

# CONECTIVIDADE (BLUETOOTH/WI-FI)

COM OS MÓDULOS E  
MICROCONTROLADORES DA RENESAS

AUGUST 2024  
DIEGO MORENO  
STAFF FIELD APPLICATIONS ENGINEER  
RENESAS ELECTRONICS CORPORATION

# DIEGO MENDES MORENO

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- Joined Renesas in February 2022
  - Field Applications Engineer (FAE) responsible for technical support in Brazil with emphasis on Renesas MCU lineup (RA, RX, Synergy and RL78)
- Bachelor of Electronics Engineering (Centro Universitário da FEI) and MBA in Software Engineering (Impacta Tecnologia)
- 9 years of experience in Embedded Systems
  - Embedded Software Engineer in precision planting products (wireless connectivity, CAN, development of internal tools, etc.)
  - Field Applications Engineer in distribution of electronic components (embedded development of various applications, technical support and technical training)



# AGENDA

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- Renesas and VLA (Representative) introduction
- RA Family of Arm® Cortex®-M based MCUs
- Connectivity Portfolio (Bluetooth LE and Wi-Fi modules)
  - DA14531MOD Bluetooth® Low Energy Module
  - DA16200MOD Ultra-Low Power Wi-Fi Modules
- Power Management
- Demo
- Q&A
- Get in Touch – Contact info

# RENESAS ELECTRONICS

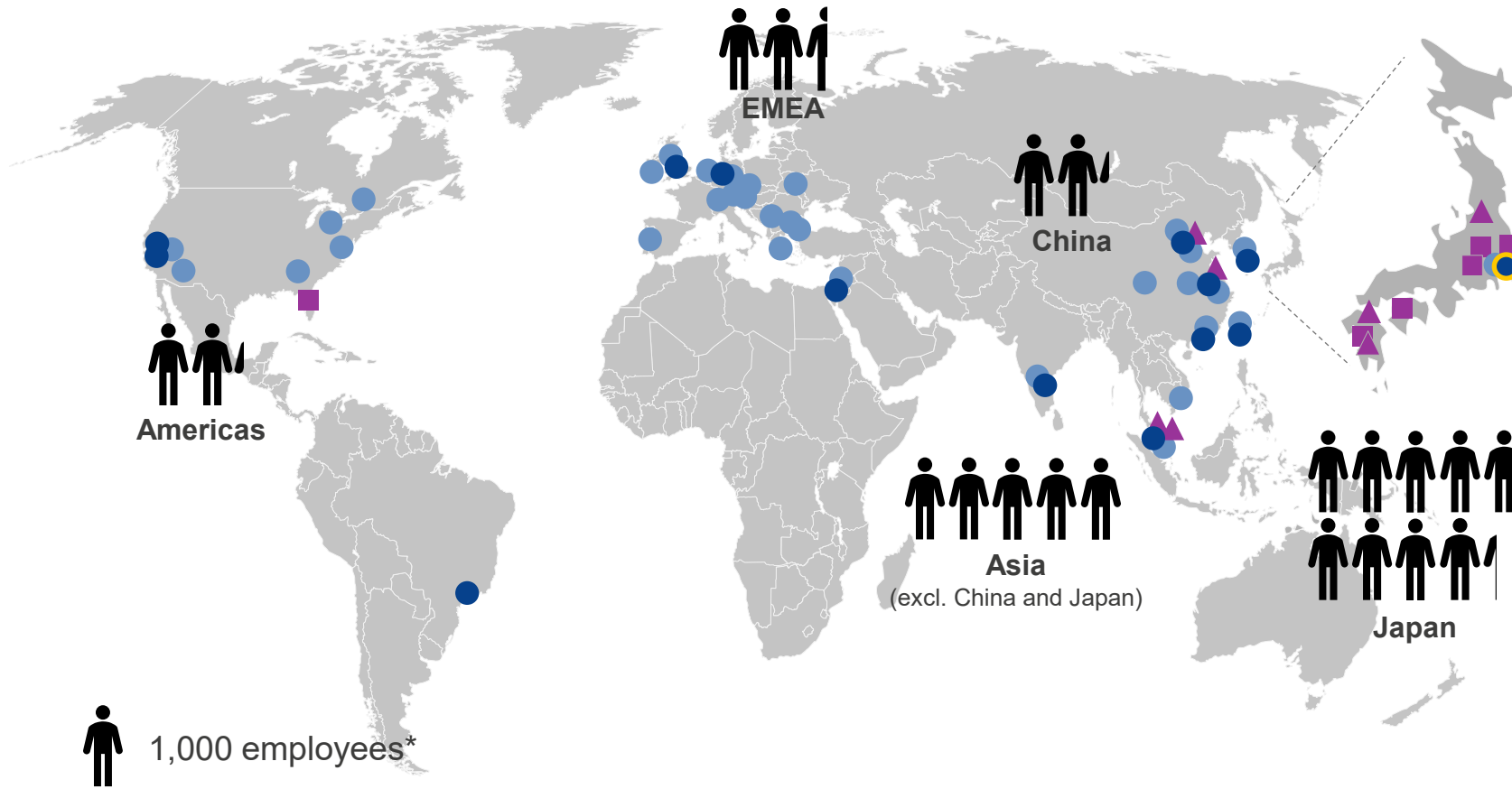
## AND VLA (REPRESENTATIVE) INTRODUCTION

# VLA & RENESAS partnering since 2004

Our history starts with the foundation of **Vista Latin America LLC**, an US based Sales Rep Company with offices in US, Mexico and Brazil. When the company went out of business due little traction in US and MX, the Brazilian executive team decided to continue the South and Central America operation, establishing **VLA Solutions LTDA** in Brazil.



# GLOBAL NETWORK



Global sales network operating across more than 20 countries

Comprehensive R&D capabilities enable seamless support across the globe

12 manufacturing facilities in Japan, China, Southeast Asia, and the US

Global partners such as TSMC and GLOBALFOUNDRIES

● Headquarters ● Major sales offices ● R&D sites ● Manufacturing sites (□Front-end, △Back-end)

\* Consolidated, as of December 31, 2023



# BROAD AND SCALABLE PRODUCT PORTFOLIO

## Microcontrollers & Microprocessors, System-on-Chips (SoCs)



High-end 32/64-bit MPUs  
High-resolution HMI, Industrial network & real-time control



Advanced 32-bit MCUs  
Arm ecosystem, Advanced security, Intelligent IoT



High Power Efficiently 32-bit MCUs  
Motor control, Capacitive touch, Functional safety, GUI

**RISC-V**  
products

General-purpose 64-bit MPUs (RZ/Five Group)  
Application-specific 32-bit MCUs



Ultra-low Energy 8/16-bit MCUs  
Bluetooth® Low Energy, SubGHz, LoRa®-based Solutions  
Automotive actuators & sensors, Low-end ECUs



Automotive 32-bit MCUs  
Rich functional safety and embedded security features



Automotive SoCs  
Next generation of automotive computing

## Analog and Power Devices

- Analog products
- Clocks & Timing
- Interface & Connectivity
- Memory & Logic
- Power & Power management
- Programmable Mixed-signal, ASIC, & IP products
- RF products
- Sensor products
- Space & Harsh environment
- Timing
- Wireless Power
- Battery Management
- Power Devices
- Power Management
- Sensors
- Video & Display

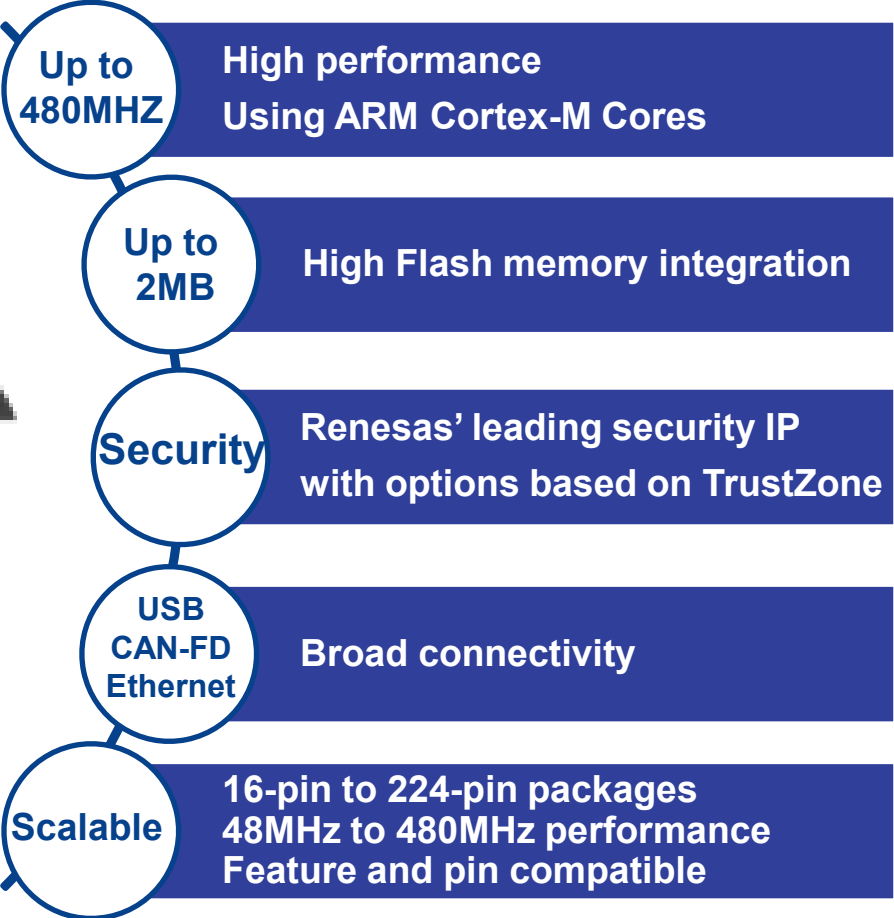
# RA FAMILY

ARM® CORTEX®-M BASED MCUS

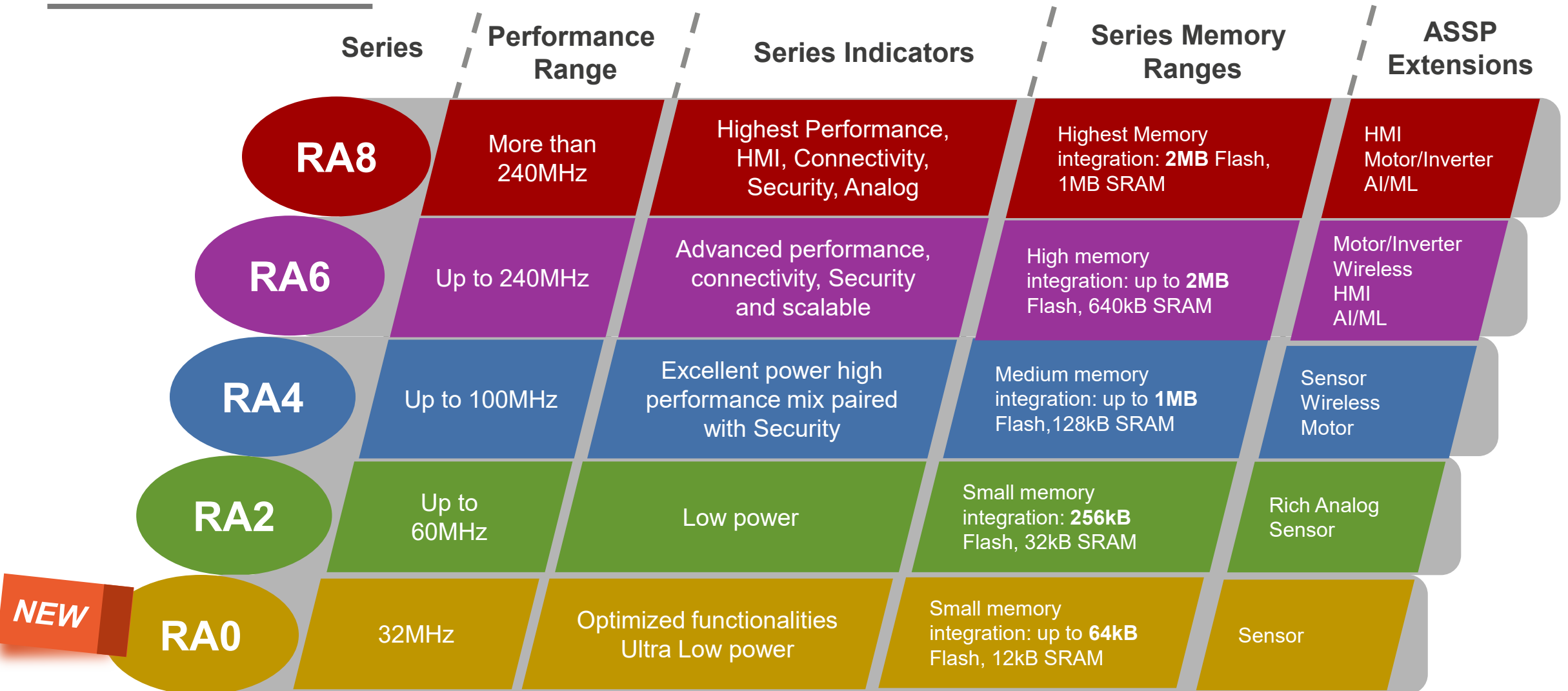


# INTRODUCING 32-BIT RENESAS RA FAMILY

HIGH PERFORMANCE, HIGH SECURITY, BROAD CONNECTIVITY AND WIDE LINE-UP



# RENESAS RA FAMILY SERIES LINE-UP



# RA PORTFOLIO



<b>RA8</b>	<b>RA8M1</b> 480MHz Cortex-M85, ~2MB Flash USBHS/FS, Ethernet, RSIP7	<b>RA8D1</b> 480MHz Cortex-M85, ~2MB Flash GLCDC, MIPI-DSI, Ethernet, RSIP7				<b>RA8T1</b> 480MHz Cortex-M85, ~2MB Flash Motor, Ethernet, RSIP7
<b>RA6</b>	<b>RA6M3</b> 120MHz Cortex-M4, ~2MB Flash Ethernet, USBHS/FS, TFT-LCD, SCE7	<b>RA6M5</b> 200MHz Cortex-M33, ~2MB Flash TrustZone, Ethernet, USB, CANFD, SCE9	<b>RA6E2</b> 200MHz Cortex-M33, ~256KB Flash TrustZone, USBFS, CANFD			<b>RA6T2</b> 240MHz Cortex-M33, ~512KB Flash 16-bit ADC, IIR Filter, TFU
	<b>RA6M2</b> 120MHz Cortex-M4, ~1MB Flash Ethernet, USBFS, CAN, SCE7	<b>RA6M4</b> 200MHz Cortex-M33, ~1MB Flash TrustZone, Ethernet, USBFS, OSPI, SCE9	<b>RA6E1</b> 200MHz Cortex-M33, ~1MB Flash TrustZone, USBFS, CAN			<b>RA6T3</b> 200MHz Cortex-M33, 256KB Flash TrustZone, USBFS, PGA, CMP, TFU
	<b>RA6M1</b> 120MHz Cortex-M4, 512KB Flash USBFS, CAN, SCE7					<b>RA6T1</b> 120MHz Cortex-M4, ~512KB Flash PWM, PGA, CMP
<b>RA4</b>		<b>RA4M3</b> 100MHz Cortex-M33, ~1MB Flash TrustZone, USBFS, CAN, SCE9	<b>RA4E2</b> 100MHz Cortex-M33, 128KB Flash TrustZone, USBFS, CANFD			
	<b>RA4M1</b> 48MHz Cortex-M4, 256KB Flash USBFS, Seg-LCD, Touch, 14bit SAR ADC	<b>RA4M2</b> 100MHz Cortex-M33, ~512KB Flash TrustZone, USBFS, CAN, SCE9	<b>RA4E1</b> 100MHz Cortex-M33, ~512KB Flash TrustZone, USBFS, CAN		<b>RA4W1</b> 48MHz Cortex-M4, 512KB Flash Bluetooth, Seg-LCD, Touch, 14bit SAR ADC	<b>RA4T1</b> 100MHz Cortex-M33, ~256KB Flash TrustZone, PGA, CMP, TFU
<b>RA2</b>			<b>RA2E3</b> 48MHz Cortex-M23, ~64KB Flash 32-48pin, 5V			
		<b>RA2L1</b> 48MHz Cortex-M23, ~256KB Flash CAN, Touch Sensing	<b>RA2E2</b> 48MHz Cortex-M23, ~64KB Flash 16-24pin, 5V, I2C(High-speed)/I3C	<b>RA2A1</b> 48MHz Cortex-M23, 256KB Flash USBFS, Touch, 24bit SD/16bit SAR ADC		
			<b>RA2E1</b> 48MHz Cortex-M23, ~128KB Flash Touch Sensing, WLCSP Package			
<b>RA0</b>			<b>RA0E1</b> 32MHz Cortex-M23, 64KB Flash, 16 – 32 pin, 1.6V-5.5V, ± 1% HOCO			
	Mainstream Line /Low Power		Entry Line	Rich Analog	Wireless	Motor Control

# FEATURE OVERVIEW OF RENESAS RA2 SERIES



## Performance

- 32MHz Arm® Cortex® M23 CPU with optimized peripherals for cost sensitive applications

## Low Power

- Best-in class low power consumption in 32-bit MCU
- 2.7 mA@32MHz in Active, 0.2 uA in Standby
- Fast wake up from Standby mode (1.6us)

## Security

- TRNG & Unique ID
- HW Safety features for IEC/UL60730 certification

## Key features

- Support wide operation voltage range: 1.6 to 5.5V
- -40 to 105°C
- High-precision ( $\pm 1.0\%$ ) high-speed on-chip oscillator

# PACKAGE LINE UP AND DEVELOPMENT SCHEDULE

## Package line up

FLASH/ RAM Size	64kB/ 12kB	RA0E1	RA0E1	RA0E1	RA0E1	RA0E1
	32kB/ 12kB	RA0E1	RA0E1	RA0E1	RA0E1	RA0E1
Pin Count Package Size Pitch		16pin HWQFN 3x3mm 0.5mm	20pin LSSOP 4.4x6.5mm 0.65mm	24pin HWQFN 4x4mm 0.5mm	32pin HWQFN 5x5mm 0.5mm	32pin LQFP 7x7mm 0.8mm



# FEATURE OVERVIEW OF RENESAS RA2 SERIES



## Performance

- Up to 48MHz with the Cortex M23 Core

## Connectivity

- Supporting a wide range of standard communication peripherals like, CAN, USB, SCI, SPI, etc....

## Security

- AES accelerator, TRNG and Unique ID to support Security requirements

## Advanced Analogue And HMI

- Support of 24bit Sigma Delta ADC and 16bit ADC on some RA2 Series devices
- Support of up to 32ch of Touch Key

# RENESAS RA2 SERIES - PRODUCT LINE-UP

FLASH / RAM Size	256kB / 32kB					RA2A1			RA2A1	RA2A1		RA2A1		RA2A1		
	128kB / 32kB										RA2L1	RA2L1		RA2L1	RA2L1	RA2L1
	128kB / 16kB				RA2E1	RA2E1	RA2E1	RA2E1			RA2E1	RA2E1	RA2E1	RA2E1	RA2E1	
	64kB / 16kB				RA2E1	RA2E1 RA2E3	RA2E1 RA2E3	RA2E1			RA2E1 RA2E3	RA2E1 RA2E3	RA2E1	RA2E1	RA2E1	
	64kB / 8kB	RA2E2	RA2E2	RA2E2												
	32kB / 16kB				RA2E1	RA2E1 RA2E3	RA2E1 RA2E3	RA2E1			RA2E1 RA2E3	RA2E1 RA2E3				
	32kB / 8kB	RA2E2	RA2E2	RA2E2												
	16kB / 8kB	RA2E2	RA2E2	RA2E2												
	Pin Count Package	16pin WL CSP	20pin QFN	24pin QFN	25pin WL BGA	32pin LQFP	32pin QFN	36pin LGA	36pin BGA	40pin QFN	48pin LQFP	48pin QFN	64pin BGA	64pin LQFP	64pin LQFP	80pin LQFP
Size in mm	1.84 x	4x4	4x4	3x3	7x7	5x5	4x4	5x5	6x6	7x7	7x7	4x4	14x14	10x10	12x12	14x14
Pitch in mm	1.87 0.4	0.5	0.5	0.4	0.8	0.5	0.5	0.8	0.5	0.5	0.5	0.4	0.8	0.5	0.5	0.5

# FEATURE OVERVIEW OF RENESAS RA4 SERIES



## Performance

- Up to 100MHz with the Cortex M33 Core
- Up to 48MHz with the Cortex M4 Core

## Connectivity

- Supporting a wide range of standard communication peripherals like, USB, CAN, SSI, SCI, SPI, QSPI, etc....
- Bluetooth 5.0

## Security

- Crypto Module with different cryptography accelerator and TRNG
- Crypto Module supports Key management
- Devices with CM33 Core supports Trust Zone and Tamper resistance

## HMI

- Segment LCD Controller of up to 38Seg and 8 Com
- Support of up to 27ch of Touch Key

# RENESAS RA4 SERIES - PRODUCT LINE-UP

FLASH / RAM Size	1MB / 128kB								RA4M3			RA4M3	RA4M3		RA4M3	RA4M3
	768kB / 128kB								RA4M3			RA4M3	RA4M3		RA4M3	RA4M3
	512kB / 128kB					RA4M2	RA4M2 RA4E1		RA4M2 RA4E1			RA4M3	RA4M2		RA4M3	RA4M3
	512kB / 96kB							RA4W1								
	384kB / 128kB					RA4M2	RA4M2		RA4M2				RA4M2			
	256kB / 128kB					RA4M2	RA4M2 RA4E1		RA4M2 RA4E1				RA4M2			
	256kB / 40kB	RA4T1	RA4T1			RA4T1	RA4T1		RA4T1							
	256kB / 32kB				RA4M1	RA4M1	RA4M1		RA4M1	RA4M1			RA4M1	RA4M1		
	128kB / 40kB		RA4E2 RA4T1	RA4E2			RA4E2 RA4T1		RA4E2 RA4T1			RA4E2				
Pin Count Package Size (mm) Pitch (mm)	32pin LQFP 7x7 0.8	32pin QFN 5x5 0.5	36pin BGA 4x4 0.5	40pin QFN 6x6 0.5	48pin LQFP 7x7 0.5	48pin QFN 7x7 0.5	56pin QFN 7x7 0.4	64pin LQFP 10x10 0.5	64pin QFN 8x8 0.4	64pin BGA 5x5 0.5	64pin BGA 6x6 0.65	100pin LQFP 14x14 0.5	100pin LGA 7x7 0.65	144pin BGA 7x7 0.5	144pin LQFP 20x20 0.5	

# FEATURE OVERVIEW OF RENESAS RA6 SERIES



## Performance

- Up to 240MHz with the Cortex M33 Core
- Up to 120MHz with the Cortex M4 Core

## Connectivity

- Supporting a wide range of standard communication peripherals like Ethernet, USB, CAN, SSI, SCI, SPI, QSPI, Octa SPI etc....

## Security

- Crypto Module with different cryptography accelerator and TRNG
- Crypto Module supports Key management
- Devices with CM33 Core supports Trust Zone and Tamper resistance

## HMI

- One chip TFT drive support by some RA6 Series devices (incl. Segger emWin)
- Support of up to 20ch of Touch Key

## Motor

- Convenient solution that easy to start evaluation right away  
CPU card, Inverter board with motor, Sample code, GUI tool
- Manage two motors with one MCU using integrated peripherals



# RENESAS RA6 SERIES - PRODUCT LINE-UP

FLASH / RAM Size	2MB / 640kB										RA6M3		RA6M3		RA6M3	RA6M3	RA6M3	
	2MB / 512kB											RA6M5		RA6M5	RA6M5		RA6M5	RA6M5
	1.5MB / 512kB											RA6M5		RA6M5	RA6M5		RA6M5	RA6M5
	1MB / 640kB											RA6M3		RA6M3		RA6M3	RA6M3	RA6M3
	1MB / 512kB											RA6M5		RA6M5	RA6M5		RA6M5	RA6M5
	1MB / 384kB											RA6M2		RA6M2		RA6M2		
	1MB / 256kB						RA6E1				RA6M4	RA6M4		RA6M4	RA6M4			
	768kB / 256kB							RA6M4			RA6M4	RA6M4		RA6M4	RA6M4			
	512kB / 384kB										RA6M4	RA6M2		RA6M2	RA6M4	RA6M2		
	512kB / 256kB						RA6E1		RA6M1			RA6M1		RA6M1	RA6M4			
	512kB / 64kB					RA6T2	RA6T2		RA6T1		RA6T2							
	256kB / 64kB					RA6T2	RA6T2		RA6T1		RA6T2							
	256kB / 40kB			RA6E2	RA6E2		RA6E2		RA6E2		RA6E2							
128kB / 40kB		RA6T3	RA6E2	RA6E2		RA6E2		RA6E2		RA6E2								
		RA6T3	RA6E2	RA6E2	RA6T3	RA6T3		RA6T3		RA6T3								
Pin Count	32pin	32pin	36pin	48pin	48pin	64pin	64pin	64pin	64pin	64pin	100pin	100pin	144pin	144pin	145pin	176pin	176pin	
Package	LQFP	QFN	BGA	LQFP	QFN	LQFP	QFN	BGA	BGA	BGA	LQFP	LGA	LQFP	BGA	LGA	LQFP	BGA	
Size (mm)	7x7	5x5	4x4	7x7	7x7	10x10	8x8	5x5	6x6	6x6	14x14	7x7	20x20	7x7	24x24	13x13		
Pitch (mm)	0.8	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.65	0.65	0.5	0.65	0.5	0.5	0.5	0.5	0.8	

# FEATURE OVERVIEW OF RENESAS RA8 SERIES



## Performance

- Up to 480MHz with high performance Arm Cortex-M85 Core
- 6.39 CM/MHz and Helium for acceleration of AI/ML and DSP tasks
- Achieving best processing and power performance

## Connectivity

- Supports a wide range of communication peripherals like Ethernet, USB, CAN-FD, SSI, SCI, SPI, I2C, I3C, xSPI compliant Octal SPI with XIP and Decryption-on-the-fly

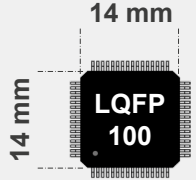
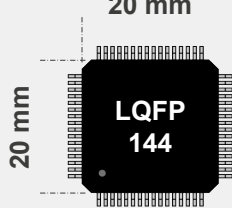
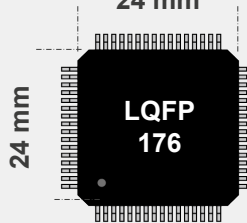
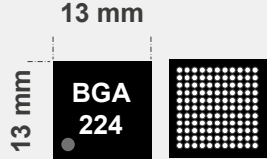
## Security

- Advanced Renesas Security IP with TRNG and leading-edge NIST compliant cryptographic algorithms
- Key management and immutable storage for FSBL
- TrustZone and Tamper resistance w/ DPA/SPA side channel protection

## HMI Graphics

- Graphics LCD Controller supporting WXGA resolutions, with parallel RGB and MIPI-DSI interfaces
- 2D Drawing Engine, 16bit Camera interface
- 32bit SDRAM interface

# RA8M1 GROUP PACKAGE LINEUP

Flash/ SRAM	2MB Flash 1MB SRAM	<b>R7FA8M1AHECFP</b>	<b>R7FA8M1AHECFB</b>	<b>R7FA8M1AHECFC</b>	<b>R7FA8M1AHECBD</b>
	1MB Flash 1MB SRAM	<b>R7FA8M1AFECFP</b>	<b>R7FA8M1AFECFB</b>	<b>R7FA8M1AFECFC</b>	<b>R7FA8M1AFECBD</b>
Pin Count		100-pin	144-pin	176-pin	224-pin
Package type		LQFP			BGA
Package view		 <p>14 mm 14 mm LQFP 100 0.5 mm pitch</p>	 <p>20 mm 20 mm LQFP 144 0.5 mm pitch</p>	 <p>24 mm 24 mm LQFP 176 0.5 mm pitch</p>	 <p>13 mm 13 mm BGA 224 0.8 mm pitch</p>

# RA8D1 GROUP PRODUCT LINEUP

Flash/RAM	Tj			
2MB/1MB	-40 to 125 °C	w/o MIPI-DSI	<b>R7FA8D1AHECFC</b>	<b>R7FA8D1AHECBD</b>
		w/ MIPI-DSI	<b>R7FA8D1BHECFC</b>	<b>R7FA8D1BHECBD</b>
1MB/1MB	-40 to 125 °C	w/o MIPI-DSI	<b>R7FA8D1AFECFC</b>	<b>R7FA8D1AFECBD</b>
		w/ MIPI-DSI	<b>R7FA8D1BFECFC</b>	<b>R7FA8D1BFECBD</b>
Pin Count			176-pin	224-pin
Package type			LQFP	BGA
Package size (body)			24 x 24 mm	13 x13 mm
Pin pitch			0.5 mm	0.8 mm

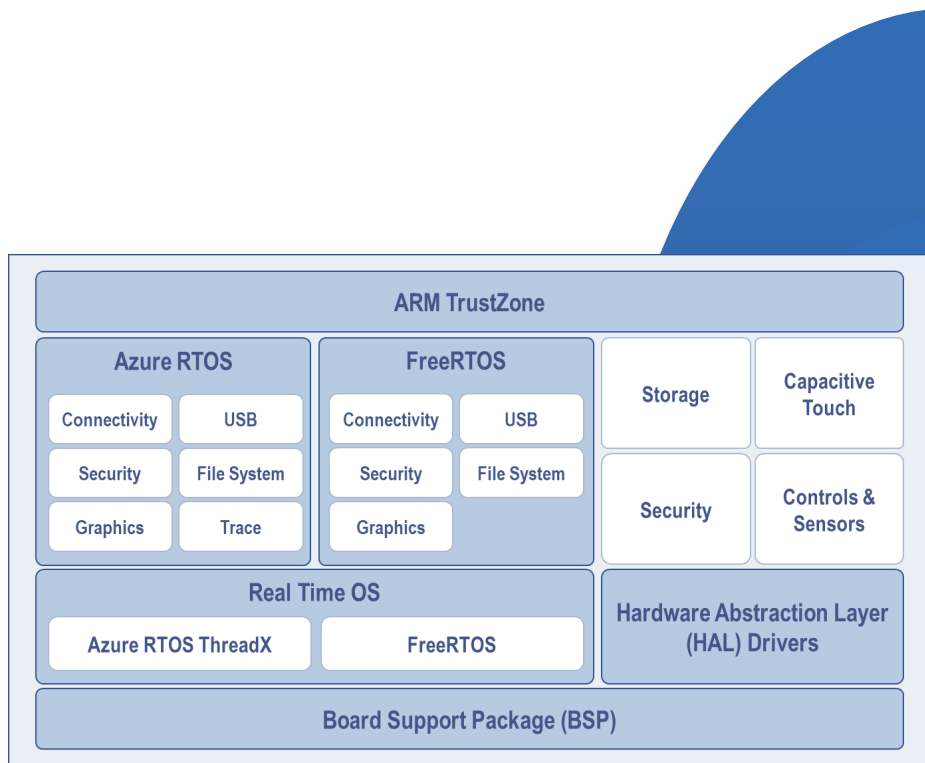
# RA8T1 GROUP PRODUCT LINEUP

Flash/RAM	Tj				
2MB/1MB	-40 to 125 °C	<b>R7FA8T1AHECFP</b>	<b>R7FA8T1AHECFB</b>	<b>R7FA8T1AHECFC</b>	<b>R7FA8T1AHECBD</b>
1MB/1MB	-40 to 125 °C	<b>R7FA8T1AFECFP</b>	<b>R7FA8T1AFECFB</b>	<b>R7FA8T1AFECFC</b>	<b>R7FA8T1AFECBD</b>
Pin Count		100-pin	144-pin	176-pin	224-pin
Package type		LQFP	LQFP	LQFP	BGA
Package size (body)		14 x 14 mm	20 x 20 mm	24 x 24 mm	13 x 13 mm
Pin pitch		0.5 mm	0.5 mm	0.5 mm	0.8 mm





# FLEXIBLE SOFTWARE PACKAGE (FSP) SUPPORTED BY FULL ARM ECOSYSTEM



## Production Ready Peripheral Drivers

- HAL APIs to access MCU peripherals and required features
- Intuitive configurator and code generator
- Unit and system tested
- Static and dynamic analysis with industry standard tools

## Uses FreeRTOS or Azure RTOS

- Latest version integrated with Flexible Software Package
- Tool configurable RTOS resources (Threads, mutexes, etc...)
- Bare metal support included

## With Connectivity

- Includes TCP/IP stack, Secure Sockets & WiFi
- Includes MQTT and TLS
- Supports connectivity with Amazon Web Services, Microsoft Azure, and Google Cloud Platform
- USB middleware for CDC, MSC, HID (Host & Peripheral)

## And Security

- Cryptographic APIs based on Arm Mbed PSA
- Crypto hardware acceleration supported
- PSA Level 2 Compliant
- Secure debugging

# EASY TO USE TOOLS

## RENESAS RA TOOLS LANDSCAPE

### On-Chip Debug

- Renesas E2 & E2 Lite



- Segger J-Link



### IDE

- Renesas e<sup>2</sup>studio



- Keil MDK



- IAR Embedded Workbench



### Compiler

- GNU



- Arm Compiler V6



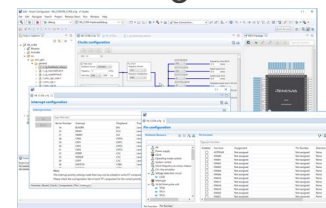
- IAR ARM Compiler



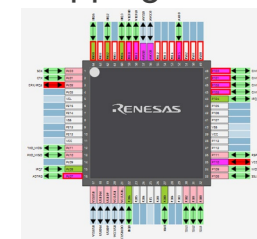
- Arm LLVM

### Support Tools

- FSP driver selection and configuration



- Intelligent pin mapping



- Flash programmer

- PG-FP6
- RFP
- A wide choice of 3<sup>rd</sup> party solution



### Kits and Boards

- Evaluation Kits

- |            |             |
|------------|-------------|
| ▪ EK-RA2A1 | ▪ EK-RA6M1  |
| ▪ EK-RA2L1 | ▪ EK-RA6M2  |
| ▪ EK-RA2E1 | ▪ EK-RA6M3  |
| ▪ EK-RA2E2 | ▪ EK-RA6M3G |
| ▪ EK-RA4W1 | ▪ EK-RA6M4  |
| ▪ EK-RA4M1 | ▪ EK-RA6M5  |
| ▪ EK-RA4M2 | ▪ EK-RA6E2  |
| ▪ EK-RA4M3 | ▪ EK-RA4E2  |
| ▪ EK-RA8M1 | ▪ EK-RA8D1  |

- Fast Prototyping Boards

- |             |             |
|-------------|-------------|
| ▪ FPB-RA2E1 | ▪ FPB-RA6E1 |
| ▪ FPB-RA2E2 | ▪ FPB-RA6E2 |
| ▪ FPB-RA2E3 | ▪ FPB-RA4E2 |
| ▪ FPB-RA4E1 |             |

- Solution Kits

- |              |              |
|--------------|--------------|
| ▪ RSSK-RA6M2 | ▪ RSSK-RA2L1 |
| ▪ RSSK-RA6T1 | ▪ MCK-RA6T2  |
| ▪ MCK-RA4T1  | ▪ MCK-RA6T3  |
| ▪ MCK-RA8T1  |              |

# CONNECTIVITY PORTFOLIO

## BLUETOOTH LE AND WI-FI MODULES



# DA14531MOD

SMARTBOND TINY™ BLUETOOTH® LOW ENERGY MODULE

# DA14531 ULTRA-LOW POWER BLUETOOTH® 5.1 SOC (SYSTEM-ON-CHIP) AND MODULES

Less material...

- Half the size of current solutions
- 1.7x2.0mm package (3.4 mm<sup>2</sup>)

Less external components...

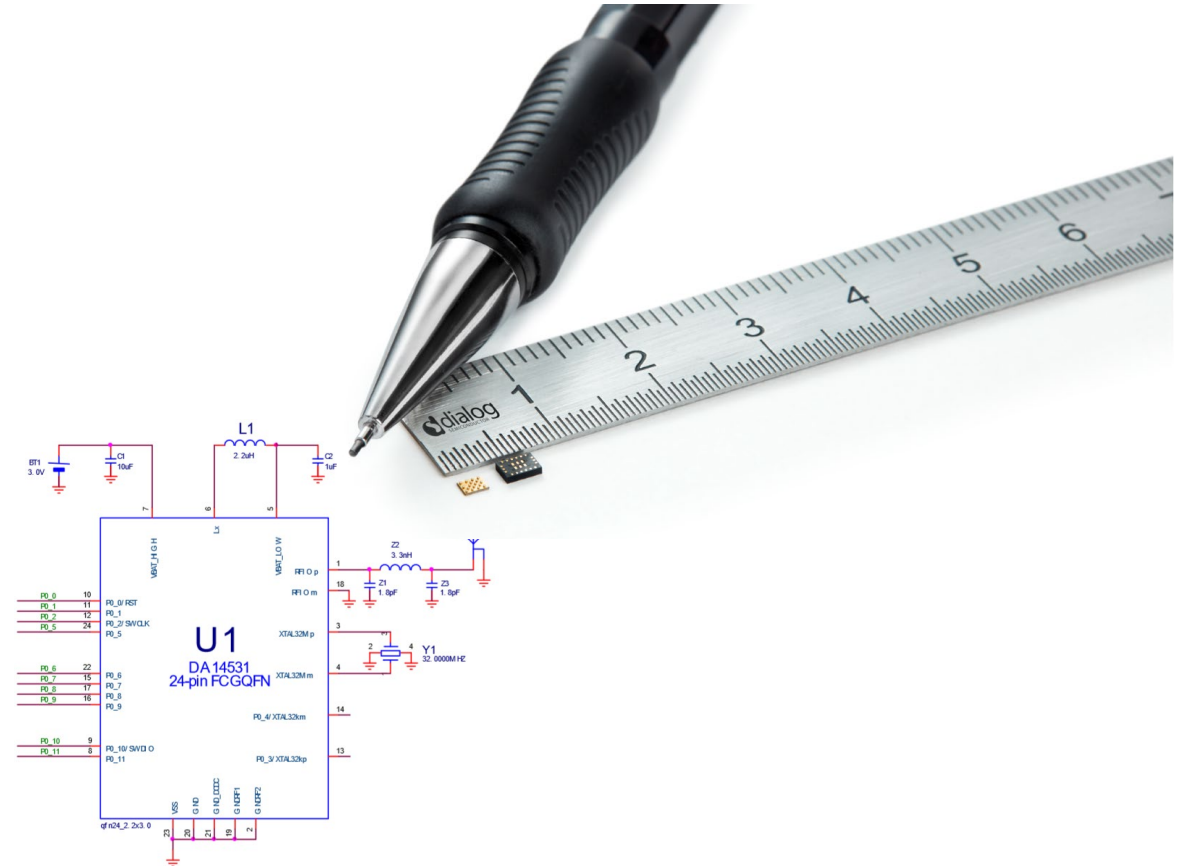
- Only 6 external passives needed
- True single XTAL operation

Smaller and cheaper batteries...

- Integrated buck/boost DCDC
- Works with the smallest, disposable, Silver Oxide, Alkaline or coin cell batteries

Low cost manufacturing...

- Two layer board, no micro vias

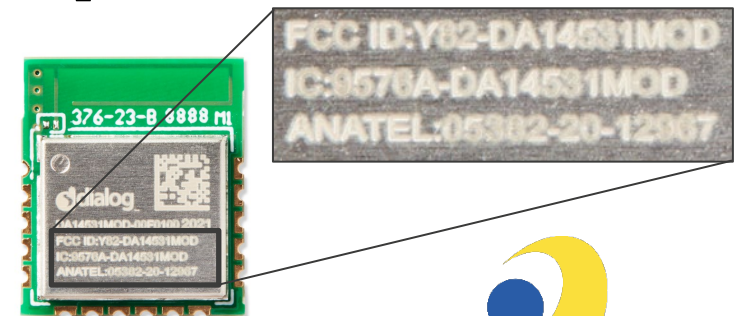
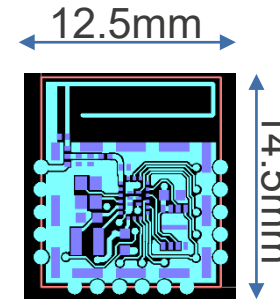
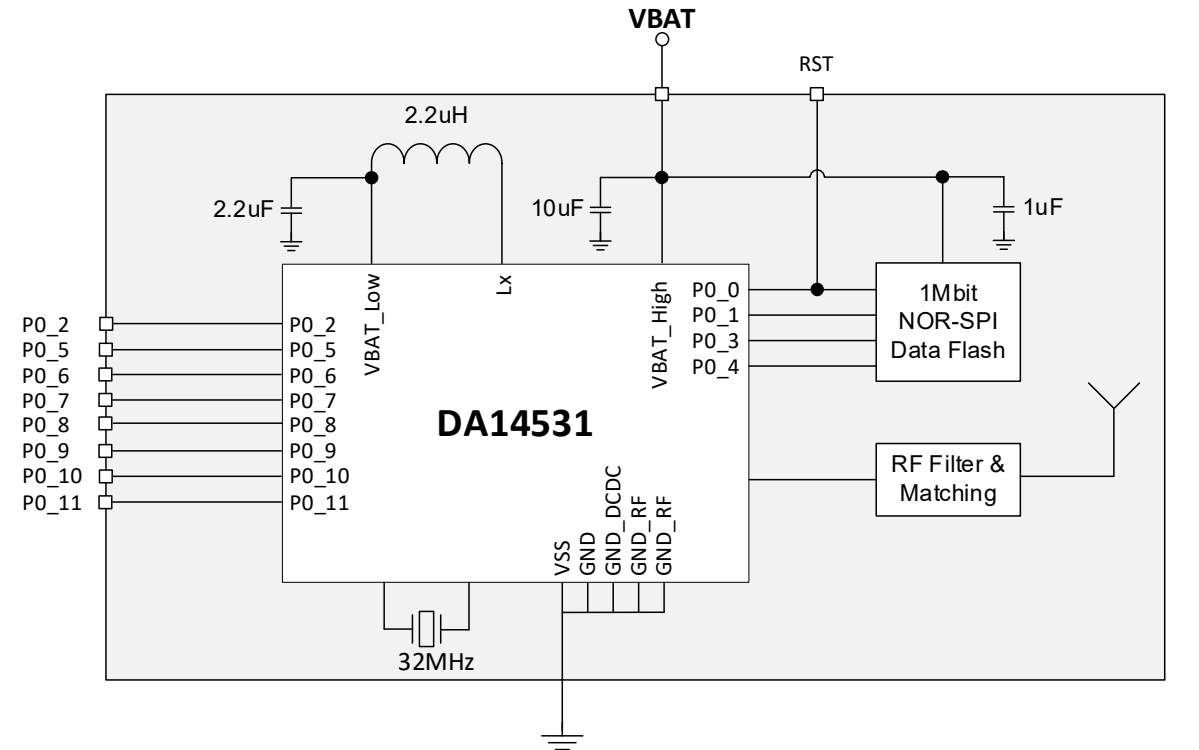




# DA14531MOD

## BLUETOOTH® LOW ENERGY MODULE (WITH ANATEL)

- 2mA module current in Rx
- 4mA module current in Tx @0dBm
- 1.8uA module current is sleep mode
- High quality build, but very cost effective
- Bluetooth 5.1 core qualified
- Worldwide qualification & certification, all test reports available (**Anatel**, FCC, CE, others)
- Integrated antenna design
- Software Update Over The Air (SUOTA) support
- 1Mb FLASH onboard
- -93dBm sensitivity
- -19 to +2.2dBm output power
- 8GPIO for I/O, ADC, SPI, I2C, PWM, Timers



# DA14531MOD

## FEATURES: LOWEST POWER (COMPETITOR COMPARISON)



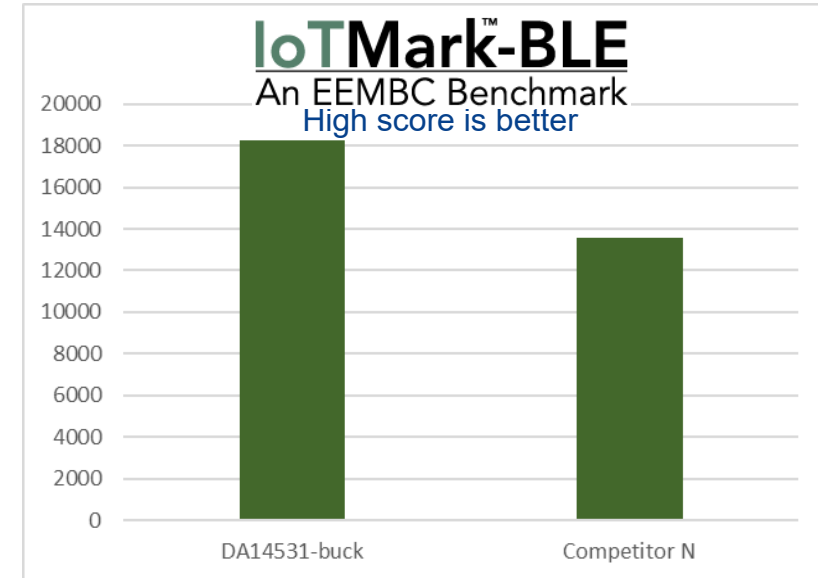
- The Embedded Microprocessor Benchmarking Consortium

### IoTMark-BLE

- Most recent benchmark for connected IoT devices
- Represents a real world Bluetooth LE sensor model

DA14531 is 35% better in power efficiency

- 3.5mA Tx current - 40% lower than key competitor
- 2.2mA Rx current - 64% lower than key competitor
- 240nA hibernation - 20% lower than key competitor



*Objective, standardized benchmarking framework for measuring the energy efficiency of internet of things (IoT) edge nodes, a platform with three primary parts: a sensor, a processor, and a radio interface.*

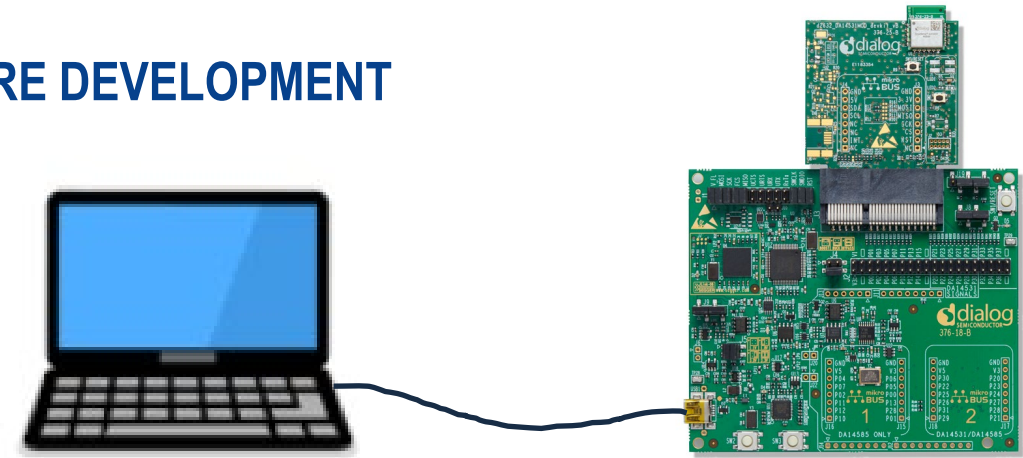
*Source: EEMBC website*

# DA14531MOD

## EASE OF USE SOFTWARE OPTIONS WITH ZERO SOFTWARE DEVELOPMENT

### Software support

- Flash programmer with automatic hardware recognition
- Select the correct software and program the flash
- Software support options: From zero touch to advanced SDK approach
- CodeLess™ and DSPS as zero software development options
- Just minutes from connecting the hardware to running a blinky project



### Software Design Selection Matrix

	DSPS SmartConfig	Codeless	GTL	HCI	SDK 6 Approach
MCU use	External MCU	External MCU or standalone application	External MCU for control (SW on chip/module)	External MCU for host stack	Standalone or External
Required BLE knowledge	Low	Low	Medium	High	High
Required software skills	Low	Low	Good	Good	Good
Flexibility	Low	Low/Medium	Medium	High	High
Ease of Use	Very High	High	Medium	Medium	Medium
Time-to-Market	Very short	Short	Medium	Long	Long

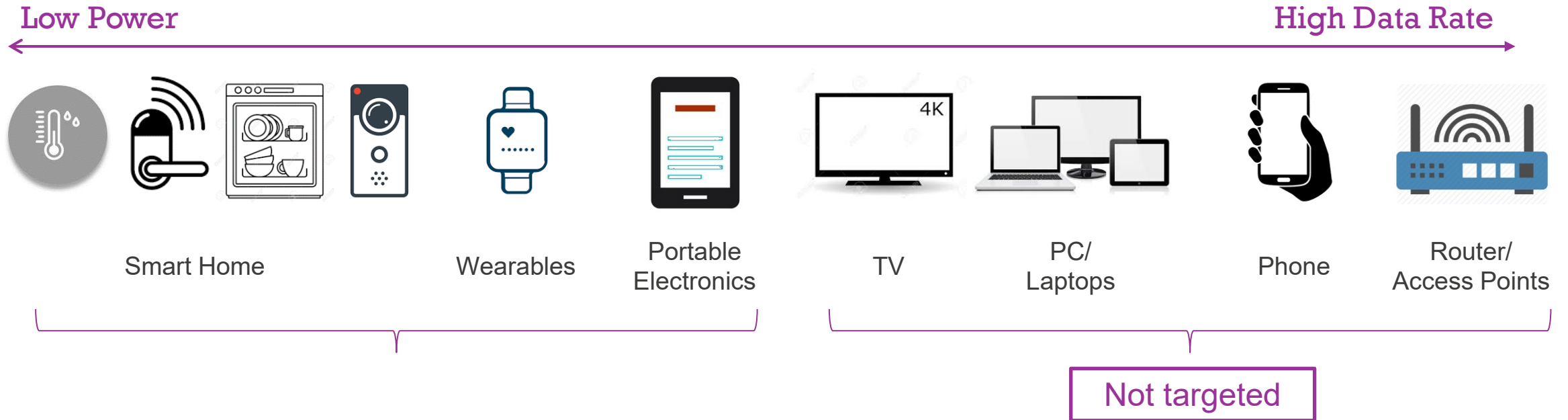




# DA16200MOD

ULTRA-LOW POWER WI-FI MODULES FOR BATTERY POWERED IOT  
DEVICES

# PRODUCT POSITIONING



## Key Product Features for target applications

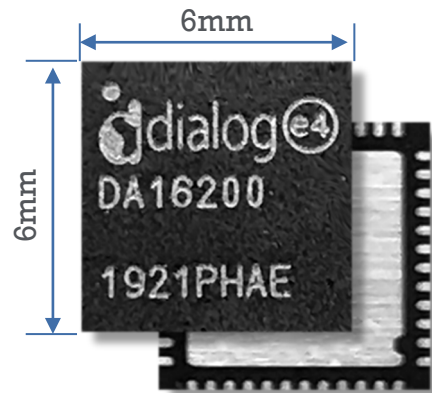
- Focus on reducing power consumption; Ideally battery operated
- Low data rates: less than 25 Mbps
- Premium product: customer focus is quality

# DA16200

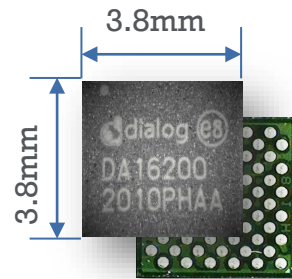
## SOC (SYSTEM-ON-CHIP) AND MODULES

### SoCs (System-on-a-chip)

- 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 u.FL connector
- Pre-certified: FCC, IC, CE, Telec, KCC, SRRC, Wi-Fi



DA16200MOD  
13.8 x 22.1 x 3.3 mm



DA16600MOD  
14.3 x 24.3 x 3.0 mm

# DA16200

## FEATURES: LOWEST POWER



### Wi-Fi Benchmark Results

- EEMBC IoTMark-Wi-Fi is designed to provide a comprehensive assessment of the entire platform in a **real usage scenario**
- Benchmarking result released in **June 2021**. Dialog's score of 815 is equivalent to about **815 days of battery life** for an IoT sensor running on **two AA batteries**
  - Phase-1 Power (Connected Idle) @ DTIM10
  - Phase-2 Power (Application Communication) @ 60sec MQTT KA
- Participants include Dialog, Silicon Labs (plus Redpine), Infineon (formerly Cypress), Texas Instruments, Altran, and STMicroelectronics.
- At least **50% better** than the closest competitor



[Dialog Semiconductor Achieves Industry's Highest Ranking for IoTMark™-Wi-Fi Benchmark | Dialog \(dialog-semiconductor.com\)](#)

### SCORES

This section is only populated after a successful run or reloading a previous session.

Score	815	marks		
Voltage	2999	mV		
Phase 1 Power	195	uW		
Phase 2 Power	408	uW		
Phase 3	n/a	uW	n/a	Mbps

# DA16200

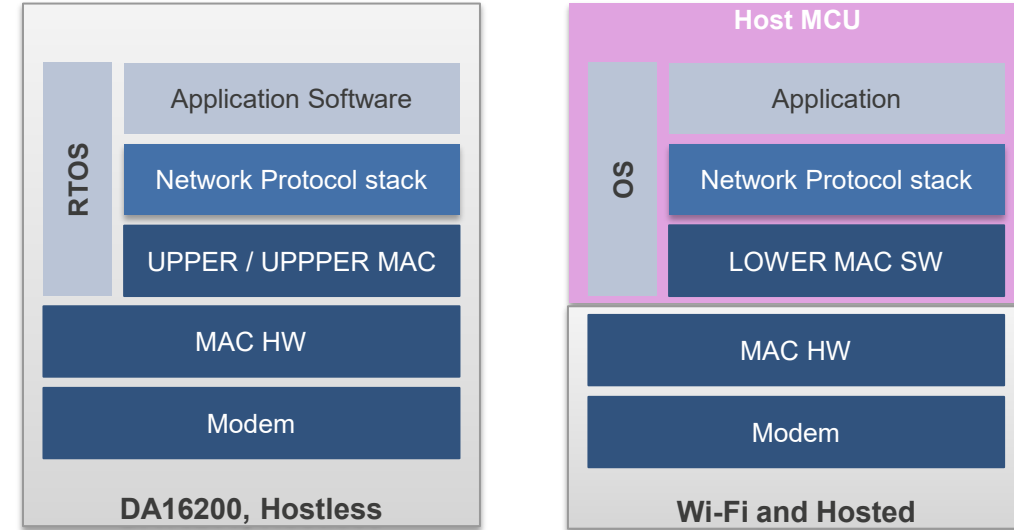
## FEATURES

### Runs self-hosted or alternatively with host product's microcontroller

- All software runs on chip
- Fully contained hosted system – full SW and network stack included
- TCP/IP, UDP, HTTP/s, MQTT, CoAP, and more

### Strong security

- Wi-Fi layer – AES, TKIP
- Protocols: WPA/2/3-Personal and Enterprise with EAP types
- Built-in hardware crypto engines for advanced security
- Elliptic Curve, 256-bit AES keys, digital certificates
- Upper layer security – TLS, HTTPs, etc.
- Secure boot, secure debugging, secure asset storage



Hostless vs. Hosted



**IoT Security** is not optional anymore



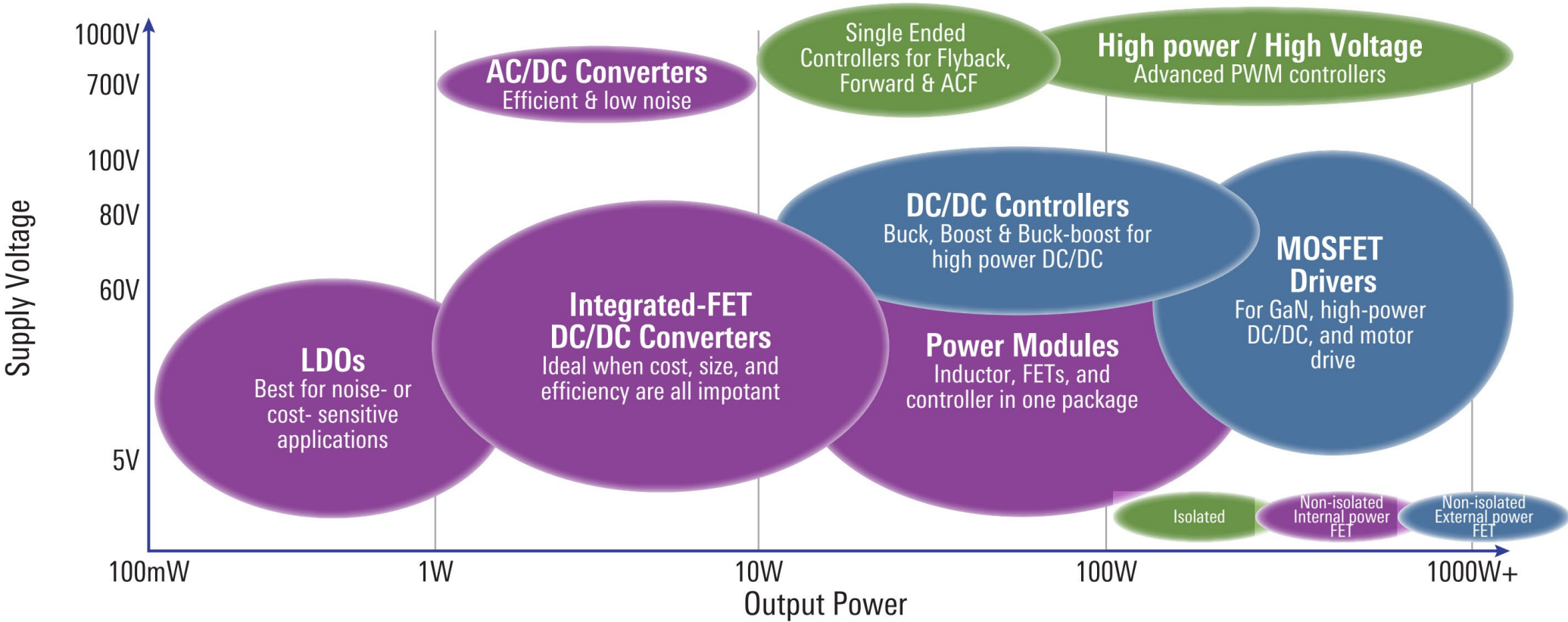
# POWER MANAGEMENT

AC/DC, DC/DC, LDO, ETC.

# POWER MANAGEMENT

FROM MILLIWATTS TO KILOWATTS, WE CAN SUPPORT YOUR APPLICATION

FROM MILLIWATTS TO KILOWATTS, WE CAN SUPPORT YOUR APPLICATION



## Industrial Power Management Brochure

[renesas.com/us/en/document/bro/industrial-power-management-brochure?r=481466](https://renesas.com/us/en/document/bro/industrial-power-management-brochure?r=481466)

# DEMO





# DEMO: QUICK-CONNECT IOT PLATFORM

FAST PROTOTYPING BY PROVIDING COMPATIBLE HARDWARE AND SOFTWARE BUILDING BLOCKS

The central image shows the EK-RA6M4 development board. To its left are three green plug-in sensors. To its right is a green connectivity module. Below the board is a laptop displaying a software interface with a file explorer showing folders like 'Arm', 'Bootloader', 'Driver', 'Intel', 'Middleware', 'Search...', 'Sensor', 'Storage', and 'USB'. A graph on the right shows humidity and temperature data over time.

Plug-in Sensors

Connectivity Solutions

Integrated Easy-to-Use Software

humidity temperature

Time	Humidity	Temperature
02:41 PM 09/22/2020	~40.5	~75.5
03:11 PM 09/22/2020	~42.5	~76.5

[renesas.com/us/en/software-tool/quick-connect-iot-platform](https://renesas.com/us/en/software-tool/quick-connect-iot-platform)

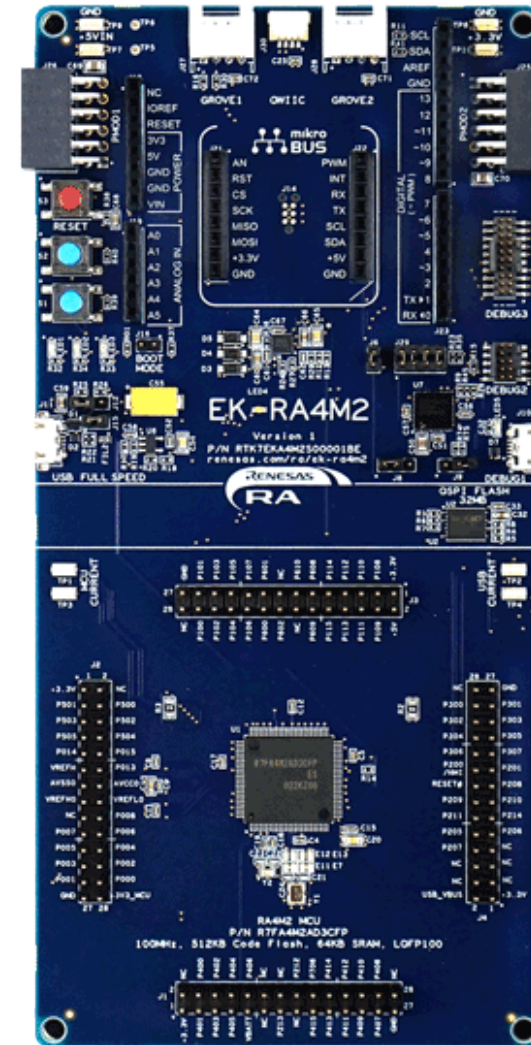
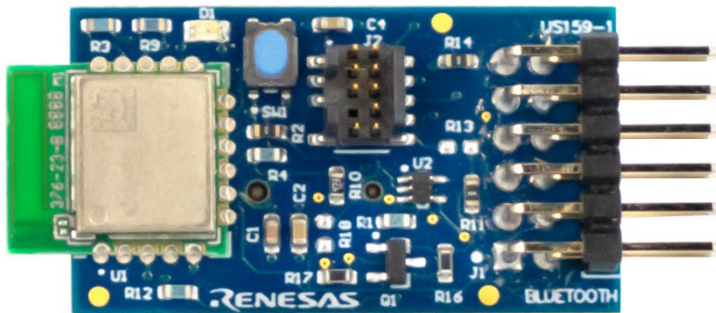
# DEMO: QUICK-CONNECT IOT WI-FI ENABLED CLOUD SOLUTION

## EVALUATION BOARD AND PMODS

- [EK-RA4M2](#): Evaluation Kit for RA4M2 MCU Group
- [US159-DA16200MEVZ](#): Ultra Low Power Wi-Fi Pmod



- [US159-DA14531EVZ](#): Low Power Bluetooth® Pmod™



# DEMO: QUICK-CONNECT IOT WI-FI ENABLED CLOUD SOLUTION

## EVALUATION BOARD AND PMODS

README MIT license

### RA Wireless Bridge

This project is an interface bridge between a RA MCU and Renesas Wireless Modules below using the SEGGER J-Link [RTT \(Real Time Transfer\)](#) terminal:

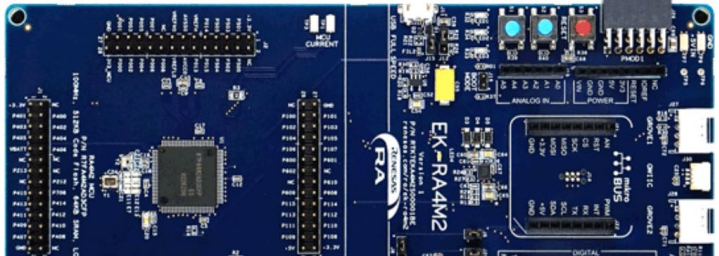
- Bluetooth Low Energy (BLE) - [DA14531MOD](#)
- Wi-Fi - [DA16200MOD](#)

### How to run it

### Hardware

This project is made for running with the boards below:

- [EK-RA4M2](#) - Evaluation Kit for [RA4M2](#) MCU Group. But it is easily portable for other MCUs. See the [How to port this project for different RA Evaluation kits \(EK\)](#) guide.



[github.com/diegomendesmoreno/ra\\_wireless\\_bridge](https://github.com/diegomendesmoreno/ra_wireless_bridge)



# Q & A



# GET IN TOUCH – CONTACT INFO

# GET IN TOUCH – CONTACT INFO

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VLA Solutions



# Presentation Feedback



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[Renesas.com](https://www.renesas.com)