The world's smallest and lowest power Bluetooth 5.1 System-on-Chip

SMARTBOND™ DA14531

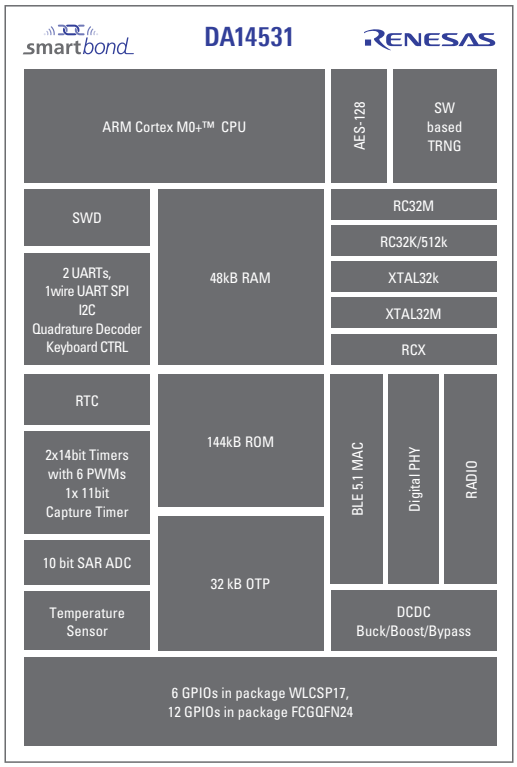
The DA14531 aka SmartBond TINY™ is the Bluetooth® low energy solution to power the next 1 billion IoT devices

SmartBond TINY™, the world's smallest and lowest power Bluetooth 5.1 System-on-Chip, brings down the cost of adding Bluetooth low energy in any system in high volumes. This awesome combination takes mobile connectivity to places previously out of reach, triggering a wave of a billion IoT devices, all with **SmartBond TINY™** at the heart.

The low system cost is achieved through the high level of integration in **SmartBond TINY™**: a complete Bluetooth low energy system can be achieved with the addition of 6 tiny external passives, a crystal and power source. And to lower the barrier of entry, **SmartBond TINY™** will also be available in an easy-to-use tiny module incorporating all the needed components, making the addition of Bluetooth low energy to any application a simple drop-in.

Record low hibernation and active power consumption ensure long operating and shelf life with even the tiniest, disposable batteries. Based on a powerful 32-bit arm Cortex M0+ with integrated memories and a complete set of analog and digital peripherals, **SmartBond TINY™** is extremely power efficient, delivering a record score of 18300 on the latest EEMBC benchmark for IoT connectivity, IoTMark™.

Available in a tiny 2.0 x 1.7 mm package, the DA14531 is half the size of its predecessor, or any offering from other leading manufacturers. And it is complemented by a flexible SDK supporting major compilers such as Keil and GCC out of the box.



Benefits

- Future proof, compliant with Bluetooth 5.1 (core)
- Optimized for disposable products in connected health, connected consumer
  - Designed to work with disposable, even printed batteries
  - Works well with smallest capacity batteries, <<30mAh
  - Supports multiple years of shelf life
  - Inrush current can be limited for disposable batteries with high internal resistance
  - Package design allows for low cost manufacturing with smallest possible footprint
- Only requiring a single 32MHz crystal
- In bypass mode no DC-DC inductor required
- No boost converter required when working with 1.5V batteries
- Production Line Tool for accelerated production ramp up, resulting in faster time to market and shortest production test time per device

Applications

- **Connected consumer:** Beacons, Smart labels, Remote controls, Proximity tags, Connected watches, Stylus pens, Mouse, Toys, Low power sensors, Bluetooth LE add on “BLE pipe” to existing applications
- **Connected health:** Connected injectors, Inhalers, Glucose monitors, Smart patches, Blood pressure meters, Thermometers
- **Automotive:** Tire Pressure Monitoring Systems and low power wireless sensors

Software and Hardware Tools

SmartSnippets SDK

The DA14531 is delivered with our complete SmartSnippets™ Software Development Kit including Renesas' mature and proven Bluetooth stack already used with DA14585, an existing device in production. The SDK allows easy migration between existing DA14585 and DA14531 if the software and features used, meet requirements.

The SDK supports

- Bluetooth 5.1 core features
- SUOTA for easy Software-Upgrade-Over-the-Air
- HCI/GTL support to act as BLE data pipe for an external MCU
- Security with software based TRNG
- Key profiles like Device information, battery service
- Software examples

SmartSnippets Studio

SmartSnippets™ Studio is a royalty-free software development platform for Smartbond™ devices. It fully supports the DA14531 and existing DA14585/6. The compiler support for DA14531 is based on the free version from Keil.

SmartSnippets Toolbox

SmartSnippets™ Toolbox is provided with the Development Kit of Renesas' Bluetooth chipset. It is targeting the main activities of programming and optimizing code for best power performance.

Key features from the Toolbox are:

- Battery life estimation
- Data rate monitoring
- Power profiling for real-time access of power consumption
- Programmer of FLASH and OTP
- Interfacing to hardware for device configuration: Power modes, radio setting etc.

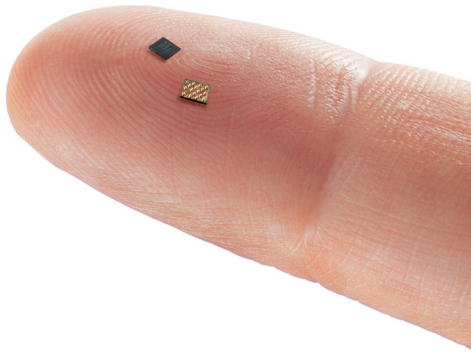
Production Line Toolkit

The Production Line Toolkit enables customers to save cost by

- Accelerated production set up (fast track to production start)
- High throughput of less than 1 sec/device by running 16 devices under test in parallel

Main functionalities

- XTAL trimming
- RF testing
- SW programming
- Functional testing



Key Features

Supports Bluetooth 5.1 core features

- Supports up to 3 Bluetooth LE connections

Processing power

- 16 MHz 32 bit ARM® Cortex-M0+ with SWD interface
- Dedicated Link Layer Processor
- AES-128 encryption Processor
- Software based certified True Random Number Generator (TRNG)

Memory architecture

- 32 kB One-Time-Programmable (OTP)
- 48 kB Retainable System RAM
- 144 kB ROM

Integrated Power Management

- Integrated Buck/Boost DCDC converter
- DCDC linear bypass mode
- Battery supply voltage range: 1.1 to 3.3V
- Clock-less Hibernation mode of 240nA @ 25˚C and 150nA @ 5˚C
- Battery voltage monitoring mechanism
- Programmable reset circuitry
- Inrush current control to facilitate operation from high-ohmic batteries

Radio transceiver

- -94 dBm receiver sensitivity
- Programmable transmit output power power from -20 dBm to +2.5 dBm
- TX: 3.5 mA at 0 dBm, RX: 2.2 mA at VBAT_HIGH = 3 V with DC-DC on
- 50 Ω matched single-wire antenna

Available packages

- WLCSP 17 (1.7x2.0, 0.5 mm pitch)
- FCGQFN 24 (2.2x3.0, 0.4 mm pitch)

Selection of digital and analog interfaces

- 12 (FCGQFN) or 6 (WL-CSP) general purpose I/Os with programmable voltage levels
- Two UARTs, one with hardware flow control, 1-wire UART
- SPI interfaces
- I2C bus interfaces at 100 kHz, 400 kHz
- Three-axis capable quadrature decoder
- Keyboard controller
- Real Time Clock (RTC)
- 2 General purpose timers with 6 PWM signals per timer
- General purpose timer with capturing capabilities
- 4-channel 10-bit ADC with averaging capability achieving 11 ENOB
- Temperature sensor

Ordering Information

DA14531 SoC's

Part number	Package	Pitch(mm)	Size (mm)	Shipment	Pack Quantity
DA14531-00000FX2	FCGQFN24	0.4	2.2x3	Reel	4k
DA14531-00000OG2	WLCSP17	0.5	1.7x2.05	Reel	4k

DA14531 Development Kits

Part number	Description
DA14531-00FXDEVKT-P	Bluetooth Low Energy Development Kit Pro for DA14531: Includes motherboard, daughterboard and cables; Primary usage is SW application development and power measurements
DA14531-00FXDEVKT-U	Bluetooth Low Energy Development Kit USB for DA14531: Includes USB board; Primary usage is SW application development
DA14531-00FXDB-P	Bluetooth Low Energy DA14531 FCGQFN24 daughterboard for the DA14531 DEVKT-P Pro motherboard
DA14531-000GDB-P	Bluetooth Low Energy DA14531 WLCSP17 daughterboard for the DA14531 DEVKT-P Pro motherboard

For more information and purchasing please visit:
www.renesas.com/DA14531

DA14531 Development Kit-Pro

DA14531 Development Kit-USB

DA14531 Daughterboard

DA14531 Daughterboard

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