RSL15

安森美更高效更智能更安全的BLE5.2蓝牙芯片

March 2022

Presentation Overview – Key Sections

1. Bluetooth® Low Energy – Background, Market Overview
2. The onsemi Bluetooth Low Energy MCU Family
3. RSL15 Value Propositions
4. RSL15 Software Development Kit – Rapid End Application Development
5. Bluetooth Low Energy Use Cases
6. RSL15 Product and Design-in Support

Bluetooth Low Energy

Background, Technology & Market Overview

Background - What We Bring to Bluetooth Low Energy

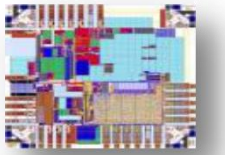
Industrial Solutions Division - Experience & Expertise

Ultra-Low-Power

Based on 20+ years developing DSP systems for hearing aids and wearable devices

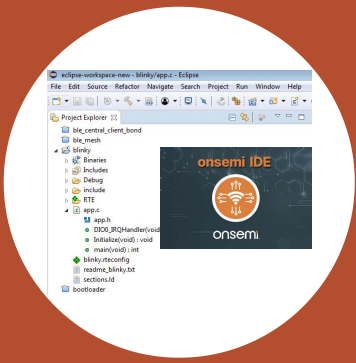
Miniaturization

Advanced 3D packaging technologies and manufacturing facilities



Analog Front End/DSP

Advanced, low-noise sensor interfacing and actuation, signal conversion, and processing



Software Tools

Comprehensive Software Development Kits with samples and tools that enable rapid application development

Market Trends and onsemi Expertise

Societal Trends	Resultant Actions	What onsemi Brings
Energy Efficiency	• Widespread initiatives to reduce overall energy consumption • Shift to sustainable energy – “get more for less”	• Expertise in ultra-low power design • We see a need in the market for enabling the use of smaller batteries or sustainable energy sources
Data Security and Protection	• Protection of individuals’ information • Emphasis on helping people feel safe that their personal information is not compromised	• Expertise in designing secure semiconductor solutions • We see a need in the market for content and data protection and cybersecurity in Bluetooth Low Energy
Big Data and Analytics	• Growing use of data-driven practices in key decision making – politically and economically • Requires large amount of data collection and computations	• Expertise in designing data processing engines • We see a need in the market for being able to wirelessly connect and process data from sensors
Automation and Connectedness	• Increasing levels of automation – less human interaction required in production • Relies on effective and targeted data connections	• Expertise in wireless communication and protocols • We see a need in the market for being able to wirelessly connect industry equipment for greater production output

Focus Markets and Application Areas

AUTOMOTIVE*

	2021	2025E	CAGR
Units	16MU	65MU	32%

Remote Keyless Entry
Tire Monitoring
Battery Monitoring
Connected

HEALTH

Patient Monitoring
Drug Delivery
Life-Critical Devices

	2021	2025E	CAGR
Units	310MU	530MU	11%

INDUSTRIAL

Smart Buildings/Cities
Lighting/ Appliances
Metering
Surveillance
Asset Tracking

	2021	2025E	CAGR
Units	363MU	900MU	18%

DATA TRANSFER

Smartphones
Wireless Charging
Wearables
- Proximity Devices
- Trackers

	2021	2025E	CAGR
Units	941M	1.46B	11%

COMPLEX AUTONOMOUS SYSTEMS

OPTIMIZED RESOURCE CONSUMPTION

SENSOR-DRIVEN DECISION ANALYTICS

ACTIVITY TRACKING & LOCATION AWARENESS

IoT

Source: IHS iSuppli, Strategy Analytics, Databeans, TSR, Gartner, Corporate Marketing, BLE SIG Market Study 2021
*Automotive AEC-Q100 RSL15 to be available in 2022

The onsemi Bluetooth Low Energy MCU Family

RSL15 Secure Wireless MCU

Part of the onsemi Bluetooth Low Energy Family

Qualified for consumer and medical applications

RSL10 QFN

6 x 6

Designed for applications where space is critical

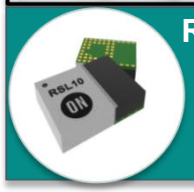
RSL10 WLCSP

2.3 x 2.3

All-in-one solution for easiest design in

Includes antenna, power management, filtering, passive components

Certified to Bluetooth and regional standards



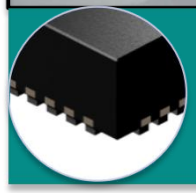
RSL10 System-in-Package (SiP)

6 x 8

Wettable flank-plated QFN

AEC-Q100 qualified (Grade 2)

Higher temperature range (-40 to +105°C)



RSL10 Automotive QFN

7 x 7

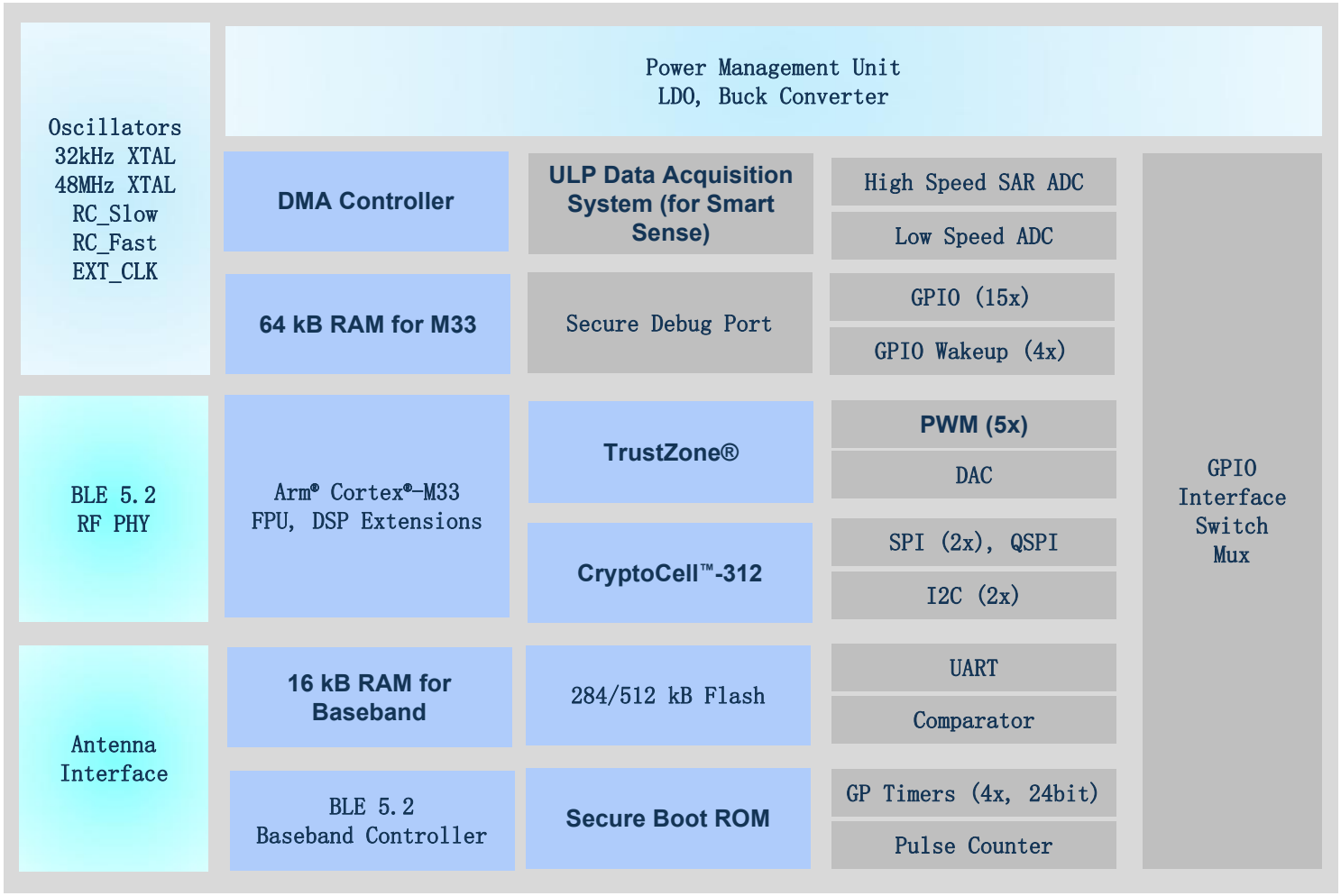
Qualified for industrial IOT applications, smallest QFN

RSL15 QFN

5 x 5

RSL15 Technical Overview – Block Diagram

RSL15 High-Level Block Diagram



RSL15 Key Attribute	Customer Benefit
BLE5.2 Baseband Controller (excl. LE Audio)	• **HW Baseband,** stable connection, minimal processor overheard • **Long Range (Coded PHY)** • **Faster, lower power** FOTA
Internal RF Balun, <500ppm RC Oscillator*	• **Reduced** number of ext. components • **Reduced overall BoM cost**
Built-in PMU (1.2V-3.3V VBAT Typ), Multiple sleep modes	• **Reduced overall BoM cost** • **Optimized** for lowest power consumption
Security (Secure Debug, Secure Keys, CryptoCell, TrustZone)	• **Life Cycle Management** for manufacturing mgmt. incl. secure boot • **No unauthorized access** to proprietary source code
Arm Cortex-M33 processor	• **Industry-recognized** microcontroller core • CMSIS-packs with **numerous samples**

Feature Comparison

Feature	RSL10	RSL15
Arm Core	M3	M33 (FPU/MPU)
DSP	LPDSP32	×
Flash	384kB	284kB / 512kB
RAM	160kB (88kB Data + 72kB Program)	80kB (10x8kB) 16kB: BB + 64kB DRAM
ROM	4kB	20kB
Security	AES128	CryptoCell-312/TrustZone/TRNG
SPI/QSPI	2	2
I^2C	1	2
12-bit PWM	2	5
8-bit PWM	×	1
GPIO	16	16
UART	1	1
ULP Data Acquisition System (for Smart Sense)	×	1
Analog Comparator	×	1

Feature Comparison – continued

Feature	RSL10	RSL15
ADC	4 ext. channels	✓
DAC	×	✓
PCM	✓	✓
Temperature Sensor	×	✓
Current Source	×	✓
Asynchronous Clock Counter	✓	×
Asynchronous Sample Rate Converter	✓	×
Audio Output Driver	✓	×
Timers	4x	4x
Supply Range	1.1V to 3.3V	1.2V to 3.6V
EEMBC ULPMark	1260 @ 2.1V	1220 @ 1.8V
Deep Sleep Mode Power	62.5 nW	75nW
Peak Receiving Power	7mW	9mW
Package	QFN48, 6x6mm, 0.4P WLCSP51, 2.325 x 2.364mm	QFN40, 5x5mm, 0.4P

Key Data Sheet Comparisons

Power Conditions	RSL10 onsemi	RSL15 onsemi	Product A	Product B	Product C
Rx Peak @ 1 Mbps, 1.25V	7.0 mW (5.6 mA)	7.25 mW (5.8 mA)	---	---	---
Rx Peak @ 1 Mbps, 3V	9 mW (3 mA)	8.1 mW (2.7 mA)	13.8 mW (4.6 mA)	10.8 mW (3.6 mA)	20.7 mW (6.9 mA)
Tx Peak @ 0 dBm, 1 Mbps, 1.25V	11.1 mW (8.9 mA)	11.4 mW (9.1 mA)	---	---	---
Tx Peak @ 0 dBm, 1 Mbps, 3V	13.8 mW (4.6 mA)	12.9 mW (4.3 mA)			
Sleep mode, I/O Wake-up, 0kB Retention, 1.25V (**lds1)	68.75nW (55 nA)	75nW (60 nA)	---	---	
Sleep mode, I/O Wake-up, 0kB Retention, 3V (**lds1)	75nW (25 nA)	108nW (36 nA)	2.58 uW (860 nA)	---	450 nW (150 nA)
* Sleep mode, RTC Wake-up, 0kB Retention, 1.25V (**lds7)	112.5 nW (90 nA)	121.25 nW (97 nA)	---		
* Sleep mode, RTC Wake-up, 0kB Retention, 3V (**lds7)	120 nW (40 nA)	171 nW (57 nA)	4.5 uW (1.5 uA)		
* Sleep mode, RTC Wake-up, 8kB Retention, 1.25V (**lds9)	375 nW (300 nA)	418.75 nW (335 nA)	---	---	---
* Sleep mode, RTC Wake-up, 8kB Retention, 3V (**lds9)	300 nW (100nA)	450 nW (150nA)	---	3.09 uW (1.03uA)	---
* Sleep mode, RTC Wake-up, 16kB Retention, 1.25V (**lds11)	---	566.25 nW (453 nA)	---		
* Sleep mode, RTC Wake-up, 16kB Retention, 3V (**lds11)	---	579 nW (193 nA)	---		
* Sleep mode, RTC Wake-up, 24kB Retention, 3V	---	---	---	3.96 uW (1.32uA)	---
* Sleep mode, RTC Wake-up, 32kB Retention, 1.25V (**lds13)	---	851.25 nW (681 nA)	---	---	---
* Sleep mode, RTC Wake-up, 32kB Retention, 3V (**lds13)	---	864 nW (288 nA)	---	4.2 uW (1.4 uA)	---
* Standby mode, RTC Wake-up, 80kB Retention, 3.6V	---	---	---		
* Sleep mode, RTC Wake-up, 256kB Retention, 3V	---	---	9.48uW (3.16 uA)		

Product A >23x more power consumption than RSL15!!!

Product C >4x more power consumption than RSL15!!!

Product A >26x more power consumption than RSL15!!!

Product B >6x more power consumption than RSL15!!!

Product B>4x more power consumption than RSL15!!!

* No Connection
** RSL15 data sheet conditions
--- not specified

Sleep w/ memory retention (typically):
Faster boot/wake times, higher sleep current

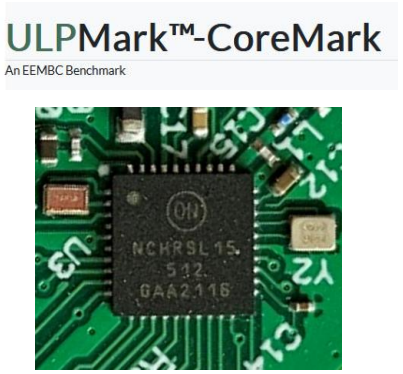
RSL10 & RSL15:
Vbat ≥ 1.8V, Buck Mode
Vbat < 1.8V, LDO Mode

RSL15 Value Propositions

RSL15 Value Propositions

1

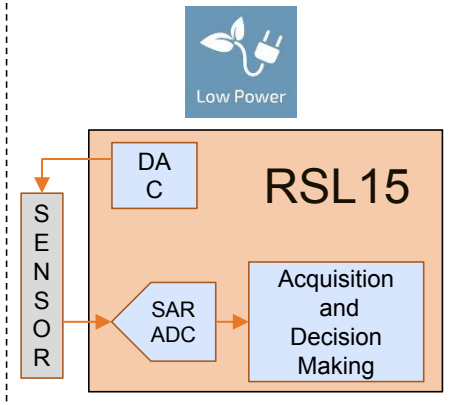
Industry Leading General-Purpose Microcontroller with Easy-to-Use SDK



General Purpose MCU

2

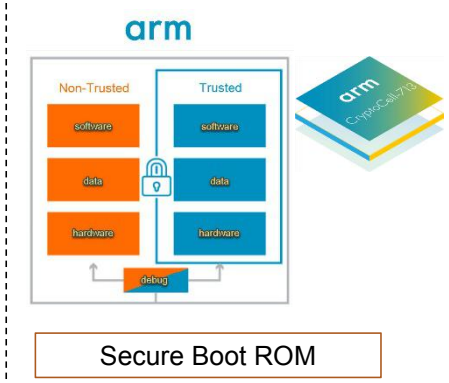
Industry's Lowest Power Flash-based Secure Bluetooth Low Energy MCU



Low Power with Sensor Modes

3

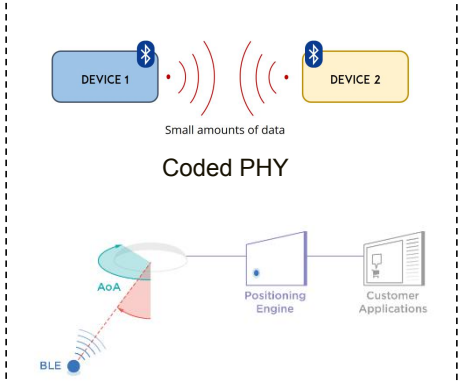
Latest in Embedded Security with Root of Trust



Security

4

Latest in Bluetooth Low Energy with Long Range and Localization



Bluetooth Low Energy 5.2

Images courtesy of Arm and Quuppa

Value Proposition #1: Best Performing General Purpose MCU by Benchmark

EEMBC develops *industry-standard* benchmarks for the hardware and software used in autonomous driving, mobile imaging, the Internet of Things, mobile devices, and many other applications. EEMBC is not affiliated with, or sponsored by, any one microprocessor company, making us completely unbiased.

EEMBC CERTIFIED

CoreMark®

CoreMark is a simple, yet sophisticated benchmark designed specifically to test the functionality of a processor core.

RSL15 CoreMark score of 177
Ahead of competitors in raw processing capability

☐	STMicroelectronics STM32WLEx/5x R...	✓	IAR C/C++ Compiler ...	Code in SRAM	164.60
☐	STMicroelectronics STM32WLEx/5x R...	✓	IAR C/C++ Compiler ...	Flash with ART and p...	163.43
☐	ON Semiconductor RSL10 (ARM Corte...	✓	IAR 8.11.2	SRAM	159.46

ULPMark™-CoreMark

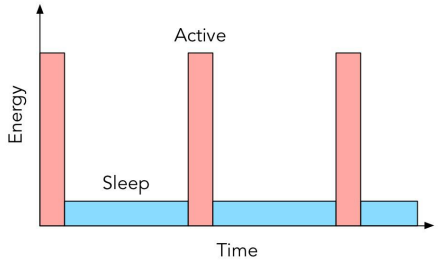
ULPMark-CoreMark is EEMBC's first active-power embedded benchmark, using CoreMark as the workload.

RSL15 is the best in ULPMark-CoreMark
The most efficient MCU in active processing

Hardware	Core	Vendor Score	Cert.	Performance↓
ON Semiconductor RSL15 SV2	ARM Cortex-M33	✓	✓	60.5 1.8V [177]
Eta Compute ECM3531 RevA	Cortex-M3	✓	✓	60.0 2.2V [332]
Dialog Semiconductor DA14531 rev AD	M0+	✓	✓	46.7 1.8V [40.3]
STMicroelectronics STM32U585 RevB	Cortex-M33	✓		35.6 1.8V [627]
STMicroelectronics STM32L452 RevY	Cortex-M4	✓		23.4 2.2V [269]
Dialog Semiconductor DA14585 rev AC	M0	✓	✓	22.9 1.8V [37.4]

ULPMark™-CoreProfile

The ULPMark-CoreProfile benchmark focuses on the MCU's core, specifically the energy cost in sleep, and the transition to and from active mode.

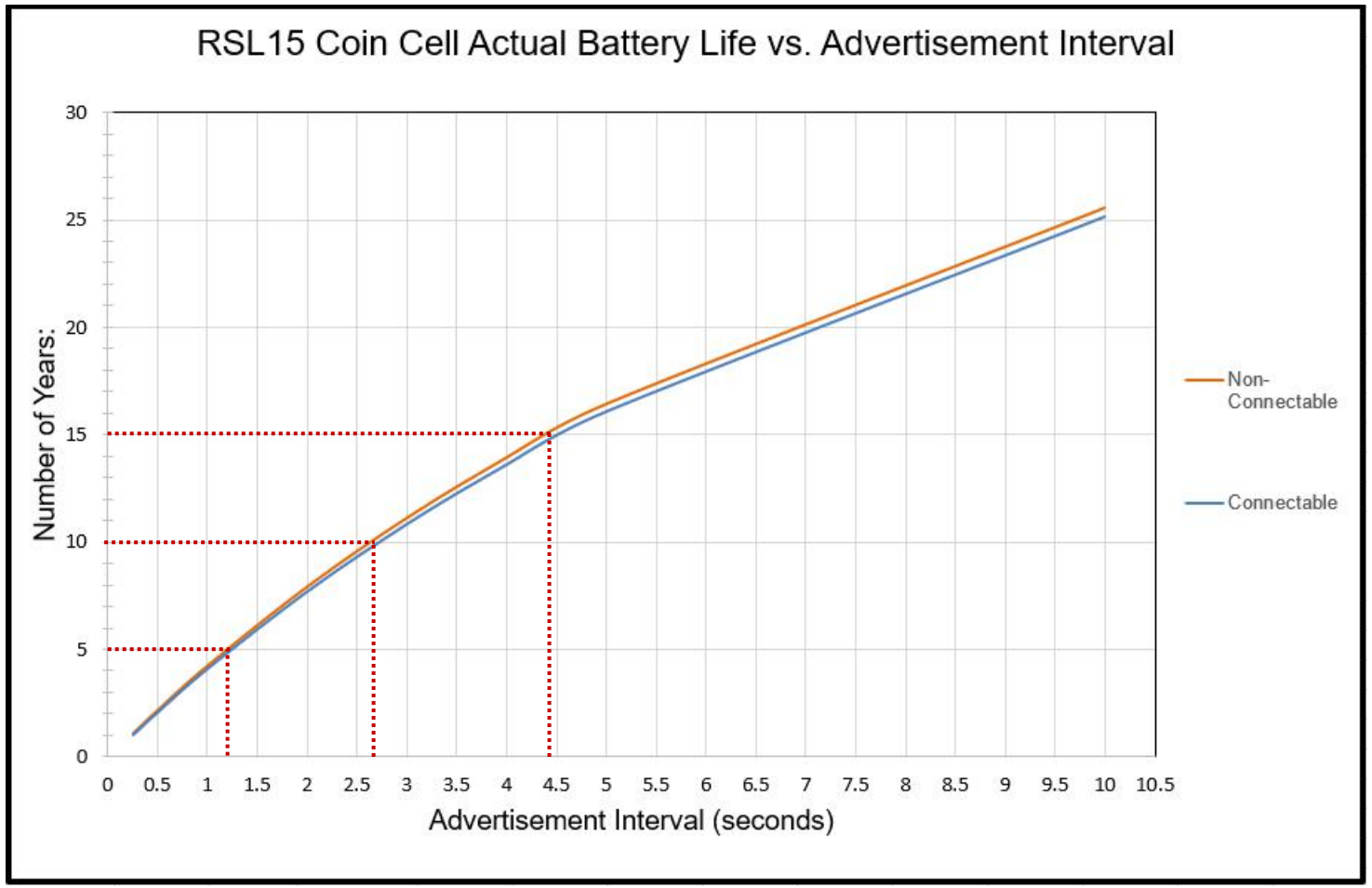


RSL15 ULPMark-CoreProfile score of 1070
Second only to RSL10

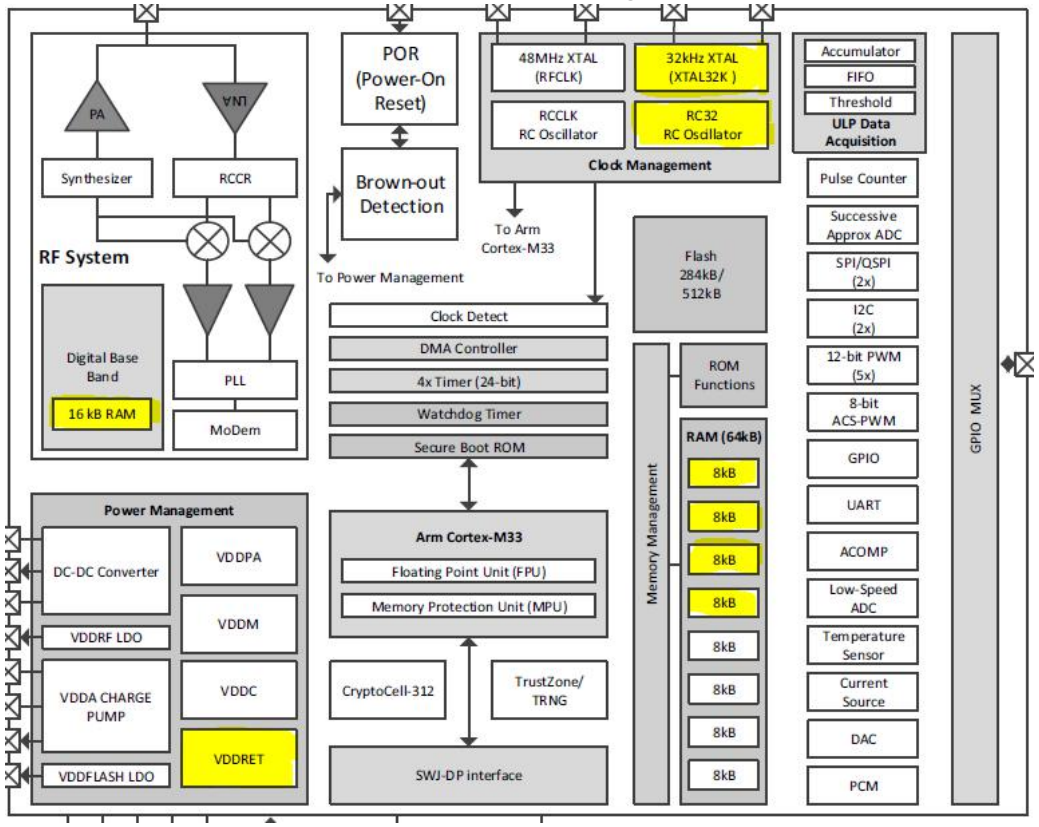
Hardware	Vendor Score	Cert.	Core Profile (3.0 V)↓	Core Profile (User)	Periph. Profile (3.0 V)	Periph. Profile (User)	Date
ON Semiconductor RSL10 Rev 1.0	✓	✓	1090	1260 2.1V			2018-02-08
Nanjing Low Power IC Technology Institute Co., Ltd LP5100 Rev.1	✓	✓	856				2020-11-18
Beijing Zhongke Xinrui Technology Co., Ltd XRM32UL051	✓		451				2021-08-06
Ambiq Micro APOLLO512-KBR Rev.A3			395	553 2.2V	33.0	54.8 2.2V	2017-09-11

onsemi

Value Proposition #2: Power Consumption During Advertising

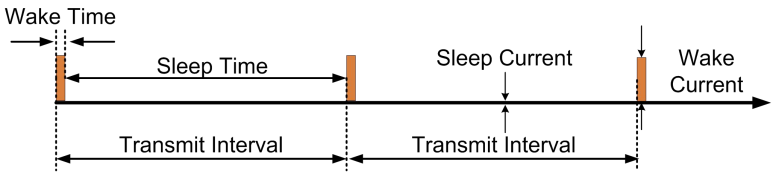


RSL15 Blocks Powered during sleep mode



Conditions:

- Advertisement event on 3 channels per BLE5.2 Specification
- 32kB Memory Retention (48kB Total: 16KB BB + 32kB DRAM) ~4msec Wake Time.
- Payload: 11 bytes
- 0dBm TX power
- Vbat = 3V CR2032, 240mAh coin cell (including 15% Derating, so very conservative)
- Not including coin cell self discharge, and extreme temp fluctuations.



Value Proposition #2: Low Power Modes

- **Sleep** – lowest power mode
- **Standby** – low power with faster wakeup time
- **Idle** – low power with fastest wakeup time
- **Smart Sense** - low power mode to run the SAR ADC to continuously sample and store sensor data at very low system level power consumption

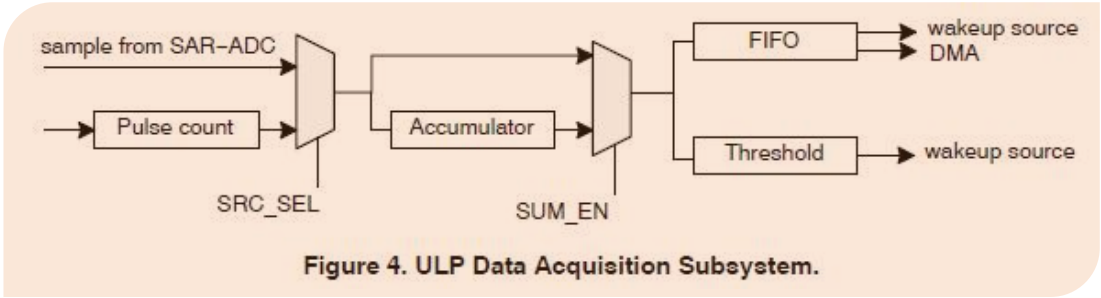
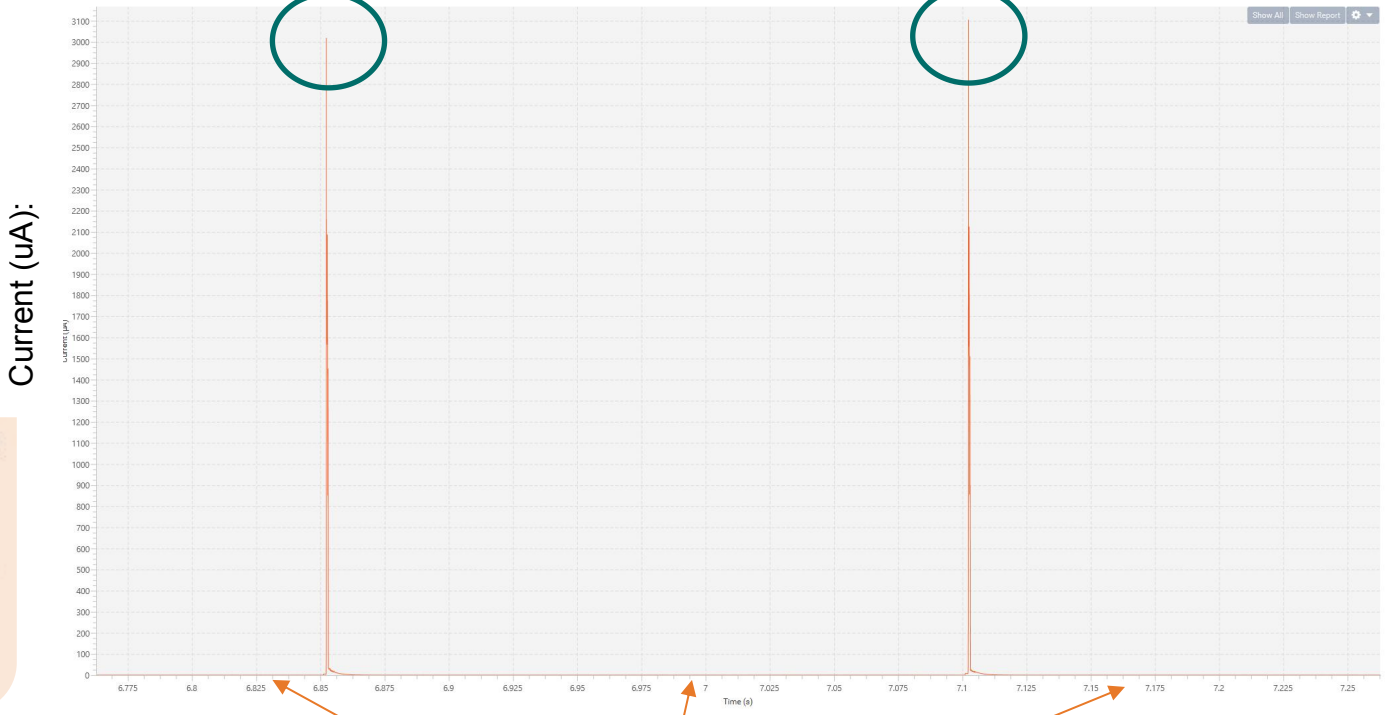


Figure 4. ULP Data Acquisition Subsystem.

Competitors have to stay in run mode to read the ADC

FIFO full interrupt,
Run mode empties FIFO to RAM

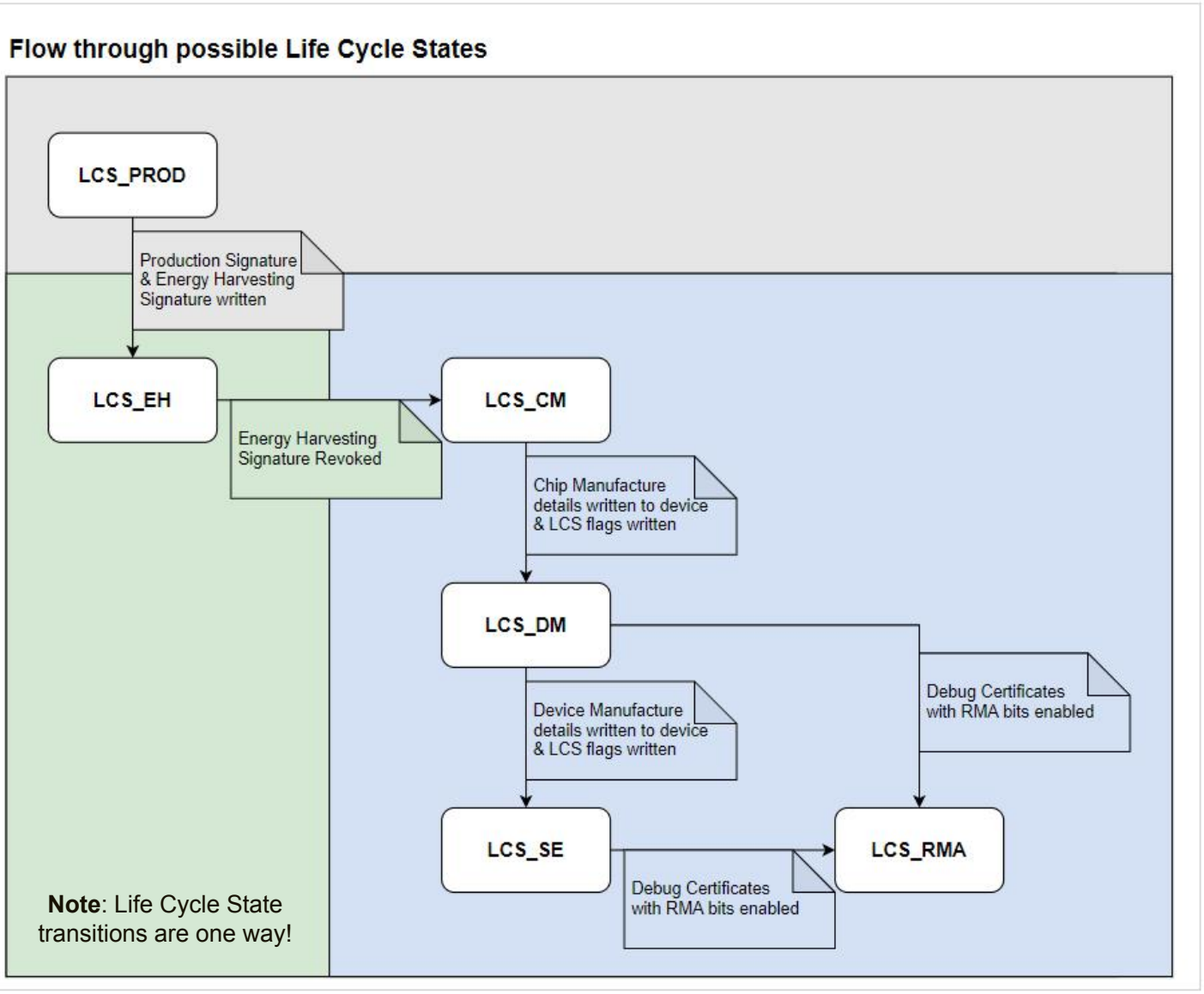


Smart Sense Wake-up Sources:

- ADC Threshold
- Sample FIFO Full
- Pulse Counter

Smart Sense mode
continuously reading ADC, filling FIFO
186nA: wakeup on ADC threshold

Value Proposition #3: Security – Life Cycle States (LCS)



- **Life Cycle States are used to manage the security needed during the various states of a product**
- **Security does not need to be enabled during initial engineering development**
- **Security can then be added gradually as the product changes hands – and end up being fully secure when shipped to the consumer**

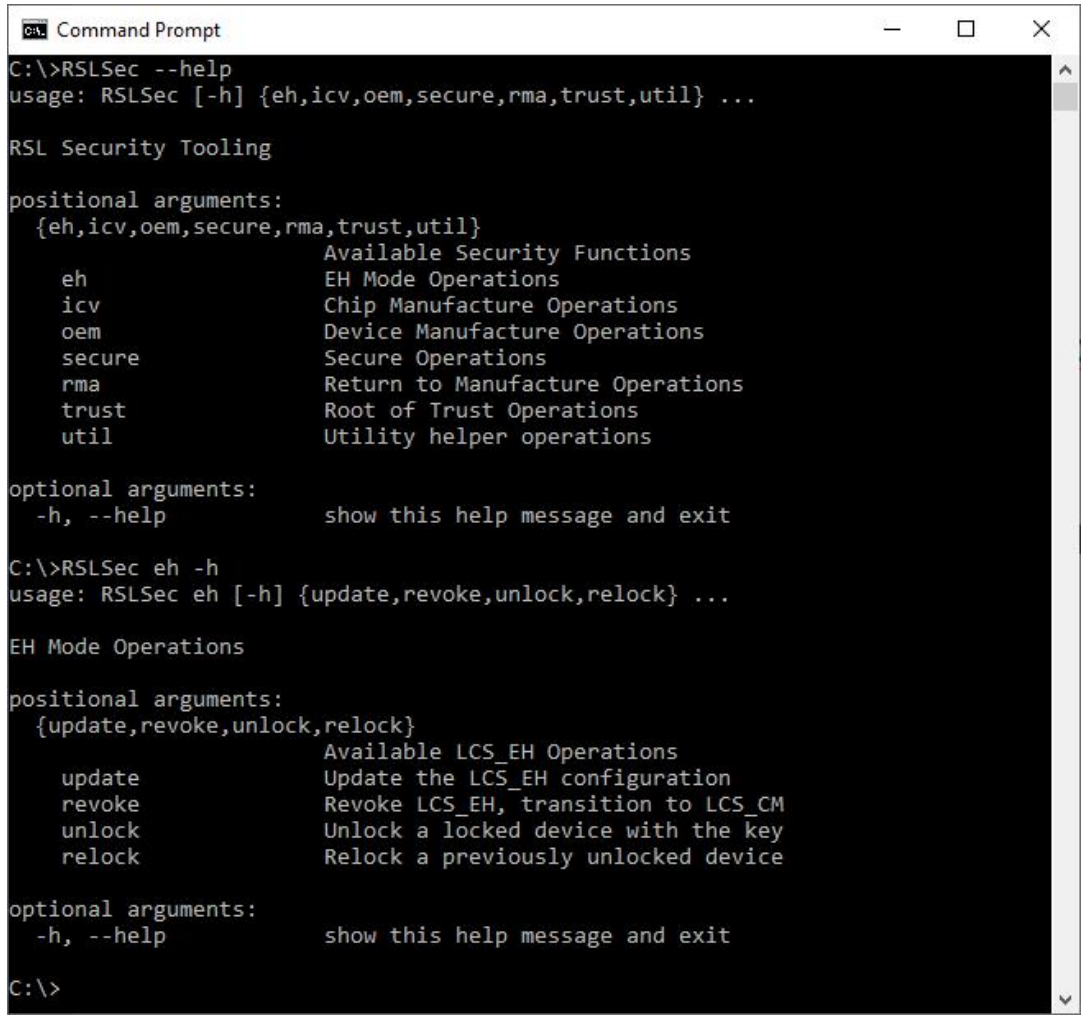
- **Energy Harvesting State (LCS_EH)**
  This is the default state upon delivery from onsemi – it allows the fastest boot to accommodate energy harvesting devices as security is disabled by default
- **Chip Manufacture State (LCS_CM)**
  This state allows provisioning of keys, setting up root of trust and generating encryption keys – typically done to create a first, secure bootloader
- **Device Manufacture State (LCS_DM)**
  Similar to Chip Manufacture State, this state allows provisioning of keys, setting up root of trust and generating encryption keys – typically done to create a second, secure bootloader
- **Secure State (LCS_SE)**
  This is the state used when shipping a device to a customer – no one can alter the content of the device without appropriate authentication
- **RMA State (LCS_RMA)**
  This is the state used if devices are returned from the field to enable troubleshooting

Value Proposition #3: Security – Life Cycle Management

Two components to make use of RSL15 security features:

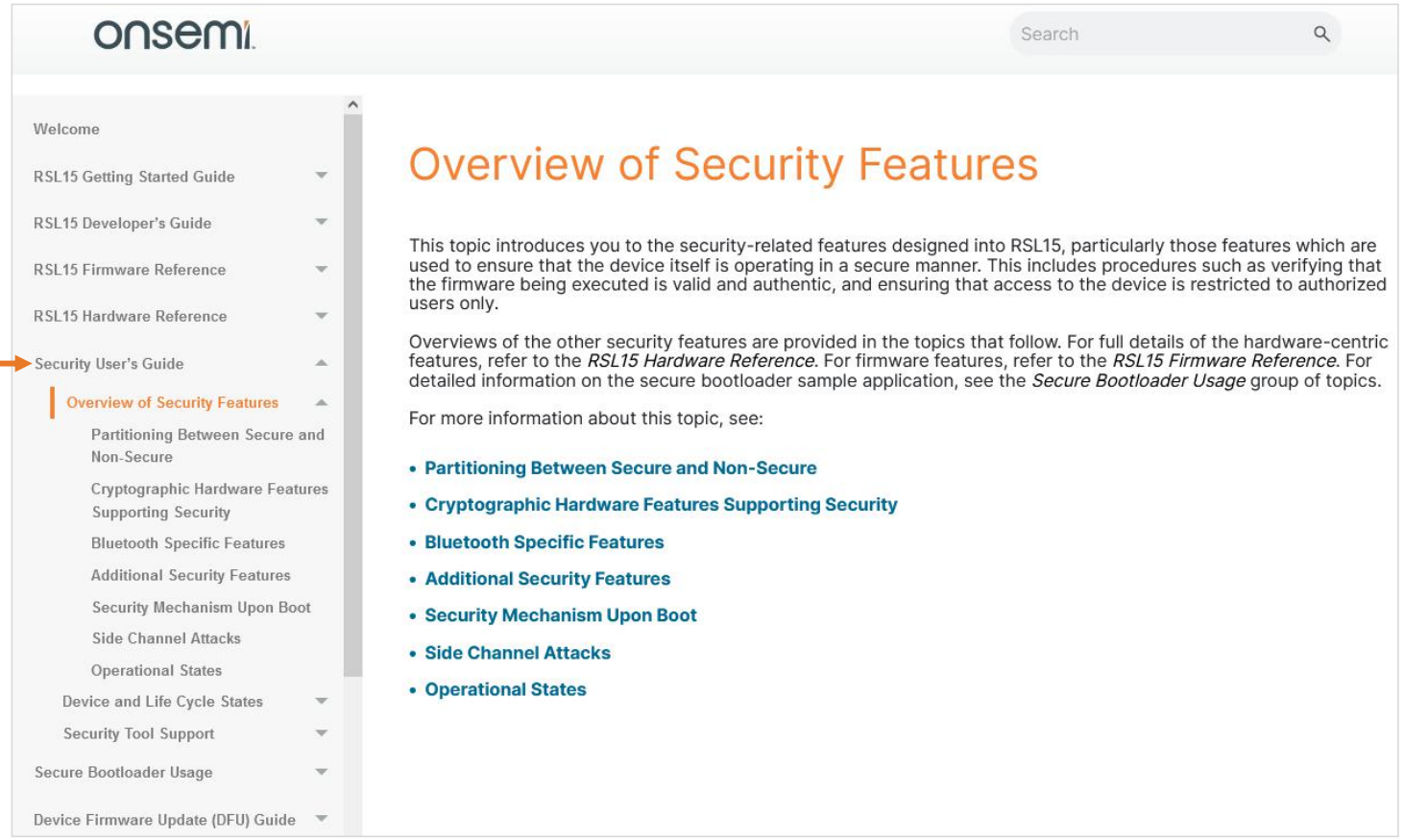
1) Command line PC application *RSLSec*
   - Creation of keys
   - Signing of applications
   - Generation of keys, hashes and certificates
   - Manages LCS and secure debug

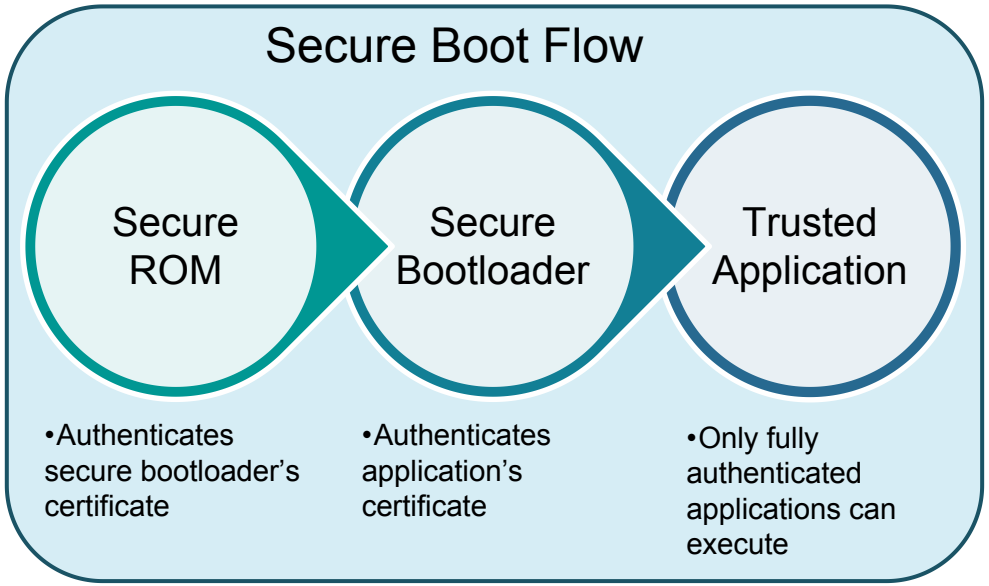
2) Embedded application on RSL15
   - Communicates with *RSLSec*
   - Performs specific lifecycle transition



Value Proposition #3: Security – Documentation

Step-by-step guides to get started with *RSLSec* and make use of RSL15 security





Value Proposition #3: Security – CryptoCell-312 and TrustZone

- True random number generator (TRNG)
- Standard encryption accelerators
- Support for a wide range of encryptions algorithms, including:
  - AES 128/192/256
  - SHA
  - PKI Support (RSA/DSA)
  - Elliptic Curve Cryptography (ECDH/ECDSA)
  - Message authentication (CMAC/HMAC)
- Secure boot embedded in hardware ROM
  - Hardware based Root of Trust using secrets stored in dedicated hardware
  - Multiple roots of trust (ICV/OEM)
  - Managed life cycle model
- Secure key storage
- Secure debug (controlled using certificates)
- Support for trusted execution environments by the incorporation of Arm TrustZone

Value Proposition #4: Latest in Bluetooth Low Energy

- Bluetooth Low Energy core spec 5.2
- All features supported from 5.1 and below
  - Up to 10 simultaneous connections
  - Long Range (Coded PHY)
  - 2 Mbit PHY (High Speed)
  - Angle of Arrival (AoA) and Angle of Departure (AoD)
  - Extended advertising
  - Backwards compatibility and support for earlier Bluetooth Low Energy specifications including 5.1, 5.0, 4.2, 4.1 and 4.0

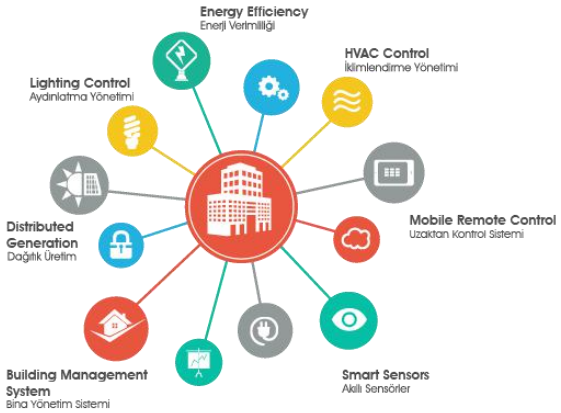
Value Proposition #4: Real-Time Localization Systems Use Cases and Concepts

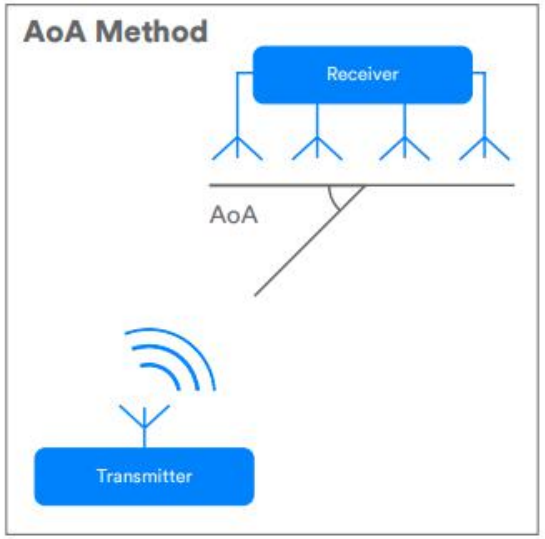
Localization Use Cases

Asset Tracking & Monitoring

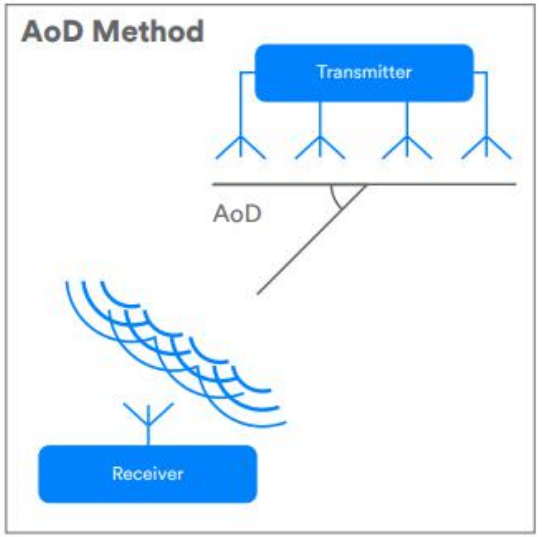
Industrial Automation

Smart Buildings





Bluetooth direction finding using angle of arrival (AoA)



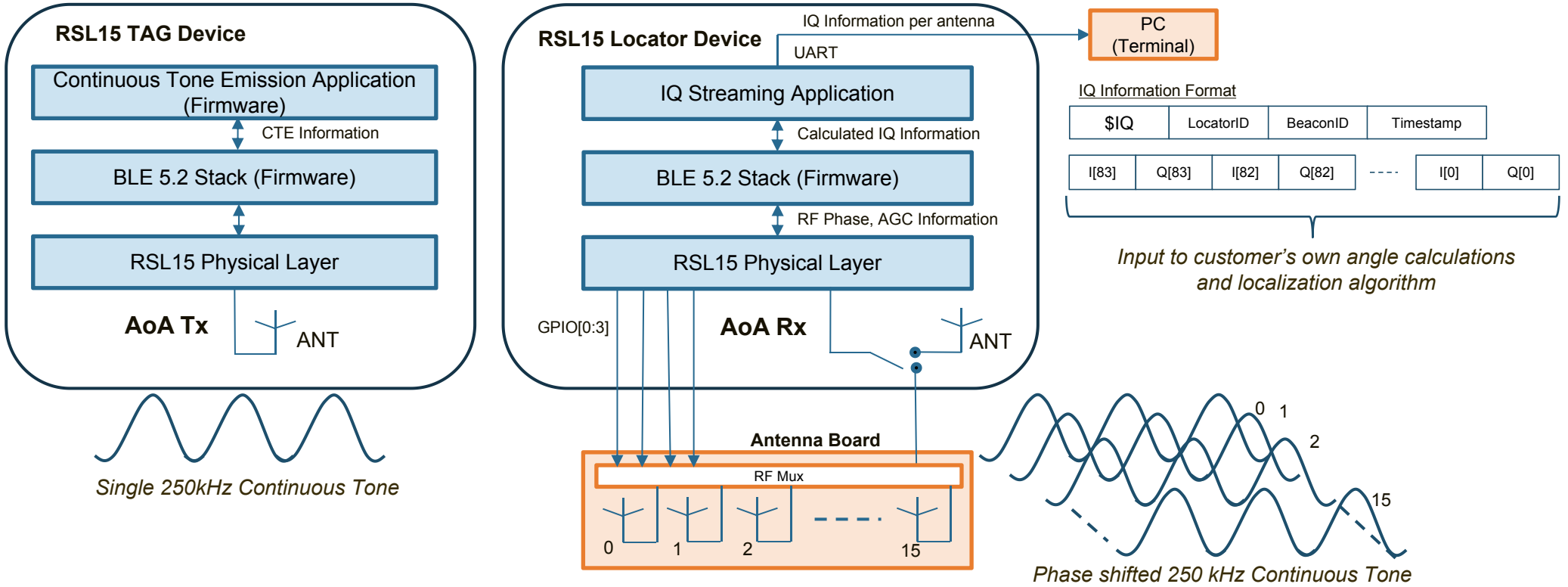
Bluetooth direction finding using angle of departure (AoD)

Localization Concepts

- **Trilateration** – localization based on RSSI – supported by RSL10/15
- **Angle of Arrival (AoA), Angel of Departure (AoD)** – supported by RSL15
- **Phase-based (HADM)–** localization based on phase difference between transmitted and received (reflected) signals – not supported by RSL10/RSL15

Images courtesy of Bluetooth SIG

Value Proposition #4: Localization Enablement



Localization Commands:

GAPM_PER_SYNC_IQ_SAMPLING_CTRL_CMD
GAPM_PER_ADV_IQ_REPORT_IND
GAPM_PER_ADV_CTE_TX_CTL_CMD

GAPC_CTE_TX_CFG_CMD
GAPC_CTE_RX_CFG_CMD
GAPC_CTE_REQ_CTRL_CMD
GAPC_CTE_RSP_CTRL_CMD
GAPC_CTE_IQ_REPORT_IND

Design Comments:

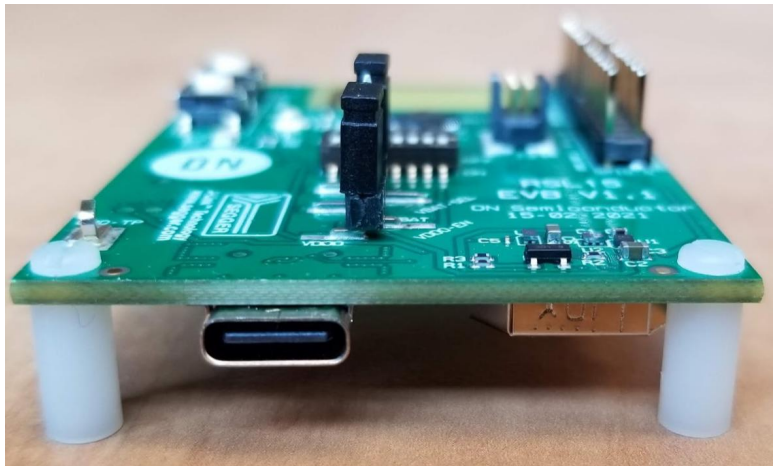
- Antenna boards with RF-mux not offered by onsemi but can be purchased from www.corehw.com or others
- Method to physical connect antenna board to RSL15 EVB will vary and software may need to be adapted

RSL15 Software Development Kit

Rapid End Application Development

RSL15 EVB - ‘Out-of-the-Box’ Experience

- Clean design for improved ease of use
- Connects to *RSL15 Central* mobile app out of the box
- CR2032 coin-cell battery holder



RSL15 Software Ecosystem Overview

Download at www.onsemi.com/rsl15

Downloads	Software Product	Description	Version	Date Updated
Download	RSL15 Documentation Package	Start here. Getting Started Guide, Developer's Guide and detailed firmware and hardware documentation	1.0	Nov 2021
Download	onsemi IDE Installer	Eclipse-based onsemi IDE	4.1.2	Dec 2021
Download	RSL15 Firmware Package	RSL15 CMSIS-Pack containing drivers, libraries, and sample code and SDK release notes	1.0	Nov 2021
Download	RSLSec	PC application to manage device security features, lifecycle states and the manufacturing provisioning process	1.0	Nov 2021
Download	BLE Explorer	PC application that acts as a Bluetooth central to your peripheral device (requires RSL10-USB001GEVK)	1.8	Nov 2021
Download	RF Tools	PC application to help test, tune and validate Bluetooth Low Energy RF PHY performance	1.0.2	Dec 2021

Visit the **Community Forums** to learn more and join the conversation.

arm KEIL

Searchable HTML documentation

Includes support for Keil µVision® IDE

Mobile app downloads:
- Android - RSL15 Central, RSL FOTA
- iOS - RSL15 Central, RSL FOTA

App source code available by request

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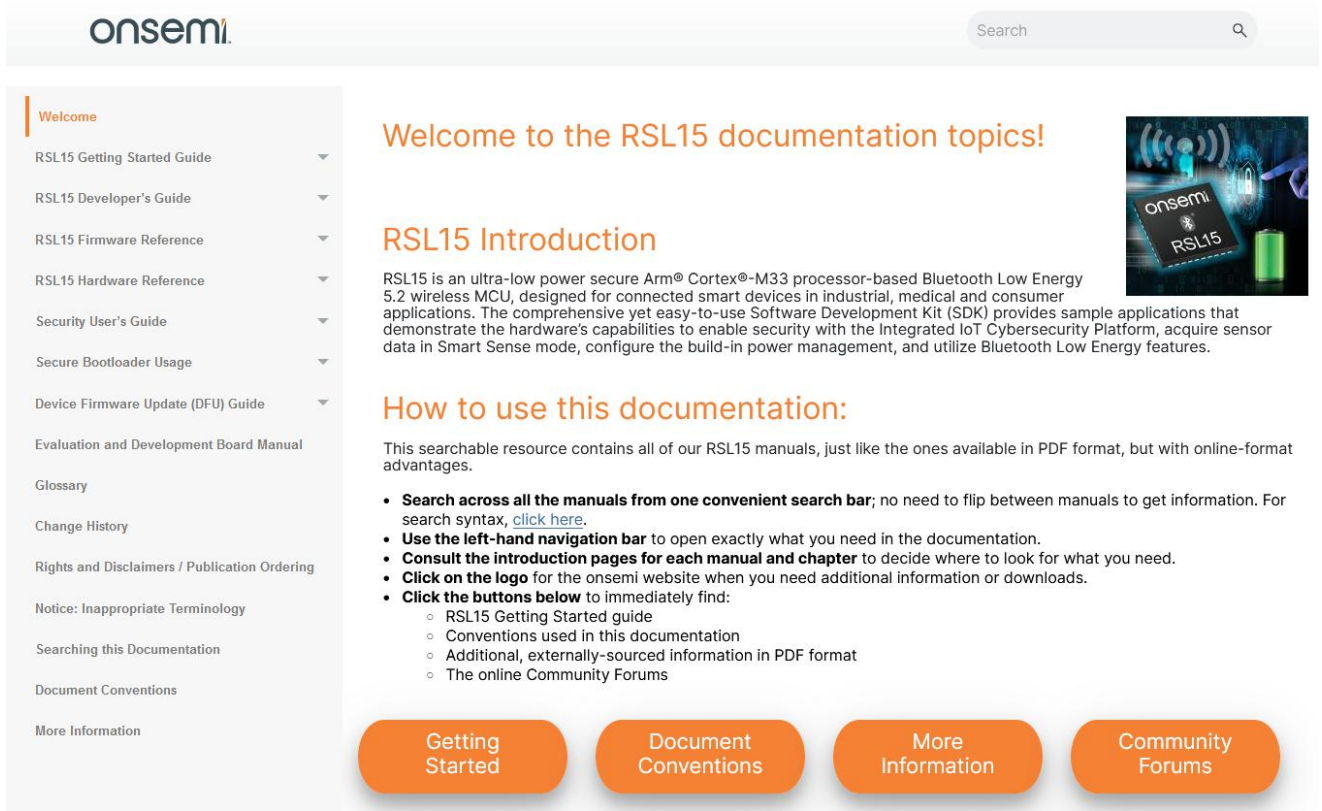
Firmware Samples

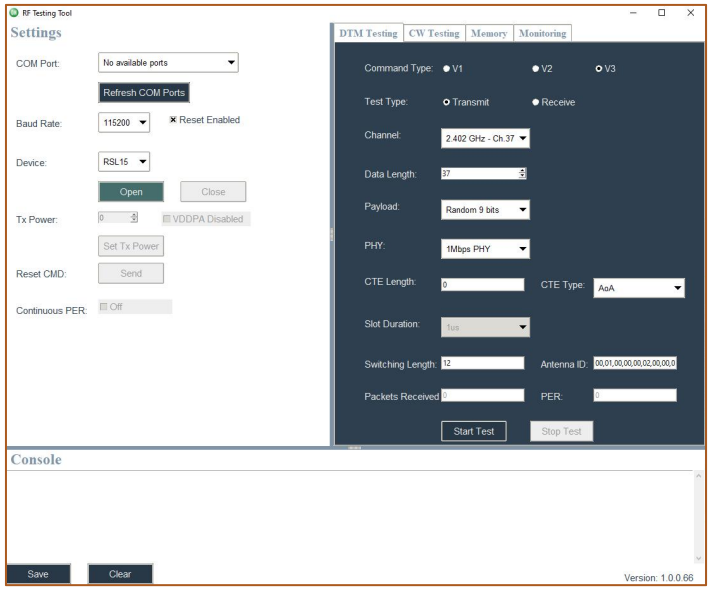
- ***ble_**** samples for BLE connectivity
- ***_cmsis*** peripheral drivers
- ***sleep_mode*** and ***standby_mode*** for power mode samples
- ***CC312**** for CryptoCell-312 encryption samples
- ***swmTrace*** for printing and logging

Example	Action	Description
ble_advertiser_DF (RSL15 Evaluation Board)	Copy	BLE Advertiser Directional Finding Sample Code
ble_central_client (RSL15 Evaluation Board)	Copy	BLE Central Client Sample Code
ble_central_DF (RSL15 Evaluation Board)	Copy	BLE Central Directional Finding Sample Code
ble_peripheral_cntl_priv (RSL15 Evaluation Board)	Copy	BLE Peripheral Server Controller Privacy Sample Code
ble_peripheral_DF (RSL15 Evaluation Board)	Copy	BLE Peripheral Directional Finding Sample Code
ble_peripheral_server (RSL15 Evaluation Board)	Copy	BLE Peripheral Server Sample Code
ble_peripheral_server_sleep (RSL15 Evaluation Bo	Copy	BLE Peripheral Server Sleep Sample Code
ble_peripheral_server_standby (RSL15 Evaluation	Copy	BLE Peripheral Server Standby Sample Code
ble_radioADC_IQ (RSL15 Evaluation Board)	Copy	BLE Radio ADC and IQ Sampling Steaming Sample Code
ble_scanner_DF (RSL15 Evaluation Board)	Copy	BLE Scanner Directional Finding Sample Code
blinky (RSL15 Evaluation Board)	Copy	Blinky Sample Code
blinky_fota (RSL15 Evaluation Board)	Copy	Blinky FOTA Sample Code
bootloader (RSL15 Evaluation Board)	Copy	Bootloader Sample Code
calibratelib_sample (RSL15 Evaluation Board)	Copy	Calibratelib Sample Code
CC312_AES (RSL15 Evaluation Board)	Copy	AES Sample Code
CC312_AES_256_CTR (RSL15 Evaluation Board)	Copy	AES-CTR Profiling Sample Code
CC312_CCM (RSL15 Evaluation Board)	Copy	CCM Sample Code
CC312_CMAC (RSL15 Evaluation Board)	Copy	CMAC Sample Code
CC312_ECDH (RSL15 Evaluation Board)	Copy	ECDH Sample Code
CC312_ECDSA (RSL15 Evaluation Board)	Copy	ECDSA Sample Code
CC312_HMAC (RSL15 Evaluation Board)	Copy	HMAC Sample Code
CC312_HMAC_Interleaved (RSL15 Evaluation Boa	Copy	HMAC Interleaved Sample Code
CC312_QuickStart (RSL15 Evaluation Board)	Copy	Crypto Quick Start Sample Code
CC312_RSA (RSL15 Evaluation Board)	Copy	RSA Sample Code
CC312_SHA (RSL15 Evaluation Board)	Copy	SHA Sample Code
CC312_TRNG (RSL15 Evaluation Board)	Copy	TRNG Sample Code
CC312_TRNG_Self_Test (RSL15 Evaluation Board)	Copy	TRNG Self Test Sample Code
dma_driver (RSL15 Evaluation Board)	Copy	DMA Driver Sample Code
flash (RSL15 Evaluation Board)	Copy	Flash Sample Code
hardfault_handler (RSL15 Evaluation Board)	Copy	HardFault Handler Sample Code
hci_app (RSL15 Evaluation Board)	Copy	BLE HCI Sample Code
i2c_cmsis (RSL15 Evaluation Board)	Copy	I2C CMSIS-Driver Sample Code
lsad (RSL15 Evaluation Board)	Copy	LSAD Sample Code
print_device_info (RSL15 Evaluation Board)	Copy	Print Device Info Sample Code
sleep_mode (RSL15 Evaluation Board)	Copy	Sleep Mode Sample Code
spi_cmsis (RSL15 Evaluation Board)	Copy	SPI CMSIS-Driver Master Sample Code
spi_master_cmsis (RSL15 Evaluation Board)	Copy	SPI CMSIS-Driver Master Sample Code
spi_slave_cmsis (RSL15 Evaluation Board)	Copy	SPI CMSIS-Driver Slave Sample Code
standby_mode (RSL15 Evaluation Board)	Copy	Standby Mode Sample Code
swmTraceExample (RSL15 Evaluation Board)	Copy	SwmTrace Sample Code
timer_driver (RSL15 Evaluation Board)	Copy	Timer Driver Sample Code
timer_free_run (RSL15 Evaluation Board)	Copy	Timer Free Run Sample Code
trustzone_non_secure (RSL15 Evaluation Board)	Copy	Trustzone non-secure Sample Code
trustzone_secure (RSL15 Evaluation Board)	Copy	Trustzone secure Sample Code
uart_cmsis (RSL15 Evaluation Board)	Copy	UART CMSIS-Driver Sample Code

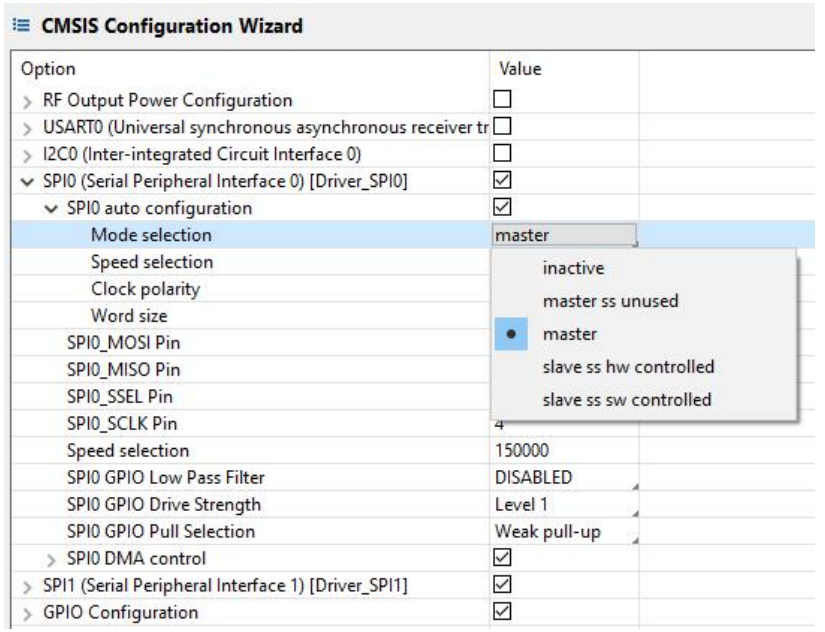
Easy-to-Use Development Tools

- Free Eclipse-based onsemi IDE for RSL10 and RSL15
- Support for Keil development environment
- Convenient CMSIS-Pack with code generation wizards
- Fully searchable HTML documentation
- RF Testing Tool for antenna development as well as pre-certification assessments



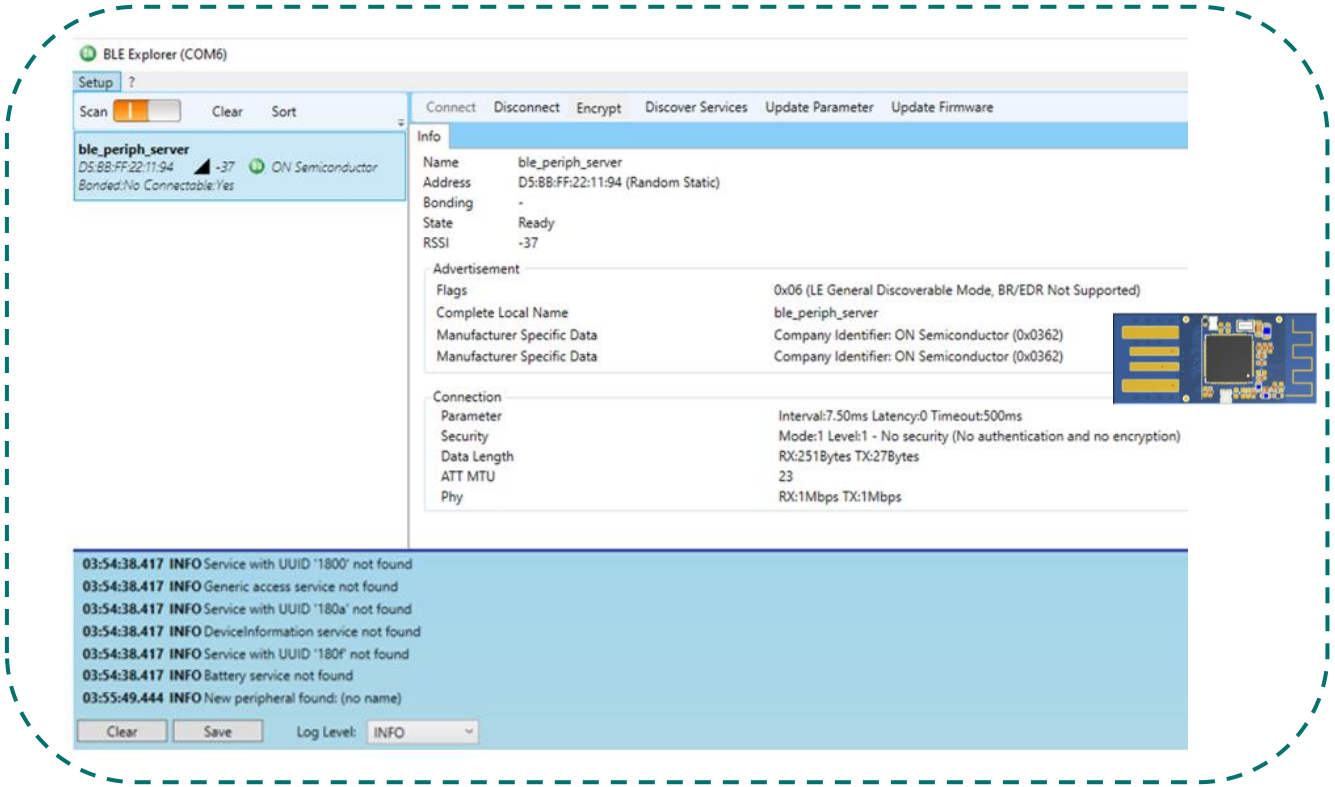


RF Testing Tool



BLE Explorer – PC Application with RSL10 USB Dongle

- Acts as a BLE central device to your RSL15 peripheral application under development
- Visualizes data, logs the wireless interactions and even displays beacon data
- Discovers peripheral services and performs FOTA



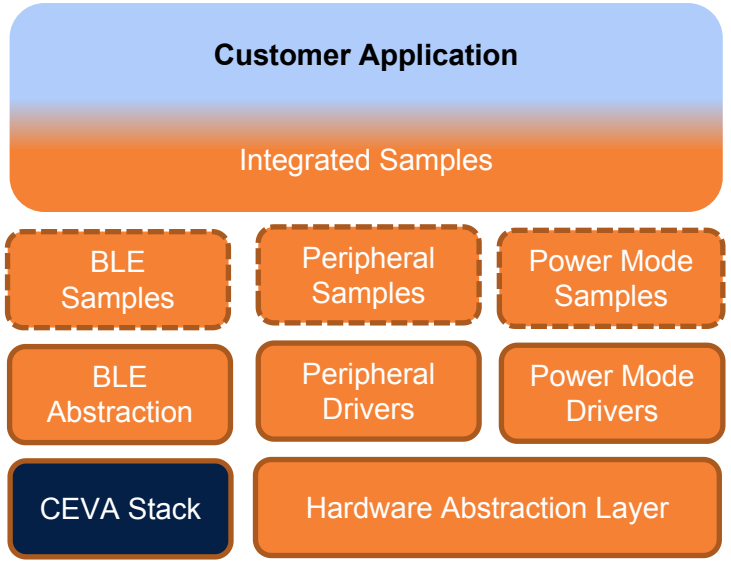
RSL15 peripheral application

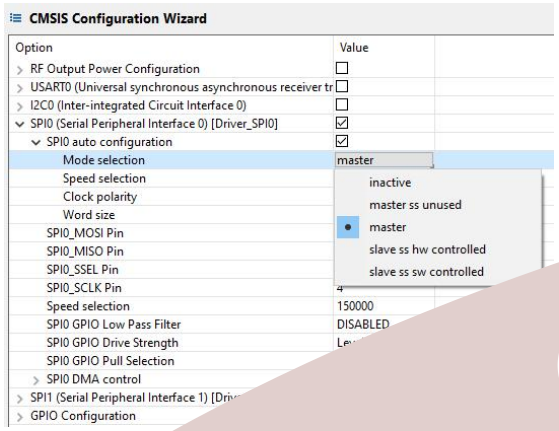
The Firmware Developer's Experience

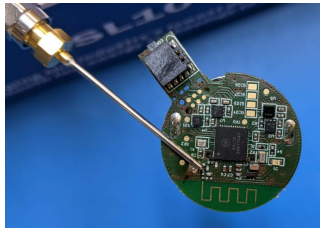
onsemi Community Forums

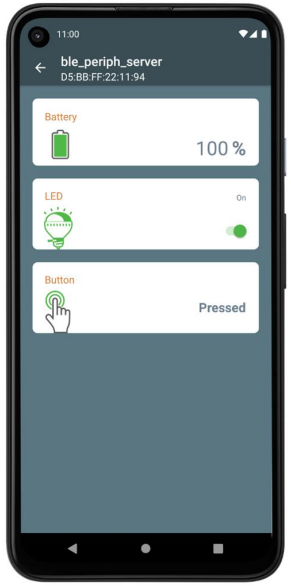
Bluetooth®

Firmware "stackup"









Start Here

- Load '*blinky*' sample onto EVB

Single Function Samples

- Focus on a single function such as *uart* or *sleep*

Wireless Samples

- Make a BLE connection without worrying about sleep
- Tune BLE parameters for your application

Integrated Samples

- Learn how *BLE sleep*, *FOTA*, etc. interact as a complete system

Build Your Application

- Build your application on top of sample code
- Follow the guide to get started quickly

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3rd part module – DXYBT015

DXYBT015支持蓝牙5.2的超低功耗蓝牙模组，主要功能是实现数据透传、及AT指令控制蓝牙模块，通过AT指令修改蓝牙的相关参数。

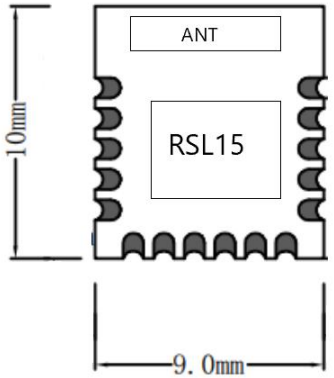
功能接口：UART、IO、WAKEUP及状态指示信号等；

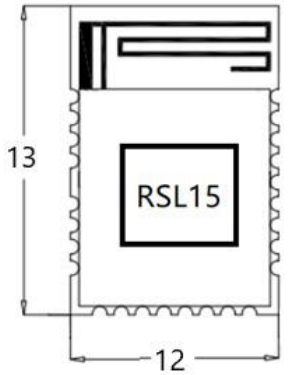
硬件：基于RSL15芯片模组，一款小尺寸模组，小陶瓷天线，另一款大尺寸，板载天线；

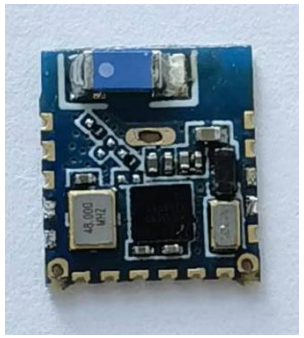
软件：透传功能，及AT指令集；

技术支持：

方案应用评估；软硬件设计指导；天线设计调试及PCB布局指导；







主要应用领域：

汽车电子；医疗电子；工业电子；

其他应用领域：

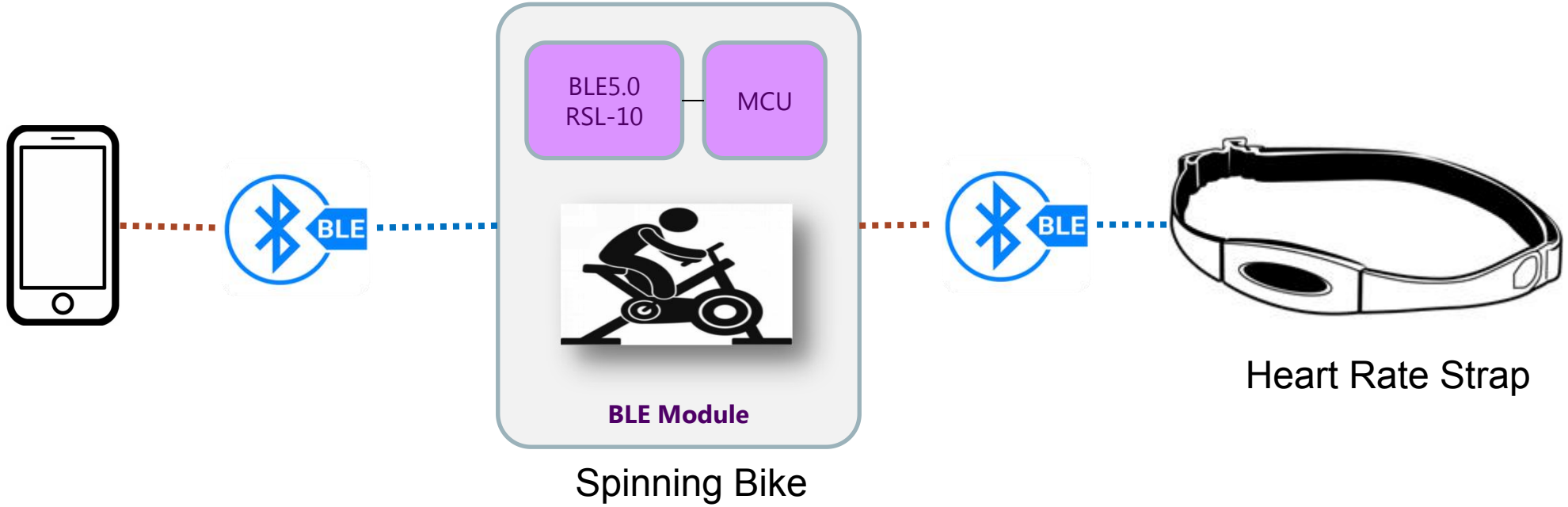
智能门锁；ESL电子货架标签，Beacon室内定位；商超广告；智能灯具，MESH组网；小家电无线数据传输；电表数据无线传输

Bluetooth Low Energy Success Stories

RSL15 Use Cases

BLE Heartbeat belt of sport

Success with RSL10 and will get better performance with RSL15 by smart sensor and higher security system

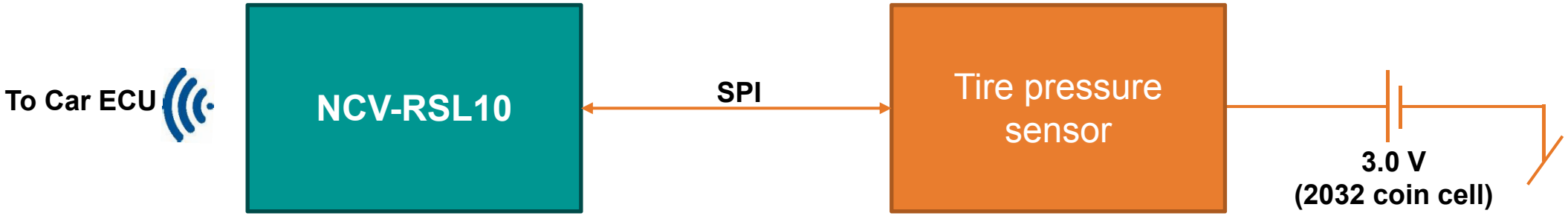


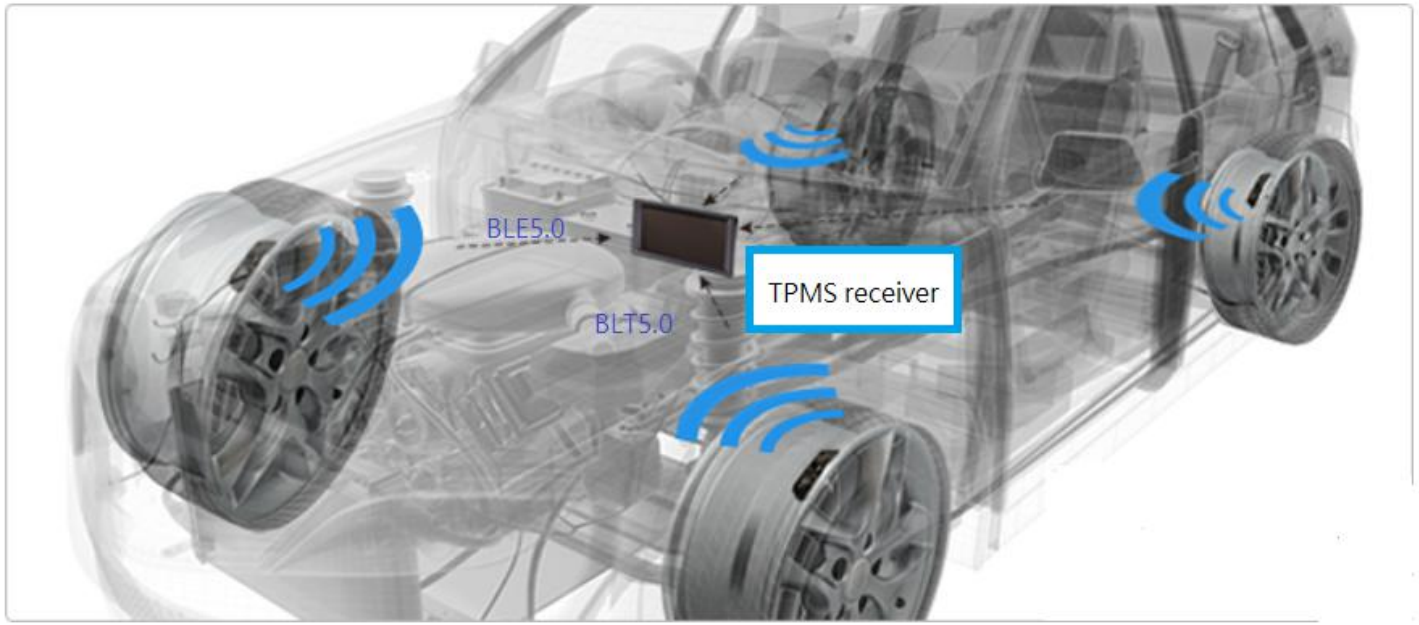
Smart Helmet

Success with RSL10 and will get better performance with RSL15 by smart sensor and higher security system

TPMS

Success with RSL10 and will get better performance with RSL15 by smart sensor feature





car access entry

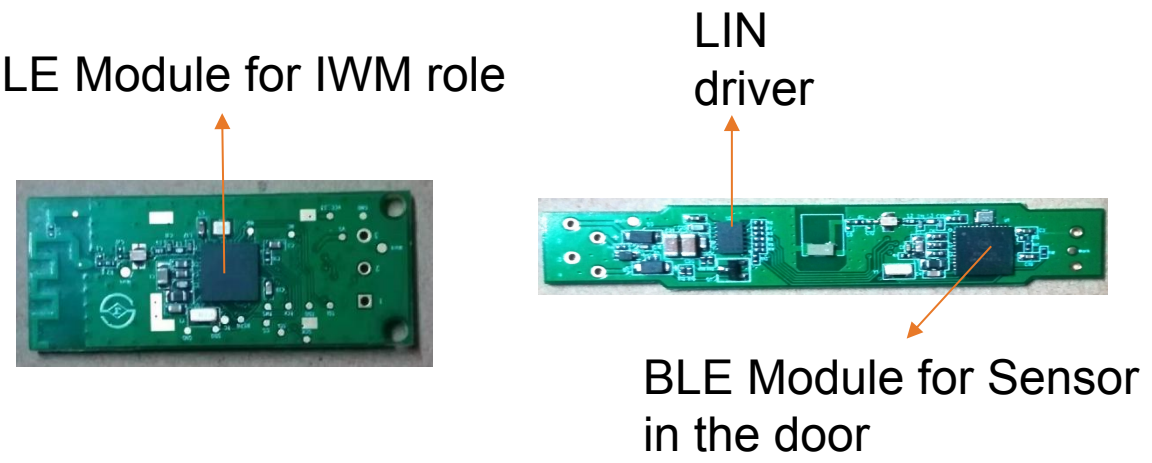
Success with RSL10 by using RSSI and will get better performance with RSL15 by using higher security system

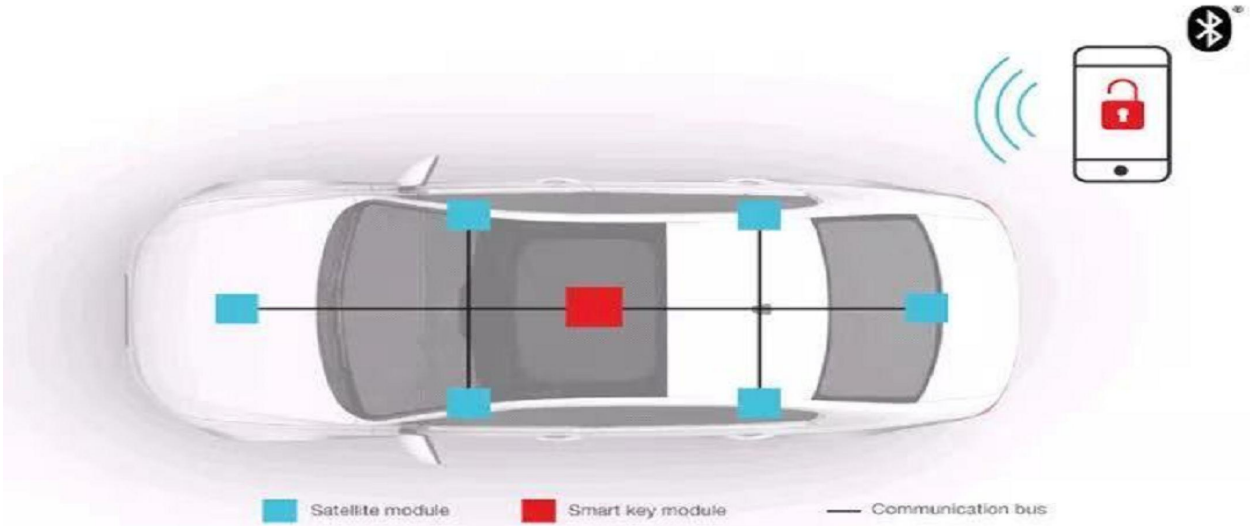
- **Advertising BLE**

  BLE naturally supports advertising function to public that any equipment can listen to. This leads to a sOBUrity concern. Meanwhile, advertising mode uses unreliable link that the signal quality is insufficient to provide positioning information at low RSSI update rate and poor RSSI resolution.

- **Connected BLE**

  A connected BLE link is dedicated to the talk between two BLE equipment, which provides a more sOBUre, quality trackable link prior to a public listen technology.





RSL15 Use Cases

With corresponding success stories based on RSL10

Smart Building
Electronic access badges, vending machines, smoke alarms, HVAC systems

Smart lock
onsemi was selected for:
- Best-in-class power consumption
- Easy connectivity to smartphone
- Excellent customer support

Smart City
People & asset tracking, door access control, fleet management, equipment control

Beacons for contact tracing and Healthcare IoT
Reasons for selecting onsemi:
- High performance processing
- Increased accuracy and reliability
- Double the battery life of previous solution

Smart Industry
Electronic tags, data logging, worker safety, machine monitors

Trackable tags for real-time location
onsemi solution selected for:
- Brand reputation
- High accuracy and reliability
- Ultra-low power consumption

Smart Industry
Electronic tags, data logging, worker safety, machine monitors

Wireless testing & reporting for commercial equipment
Customer selected onsemi for:
- Ultra-low power consumption
- Small size and high quality
- Timely responses from support team
- FOTA (Firmware-over-the-Air) capability

Low/No-Power Connected Devices
Circuit breakers, light switches, utility meters, thermostats

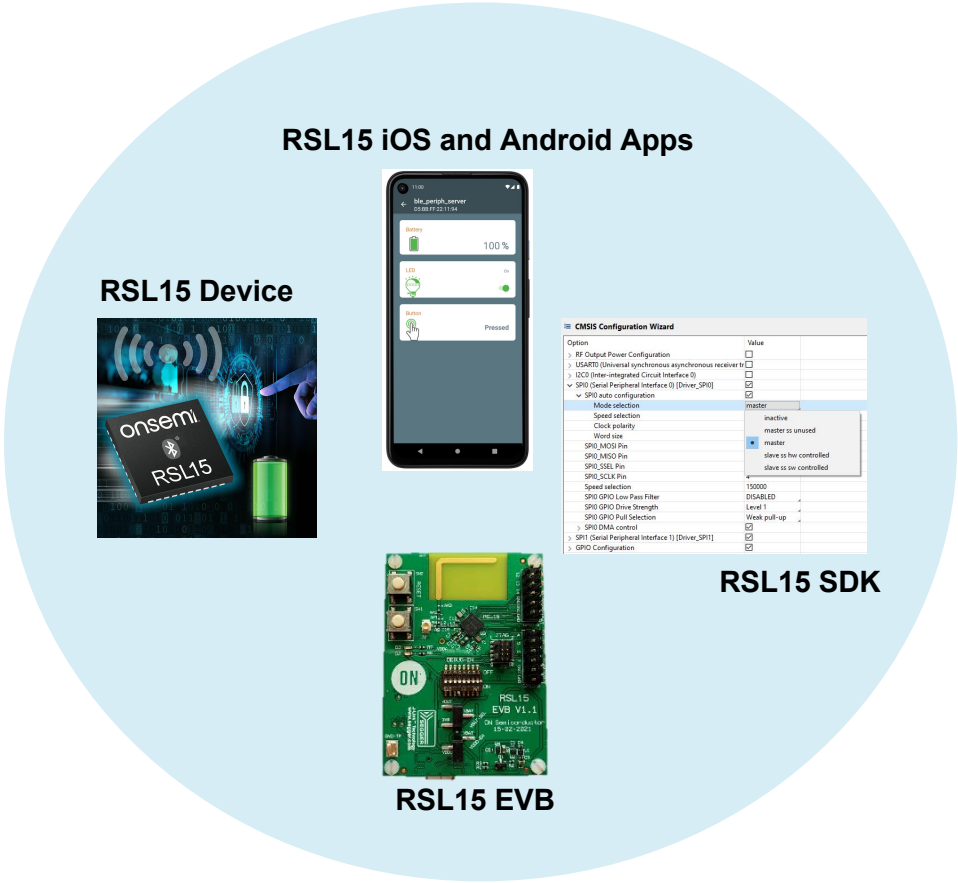
Energy harvesting light control
Reasons onsemi was selected:
- Allows for smartphone control
- Eliminates need for wiring from switch to light
- Switch can be placed anywhere, no battery or wall power required

RSL15 Ordering Information

RSL15 Ordering Information

- Two P/Ns available:
  - NCH-RSL15-284-101Q40-ACG (284kB Flash)
  - NCH-RSL15-512-101Q40-ACG (512kB Flash)
- Evaluation board:
  - RSL15-EVB (come with 512kB Flash)

- Eval boards & samples available directly from onsemi, and also via distributors

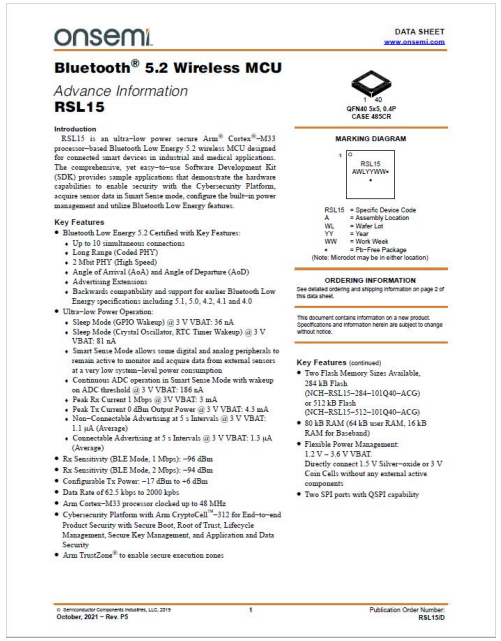


RSL15 Product and Design-In Support

Support and Collateral at www.onsemi.com/RSL15

Links to resources will be live on launch date

Data Sheet
Click Here


onsemi DATA SHEET www.onsemi.com

Bluetooth® 5.2 Wireless MCU

Advance Information

RSL15

QFN40 5x5, 0.4P
CASE 485CR

MARKING DIAGRAM

RSL15
AWLYYWW+

RSL15 = Specific Device Code
A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week
+ = Pb−Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

This document contains information on a new product. Specifications and information herein are subject to change without notice.

Introduction

RSL15 is an ultra−low power secure Arm® Cortex®−M33 processor−based Bluetooth Low Energy 5.2 wireless MCU designed for connected smart devices in industrial and medical applications. The comprehensive, yet easy−to−use Software Development Kit (SDK) provides sample applications that demonstrate the hardware capabilities to enable security with the Cybersecurity Platform, acquire sensor data in Smart Sense mode, configure the built−in power management and utilize Bluetooth Low Energy features.

Key Features

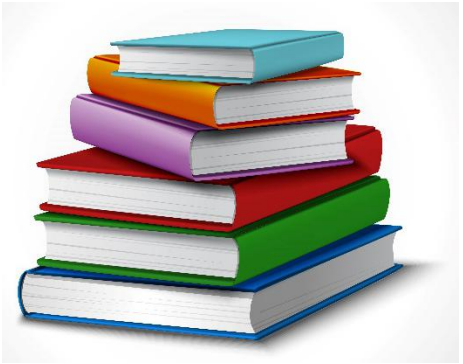
- Bluetooth Low Energy 5.2 Certified with Key Features:
  - Up to 10 simultaneous connections:
  - Long Range (Coded PHY)
  - 2 Mbit PHY (High Speed)
  - Angle of Arrival (AoA) and Angle of Departure (AoD)
  - Advertising Extensions
  - Backwards compatibility and support for earlier Bluetooth Low Energy specifications including 5.1, 5.0, 4.2, 4.1 and 4.0
- Ultra−low Power Operation:
  - Sleep Mode (GPIO Wakeup) @ 3 V VBAT: 36 nA
  - Sleep Mode (Crystal Oscillator, RTC Timer Wakeup) @ 3 V VBAT: 81 nA
  - Smart Sense Mode allows some digital and analog peripherals to remain active to monitor and acquire data from external sensors at a very low system−level power consumption
  - Continuous ADC operation in Smart Sense Mode with wakeup on ADC threshold @ 3 V VBAT: 186 nA
  - Peak Rx Current 1 Mbps @ 3V VBAT: 3 mA
  - Peak Tx Current 0 dBm Output Power @ 3 V VBAT: 4.3 mA
  - Non−Connectable Advertising at 5 s Intervals @ 3 V VBAT: 1.1 μA (Average)
  - Connectable Advertising at 5 s Intervals @ 3 V VBAT: 1.3 μA (Average)
- Rx Sensitivity (BLE Mode, 1 Mbps): −96 dBm
- Rx Sensitivity (BLE Mode, 2 Mbps): −94 dBm
- Configurable Tx Power: −17 dBm to +6 dBm
- Data Rate of 62.5 kbps to 2000 kpbs
- Arm Cortex−M33 processor clocked up to 48 MHz
- Cybersecurity Platform with Arm CryptoCell™−312 for End−to−end Product Security with Secure Boot, Root of Trust, Lifecycle Management, Secure Key Management, and Application and Data Security
- Arm TrustZone® to enable secure execution zones

Key Features (continued)

- Two Flash Memory Sizes Available,
  284 kB Flash
  (NCH−RSL15−284−101Q40−ACG)
  or 512 kB Flash
  (NCH−RSL15−512−101Q40−ACG)
- 80 kB RAM (64 kB user RAM, 16 kB RAM for Baseband)
- Flexible Power Management:
  1.2 V − 3.6 V VBAT.
  Directly connect 1.5 V Silver−oxide or 3 V Coin Cell without any external active components
- Two SPI ports with QSPI capability

© Semiconductor Components Industries, LLC, 2019 October, 2021 − Rev. P5 1 Publication Order Number: RSL15/D

Docs Package
Click Here



RSL15 Documentation Package:

- Getting started guide
- Developer's guide
- Firmware reference manual
- Hardware reference manual
- And more …

User Manual
Click Here


onsemi EVAL BOARD USER'S MANUAL www.onsemi.com

RSL15 Evaluation and Development Board User's Manual

EVBUM2757/D

INTRODUCTION

Purpose

This manual provides information on the hardware configuration and use of the RSL15 Evaluation and Development Board.

The Evaluation and Development Board (referred to as the EVB) is designed to be used with the RSL15 Software development kit. It is intended for evaluating the performance and capabilities of RSL15, and for developing software applications for this device. The Software Development Kit is available at www.onsemi.com/rsl15.

Conventions

In this manual, component and pin names are shown in A CAPITALIZED MONOSPACE font.

Manual Organization

The RSL15 Evaluation & Development Board User Guide contains the following sections:

- "Introduction" describes the purpose of this manual, explains how the manual is organized, and provides a list of suggested reading for more information.
- "Board Design and Overview" provides an overview of the Evaluation and Development Board as described in this manual.
- "Configuration" provides detailed information about the Evaluation and Development Board. This chapter contains information on the following topics:
  - Automatic switching power supply
  - SEGGER® J−Link® on−board Debug Port
  - RF Outputs
  - General Purpose Input/Output (GPIO)
  - Test Points
  - Indicator LEDs

Further Reading

For any technical information not covered in this manual, refer to the following documents:

- The searchable HTML documentation
- RSL15 Evaluation and Development Board Schematics
- RSL15 Evaluation and Development Board 3D Model

The above documentation can be found at www.onsemi.com/rsl15.

(Top Side)

(Bottom Side)

Figure 1. RSL15 Evaluation and Development Board Overview

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Evaluation Board
Click Here

onsemi Community Forums for RSL10 and RSL15

onsemi Community Forums

www.onsemi.com/forums

Explore Knowledge Base articles and FAQs

Collaborate with onsemi SMEs and customers

Start a new topic or respond to a thread to share your insights

Search for specific topics or products

Share ideas, firmware and design solutions

Filter by connectivity type to find exactly what you're looking for

Log in with your MyON account to contribute

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