of eSIM.

Type 1SC
LBAD0XX1SC



FEATURES

- **Small size**
  Size attractive to wearables that previously had no means of cellular connectivity
- **Standardized**
  Through PTCRB/GCF certification improved global interoperability with global wireless networks operators for IoT applications
- **Low power**
  Protocol designed specifically for low current consumption extending battery lifetime up to 10+ years

PRODUCT SPECIFICATIONS

- **Support LTE Band:**
  Low Bands 5,8,12,13,14 (CAT M1 Only), 17,18,19,20,26,28 - Mid Bands 1,2,3,4,25
- **Chipset**: Altair ALT1250
- **Modulation:** LTE Cat.M1/NB-IoT Release 13 (*Release 14 – SW Upgrade)
- **Antenna:** External
- **Type Package:** Resin Mold
- **Dimension**: 11.1 x 11.4 x 1.5 mm (max)
- **Transmit Power:** +23dBm max
- **Sleep Mode Current:**
  eDRX Current Consumption (avg)/LTE-M: 43 uA
  PSM Current Consumption (avg)/LTE-M: 1.4 uA
- **RoHS:** Yes
- **Software Features**: AT commands, IPv4/IPv6 stack with TCP and UDP protocol, SSL/TLS, MQTT, OpenMCU(Optional), GPS/GLONASS(Optional), iUICC(Optional)
- **Certified:**
  FCC/IC/RED/TELEC/KC/NCC GCF/PTCRB
- **Certified Carrier:**
  AT&T, KT, SKT, Pelion, Deutsch Telekom, Vodafone, Softbank, KDDI, Docomo, Soracom, Truphone

APPLICATIONS

- **Smart metering**
- **Smart parking**
- **Home security/home automation**
- **Vehicle fleet management**
- **Wearables/trackers**
- **Industrial M2M communication**
- **IoT edge nodes**

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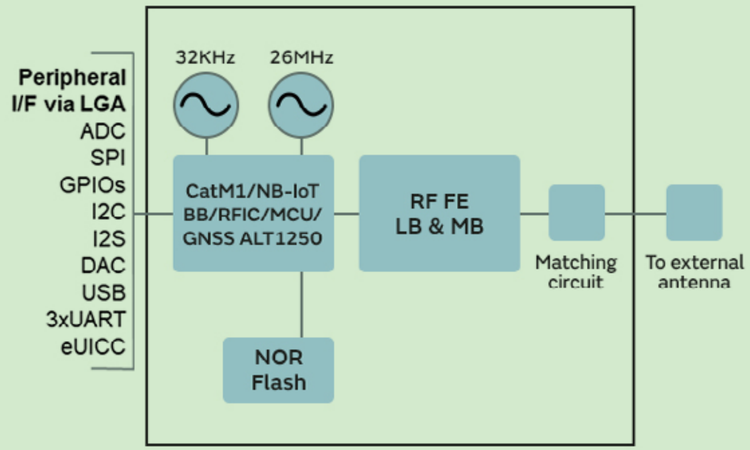

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LPWA Modules

Wireless communications

Type 1SJ

The Type 1SJ (LBAA0QB1SJ) module is one of the smallest **LoRaWAN™** modules in the industry.

This module has a lower power consumption and higher output than previous products. Radio Law certification has already been obtained for major regions.

Open MCU design support is available.

Type 1SJ
LBAA0QB1SJ

APPLICATIONS

- **Smart metering**
- **Smart lighting**
- **Smart parking**
- **Smart agriculture**
- **Industrial M2M**
- **IoT edge nodes**

FEATURES

- **Compact and low cost**
- **Battery life**
  10 years
- **Low Range**
  10km
- **Pre-certified radio regulatory approvals**
  868 & 915 MHz spectrum

PRODUCT SPECIFICATIONS

- **RF/BB chipset:** SX1262
- **MCU chipset:** STM32L0 series
  CPU: Cortex M0+
  RAM: 20KB
  Flash: 192KB
- **Peripheral interfaces:**
  UART/SPI/I2C/GPIOs/ADC
- **Radio certification:**
  FCC, IC, CE
- **Module size:** 10.0x8.0x1.60mm
- **Package:** Shielded Resin Mold
- **Frequencies:** EU / US / India / Pacific
- **Operating temp:** -40 to +85 °C
- **Supply voltage:** 2.2V to 3.6V
- **RF transmit power:**
  +14dBm / +21.5dBm
- **RF sensitivity:** -135dBm
- **Frequency band:** 860MHz-930MHz

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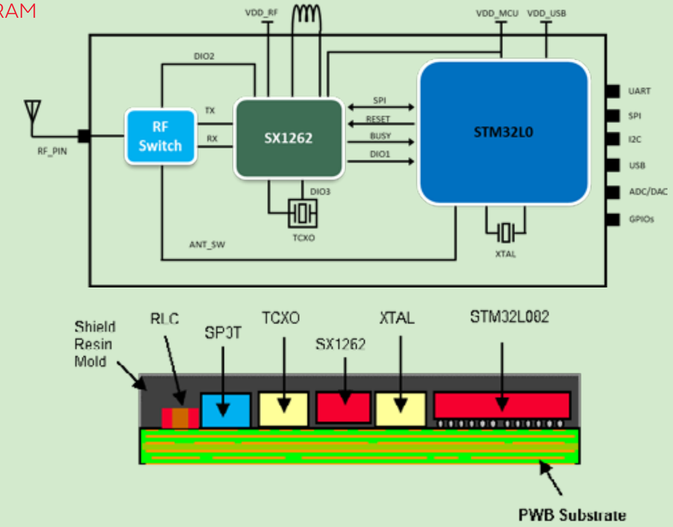

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Modular Solutions

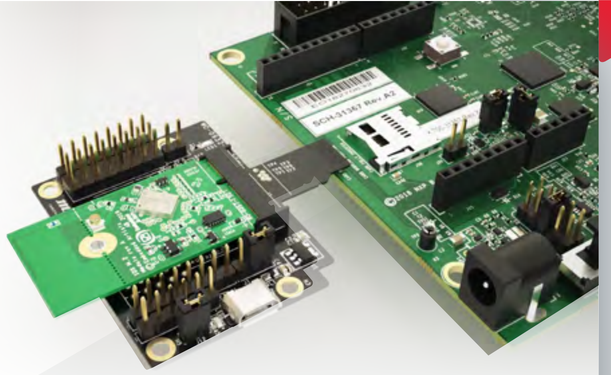
Wireless communications

M.2 boards

Our M.2 modules, co-developed by Embedded Artists, are designed for evaluation, integration and ease-of-use. These professionally designed and proven M.2 modules provide easy evaluation of different Wi-Fi®/Bluetooth® solutions, lower your risk and shorten your time to market.

FEATURES

- **Standard M.2 form factor**
- **Reference-certified antennas & snap-off option**
- **UFL connectors for antenna or conducted testing**
- **Comprehensive interface support including SDIO, PCIe, UART, PCM, and radio control lines**



µSD adapter

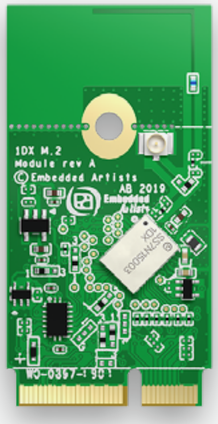
Murata's µSD-M2 adapter board offers an out-of-the-box experience for NXP i.MX with Murata's M.2 module family. All WLAN/BT- necessary signals are included on M.2 connector pins (Key 'E') including:

- **WLAN SDIO**
- **WLAN PCIe**
- **BT H4 UART**
- **BT PCM/I2S**
- **GPIOs**

Type 1XA
Dual band
Wi-Fi®11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (PCIe)

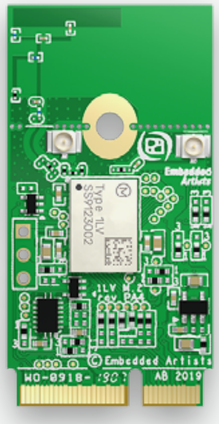
Type 1XZ
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (SDIO)

Type 1YM
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO
+ Bluetooth® 5.2



Type 1DX
Wi-Fi® 11b/g/n
+ Bluetooth® 5.1

Type 1MW
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0



Type 1LV
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0

Type 1ZM
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.1

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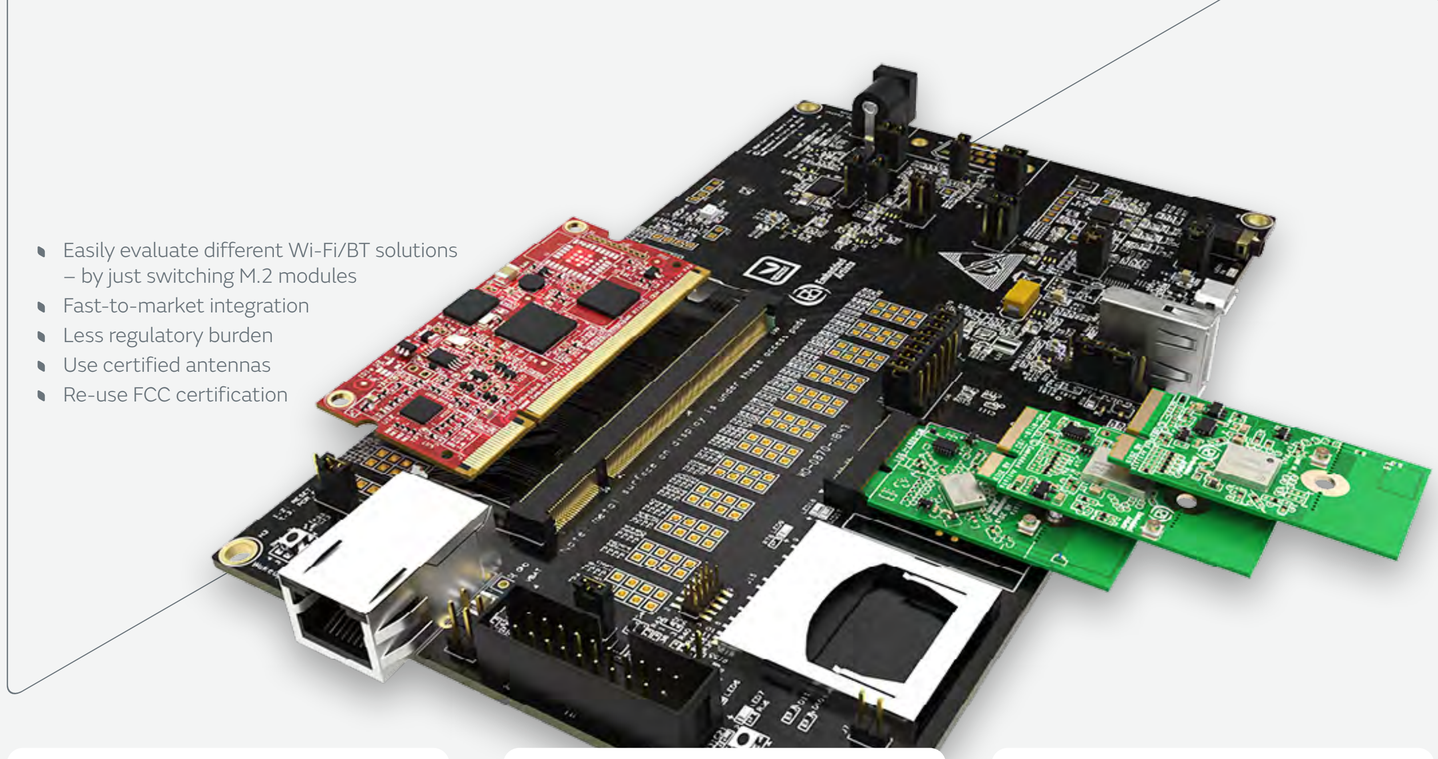
Fully Modular Systems

Wireless communications

Murata and Embedded Artists have developed a full modular system which offers IoT designers a quick, easy and cost-effective route to world-class connectivity.

Development kits are available for use as your evaluation/prototyping platform. The kits include the hardware and software components needed to get up-and-running with your software development on day 1.

- Easily evaluate different Wi-Fi/BT solutions – by just switching M.2 modules
- Fast-to-market integration
- Less regulatory burden
- Use certified antennas
- Re-use FCC certification



1. CHOOSE A COM/OEM BOARD

Embedded Artists have developed a suite of COM computer-on-module (COM) units and OEM boards, integrating all core components around a variety of NXP processors and microcontrollers:

- i.MX RT1062
- i.MX RT1052
- i.MX 8M Quad
- i.MX 8M Mini uCOM
- i.MX 8M Nano uCOM
- i.MX 6Quad
- i.MX 6DualLite
- i.MX 6Ultralite
- i.MX 6SoloX
- i.MX 7Dual
- i.MX 7Dual uCOM
- i.MX 7ULP uCOM

2. PLUG INTO COM CARRIER BOARD

There are two types of carrier boards: One for i.MXRT family boards (with a slot for the COM or OEM board) and one which is suitable for the MPU COM boards and offers...

- Support for i.MX8 designs
- Support for M.2 Key E interface (typically Wi-Fi®/BT), including advanced debug features developed in cooperation with Murata and Cypress
- Support for M.2 Key B interface (typically Cellular/SSD)
- Support for USB 3.0

3. PLUG IN YOUR CONNECTIVITY

Choose the Murata/Embedded Artists M.2 connectivity module appropriate for your application in terms of:

- Performance
- Power consumption
- Range
- Cost
- Temperature range
- Supported standards

4. START YOUR EVALUATION

- Pre-loaded software drivers
- Comprehensive user manuals
- Responsive support

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A Wide Range of Wireless

Communication Modules

Murata offers an extensive portfolio of wireless modules based on Cypress and NXP chipsets.

Modules with integrated MCUs are used in combination with Cypress WICED software. Wi-Fi® and Bluetooth® capabilities are also incorporated and the MCU can be used to run an application.

Other modules are radio-only and they can be used in combination with a MPU (Linux®) or MCU (RTOS).

These modules cover a wide array of different specifications - from single band Wi-Fi® 2.4GHz to dual band Wi-Fi® 11ac 2.4GHz and 5GHz with MIMO. Most of the options also include Bluetooth®.

With this variety of wireless modules Murata can cover a diverse breadth of applications - going all the way from small connected gadgets or sensor nodes to high data rate video streaming devices.

NXP GOLD PARTNER

Module with MCU

Type ABR

802.11 b/g/n WiFi
- *NXP 88MW320 chipset*
- *ARM Cortex-M4 200MHz*

Radio-only modules

Type 1ZM

Wi-Fi 11 a/b/g/n/ac
Bluetooth 5.1
- *NXP 88W8987 chipset*

Infineon + CYPRESS

Modules with MCU

Type 1LD

Shielded ultra-small Wi-Fi 11b/g/n+Bluetooth 5.2 + MCU
- *Cypress CYW43438 chipset*
- *STM32 (ARM Cortex-M4F) MCU*

Type 1GC

Shielded ultra-small dual band Wi-Fi 11a/b/g/n + Ethernet + MCU
- *Cypress CYW43907 chipset*
- *Processor: ARM Cortex-R4*

Radio-only modules

Type 1FX

Shielded ultra-small Wi-Fi 11b/g/n
- *Cypress CYW43364 chipset*

Type 1DX

Shielded ultra-small Wi-Fi 11b/g/n + Bluetooth 5.1
- *Cypress CYW4343W chipset*

Type 1LV

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43012 chipset*

Type 1MW

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43455 chipset*

Soldered-down in major development platforms

Wireless communications

Many of Murata's extensive range of wireless modules are designed into leading development platforms. These include Linux®, FreeRTOS, etc.

- **NXP i.MX**
  - i.MX 8M Mini EVK - Type 1MW
  - i.MX 8M Nano EVK - Type 1MW
  - i.MX 7ULP EVK - Type 1DX
  - i.MX RT Alexa Voice Board - Type 1DX
- **Cypress WICED**
  - PSoC® 6 WiFi-BT Pioneer Board &
  - Prototyping Kit - Type 1DX/Type 1LV
  - CYW43907 Eval Kit - Type 1GC
- **ST Micro - Linux®**
  - STM32MPI Discovery Kit - Type 1DX
- **Micropython**
  - Arduino Portenta H7 - Type 1DX

Arduino Portenta H7

i.MX 8M Nano EVK

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Smart Infrastructure

Maximizing the efficiency of energy usage

- Smart metering is now an essential element of modern commercial and residential buildings. Through it, utility bills can be kept in check and significant environmental benefits realized.
- Research published by Wood Mackenzie Power & Renewables states that yearly investment in advanced metering infrastructure is continuing to rise. It will surpass $127 billion by 2025, with close to 1.3 billion smart meters in operation globally by that time.
- Smart grid networks require streams of constantly updated data. By leveraging bi-directional communication, supply can be correctly matched with demand.
- Wireless hardware based on cellular IoT protocols (Cat-M1 and NB-IoT) is proving extremely popular in a smart grid context. It allows reasonable amounts of data to be transferred at very low power, while also being simple to implement (as supporting gateway infrastructure does not have to be put in place).
- Murata magnetic sensors are being widely deployed for measuring gas flow and water flow. Alongside these, there are the low power wireless modules for carrying the data required by smart grids, plus the batteries and DC-DC converters for powering this hardware.

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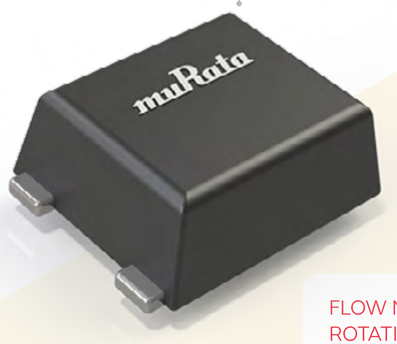
AMR magnetic sensor

Design flexibility, narrower sensitivity range and higher reliability

The AMR series consists of sensors that include an IC to detect changes in the magnetic resistance of a magneto resistive element that is effected by an external magnetic field. This is achieved from a ferromagnetic NiFe alloy thin film that is deposited over the IC circuit. We offer more than 30 models that support a broad range of applications backed by our experienced design consulting service.

MRUS74S
1.5 mm x 1.8mm

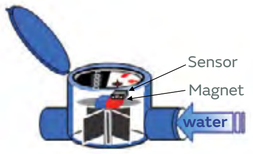


FEATURES

- **Excellent immunity characteristic to electromagnetic waves**
- **Easy human movement detection**
- **Wide detection area using lens**

OPEN-CLOSE DETECTION

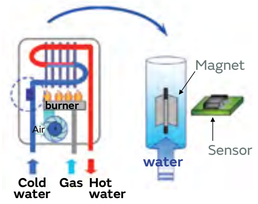
- **Part number:** MRMS20 series
- **Sensitivity (mT):** 0.5 to 2.5
- **Dimensions (mm):** 2.9x2.8x1.1
- **Features:**
  - Std. performance, compact package
- **Applications:**
  - Std. open-close, position detection
  - Low-speed rotation detection



Water meter

FLOW METERING BY ROTATION DETECTION

- **Part number:** MRSS29DR-001
- **Sensitivity (mT):** 1.2 to 3.2
- **Dimensions (mm):** 2.9x2.8x1.1
- **Features:**
  - High voltage operation (3.5 to 30V)
  - High speed detection (Typ. 5kHz)
  - Built-in voltage regulator
- **Applications:**
  - Flow metering for industrial equipment

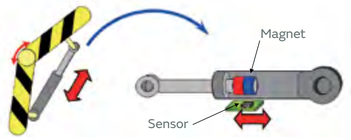


Water boiler

CYLINDER CONTROL BY POSITION DETECTION

- **Part number:** MRMS543E
- **Sensitivity (mT):** 0.5 to 3.1
- **Dimensions (mm):** 1.45x1.45x0.55
- **Features:**
  - High accuracy, high-speed detection (Typ. 500Hz (min.))
  - Built-in temp. compensation circuit
  - Low voltage, low power operation
- **Applications:**
  - Position, proximity detection
  - High-speed rotation detection for industrial equipment

- **Part number:** MRMS541E
- **Sensitivity (mT):** 0.9 to 2.7
- **Dimensions (mm):** 1.45x1.45x0.55
- **Features:**
  - Typ. 1kHz (min.)
  - Built-in temp. compensation circuit
- **Applications:**
  - Position, proximity detection
  - High-speed rotation detection for industrial equipment



Cylinder control

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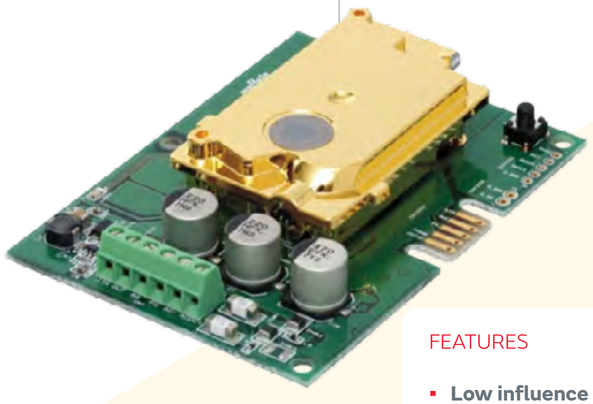
NDIR CO2 sensor

Long-term stability using auto-calibration

Murata's CO2 sensor is a product that exhibits long-term stability and high measurement accuracy. Its maintainability is improved through an automatic calibration feature incorporated. This is based on a unique calibration curve algorithm and a dual wavelength non-dispersive infrared (NDIR) system. One wavelength is for measurement and the other for reference.

IMG-CA0014-00
67 x 92 x 20mm



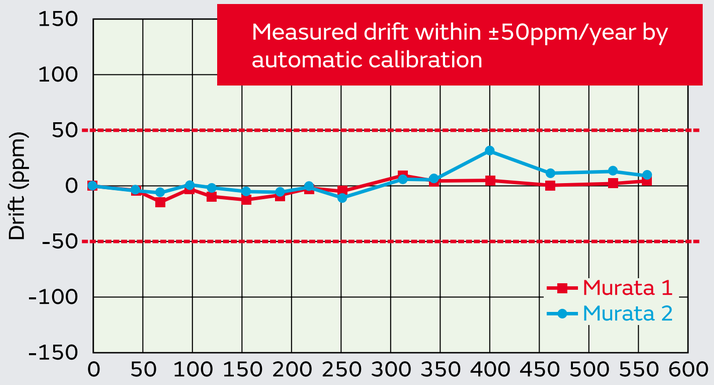
FEATURES

- **Low influence of other gases by NDIR principle**
- **Excellent temperature characteristics and high accuracy**
- **Excellent long-term stability and high reliability by automatic calibration**

PRODUCT SPECIFICATIONS

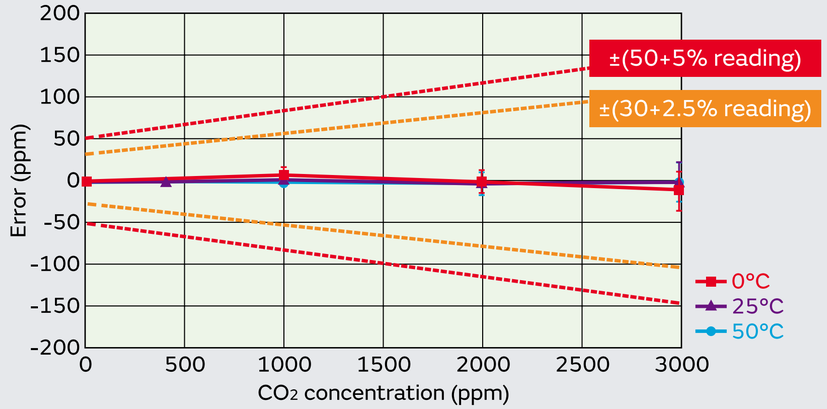
- **Operating temperature:** 0 to 50 °C
- **Storage temperature:** -20 to 50 °C
- **Measurement range:** 0 to 2000ppm, 0 to 3000ppm
- **Accuracy:** ± (50ppm+5% of reading) Typ. ± (30ppm+2.5% of reading)
- **Long-term stability (drift):** ±50ppm/Year @ 1000ppm
- **Power input:** AC/DC 24V, DC12V
- **Peak power consumption:** Avg. 0.5W/Max. 2.0W
- **Output interface:** Analog 0 to 5V
- **Measurement interval:** 5s
- **Dimensions:** 67x92x20mm

Long-term test in building



Tested by TODA Corp.
Tested by standard gas @ 1000ppm

Measurement accuracy



Smart Infrastructure
Sensors

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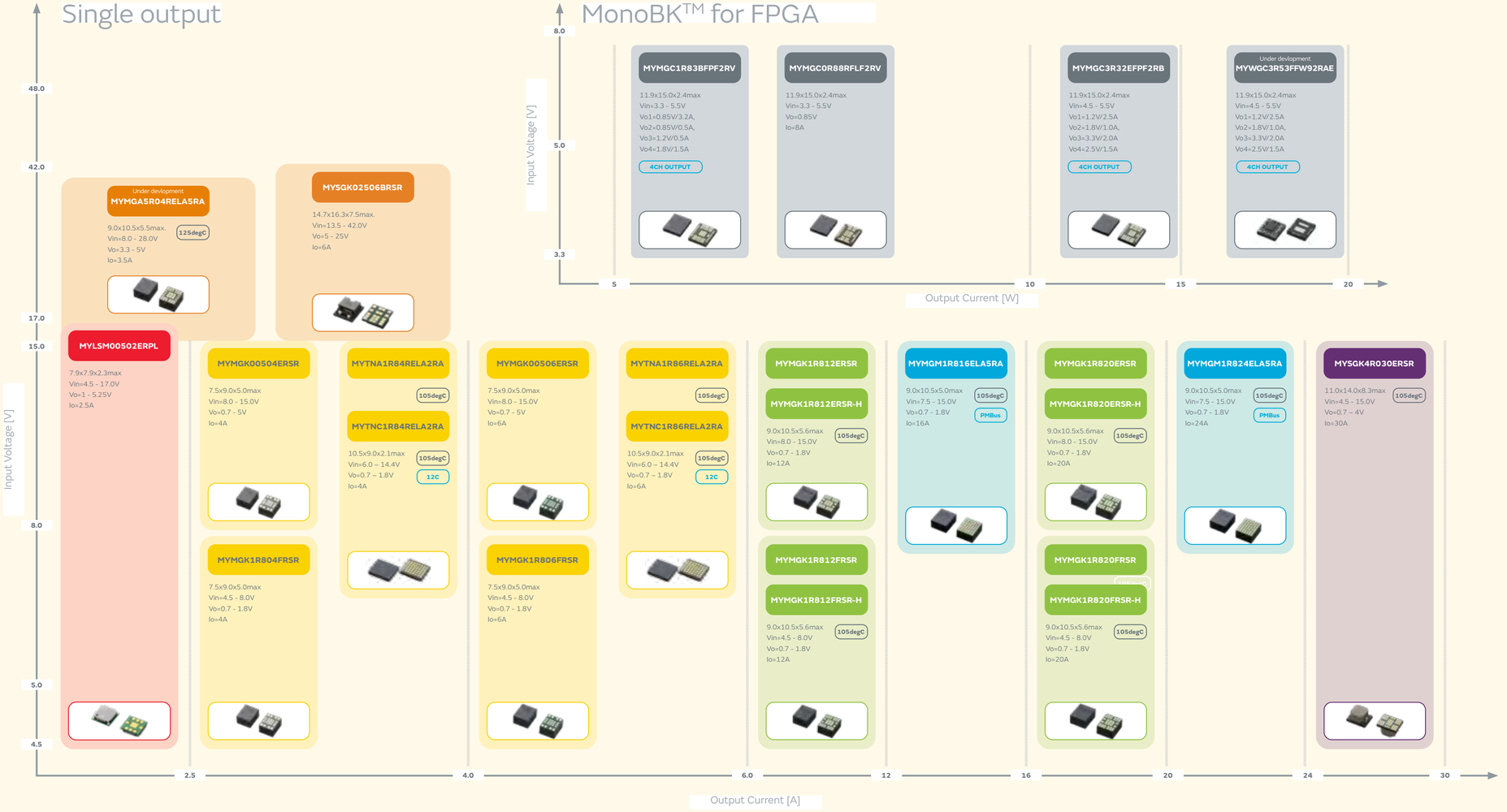
MonoBK™ and UltraBK™

Line-up | Small POL DC-DC converter



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Wi-Fi®
Smart Module

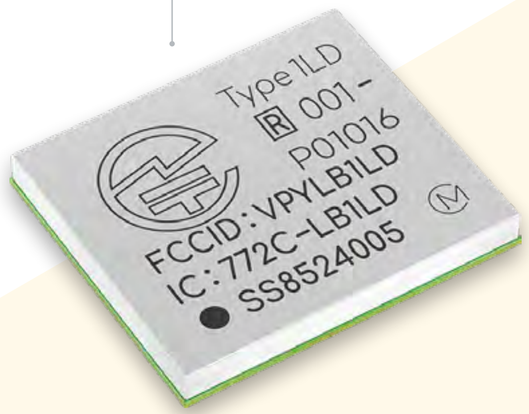
Wireless communications

Type 1LD

Murata is market leader in Wi-Fi® modules for embedded systems, providing superior quality, elevated performance modules for high volume production.

Murata's wireless modules will streamline your assembly operations, thus significantly reducing customer's design time. Additionally, we offer a variety of low-power products for sensor networks.

Type 1LD



APPLICATIONS

- **Home and building automation**
  - Lighting control
  - Heating, Ventilation, Air-conditioning
- **Energy management system (EMS)**
- **Simple sensor network**
- **Home security**
- **Healthcare & fitness**

FEATURES

- **Highly integrated**
- **FCC/IC/CE/TELEC compliant**
- **Shielded Ultra Small Wi-Fi® 11b/g/n + Bluetooth® 5.2 + MCU Module**

PRODUCT SPECIFICATIONS

- **Chipset:**
  - Infineon (CYW43438)
  + STM32 (ARM Cortex-M4F)
- **Size:** 8.9 x 7.8 x 1.2 mm
- **Peripheral Interface:**
  GPIO/SPI/UART/I2C/ADC/PWM
- **Operating Temperature:**
  -40°C to 85°C
- **Package:** Shielded Resin
  Feature rich software hosted on module 802.11 b/g/n 65Mbps, Wi-fi® Stack runs inside, 1MB Flash, 256KB RAM
  Infineon WICED, SPP on Bluetooth® and GATT on Bluetooth® LE are supported by WICED Qualified for AWS IoT Core devices

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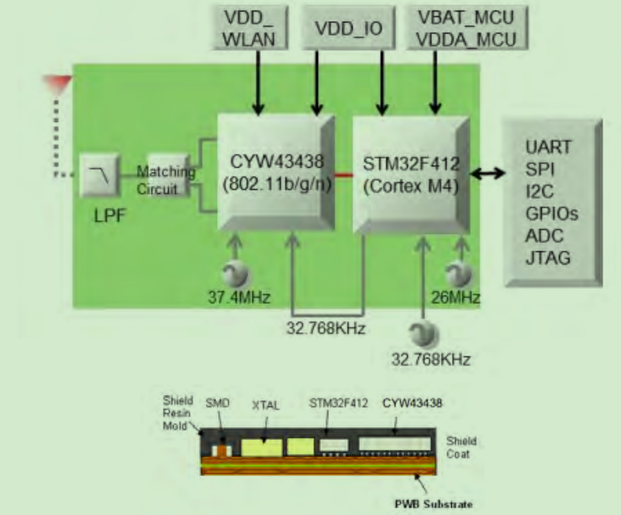

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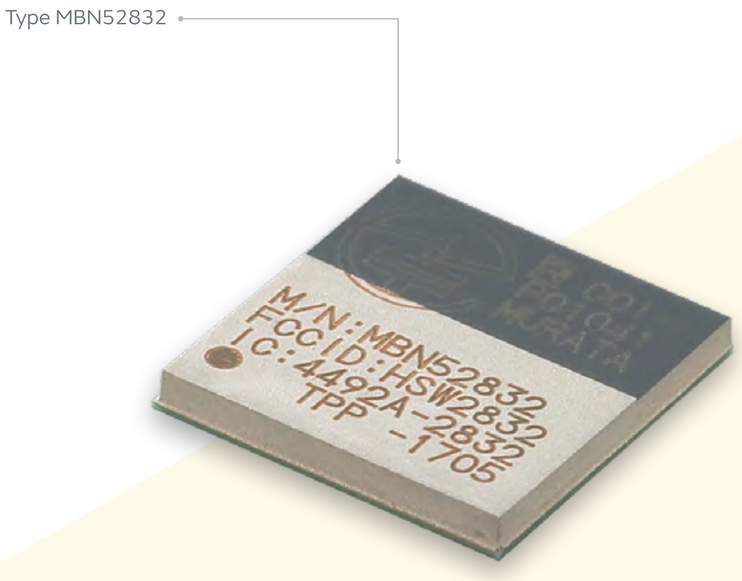
Bluetooth® Low Energy Module

Wireless communications

Type MBN52832

BLE is an ultra-low power communication technology that enables several years of operation off a button battery. Widespread adoption is being seen in fields like health management, fitness and home networks. BLE has also been adopted as a communication method by the Continua Health Alliance, a non-profit organization of healthcare and technology companies.



APPLICATIONS

- **Proximity services**
- **Building automation**
- **Medical/healthcare**
- **Bluetooth beacons**

FEATURES

- **Powerful MCU core with large RAM and flash for user application**
  - ARM Cortex M4; 64K RAM; 512K flash
- **Low power consumption**
  - Tx 7mA @ 3.5dBm (DCDC mode)
  - Rx 6mA (DCDC mode)
- **Rich peripheral interface-20 GPIO ports**
- **Very small size:** 7.4x7.0x0.9mm (max.)
- **Fully certified**
  - FCC (US), IC (Canada), ETSI (EU), TELEC (Japan)
  - BT SIG Certificate
- **Support both on-board and external antenna version**
  - On-board PCB pattern antenna
  - External patch antenna
  - External dipole antenna
- **Bluetooth® 5.0**

PRODUCT SPECIFICATIONS

- **Chipset:** nRF52832 Bluetooth® LE IC
- **Dimension:** 7.4x7.0x0.9mm
- **Package:** LGA
- **Antenna:** on-board or external
- **Max output power:** +4dBm (LDO mode)
- **Interfaces:**
  UART, SPI, 20 GPIO, 5ADC, SWD, PWM, I2C
- **Operating voltage:** 1.7V to 3.6V
- **Operating temperature range:**
  -40 to 85°C
- **OTA firmware upgrade**
- **RoHS compliant**
- **Regulatory certificate:**
  FCC/IC/ETSI/TELEC
- **Bluetooth® SIG qualification**

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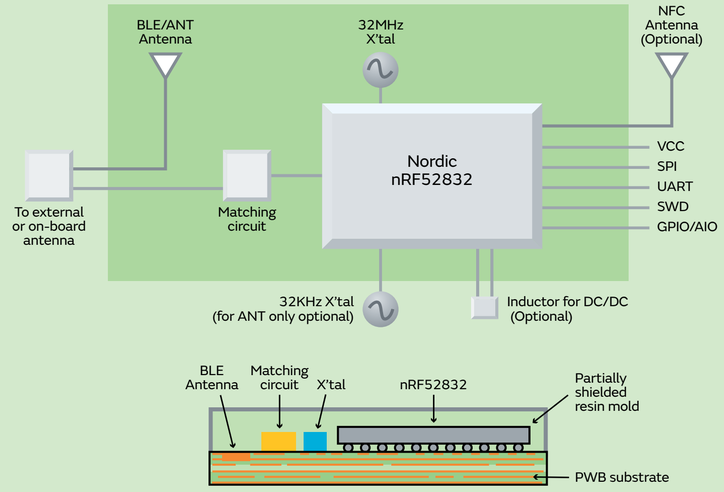

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UWB Modules

Wireless communications

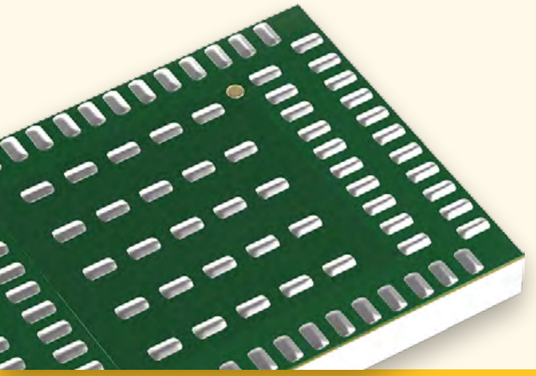
Ultra-wideband (UWB) technology provides a highly effective means for providing secure and precise distance measurement. This is based on determining the time-of-flight (ToF) of radio waves. Murata offers an extensive portfolio of UWB modules.

FEATURES

- **Ultra-small dimensions**
- **High quality**
- **Lower power consumption**

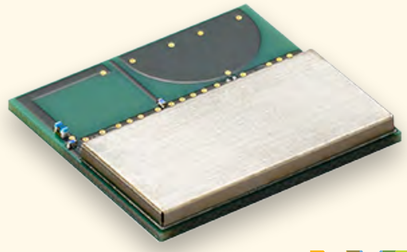
APPLICATIONS

- **Indoor navigation**
- **Smart retail/point-of-sales**
- **Smart building**
- **Smart locks**
- **Tags/tracking**
- **Contactless presence detection**



TYPE 2BP

- **Ultra small UWB module which includes NXP's SR150 UWB chipset, clock, filters and peripheral components.**
- **3 Antenna support (3D AoA or 2D AoA support)**
- **UWB Chip set:** NXP Trimension SR150
- **Antenna:** External



TYPE 2DK

- **All-in-one UWB + Bluetooth LE combo module which integrates NXP Trimension™ SR040 UWB Chipset, NXP QN9090 Bluetooth LE + MCU chipset, On board antenna and peripheral components.**
- **Ideally suited for UWB Tag/Tracker which operates by coin-cell battery, and general IoT devices.**
- **UWB Chip set:** NXP Trimension™ SR040
- **Antenna:** Integrated

TYPE 2AB

- **UWB Chip set : Qorvo DW3110/3120**
- **FCC/IC/TELEC Reference Certified (Planed)**
- **Hostless module Integrated Nordic IC / nRF52840 which also have Blutooth Low Energy function for waking up UWB and updating FW.**
- **Integrated 3-Axis sensor for saving battery**
- **Reference clock for UWB and MCU are embedded**
- **UWB Chip set:** Qorvo DW3110/3120
- **Antenna:** External

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LPWA Modules

Wireless communications

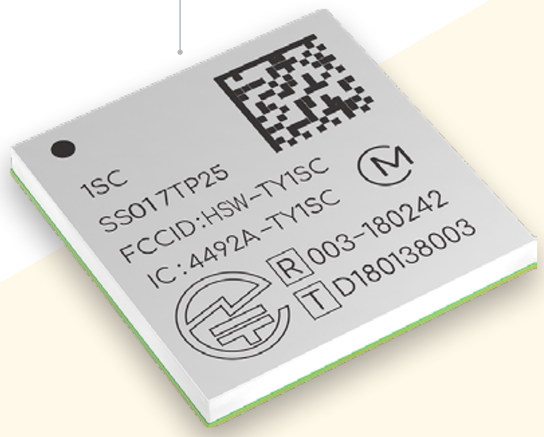
Low power wide area (LPWA) networks provide a power efficient wireless communication technology for interconnecting devices together over a long range. LPWA is most suitable for applications such as IoT and machine-to-machine (M2M) communication, as well as various other situations where lower cost and lower power consumption are required. To respond to customers' needs, Murata has formed strategic partnerships with market leaders, and is accelerating the development of products using this highly appealing emerging technology.

Type 1SC

The Type 1SC (LBAD00XX1SC) module is the world's smallest **Cat. M1/NB-IoT module** with global certification. It supports GPS/GNSS, OpenMCU, Integrated SIM.

Murata has partnered with Truphone, making MVNO network communications possible through the use of eSIM.

Type 1SC
LBAD0XX1SC



FEATURES

- **Small size**
  Size attractive to wearables that previously had no means of cellular connectivity
- **Standardized**
  Through PTCRB/GCF certification improved global interoperability with global wireless networks operators for IoT applications
- **Low power**
  Protocol designed specifically for low current consumption extending battery lifetime up to 10+ years

PRODUCT SPECIFICATIONS

- **Support LTE Band:**
  Low Bands 5,8,12,13,14 (CAT M1 Only), 17,18,19,20,26,28 - Mid Bands 1,2,3,4,25
- **Chipset**: Altair ALT1250
- **Modulation:** LTE Cat.M1/NB-IoT Release 13 (*Release 14 – SW Upgrade)
- **Antenna:** External
- **Type Package:** Resin Mold
- **Dimension**: 11.1 x 11.4 x 1.5 mm (max)
- **Transmit Power:** +23dBm max
- **Sleep Mode Current:**
  eDRX Current Consumption (avg)/LTE-M: 43 uA
  PSM Current Consumption (avg)/LTE-M: 1.4 uA
- **RoHS:** Yes
- **Software Features**: AT commands, IPv4/IPv6 stack with TCP and UDP protocol, SSL/TLS, MQTT, OpenMCU(Optional), GPS/GLONASS(Optional), iUICC(Optional)
- **Certified:**
  FCC/IC/RED/TELEC/KC/NCC GCF/PTCRB
- **Certified Carrier:**
  AT&T, KT, SKT, Pelion, Deutsch Telekom, Vodafone, Softbank, KDDI, Docomo, Soracom, Truphone

APPLICATIONS

- **Smart metering**
- **Smart parking**
- **Home security/home automation**
- **Vehicle fleet management**
- **Wearables/trackers**
- **Industrial M2M communication**
- **IoT edge nodes**

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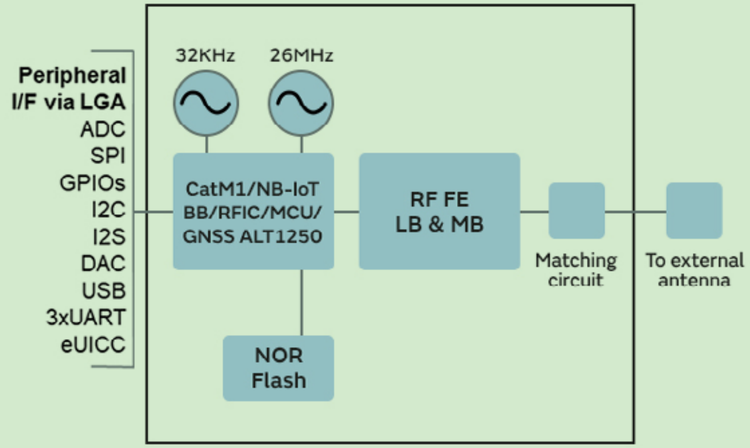

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LPWA Modules

Wireless communications

Type 1SJ

The Type 1SJ (LBAA0QB1SJ) module is one of the smallest **LoRaWAN™** modules in the industry.

This module has a lower power consumption and higher output than previous products. Radio Law certification has already been obtained for major regions.

Open MCU design support is available.

Type 1SJ
LBAA0QB1SJ

APPLICATIONS

- **Smart metering**
- **Smart lighting**
- **Smart parking**
- **Smart agriculture**
- **Industrial M2M**
- **IoT edge nodes**

FEATURES

- **Compact and low cost**
- **Battery life**
  10 years
- **Low Range**
  10km
- **Pre-certified radio regulatory approvals**
  868 & 915 MHz spectrum

PRODUCT SPECIFICATIONS

- **RF/BB chipset:** SX1262
- **MCU chipset:** STM32L0 series
  CPU: Cortex M0+
  RAM: 20KB
  Flash: 192KB
- **Peripheral interfaces:**
  UART/SPI/I2C/GPIOs/ADC
- **Radio certification:**
  FCC, IC, CE
- **Module size:** 10.0x8.0x1.60mm
- **Package:** Shielded Resin Mold
- **Frequencies:** EU / US / India / Pacific
- **Operating temp:** -40 to +85 °C
- **Supply voltage:** 2.2V to 3.6V
- **RF transmit power:**
  +14dBm / +21.5dBm
- **RF sensitivity:** -135dBm
- **Frequency band:** 860MHz-930MHz

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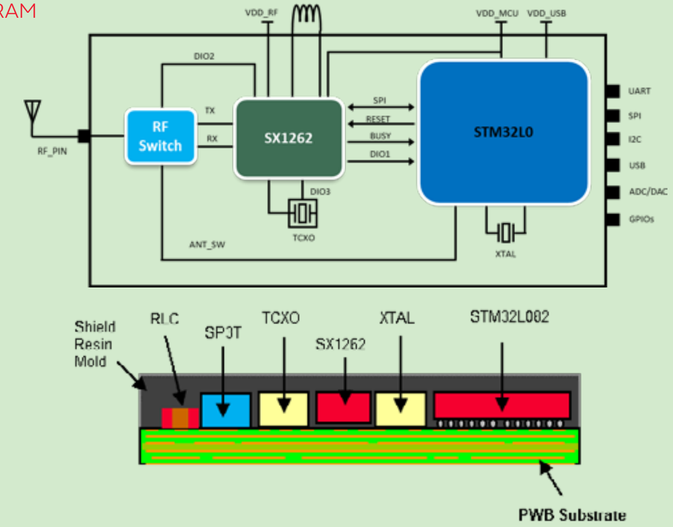

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Modular Solutions

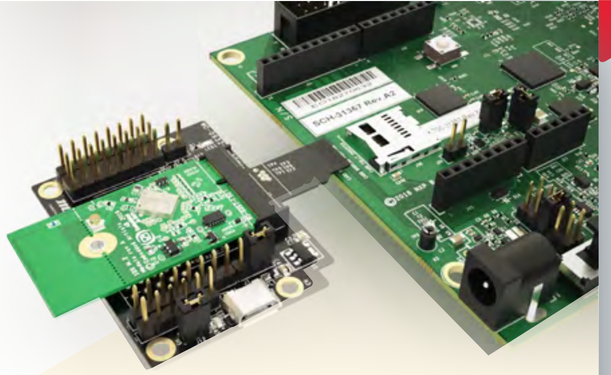
Wireless communications

M.2 boards

Our M.2 modules, co-developed by Embedded Artists, are designed for evaluation, integration and ease-of-use. These professionally designed and proven M.2 modules provide easy evaluation of different Wi-Fi®/Bluetooth® solutions, lower your risk and shorten your time to market.

FEATURES

- **Standard M.2 form factor**
- **Reference-certified antennas & snap-off option**
- **UFL connectors for antenna or conducted testing**
- **Comprehensive interface support including SDIO, PCIe, UART, PCM, and radio control lines**



µSD adapter

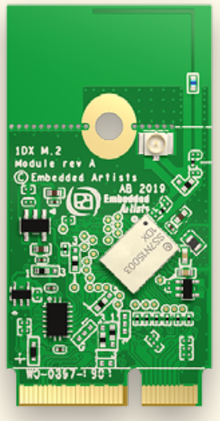
Murata's µSD-M2 adapter board offers an out-of-the-box experience for NXP i.MX with Murata's M.2 module family. All WLAN/BT- necessary signals are included on M.2 connector pins (Key 'E') including:

- **WLAN SDIO**
- **WLAN PCIe**
- **BT H4 UART**
- **BT PCM/I2S**
- **GPIOs**

Type 1XA
Dual band
Wi-Fi®11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (PCIe)

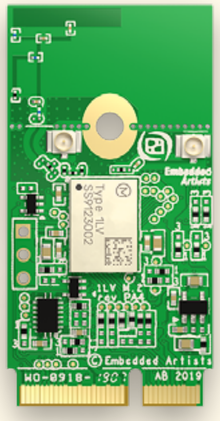
Type 1XZ
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO / RSDB
+ Bluetooth® 5.2 (SDIO)

Type 1YM
Dual band
Wi-Fi® 11a/b/g/n/ac
2x2 MIMO
+ Bluetooth® 5.2



Type 1DX
Wi-Fi® 11b/g/n
+ Bluetooth® 5.1

Type 1MW
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0



Type 1LV
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.0

Type 1ZM
Dual band
Wi-Fi® 11a/b/g/n/ac
+ Bluetooth® 5.1

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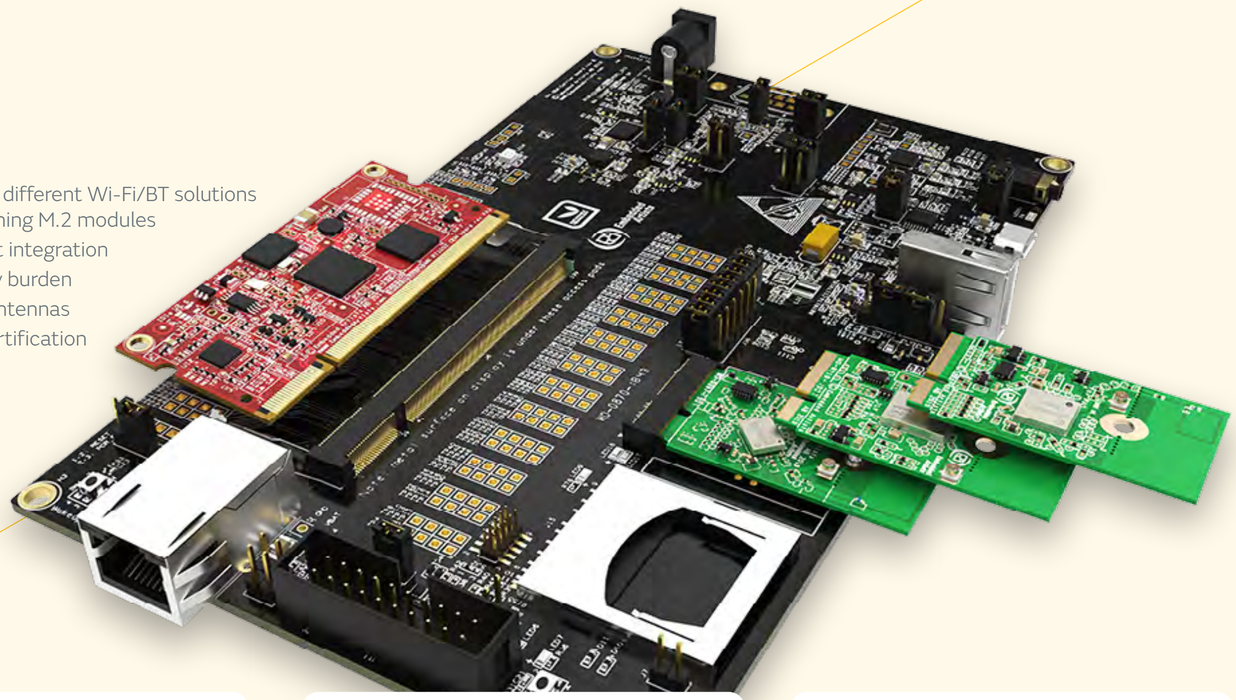
Fully Modular Systems

Wireless communications

Murata and Embedded Artists have developed a full modular system which offers IoT designers a quick, easy and cost-effective route to world-class connectivity.

Development kits are available for use as your evaluation/prototyping platform. The kits include the hardware and software components needed to get up-and-running with your software development on day 1.

- Easily evaluate different Wi-Fi/BT solutions – by just switching M.2 modules
- Fast-to-market integration
- Less regulatory burden
- Use certified antennas
- Re-use FCC certification



1. CHOOSE A COM/OEM BOARD

Embedded Artists have developed a suite of COM computer-on-module (COM) units and OEM boards, integrating all core components around a variety of NXP processors and microcontrollers:

- i.MX RT1062
- i.MX RT1052
- i.MX 8M Quad
- i.MX 8M Mini uCOM
- i.MX 8M Nano uCOM
- i.MX 6Quad
- i.MX 6DualLite
- i.MX 6Ultralite
- i.MX 6SoloX
- i.MX 7Dual
- i.MX 7Dual uCOM
- i.MX 7ULP uCOM

2. PLUG INTO COM CARRIER BOARD

There are two types of carrier boards: One for i.MXRT family boards (with a slot for the COM or OEM board) and one which is suitable for the MPU COM boards and offers...

- Support for i.MX8 designs
- Support for M.2 Key E interface (typically Wi-Fi®/BT), including advanced debug features developed in cooperation with Murata and Cypress
- Support for M.2 Key B interface (typically Cellular/SSD)
- Support for USB 3.0

3. PLUG IN YOUR CONNECTIVITY

Choose the Murata/Embedded Artists M.2 connectivity module appropriate for your application in terms of:

- Performance
- Power consumption
- Range
- Cost
- Temperature range
- Supported standards

4. START YOUR EVALUATION

- Pre-loaded software drivers
- Comprehensive user manuals
- Responsive support

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A Wide Range of Wireless

Communication Modules

Murata offers an extensive portfolio of wireless modules based on Cypress and NXP chipsets.

Modules with integrated MCUs are used in combination with Cypress WICED software. Wi-Fi® and Bluetooth® capabilities are also incorporated and the MCU can be used to run an application.

Other modules are radio-only and they can be used in combination with a MPU (Linux®) or MCU (RTOS).

These modules cover a wide array of different specifications - from single band Wi-Fi® 2.4GHz to dual band Wi-Fi® 11ac 2.4GHz and 5GHz with MIMO. Most of the options also include Bluetooth®.

With this variety of wireless modules Murata can cover a diverse breadth of applications - going all the way from small connected gadgets or sensor nodes to high data rate video streaming devices.

NXP GOLD PARTNER

Module with MCU

Type ABR

802.11 b/g/n WiFi
- *NXP 88MW320 chipset*
- *ARM Cortex-M4 200MHz*

Radio-only modules

Type 1ZM

Wi-Fi 11 a/b/g/n/ac Bluetooth 5.1
- *NXP 88W8987 chipset*

Infineon + CYPRESS

Modules with MCU

Type 1LD

Shielded ultra-small Wi-Fi 11b/g/n+Bluetooth 5.2 + MCU
- *Cypress CYW43438 chipset*
- *STM32 (ARM Cortex-M4F) MCU*

Type 1GC

Shielded ultra-small dual band Wi-Fi 11a/b/g/n + Ethernet + MCU
- *Cypress CYW43907 chipset*
- *Processor: ARM Cortex-R4*

Radio-only modules

Type 1FX

Shielded ultra-small Wi-Fi 11b/g/n
- *Cypress CYW43364 chipset*

Type 1DX

Shielded ultra-small Wi-Fi 11b/g/n + Bluetooth 5.1
- *Cypress CYW4343W chipset*

Type 1LV

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43012 chipset*

Type 1MW

Shielded ultra-small dual band Wi-Fi 11a/b/g/n/ac + Bluetooth 5.0
- *Cypress CYW43455 chipset*

Soldered-down in major development platforms

Wireless communications

Many of Murata's extensive range of wireless modules are designed into leading development platforms. These include Linux®, FreeRTOS, etc.

- **NXP i.MX**
  - i.MX 8M Mini EVK - Type 1MW
  - i.MX 8M Nano EVK - Type 1MW
  - i.MX 7ULP EVK - Type 1DX
  - i.MX RT Alexa Voice Board - Type 1DX
- **Cypress WICED**
  - PSoC® 6 WiFi-BT Pioneer Board &
  - Prototyping Kit - Type 1DX/Type 1LV
  - CYW43907 Eval Kit - Type 1GC
- **ST Micro - Linux®**
  - STM32MPI Discovery Kit - Type 1DX
- **Micropython**
  - Arduino Portenta H7 - Type 1DX

Arduino Portenta H7

i.MX 8M Nano EVK

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CR Batteries

Micro Batteries

Murata offers a wide range of primary micro batteries with high performance and reliability, taking advantage of 40+ years technology development and manufacturing expertise.

FEATURES

- **40+ years technology development and manufacturing expertise.**
- **Acquisition of ISO 9001/14001 certification.**
- **Full automated assembling lines with high productivity.**

Coin Manganese Dioxide Lithium Batteries

- High voltage, high energy density
- Wide range; including heat-resistant models
- ISO/TS16949 certified

Lightweight, High Voltage and High Energy Density

The battery voltage is 3V, almost double that of normal alkaline or manganese batteries.

Excellent discharge characteristics

Voltage characteristics remain stable even for a long period of discharge.

Excellent long-term reliability

Murata's innovative sealing technology minimize battery self-discharge.

Battery	Type	Nominal Voltage	Capacity	Operating Temp.	Features
Coin Manganese Dioxide Lithium (CR)	Standard	3.0V	30-1000mAh	-30 to 70ºC	Lineup of 10 models from small size and thin models to high capacity models
	Extended Temp.	3.0V	220-2000mAh	-40 to 85ºC	Good balance between wide operating temperature and affordability
	Heat resistant	3.0V	210-1000mAh	-40 to 125ºC	Wide operating temperature
	High Drain	3.0V	200-500mAh	-30 to +70ºC	High peak 50mA pulse (x2 times) vs. Standard

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Global Locations

For details please visit www.murata.com

⚠ Note

1 Export Control

For customers outside Japan:

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For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.

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1. *Aircraft equipment*
2. *Aerospace equipment*
3. *Undersea equipment*
4. *Power plant equipment*
5. *Medical equipment*
6. *Transportation equipment (vehicles, trains, ships, etc.)*
7. *Traffic signal equipment*
8. *Disaster prevention / crime prevention equipment*
9. *Data-processing equipment*
10. *Application of similar complexity and/or reliability requirements to the applications listed above*

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5 This catalog has only typical specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

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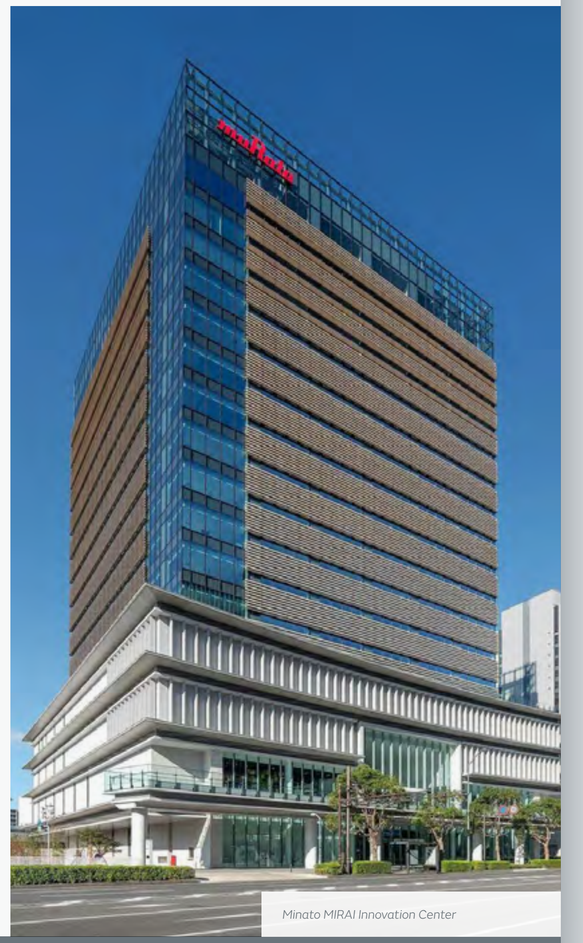

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