RENESAS

BLUETOOTH™ LOW ENERGY
LOW POWER WIFI

© 2021 Renesas Electronics Corporation. All rights reserved.

LEADER IN BLUETOOTH® LOW ENERGY

Portfolio spanning from lowest cost IC to highly integrated wireless application processor

Bluetooth™ low energy (BLE): Market leader, ranked #2

- 500M+ Bluetooth LE SoCs shipped in a wide range of applications in all markets
- Mature Bluetooth stack, proven in millions of customer products
- Leader in wearables, proximity tags, smart home and VR controllers
- Highest integration level (PMU, security, voice, display, haptics, charger)
- High level of security features
- Roadmap driving towards lowest power and system cost

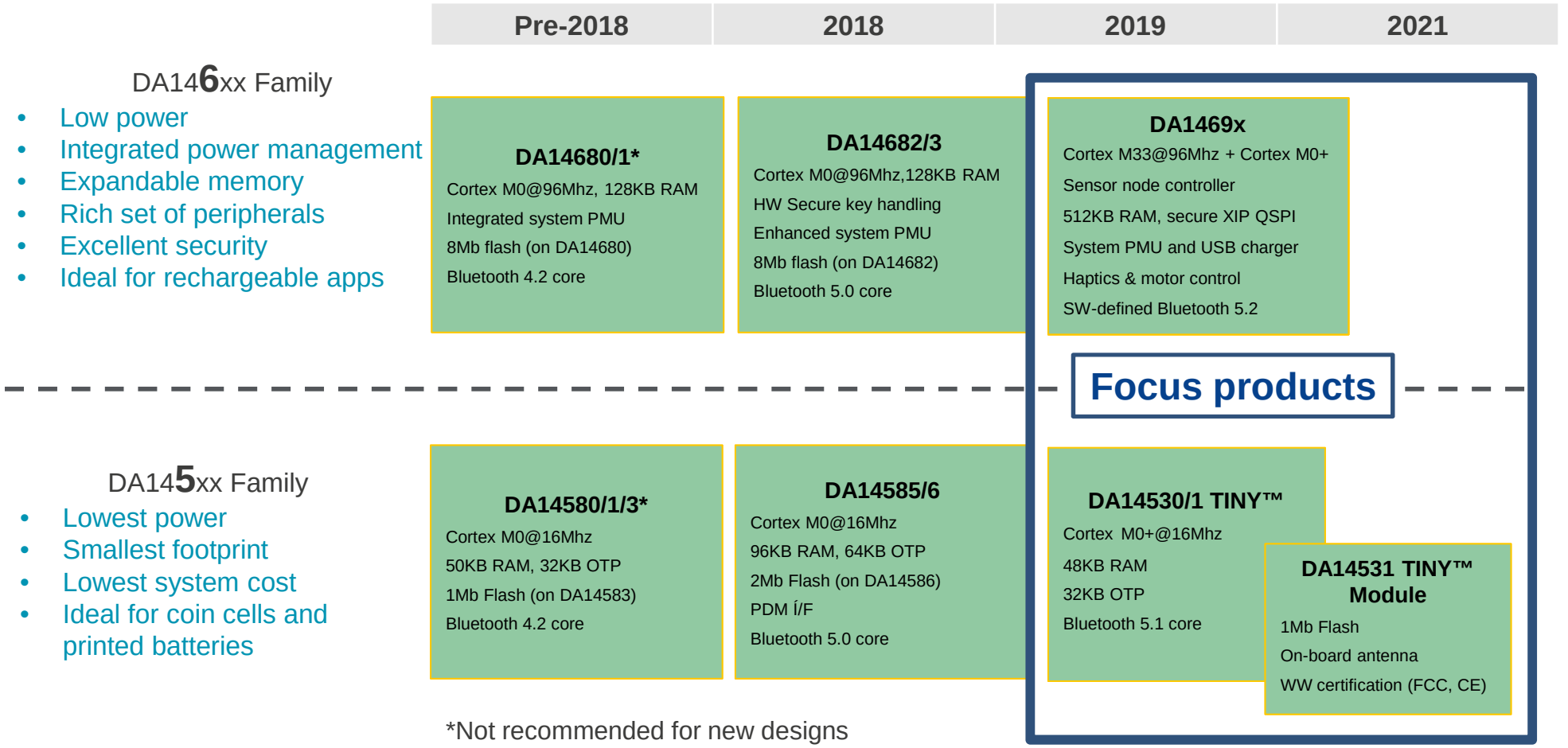


smartbond

© 2021 Renesas Electronics Corporation. All rights reserved.

SMARTBOND™ BLUETOOTH® LE PORTFOLIO

Two main branches of Bluetooth LE SoC families

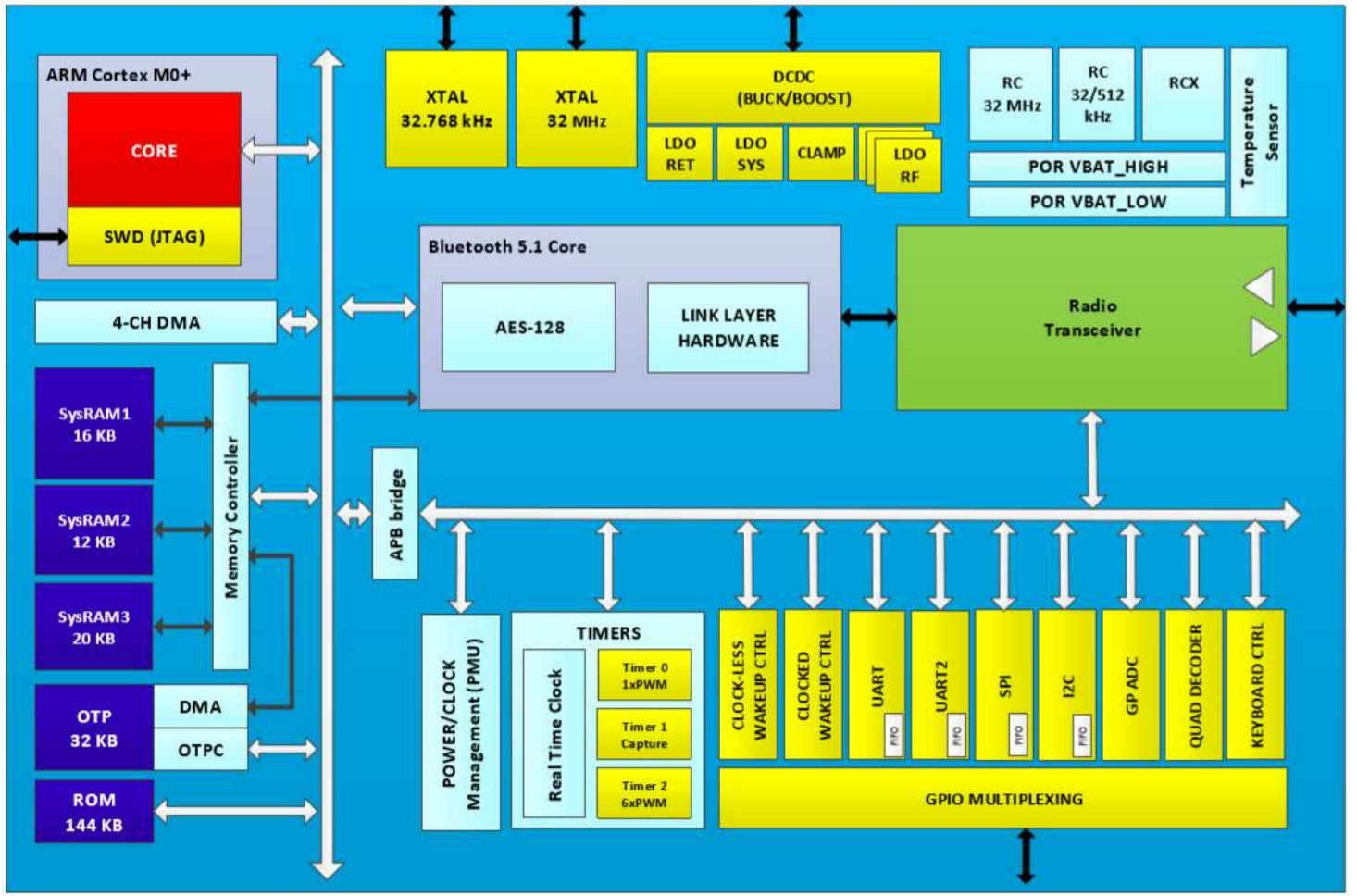


*Not recommended for new designs

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14531 SMARTBOND™ TINY BLOCK DIAGRAM



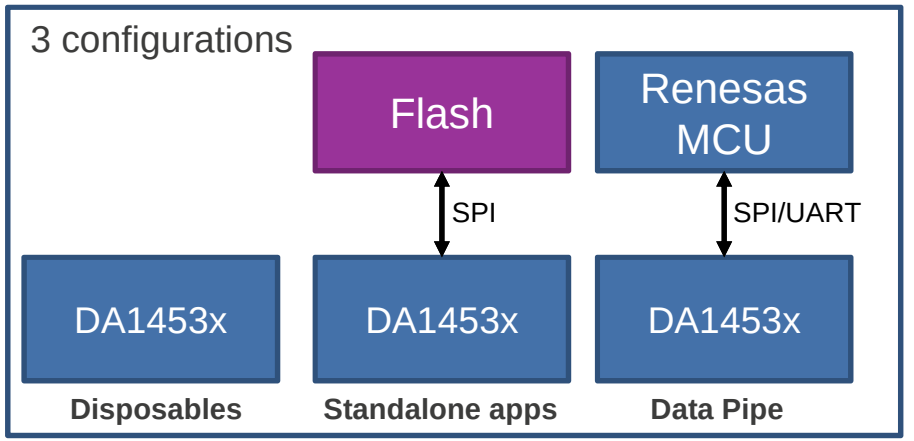
- Complies with BLE V5.1
- ARM M0+ at 16MHz
- Memory:
  - 48kB RAM (12KB, 20KB, 16KB)
  - 32kB OTP and 144kB ROM
- Power Management:
  - Integrated Buck/Boost DCDC and DCDC by-pass mode (Coincell, disposable printed batteries, Silver Oxide and Alkaline cells)
- Active current: Tx 3.5mA and Rx 2.2mA @3V
- Sleep currents
  - 150nA/240nA at 5C/25C hibernation
  - 700nA with all RAM active
  - 1.6uA extended sleep with all RAM
- Sensitivity: -93dBm and up to +2.5dBm Tx power
- Single 32MHz XTAL operation (Int RC 32kHz)
- 3x Timers, 1x RTC (10ms granularity), 7PWM
- Temperature sensor (up to 4°C precision)
- GP-ADC 11 bit resolution (4 channel)
- 2x UART, 1xSPI, 1xI2C
- Quad decoder (3 channels)
- Keyboard controller
- GPIOs:
  - 12 in 2.2x3.0mm GQFN24 package
  - 6 in 1.7x2.0mm WLCSP package

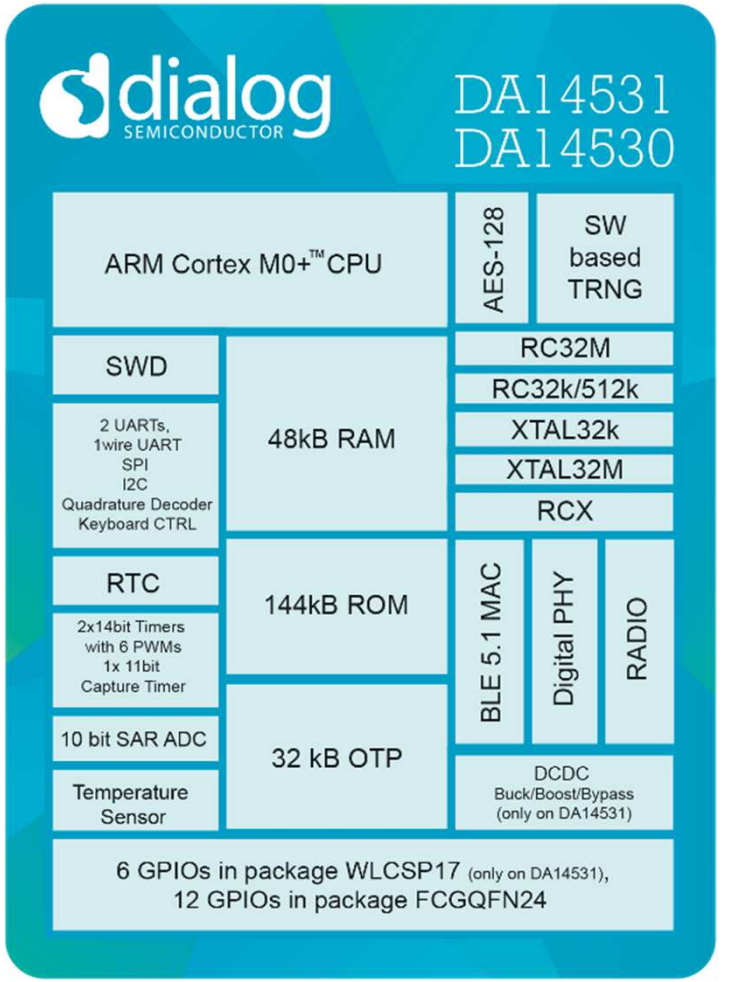
© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA1453X KEY FEATURES

- Arm M0+ Bluetooth LE devices targeted at enabling connectivity in any application
- Fully optimized to reduce size, power and cost
- Integrates power management and offers basic set of peripherals
- Supports application Software OTA with external Flash or external MCU
- Ideal as standalone device for small applications or as a data pump alongside a Renesas MCU



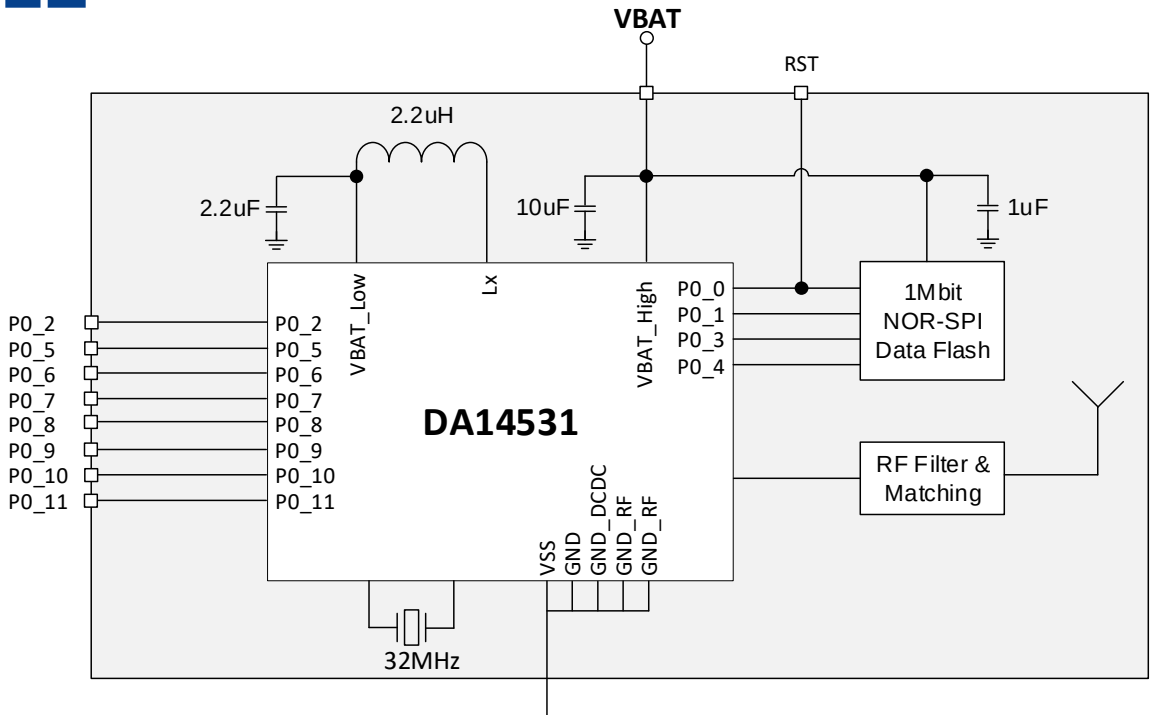


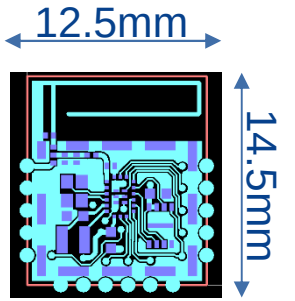
© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14531 SMARTBOND TINY MODULE

- Based on the lowest power DA14531 SoC
- Bluetooth 5.1 core qualified
- Integrated antenna
- Worldwide certification (incl FCC, CE)
- 1Mb FLASH onboard
- -93dBm sensitivity
- -19 to +2.2dBm output power
- 8GPIO + 1 shared GPIO/RST
- Shield
- Ultra-Low power consumption
  - 2mA module current in Rx
  - 4mA module current in Tx @0dBm
  - 1.8uA module current is sleep mode
- 12.5x14.5x2.8mm dimensions







© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14531 TINY MODULE – PRODUCT OFFERING

All you need for fast time-to-market

Module



Dev kit



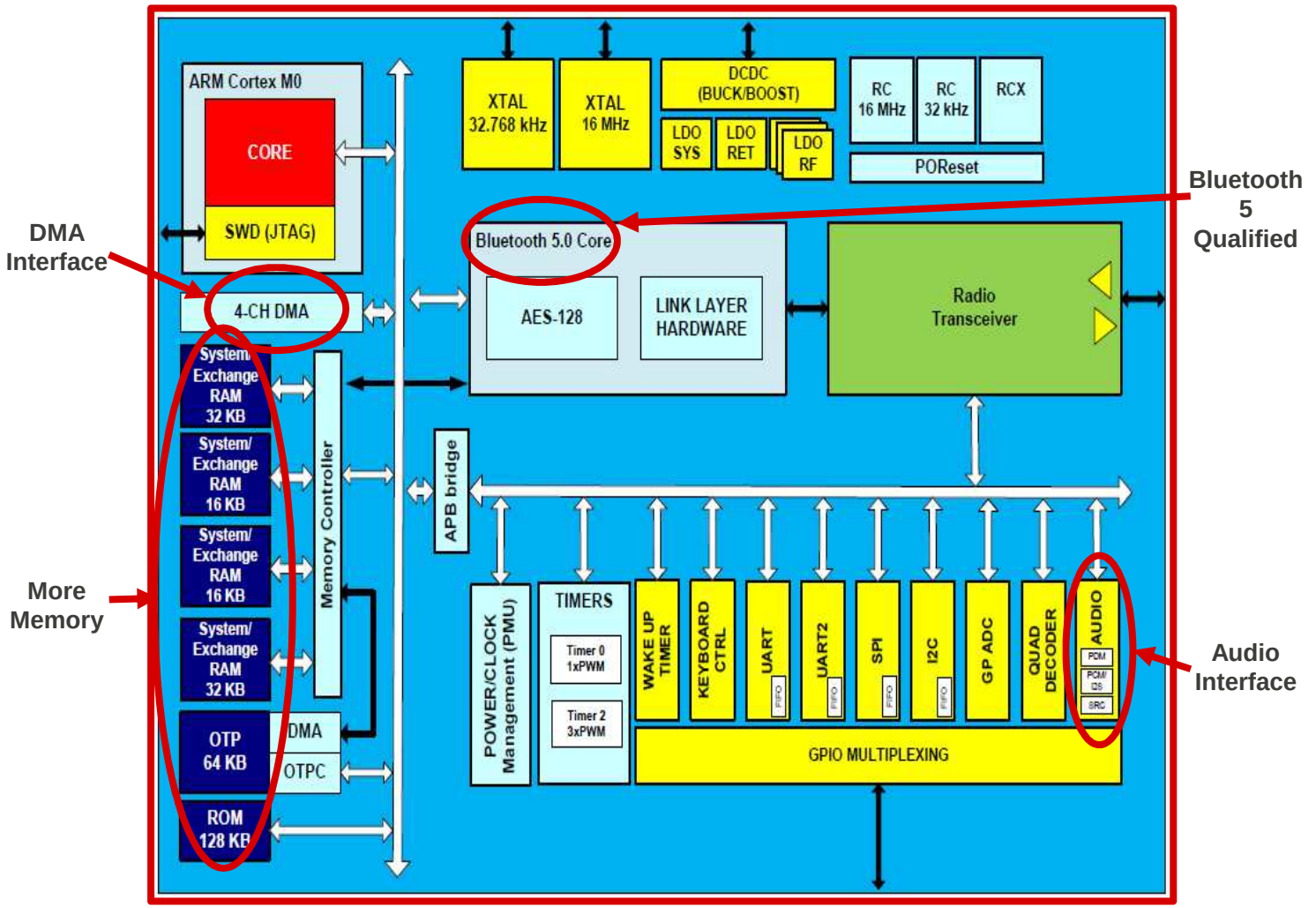
Worldwide certification

Easy-to-use software

CodeLess AT Commands
Reference design

© 2021 Renesas Electronics Corporation. All rights reserved.

DA14585 SYSTEM DIAGRAM

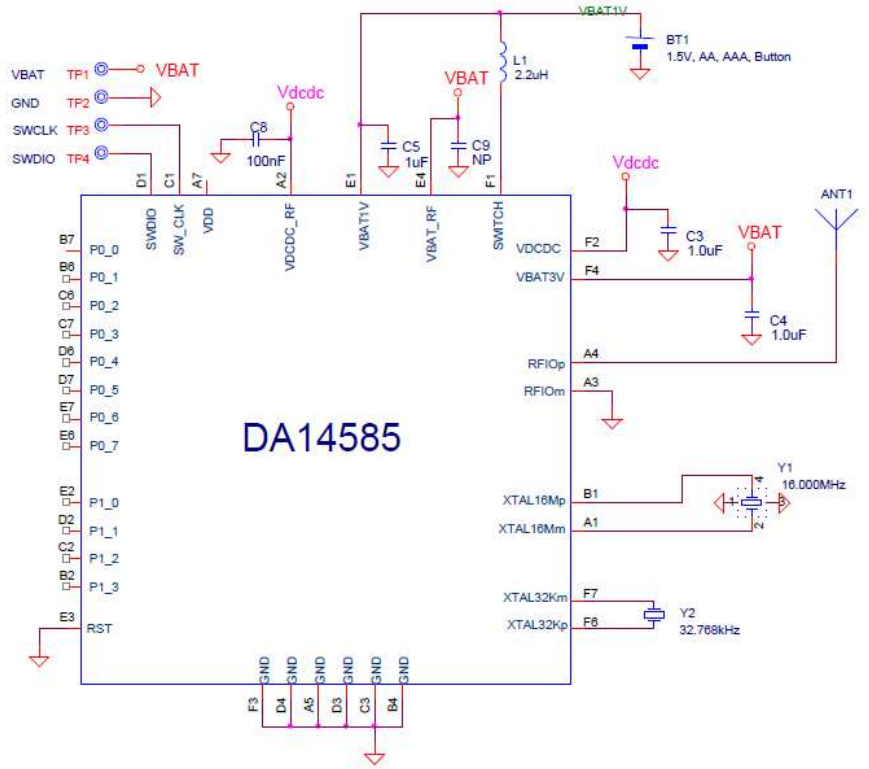


- Complies with BLE V5.0
- ARM M0 at 16MHz
- Memory:
  - 96kB RAM
  - 64kB OTP and 128kB ROM
- Power Management:
  - Integrated Buck/Boost DCDC and DCDC by-pass mode (Coincell, disposable printed batteries, Silver Oxide and Alkaline cells)
- Active current: Tx 4.9mA and Rx 5.3mA @3V
- Sleep currents
  - 520nA deep sleep
  - 4uA extended sleep with all RAM
- Sensitivity: -93dBm and up to 0dBm Tx power
- Single 16MHz XTAL operation (Int RC 32kHz)
- 2x Timers, 5PWM
- GP-ADC 10 bit resolution (4 channel)
- 2x UART, 1xSPI, 1xI2C
- Quad decoder (3 channels)
- Keyboard controller
- GPIOs:
  - 25 in 5.0x5.0mm QFN40 package
  - 14 in 2.4x2.7mm WLCSP package

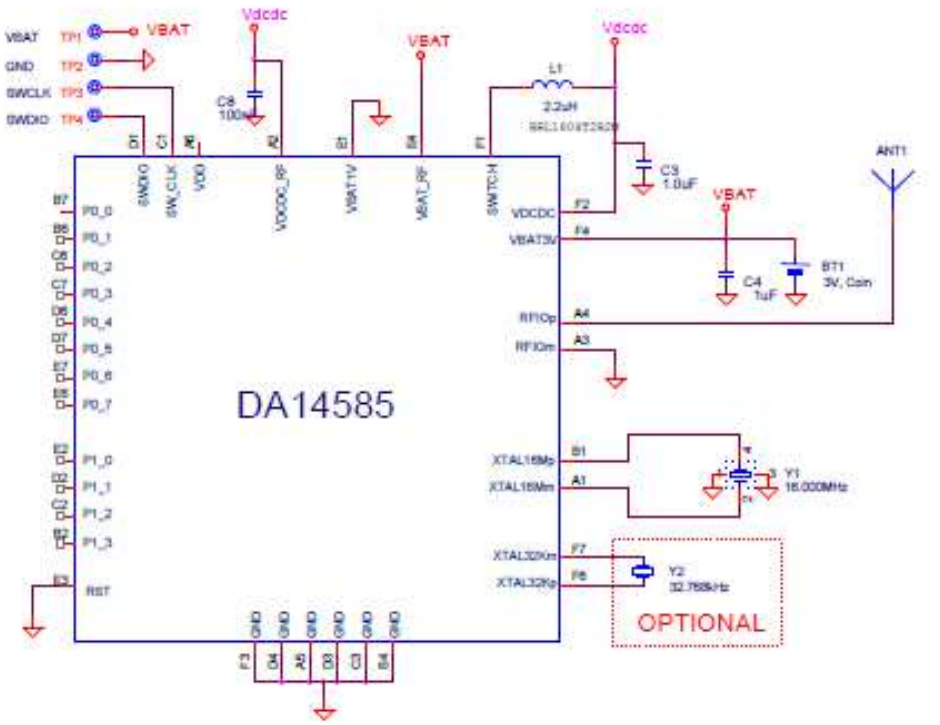
© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14585 BUCK AND BOOST MODE



Boost Mode
(0.9 – 3.3V)



Buck Mode
(1.8V – 3.6V)

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14585 VS DA14531

DA14585	DA14531
M0+ @16MHz and 96kB of RAM	M0 @16MHz and 48kB of RAM
Power Management Buck Mode: 1.8 – 3.6V Boost mode: 0.9 – 1.8V	Power Management Buck Mode: 1.8 – 3.3V Boost mode: 1.1 – 1.8V (OTP boost)
Power consumption 4.9mA vs 12.4mA in Tx (buck vs boost mode) 5.3mA vs 13.4mA in Rx (buck vs boost mode) ~600nA Hibernation	Power consumption 3.5mA vs 8.0mA in Tx (buck vs boost mode) 2.2mA vs 5.0mA in Rx (buck vs boost mode) <240nA Hibernation & 700nA with 48kB active <150nA Hibernation @ 5C
2xUART, SPI, I2C, GP ADC, Keyboard Scanner, Quad Dec, Audio I/F	2xUART, SPI, I2C, GP ADC, Keyboard Scanner, Quad Dec
16MHz Main XTAL 32kHz XTAL optional (buck mode)	Connection Intervals <1s and beacon mode: Single 32MHz XTAL 32kHz XTAL is truly optional: ~10% max power saving for CI >1sec
Output power of 0dBm (10dBm with Range Ext)	Adaptive radio output power from -20 to +2.5dBm
2.4x2.7mm WLCSP with 14 GPIO 5.0x5.0mm QFN 40 with 25GPIO	1.7x2.0mm WLCSP with 6 GPIO 2.2x3.0mm FCGQFN with 12 GPIO
Working with Dialog SDK 6	Working with Dialog SDK 6

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14531 APPLICATION

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14531 TARGET MARKETS AND APPLICATIONS

- STB, printer, camera, coffee maker, access point etc
- Simple BLE pipes added to existing MCU designs
- Simple wireless sensors, e.g. wireless temperature meters
- Low cost remote controls
- PC accessories, mice, stylus pens
- Active RFID replacement
- Asset tracking in hospitals, factories, distribution centers
- Cold food / medicine chain monitoring
- Connected Health: Injectors, inhalers, blood pressure monitors, patches
- Automotive TPMS and wireless sensors





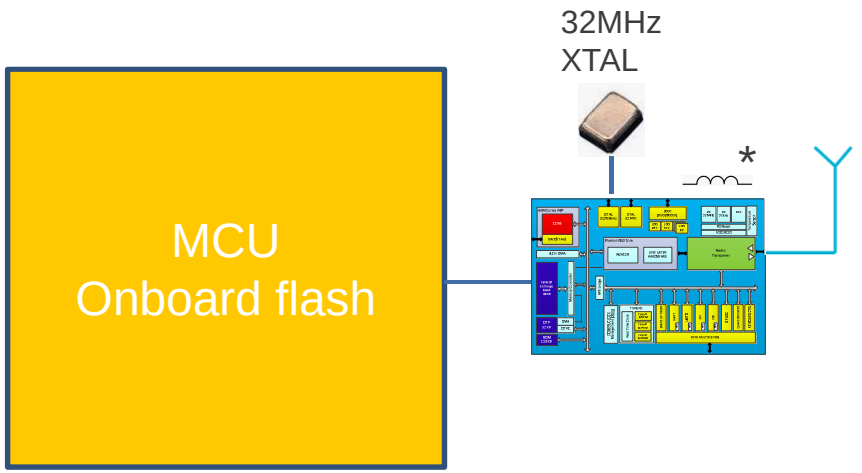


© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14531 AS SIMPLE BLE DATA PIPE

Value Proposition



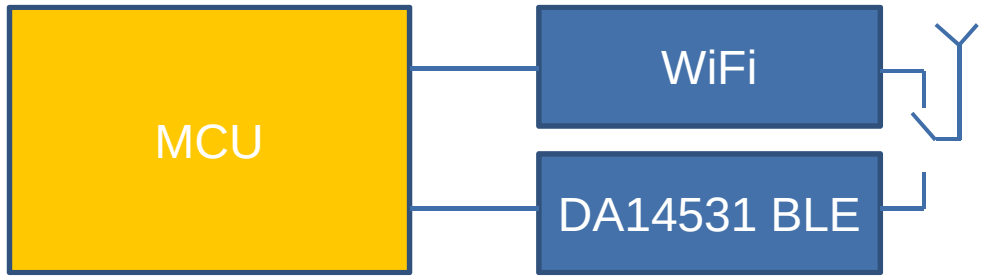
Feature	Benefit
Adding BLE to existing MCU design	Fast time to market to add BLE Reduced development time & cost Platform scalability in MCU flavors
Boost, Buck mode and bypass mode Works from 1.1 – 3.3V	Boost mode: no extra DC-DC required Bypass mode: no power inductor required to save cost, ~$0.02
MCU flash space used in data pipe application to load BLE software “Borrow MCU Flash space”	No external flash required to save cost, $0.05-0.10 for external flash and ~25% vs BLE devices with onboard flash due to process cost
Very low sleep and active power 700nA hibernation with GPIO wake up 2.3mA Rx at 3V for full BLE function 3.3mATx at 3V for full BLE function (0dBm)	Adding BLE function without compromising battery life
Minimum component count ▪ Single 32MHz XTAL ▪ Power Inductor (skipped in bypass) ▪ 2 bypass caps ▪ Filter: 2 caps and 1 inductor	Adding BLE function at lowest BOM cost

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14531 FOR EASY COMMISSIONING

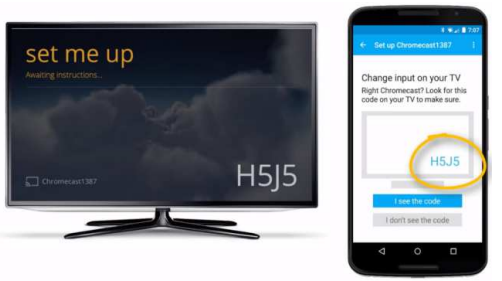
Easy Commisioning



Feature	Benefit
Adding BLE for easy commissioning and control	Increase user experience with a far more simple set up procedure with an app
MCU flash space used in data pipe application to load BLE software “Borrow MCU Flash space”	No external flash required to save cost, $0.05-0.10 for external flash and ~25% vs BLE devices with onboard flash due to process cost
Very low sleep and active power 700nA hibernation with GPIO wake up 2.3mA Rx at 3V for full BLE function 3.3mATx at 3V for full BLE function (0dBm)	Adding BLE function while introducing a super low power standby mode
Minimum component count ▪ Single 32MHz XTAL ▪ Power Inductor (skipped in bypass) ▪ 2 bypass caps ▪ Filter: 2 caps and 1 inductor	Adding BLE function at lowest BOM cost Cost saving options In bypass mode, $ 0.02 (power inductor) Using SoC Flash, $0.05-0.10







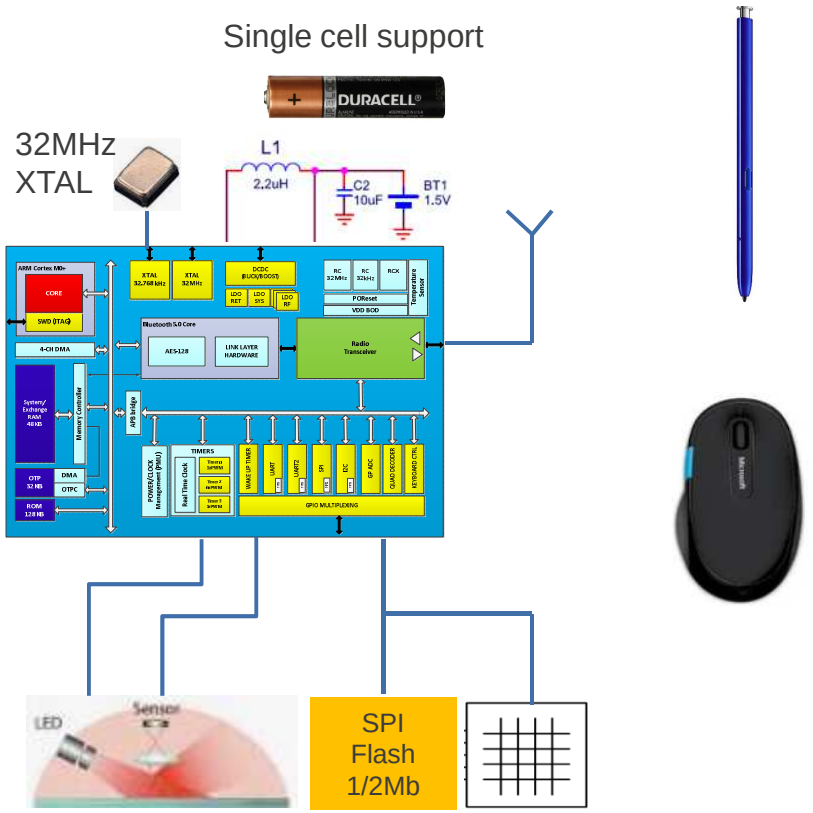


© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14531 IN PC ACCESSORIES

Value Proposition



Feature	Benefit
Single cell, 1.5V battery operation Coin cell, 3V battery operation Boost, Buck mode and bypass mode Works from 1.1 – 3.3V	Cost saving No external boost mode DC-DC to work from single cell
Quadrature decoder active in deep sleep	Longlasting battery <300nA supply current in sleep
SUOTA	Supports Software Updates over the air
Very low sleep and active power	Can work with small capacity batteries or support longer battery life
Minimum component count ▪ Single 32MHz XTAL ▪ Power Inductor (skipped in bypass) ▪ 2 bypass caps ▪ Filter: 2 caps and 1 inductor	Lowest BOM cost

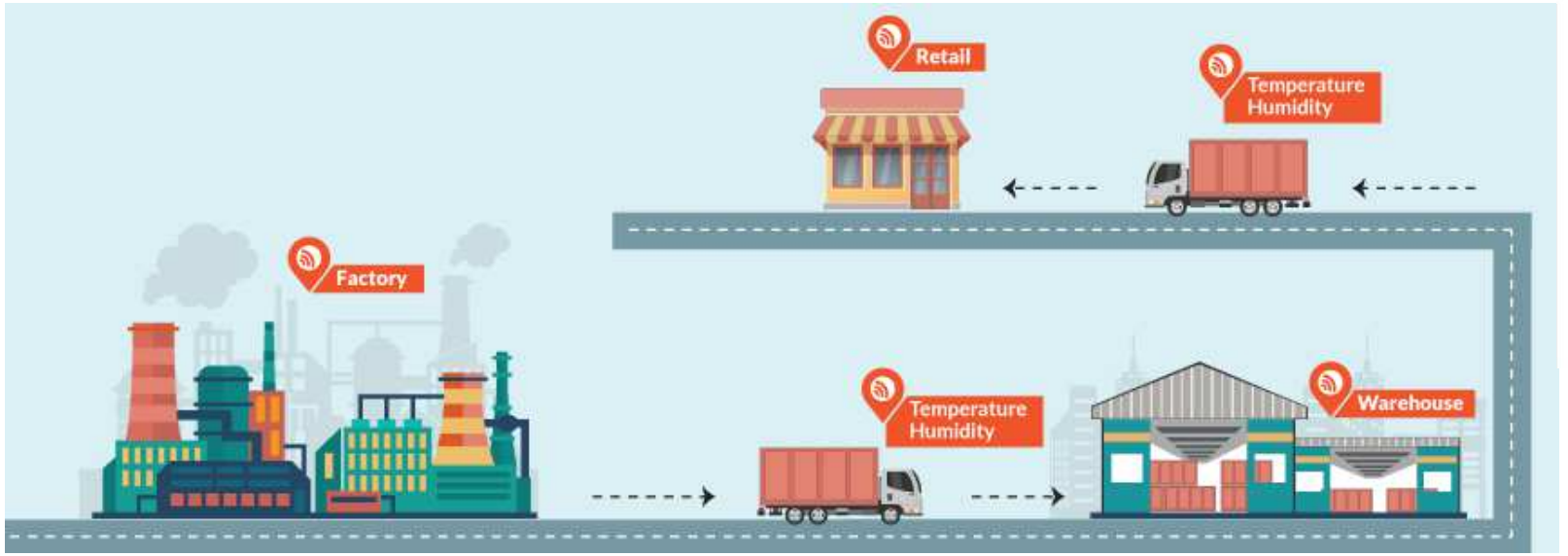
© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14531 IN ASSET TRACKING

Smart label or sticker beacon example design in progress

- Using truly disposable printed battery technology
- Using e-paper display to provide status on movement, temperature or remaining battery life
- Smart beaconing with motion triggered configurable beacon interval to maximize battery life





Business card size

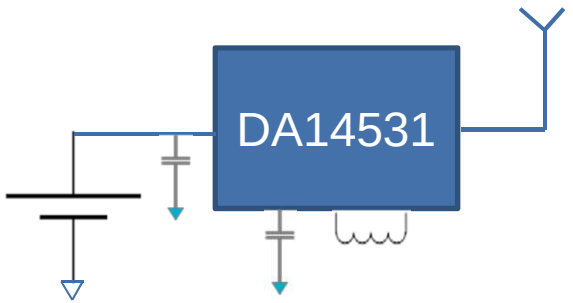
- <1mm thickness including e-paper display
- Motion sensor
- Printed disposable battery

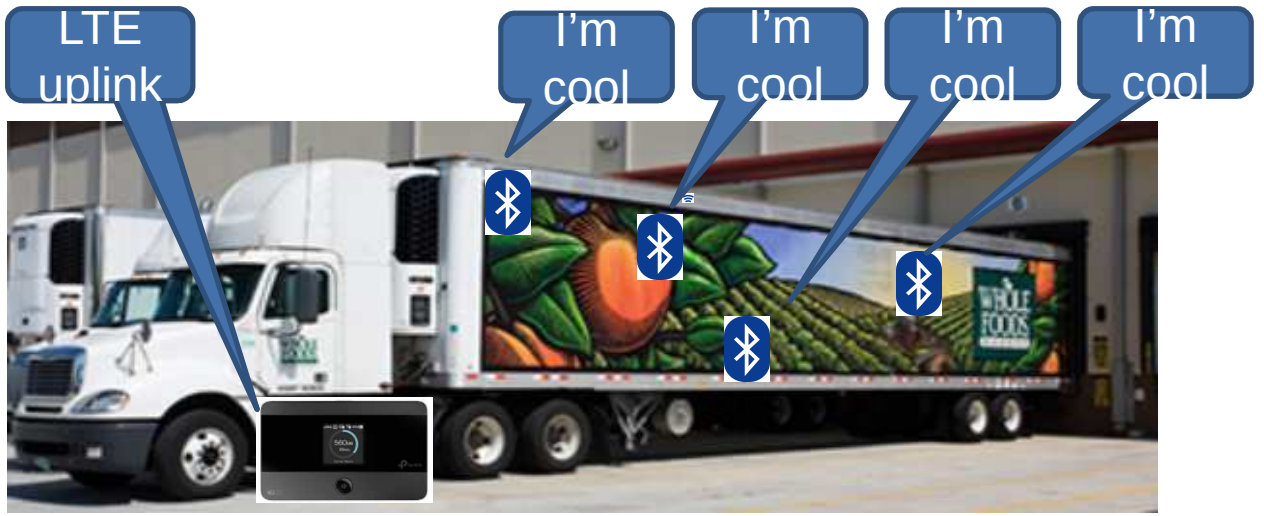
© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14531 IN COLD / FOOD CHAIN MONITORING

Simple beacon mode



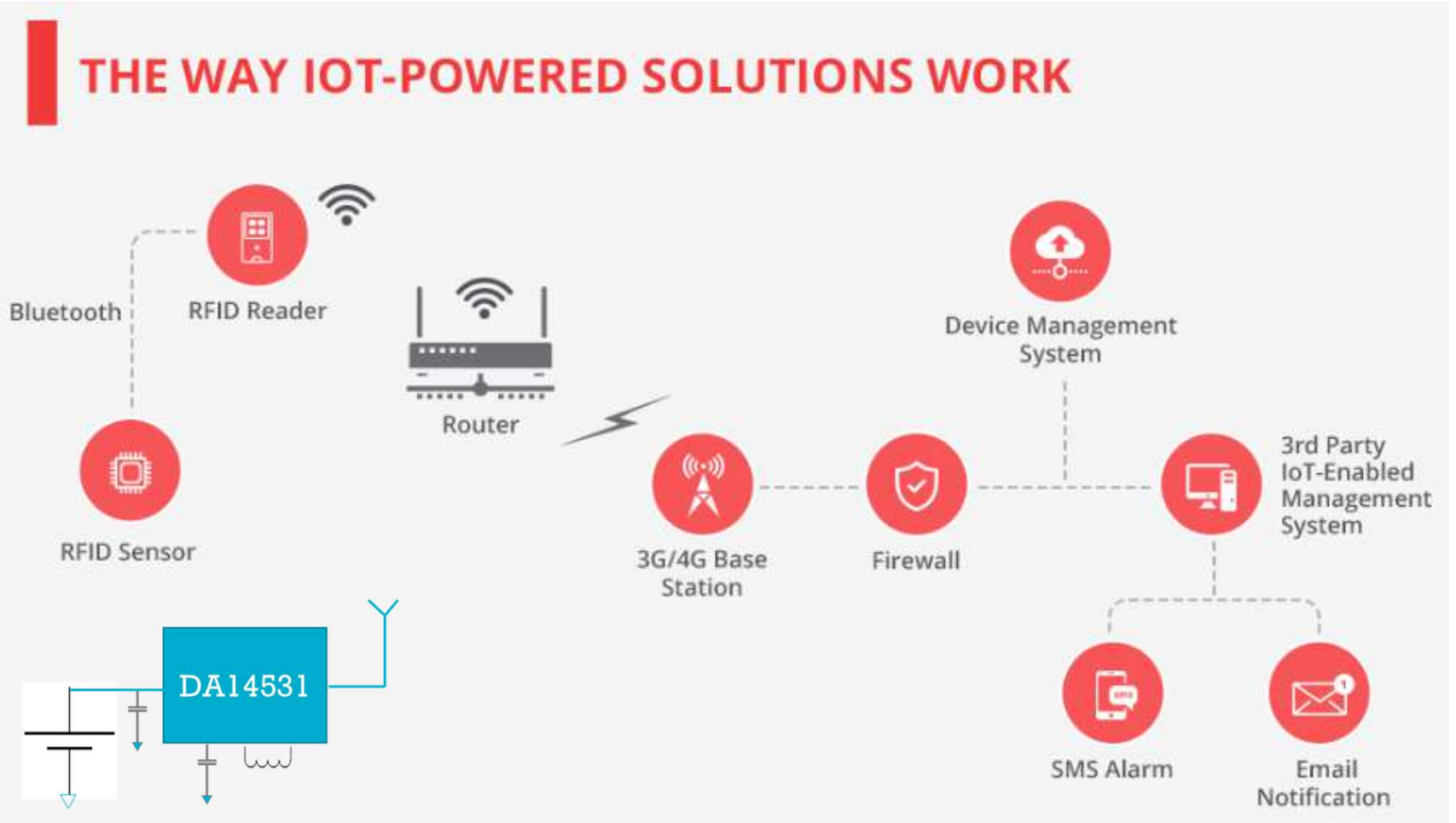


Feature	Benefit
Single cell and coin cell battery operation Works from 1.1 – 3.3V	Cost saving No external DC-DC when using single 1.5V battery
Inrush current control	Work with lower cost, small batteries with high internal impedance
Very low sleep and active power 150nA hibernation @5C 250nA hibernation @25C Total power 3.5mA @3V Total power of 2.2mA @3V	Can support multiple years of shelf life Long battery life by low active current
Tx power from -18 to +2.5dBm	Longer range than DA1458x
Minimum component count ▪ Single 32MHz XTAL ▪ Power Inductor (skipped in bypass) ▪ 2 bypass caps ▪ Filter: 2 caps and 1 inductor	Lowest BOM cost
Sticker beacon design	Proofs working with disposable, printed batteries and long battery life

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14531 IN COLD / FOOD CHAIN MONITORING



© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

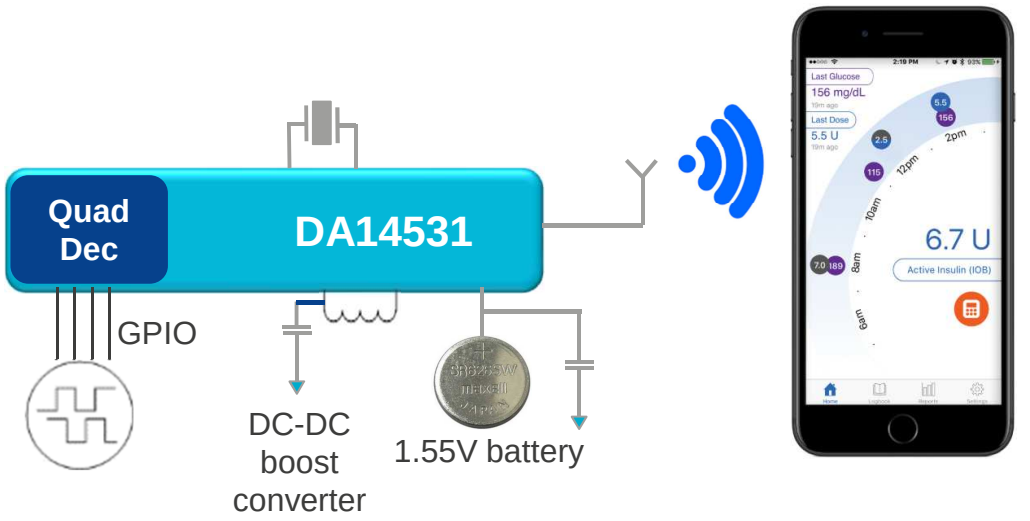
DA14531 IN CONNECTED HEALTH - INJECTORS

Value Proposition

- Low current hibernation mode with fast wake up for 2-4 years storage at low temperature
- Lowest power to meet an active life time up to 12 hours to 60 days
- Integrated quadrature decoder HW (rotary dial detection w/o MCU)
- Lowest power, programmable output power
- Smallest package and lowest external component count
- Boost mode, 1 XTAL, low cost manufacturing support



BLE for time stamping and dose monitoring

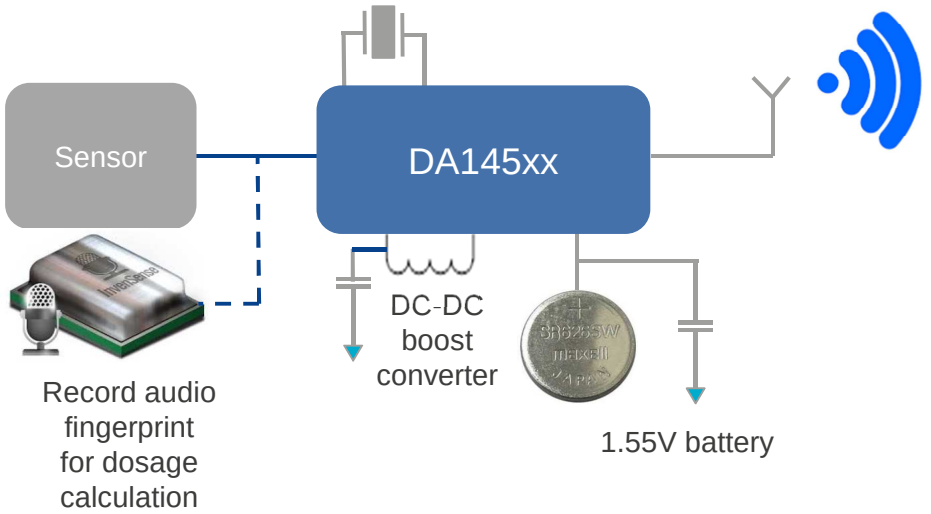


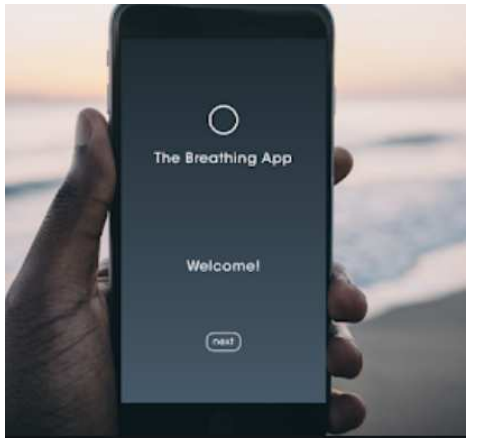
© 2021 Renesas Electronics Corporation. All rights reserved.

DA14531 SMARTBOND™ TINY EXAMPLE APPLICATION

Connected Health







- Low hibernation mode current
  2-4 years storage at low temperature

Lowest power to achieve active life Smallest package and lowest external component count

DC-DC Boost mode for disposable battery, 1 XTAL, low cost manufacturing

Inhaling noise recording for user feedback

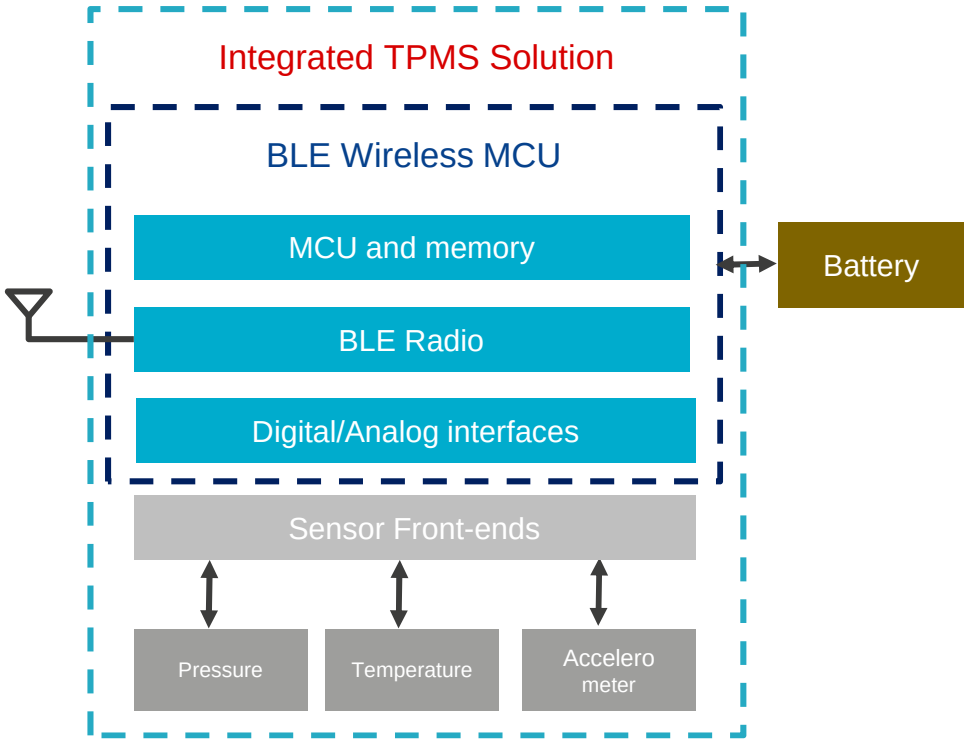
Lowest power, programmable output power

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA14531 IN AUTOMOTIVE

TPMS and wireless sensors



Feature	Benefit
Single cell and coin cell battery operation Works from 1.1 – 3.3V	Cost saving No external DC-DC when using single 1.5V battery
700nA hibernation mode with wake up from trigger	Enables much longer battery life for applications with long sleep time
AECQ100 grade 2 version planned	Automotive qualification up to 105C
Very low sleep and active power 150nA hibernation @5C 250nA hibernation @25C Total power 3.3mA @3V Total power of 2.3mA @3V	Long shelf life Long battery life
Tx power from -18 to +3dBm	Longer range than DA1458x
Minimum component count ▪ 32MHz XTAL, 32k XTAL TBC ▪ Power Inductor ▪ 2 bypass caps ▪ Filter: 2 caps and 1 inductor	Lowest BOM cost

© 2021 Renesas Electronics Corporation. All rights reserved.

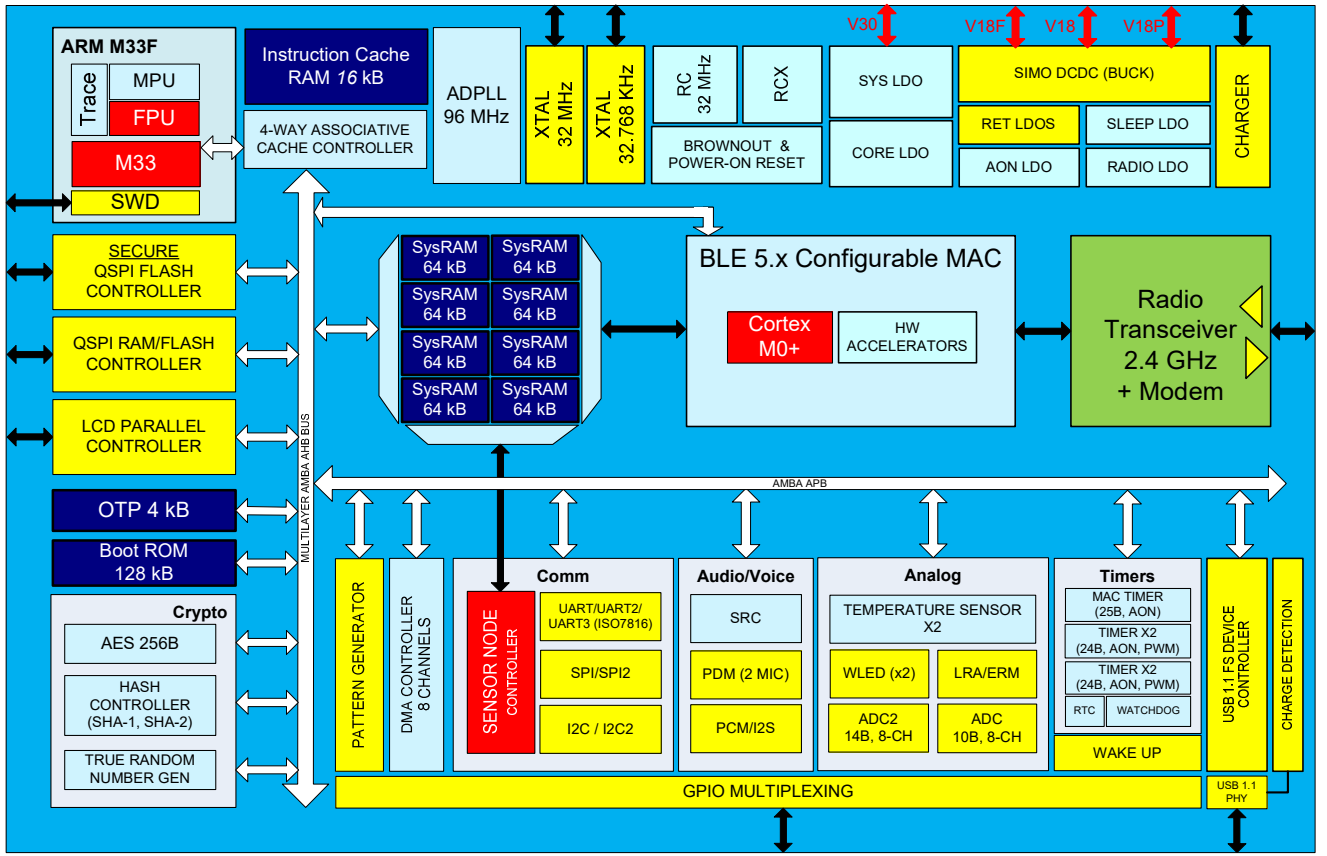
BIG IDEAS FOR EVERY SPACE RENESAS

DA1469X

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA1469X BLOCK DIAGRAM



BLE 5.x supports 2Mbps

BLE 5.x supports Advertising Ext.

- M33 delivers 144 DMIPS @96MHz
- M0+ implements timing critical BLE stack (Controller)
- TinyCPU for Sensor Node Control and data acquisition
- 512 Kbytes of RAM
  - ~120 needed for M0+ code/data. Rest for App
- LCD controller
  - with own DMA
  - SPI/Parallel support
  - Ext. PSRAM if needed
- Security:
  - Encrypted FLASH img
  - Authentication @booting
  - HW key manipulation
  - Protected OTP key area
  - Sticky bits for config.
- Full JEITA supporting USB Charger in HW
- Power Management Unit for external components:
  - 3V pin, 150 mA
  - 1.8V pin, 50 mA
  - 1.8V/1.2V pin, 50 mA

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

A DEVICE FOR EACH APPLICATION

DA1469x Product Family

Features	DA14691	DA14695	DA14697	DA14699
MCU	M33F, M0+, SNC	M33F, M0+, SNC	M33F, M0+, SNC	M33F, M0+, SNC
RAM size	384KB	512KB	512KB	512KB
Multi-core	yes	yes	yes	yes
USB Controller and USB pins	yes	yes	yes	yes
1.8V and 3.0V power rails	yes	yes	yes	yes
Audio Processing Unit	yes	yes	yes	yes
Charger	no	yes	yes	yes
Parallel LCD Controller	no	yes	yes	yes
QSPI RAM controller	no	yes	yes	yes
LRA/ERM	no	no	yes	yes
White LEDs	no	no	yes	yes
Analog hand driver	no	no	no	yes
Total GPIOs	44	44	55	55
Packages	VFBGA86, 6x6mm, Pitch 0.55mm	VFBGA86, 6x6mm, Pitch 0.55mm	VFBGA100, 5x5mm, Pitch 0.475mm	VFBGA100, 5x5mm, Pitch 0.475mm



Generic MCU applications

Application-specific

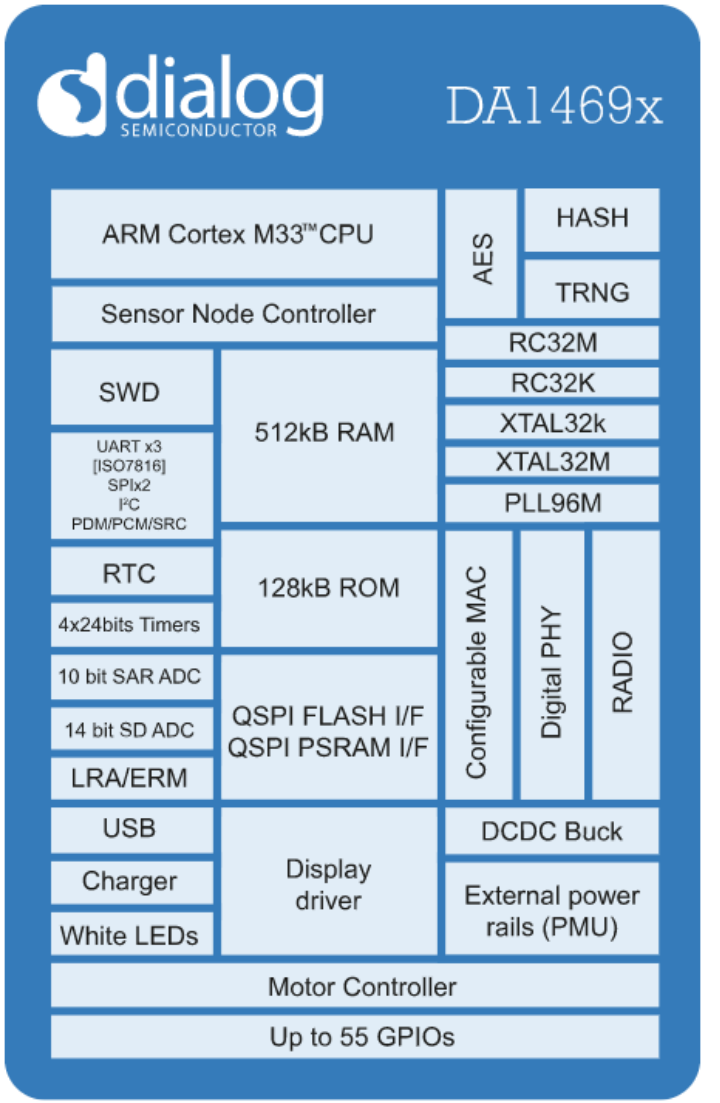
© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA1469X KEY FEATURES AND BENEFITS

- Multi-core wireless microcontroller family
- World's first Arm Cortex M33™ wireless microcontrollers in production
- Configurable protocol engine supporting latest Bluetooth® 5.2 standard
- **State-of-the-art built-in system power management unit**
- **Integrated battery charger**
- **Unique mix of analog and digital peripherals**
- Saves on PCB space and system cost

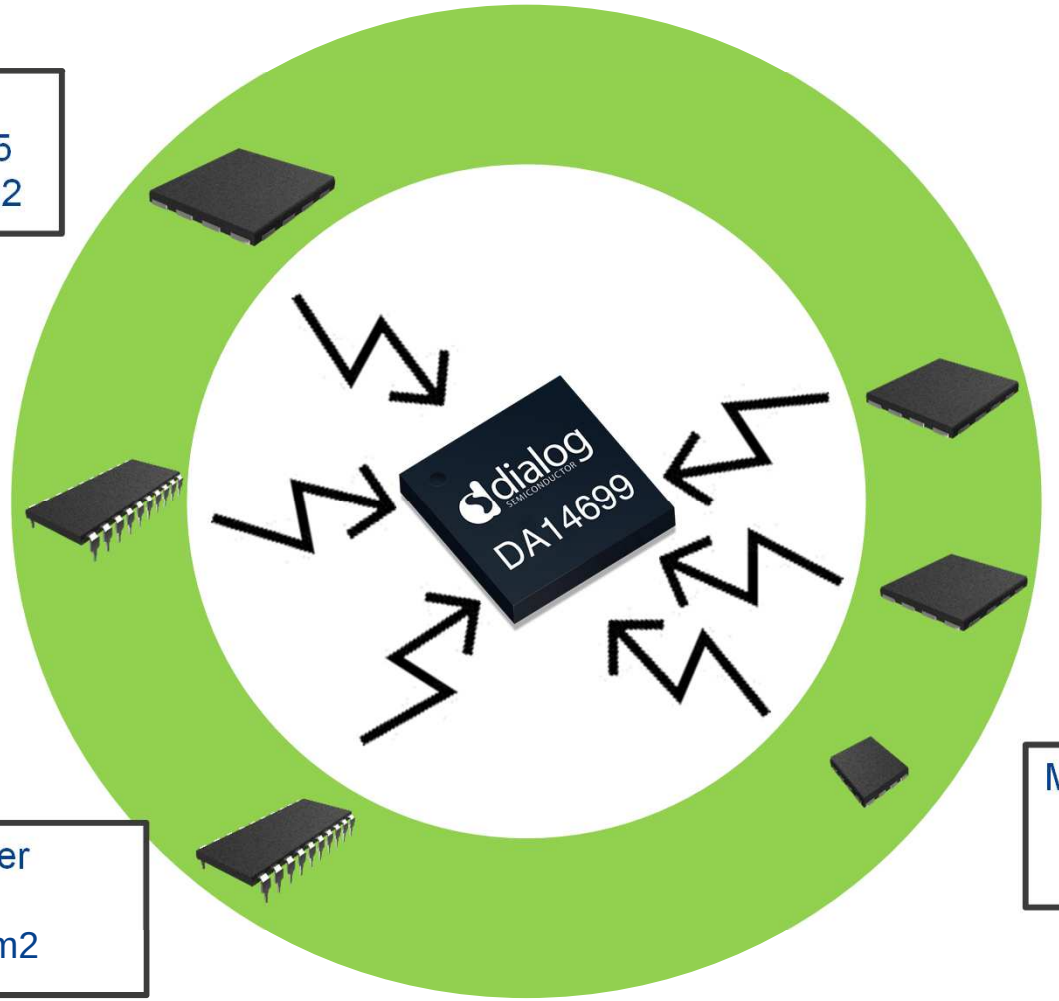




© 2021 Renesas Electronics Corporation. All rights reserved.

DA14699 PCB SPACE AND COST SAVINGS

DA14699 Integration



LRA driver
- $0.25
- 9mm2

Level shifters
- $0.03
- 2.8mm2

Parallel I/F driver
- $0.30
- 2.5mm2

Battery charger
- $0.3
- 6.25mm2

PMIC
- $0.25
- 4.8mm2

Motor control
- $0.15
- 4mm2

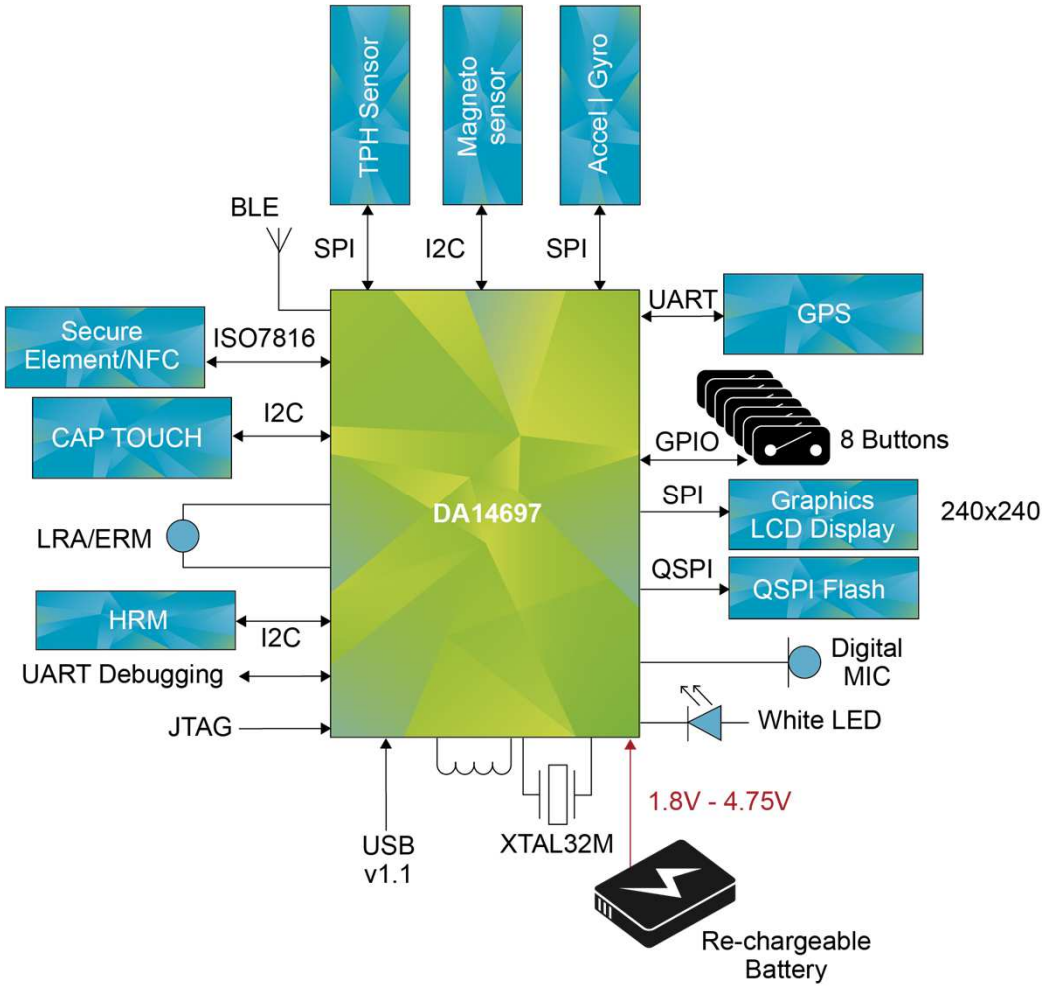
Save up to:
- $1.28 on BoM
- 38mm2 on PCB space*

*: includes 30% routing overhead

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA1469X TARGET MARKETS AND APPLICATIONS



Connected Sports Watch

- True single-chip system solution
- Simplifies hardware development
- Delivers great battery lifetime
- Lowers system cost
- Improves production reliability
- No external PMIC needed

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA1469X APPLICATION

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA1469X TARGET MARKETS AND APPLICATIONS

Applications	Target Customers
Wearables	Fitbit, Garmin, Polar, Suunto, Fossil, Samsung, Xiaomi, Huawei
Game console and virtual reality controllers and headsets	Google, Samsung, Facebook (Oculus), Valve, Nvidia, Nintendo, Sony, Amazon, Xiaomi, Microsoft
Voice remote controllers	Apple, Amazon, UEI, Roku, Sony, Samsung, LG, Panasonic
Consumer and Smart home applications	Dyson, Google, Honeywell, GE, Philips, Samsung, Xiaomi, Shark Ninja, Panasonic
E-Cigarettes	Philip Morris (iQOS), BAT, Imperial tobacco (myBlu), R.J. Reynolds (Vuse), Japan tobacco (Logic), Markten
Toys	Mattel, Vtech, Disney, Nikko, Lego, Simba, Clementoni, Scalextric, Furby, Hasbro
Access control	ASSA Abloy, Bosch Security, Kaba group, Honeywell, Siemens, Tyco, Dorma, ADT LLC, DDS, Schneider, Panasonic
Advanced Proximity (WiRa)	Contact tracing (Disney entertainment parks, Carnival Cruises), Parking garage management (Didi), Door Locks (August, ASSA Abloy, Indoor positioning)



© 2021 Renesas Electronics Corporation. All rights reserved.

PROVEN INTEROPERABILITY (IOP)

Dialog tests for seamless connectivity with over 500 smartphone models from around the globe



dialog SEMICONDUCTOR

Company confidential

Interoperability Testing Report

Smart Tag Global Interoperability Report

QA-C-001

t describes the activities and results for tests that were performed using Dialog Semiconductor rence device and a global device database of 500 mobile phones.

Area	Phones	Results
Europe	158	Pass
North America	96	Pass
Japan (Asia)	28	Pass
China	145	Pass
Korea (Asia)	24	Pass
Others (Asia)	49	Pass
Total	500	Pass

The test results were all Pass for all regions.

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

SOFTWARE AND DEV KITS/EVAL BOARDS

	DA1453x	DA1469x
IDE	SmartSnippets (Eclipse)	SmartSnippets (Eclipse)
Compiler	GCC/Keil/IAR	GCC/Keil
SDK OS base	Bare metal scheduler	FreeRTOS
AT commands	CodeLess	N/A
Tools	SmartSnippets Toolbox - Board setup - Memory programming tool (Flash/OTP) - Terminal scripting - Logging - Power measurement and profiling - Battery lifetime estimator - RF Master tool	SmartSnippets Toolbox - Board setup - Memory programming tool (QSPI Flash) - Terminal scripting - Logging - Power measurement and profiling - RF Master tool
Production Support	Production Line Tool (PLT)	Production Line Tool (PLT)

smart{snippets}

GCC

KEIL Tools by ARM

freeRTOS

CodeLess

smart{snippets}



PRO DK







USB DK

ARDUINO

mikro BUS

+



Easy PoC design using sensor click boards and software examples

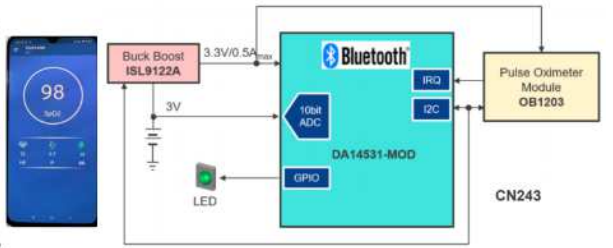
© 2021 Renesas Electronics Corporation. All rights reserved.

WINNING COMBO'S: A GREAT WAY OF CROSS SELLING

CN243 SMART CONNECTED PULSE OXIMETER

System Overview

Smart health applications continue to be an expanding market which needs to account for high performance, low power and high integration in various medical solutions. The pulse oximeter is a small electronic device that measures an individual's oxygen saturation level, or the oxygen levels in the blood. It is an important device used to monitor the health of individuals with any type of condition that can affect blood oxygen levels. Renesas' Smart Oximeter with Mobile App is a turnkey solution that provides a full system reference design, medical level algorithm and mobile connectivity with reference apps. This super-low power solution has the ability of measuring accurately even on the most difficult of human subjects.



System Benefits

- Smallest biosensor module : 4.2 x 2 x 1.2mm
- Includes the OB1203 heart rate, blood oxygen concentration, pulse oximetry, proximity, light and color sensor for accurate measurements
- Open-source code for reference design
- Super-low power Bluetooth® Low Energy (LE) for portable equipment
- Mobile App is available

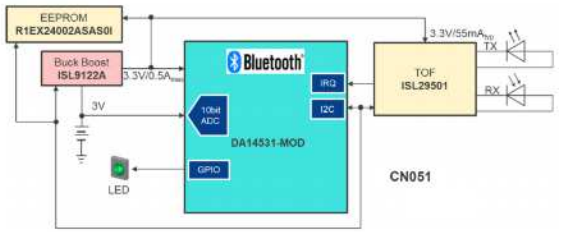
Target Applications

- Home healthcare
- Treadmill with added oximeter
- IoT healthcare
- Wearable device (finger mode)

CN051 SMART TOF BASED RANGEFINDER WITH MOBILE APP

System Overview

A rangefinder is a device used to measure the distance from an observer to a target. This smart rangefinder solution, which incorporates Renesas' ISL29501 Time of Flight (ToF) sensor IC, is easy to design and control, while also achieving accurate wide range distance measurement. Optimized for handheld applications, this solution includes the world's lowest power Bluetooth® Low Energy (LE) system-on-chip (SoC) to implement wireless communication and offers long battery life.



System Benefits

- Long distance measurement: 0.15m to 10m
- Distance measurement accuracy <3%
- High ambient light immunity in outdoor light
- Super-low power Bluetooth LE for portable equipment
- Mobile App is available

Target Applications

- Home automation
- Industrial proximity sensing
- Distance measurement

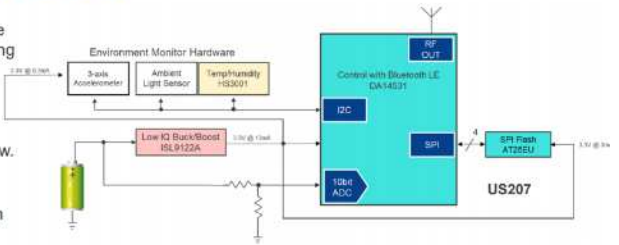
Device Category	P/N	Key Features
Dialog	DA14531MOD	SmartBond TINY™ Module with the lowest power Bluetooth 5.1
Power	ISL9122A	A buck-boost switching regulator with low quiescent current consumption
Analog	ISL29501IRZ-T7	TOF Sensor, Time of Flight based signal processing integrated circuit
	R1EX24002ASAS0I	Two-wire serial interface 2k EEPROM

US207 SMART ASSET TRACKING LABEL

System Overview

The smart tracking label provides a method of container and device tracking that provides environmental data during transit. The tracking can report a container's or device's presence via Bluetooth® 5.1 either at a depot or through a tablet or mobile phone application.

Renesas' Smart Tracking Label design is optimized with ultra-low power devices and several standby options for minimal current draw.



System Benefits

- The DA14531 module provides Bluetooth Low Energy (LE) with only 9mA TX current and less than 1µA hibernation mode
- Low IQ buck-boost regulator allows maximum use of battery life and numerous battery topology options
- Serial FLASH for data logging, consuming only 3mA for read/write
- Sniff-mode to wake-up the DA14531 Bluetooth LE module from hibernation

Target Applications

- Container tracking
- Security locker monitor
- Device tracking

Device Category	P/N	Key Features
Analog	HS3001	High Performance Relative Humidity and Temperature Sensor
Power	ISL9122A	Ultra-Low Iq Buck-Boost Regulator
Dialog	DA14531	Ultra Low Power Bluetooth 5.1 SoC
	AT25EU	Ultra-low Energy Serial NOR Flash with Fast Erase

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

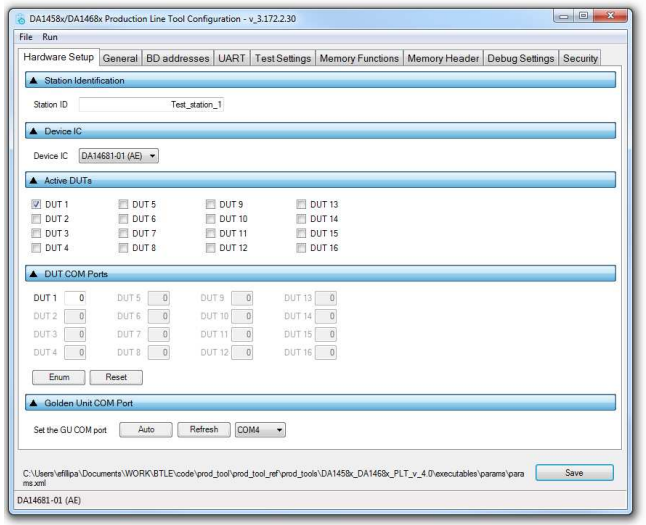
THE PRODUCTION LINE TOOL ADVANTAGE

Unique production ramp-up support

Over 120 customers have eased into mass production using Dialog's unique **Production Line Tool**

- Such as Alibaba, Huawei, Microsoft, Samsung/Wacom, Xiaomi





Reduce cost and increase throughput in volume test & programming of units

- High volume and short testing time
  - Up to 16 products in parallel
- Low overall cost of tester equipment
  - Works with industry standard Anritsu test equipment
- Ease of integration
  - DLL based commands
- Flexibility in programming to OTP, Flash or EEPROM memory

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

SUPPORT AND SALES COLLATERAL

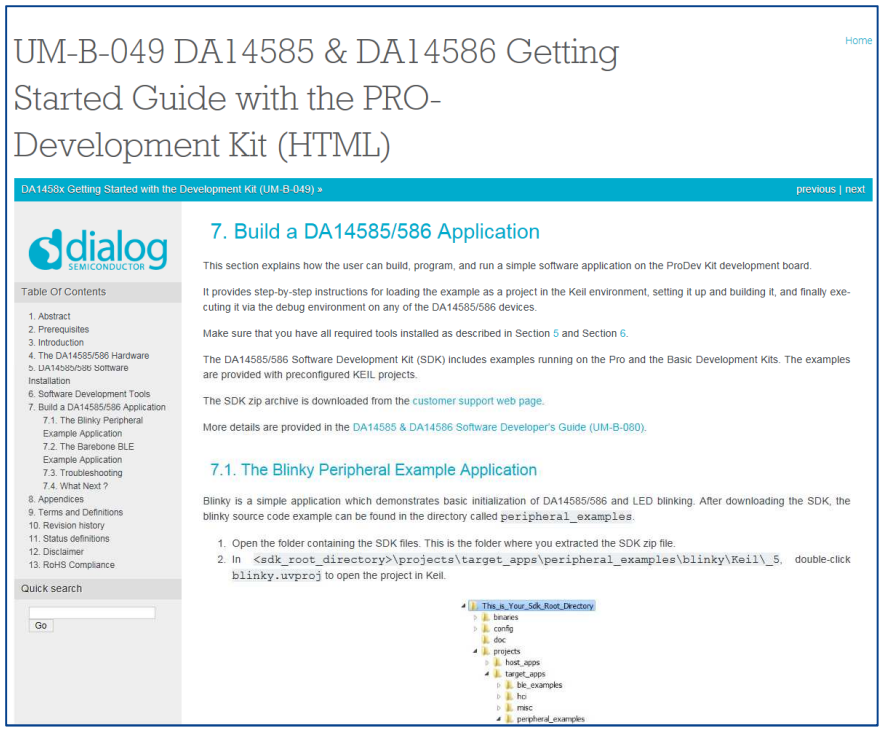
Dialog Semiconductor Website / Connectivity / Bluetooth low energy section

- Datasheets, app notes, user guides, reference designs, software, white papers, webinars, newsletters
- https://www.dialog-semiconductor.com/bluetooth-low-energy

Online forum support, your question may be answered already

- Knowledge base on 6000 different topics and 20000 different users
- https://support.dialog-semiconductor.com/forum
- https://servicedesk.dialog-semiconductor-wp.com

FAE support for all regions



© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

SUMMARY

Bluetooth LE SmartBond portfolio delivers

- Lowest power consumption and smallest size with integrated buck/boost power management (DA145xx)
- Highest level of integration, e.g. integrated system PMU/charger (DA1469x)
- Flexibility, e.g. multi core devices with configurable MAC (DA1469x)
- Best in class radio

DA1453x is ideal for simple standalone applications or as an easy way to enable connectivity to an existing MCU solution

DA1469x is ideal for applications requiring higher processing power and more flexibility on memory and interfaces

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

LOW POWER WIFI PRODUCTS

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

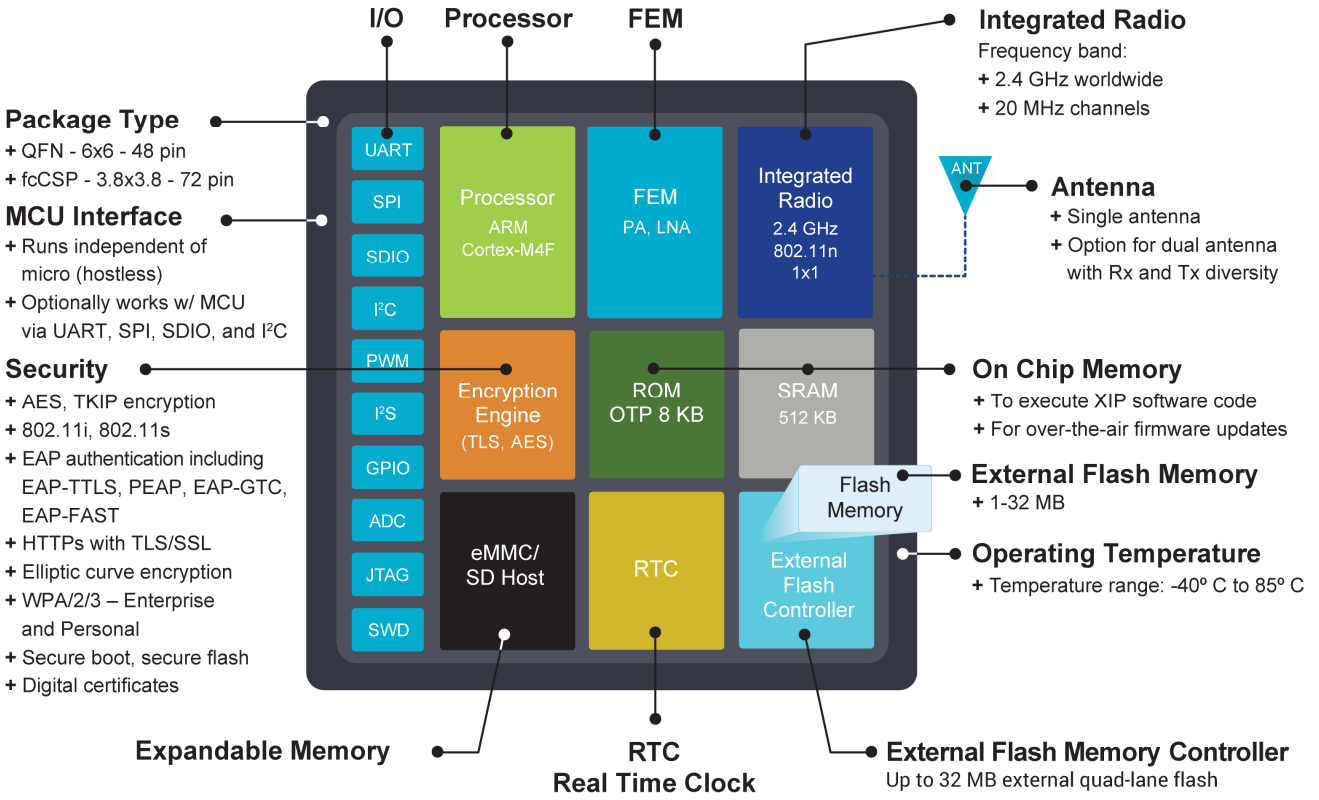
DA16200 BLOCK DIAGRAM

- **Fully integrated** Wi-Fi system on an SoC
  - All full front-end included Wi-Fi BB/MAC/RF PA, LNA, RF switch
  - 802.11 b/g/n 1x1 2.4 GHz
  - CPU core subsystem

    30~160MHz ARM Cortex-M4F

    512KB SRAM, 256KB ROM, 8KB OTP
  - Dedicated HW encryption security block
  - Extensive I/O

- Additional components needed: Flash, Antenna, Xtals (1-2), RLCs
  - **60-90 cents of rBoM**



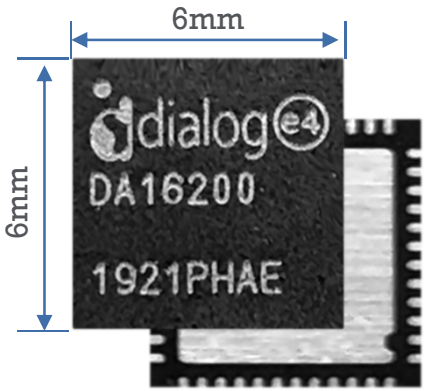
© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

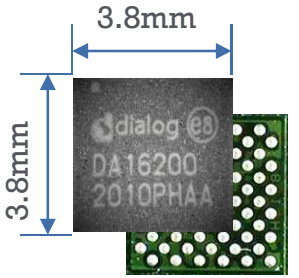
DA16200 CHIPS AND MODULES

SoCs

- Two packages for chip down designs
  - DA16200-00000A32: QFN (6x6mm), Lower Cost
  - DA16200-00000F22: fcCSP (3.8x3.8mm), Smaller Size



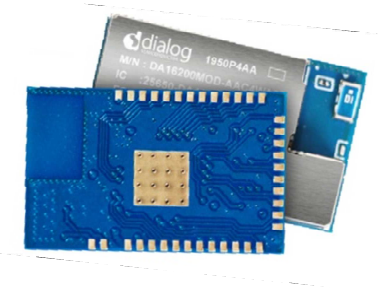
DA16200-00000A32



DA16200-00000F22

Modules

- DA16200MOD: Low power Wi-Fi System on Module
- DA16600MOD: Lowest Power Wi-Fi and Lowest Power BLE module on the market
  - Wi-Fi / BT Co-existence
- Two SKUs each with chip antenna and uFL connector
- Pre-certified: FCC, IC, CE, Telec, KCC, SRRC, Wi-Fi



DA16200MOD
13.8 mm x 22.1 mm x 3.3 mm



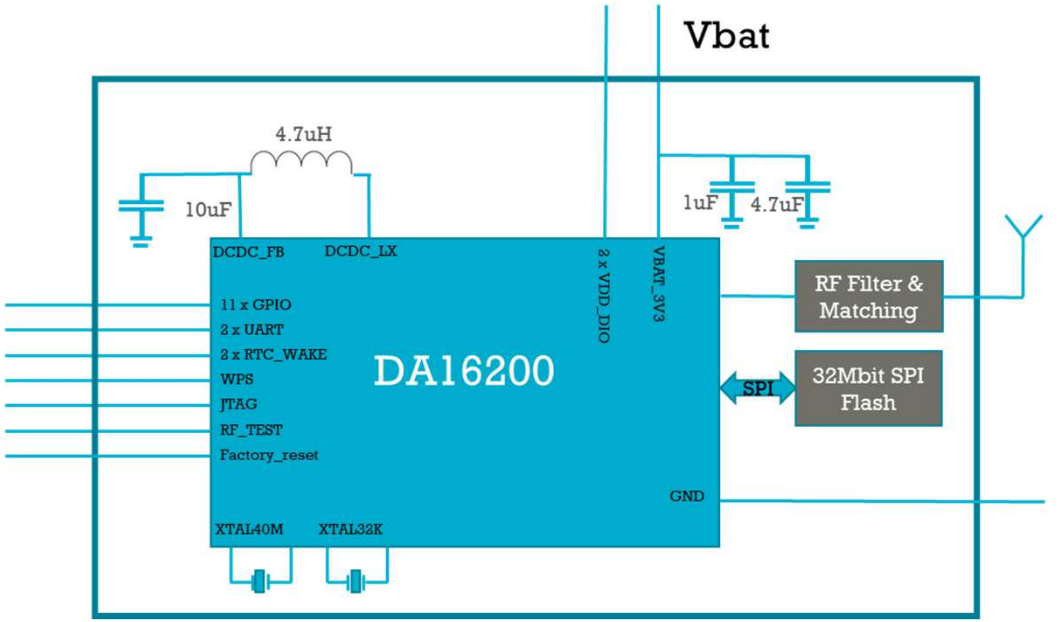
DA16600MOD
14.3 mm x 24.3 mm x 3.0 mm

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA16200MOD - MODULE

- World leading Ultra low Power Wi-Fi
- Utilizing VirtualZero™ technology
- Extended range with a class leading Link Budget (119.5dBm)
- 802.11 b/g/n 1x1 2.4 GHz
- Worldwide certifications
  - FCC, CE, IC, Telec, KC, SRRC
- Integrated Chip Antenna
- Onboard Flash and Xtal
- Fully integrated AT Command solution
  - Seamless integration with a host MCU
  - No software development needed on WiFi
- 13.8 x 22.1mm dimensions





DA16200MOD-AA**C**4WA32



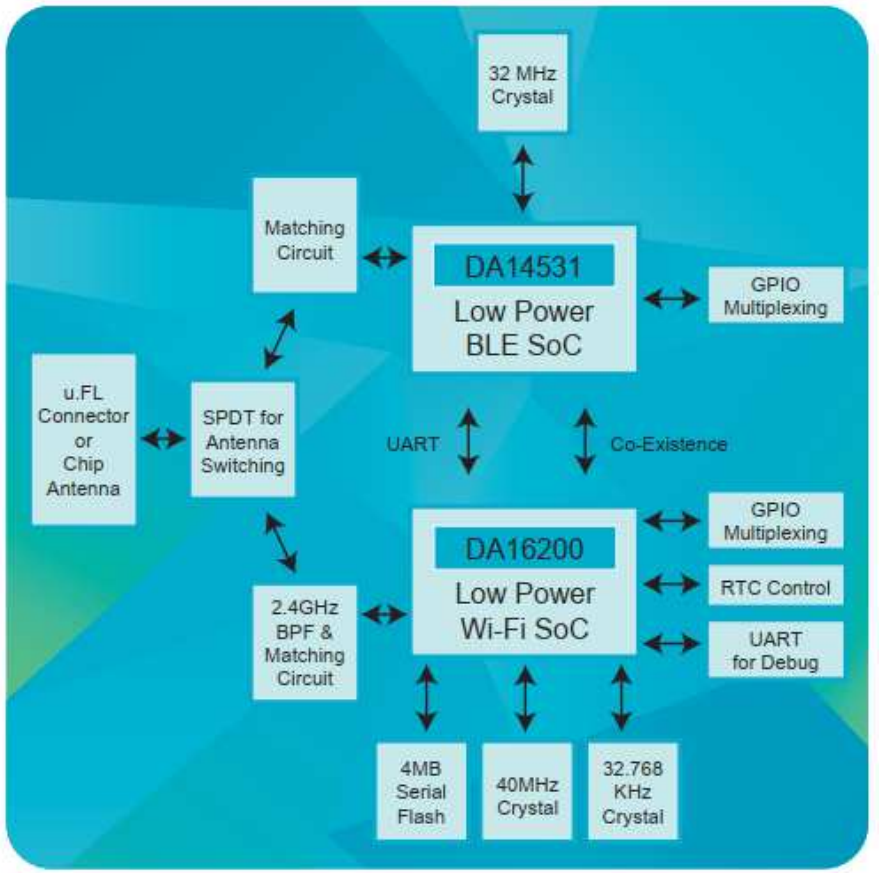
DA16200MOD-AA**E**4WA32

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

DA16600 MODULE - WI-FI/BLE COMBO

- Fully integrated Wi-Fi and BLE combo module
- DA16600 integrates
  - Wi-Fi SoC : DA16200 and BLE SoC : DA14531
- Onboard 32mbit Flash and Xtal's (40MHz, 32KHz)
- Integrated Chip Antenna
- Integrated Co-existence
- 14.3mm x 24.3 mm x 3 mm
- World wide Certifications
  - FCC, IC, CE, Korea, Telec, KRRC
- Perfect for customers looking for BLE provisioning



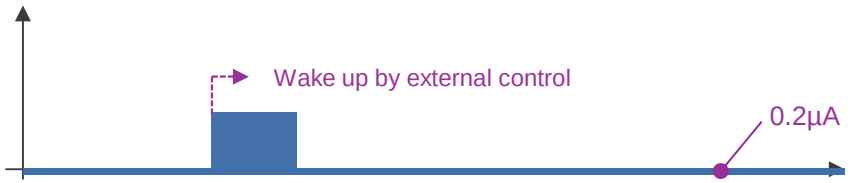
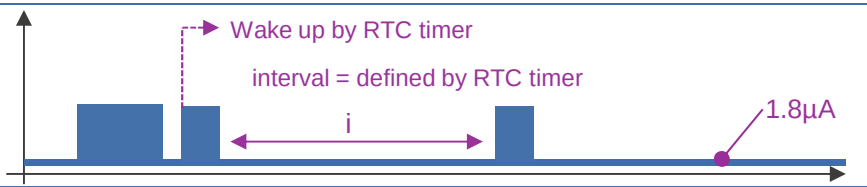
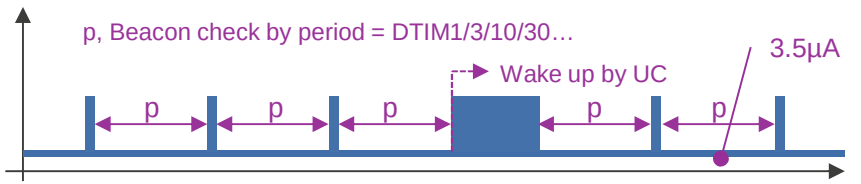
© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

VIRTUALZERO™ TECHNOLOGY

Unique sleep modes to optimize power consumption for each IoT application

- Virtually no power consumption in sleep state
- Validated for 200+ commonly used Legacy Access Points
  - Has interoperability for both lower current and communication success
- Supports 3 sleep modes based on application requirement as below:

Sleep 1	200nA	Power on/off	
Sleep 2	1.8uA	RTC enable Keeps network credentials	
Sleep 3	3.5uA	RTC enable Network reloadable	

© 2021 Renesas Electronics Corporation. All rights reserved.

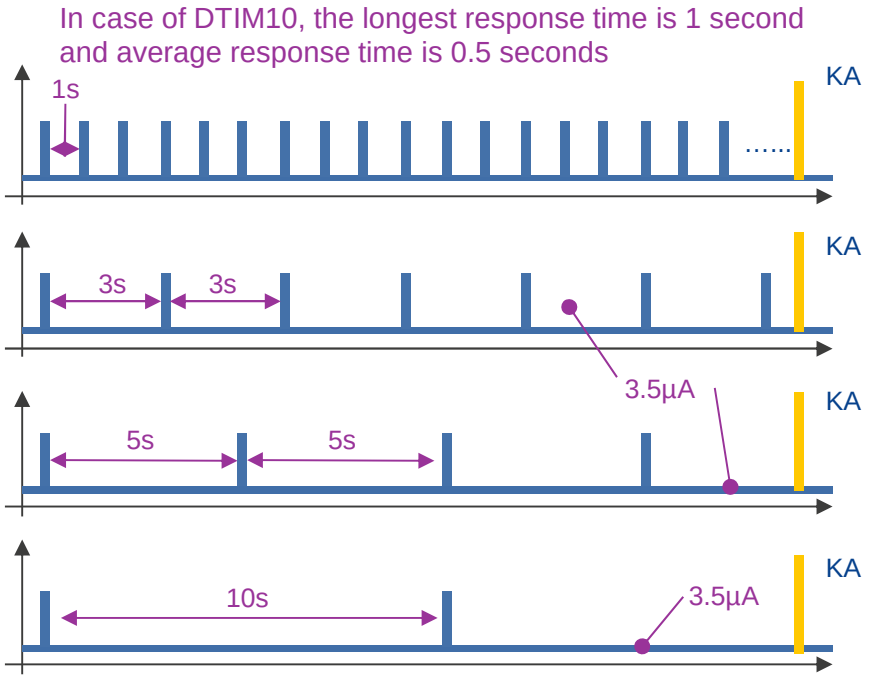
VIRTUALZERO™ TECHNOLOGY

AVG. CURRENT WITH SLEEP MODE 3

DA16200 shows the lowest average current on various APs

Sleep period	Average Current Consumption
1 second sleep (DTIM10)	72μA 1)
3 second sleep (DTIM30)	34μA 1)
5 second sleep (DTIM50)	26uA 2)
10 second sleep (DTIM100)	21uA 2)

Beacon check and KA is supported by PTIM



Note 1) Measured value, average value from 200+ APs result, Based on DTIM=1 @ AP
Note 2) Calculated value based on AP KA 30sec, AP deauthentication check 30secs, ARP update 150sec

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

KEY FEATURES: EXTENDED RANGE

For extended range, DA16200 has market leading Link budget

- +20dBm TX output power
- -99.5 dBm RX sensitivity

Item	Normal mode	Low Power mode
Tx (.11b - 1Mbps)	+20.0dBm @ 280mA	+9.5dBm @ 85mA
Tx (.11n – MCS7)	+15.5dBm @ 200mA	+2.0dBm @ 70mA
Rx Sens (1Mbps)	-99.5dBm	-99.5dBm
Link Budget	119.5dB	109.0dB

Long distance checks @ open air

Distance	RSSI	TCP Tx	TCP Rx	UDP Tx	UDP Rx
10m	-3dBm	17.6	14.3	25	39.5
50m	-48dBm	17.5	13.8	25.5	38
100m	-55dBm	17.8	13.6	24.3	25.5
200m	-76dBm	4.7	2.8	20.3	24.3
250m	-76dBm	1.8	2.1	4.9	10.2
300m	-80dBm	0.2	0.5	4.2	3.9

@ Normal Power mode, Tx Power grade 0, External Antenna

© 2021 Renesas Electronics Corporation. All rights reserved.

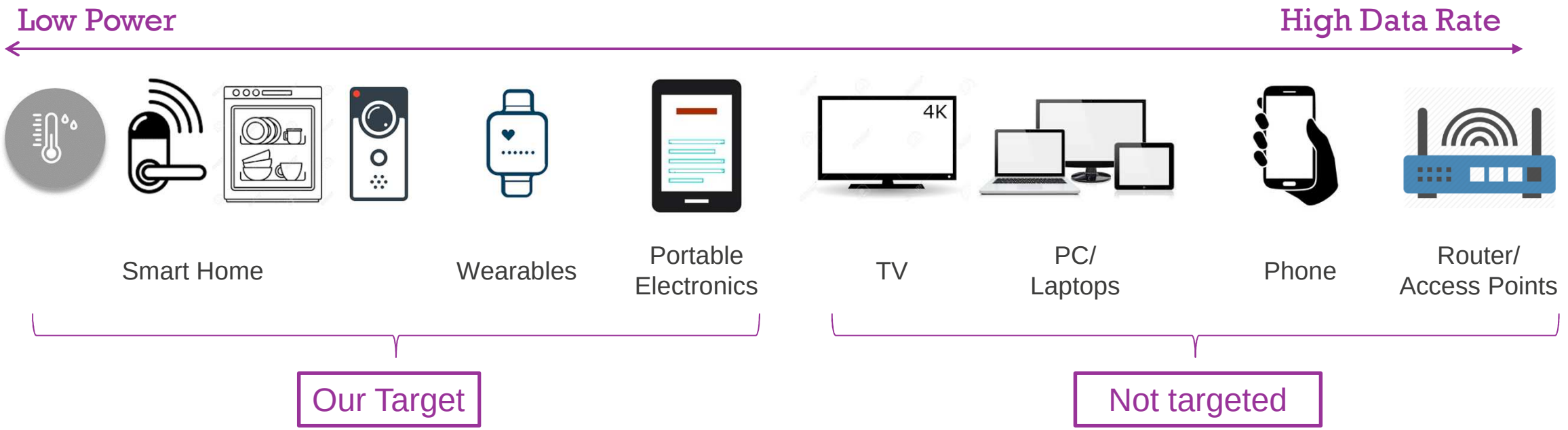
BIG IDEAS FOR EVERY SPACE RENESAS

TARGET APPLICATION

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

PRODUCT POSITIONING



Key Product Features for target applications

- Focus on reducing power consumption; Ideally battery operated
- Low data rates: less than 25 Mbps
- Premium product: customer focus is quality

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

TARGET APPLICATIONS

Wearable Devices



Smart Watches



Fitness Bands



Pet Trackers

Battery operated IoT products



Smart Doorbells



Smart Thermostats



Smart Door Locks



Smart Pens

Zigbee/Z-wave Replacement



Occupancy Sensor



Humidity Sensors



Smoke Alarm



Flow Sensors (Meter)

© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

WIRELESS SENSOR

- Thermostat
  - 30 events/day
  - 5 second sleep mode
  - 3+ years battery life

- Temperature/Humidity Sensor
  - 1,440 events/day (posts every minute)
  - 4+ years battery life with 2AAA
    - 1.2 years w/FC9000







© 2021 Renesas Electronics Corporation. All rights reserved.

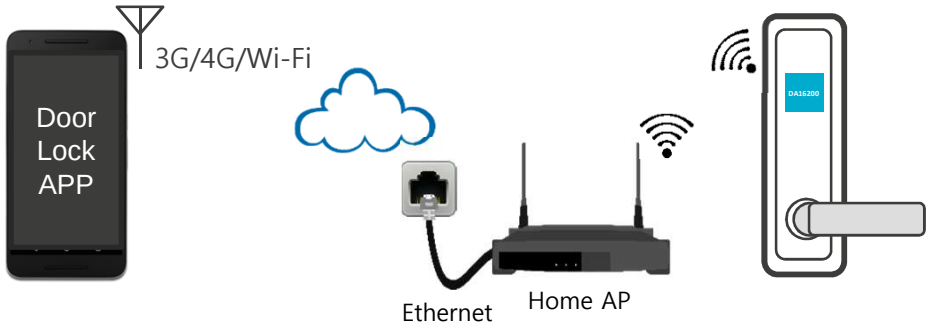
BIG IDEAS FOR EVERY SPACE RENESAS

DOOR LOCK

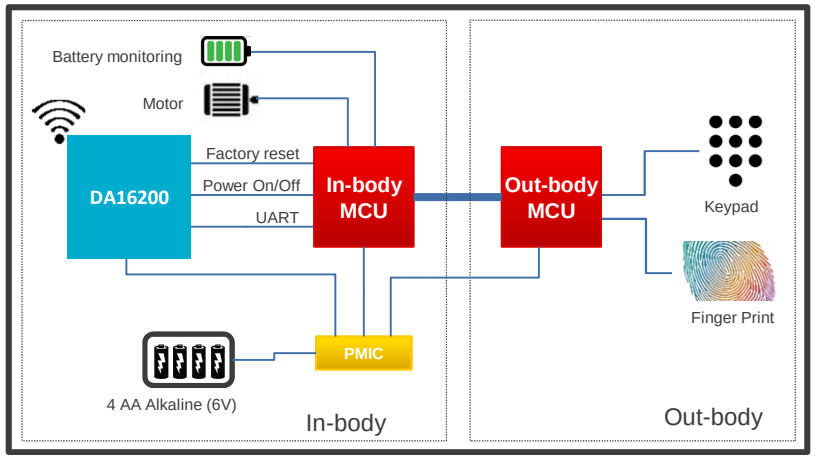
- Always Connected
- Open / close the door whenever user wants to wherever they are
- Check door status remotely in real-time
- Upload events, log, and battery status to server in real-time

- Support provisioning methods; SoftAP Mode

- OTA support including Host firmware update



- Example System diagram



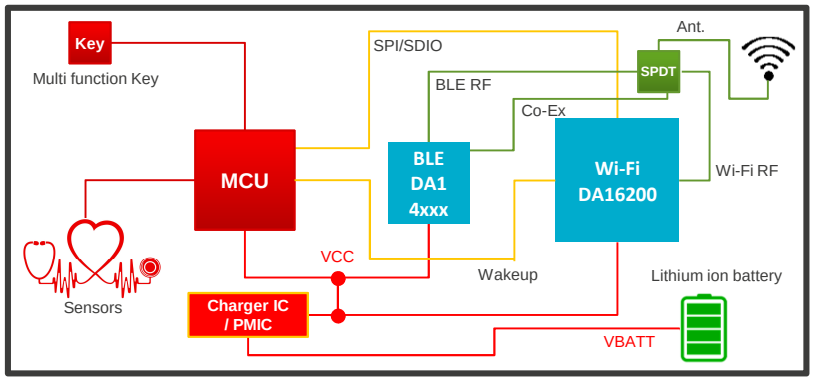
- low power consumption/long battery life: 1+ life time
- Battery life time is depending on application type
- 20times/day, check batter life time on existing door Lock performance

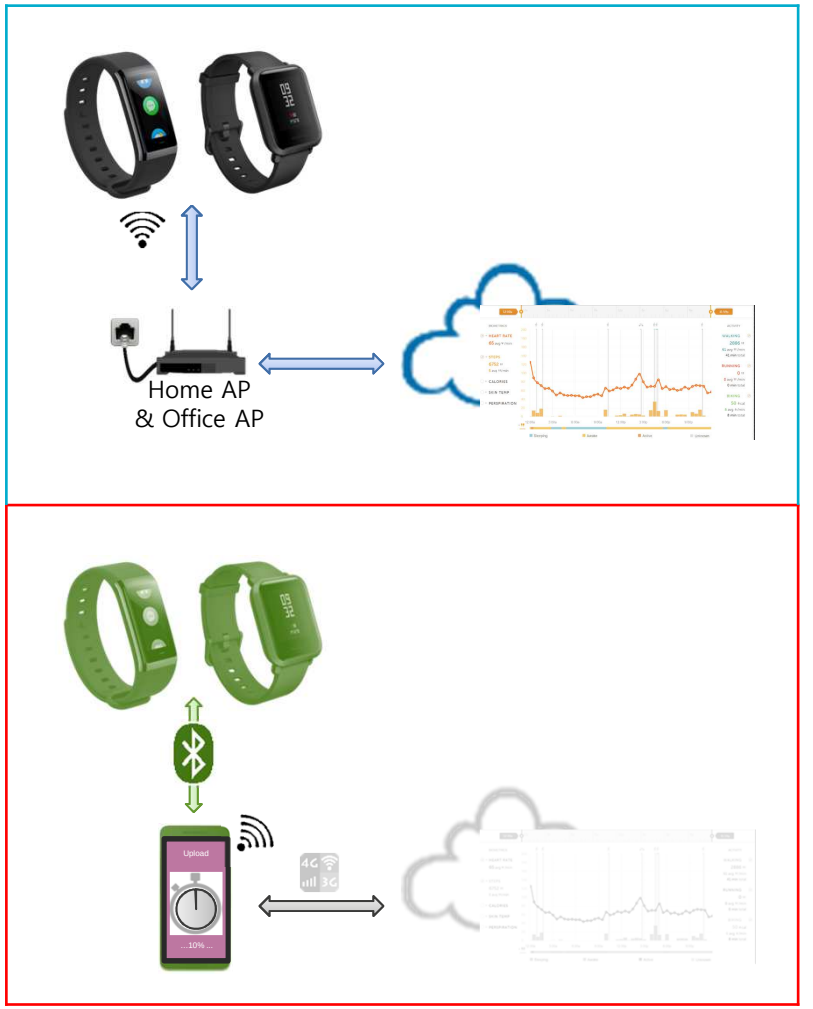
© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

SMART WATCH/BAND

- Smart Watch with DA16200
- Can transmit huge sensor data to Cloud within 0.5mins [1)]
- Can access Cloud not through Smartphone/Gateway
- Support multiple provisioning data
- BLE Coexistence, OTA System upgrade
- Block diagram





Existing Smart Watch/Band

- Uses BLE so it take 60mins to send huge sensor data to Cloud
- Mobile phone access is mandatory to be connected with Cloud

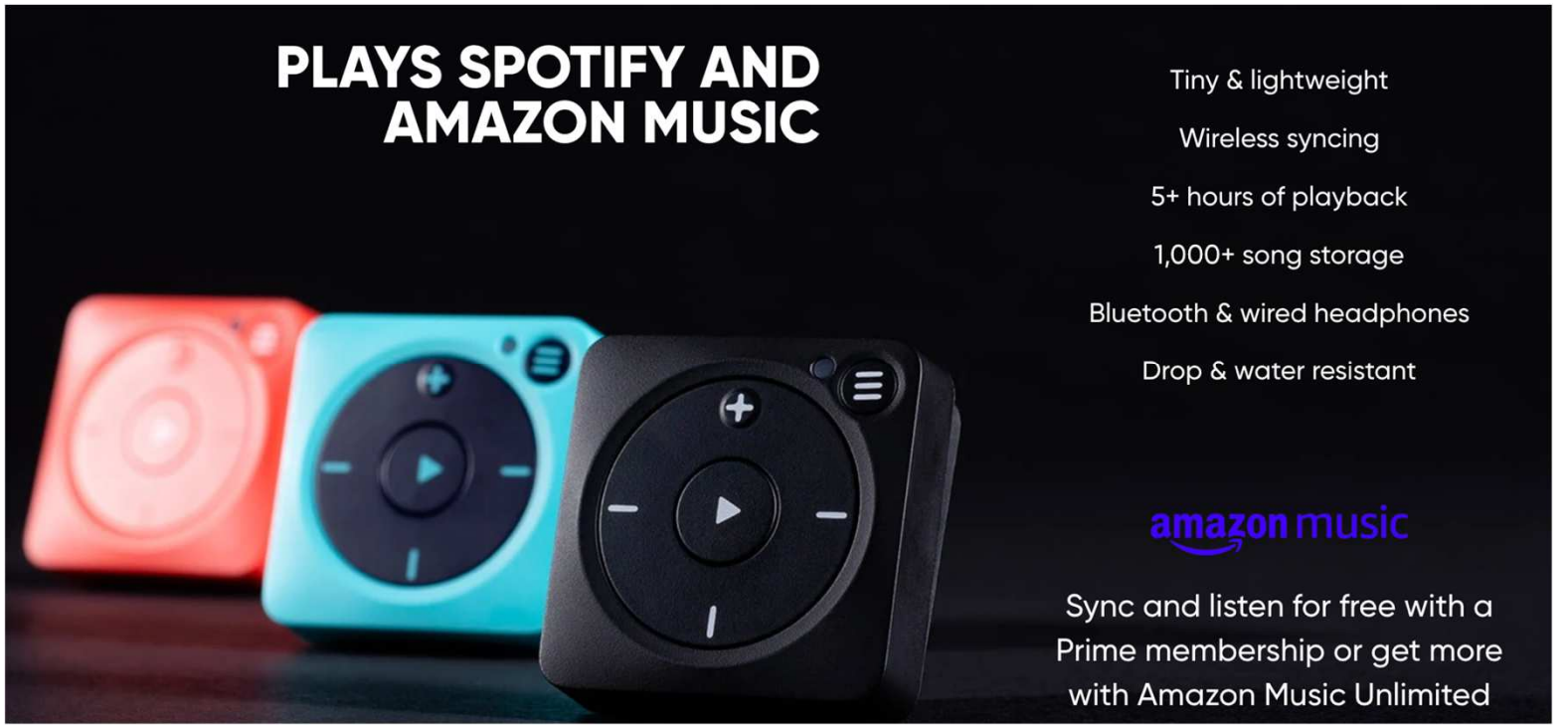
© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

MUSIC PLAYER

Keys to the win:

- Full SoC with stack
- Low power
- Integration support



© 2021 Renesas Electronics Corporation. All rights reserved.

BIG IDEAS FOR EVERY SPACE RENESAS

Renesas.com

© 2021 Renesas Electronics Corporation. All rights reserved.