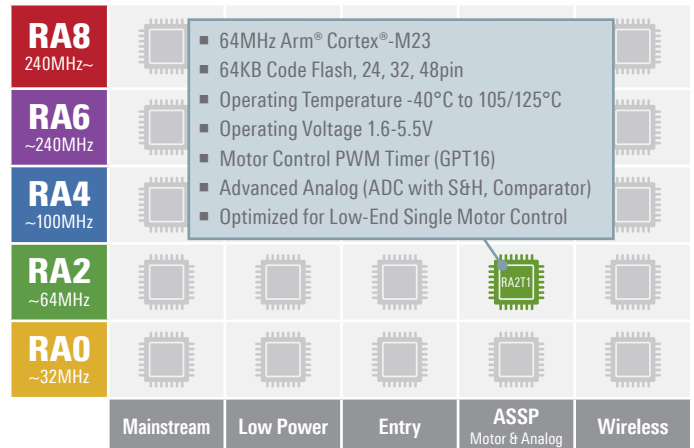# RENESAS

32-BIT MCU FAMILY
RENESAS RA2T1 GROUP

64MHz Arm® Cortex®-M23 Motor Control Microcontroller

The RA2T1 group is the microcontroller optimized for single motor control applications, based on a 64MHz Arm® Cortex®-M23 core. Featuring PWM timer and advanced analog, including 3 sample-and-hold circuits integrated in the A/D converter, it is suitable for efficient low-end motor control applications such as power tools, fans and home appliances. Supporting a wide operating range of 1.6V to 5.5V and offered in a compact 24-pin QFN package, the RA2T1 meets the needs of cost-sensitive and space-constrained designs.

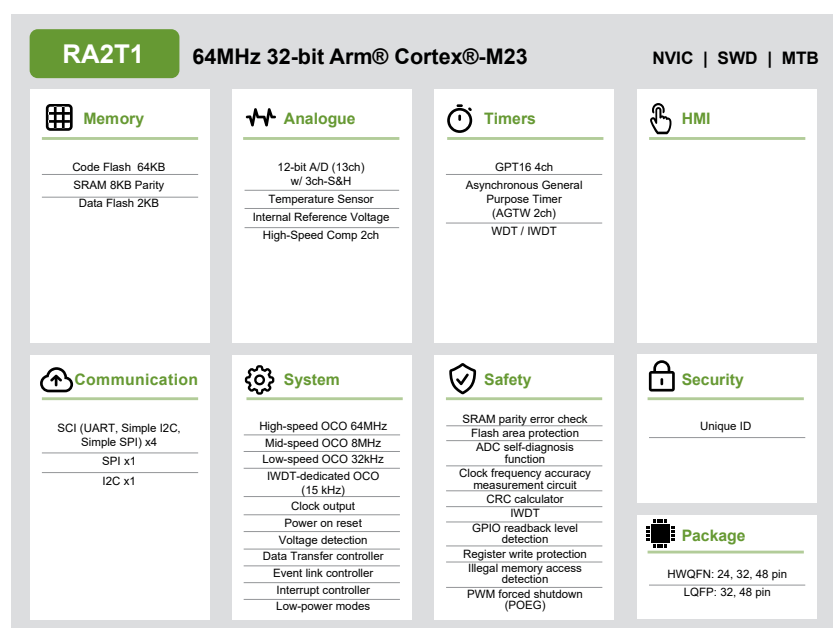|				
RA8 240MHz~			■ 64MHz Arm® Cortex®-M23	
RA6 ~240MHz			■ 64KB Code Flash, 24, 32, 48pin ■ Operating Temperature -40°C to 105/125°C	
RA4 ~100MHz			■ Operating Voltage 1.6-5.5V ■ Motor Control PWM Timer (GPT16) ■ Advanced Analog (ADC with S&H, Comparator)	
RA2 ~64MHz			■ Optimized for Low-End Single Motor Control RA2T1	
RA0 ~32MHz				
Mainstream	**Low Power**	**Entry**	**ASSP** Motor & Analog	**Wireless**

Key Features

- 64MHz Arm® Cortex®-M23 core
- 64KB flash memory and 8KB SRAM
- 2KB data flash memory to store data as in EEPROM
- Scalable from 24-pin to 48-pin with LQFP & HWQFN packages
- PWM timer
- 12-bit A/D converter with 3 sample-and-hold circuits
- High speed comparator
- SCI (UART, Simple SPI, Simple I2C), SPI, I2C
- Wide voltage range of 1.6V to 5.5V
- Wide operating temperature range from -40 to 125°C
- Safety Functions

Target Applications

- Power Tools & Industrial Applications
  (Fan, Impact driver, Chainsaw, Conveyor belts)
- Home Appliances
  (Ceiling Fan, Ventilation fan, Vacuum cleaner, Refrigerator)
- Building system
  (Ventilation systems, Exhaust fans, Automated blinds and curtains)
- Office Equipment
  (Printers and copiers, Paper shredders, Projector)
- Commercial Equipment
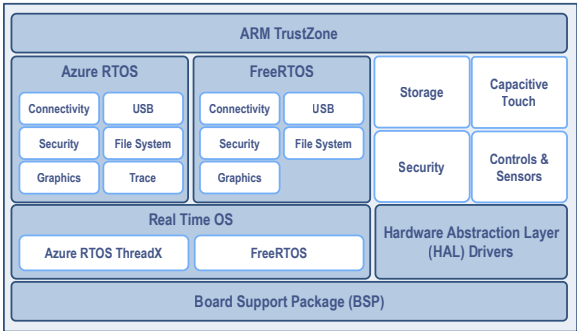 (Hair Dryer, Hand dryers, Vending machines)

Block Diagram

RA2T1 64MHz 32-bit Arm® Cortex®-M23   NVIC | SWD | MTB

Memory
- Code Flash 64KB
- SRAM 8KB Parity
- Data Flash 2KB

Analogue
- 12-bit A/D (13ch) w/ 3ch-S&H
- Temperature Sensor
- Internal Reference Voltage
- High-Speed Comp 2ch

Timers
- GPT16 4ch
- Asynchronous General Purpose Timer (AGTW 2ch)
- WDT / IWDT

HMI

Communication
- SCI (UART, Simple I2C, Simple SPI) x4
- SPI x1
- I2C x1

System
- High-speed OCO 64MHz
- Mid-speed OCO 8MHz
- Low-speed OCO 32kHz
- IWDT-dedicated OCO (15 kHz)
- Clock output
- Power on reset
- Voltage detection
- Data Transfer controller
- Event link controller
- Interrupt controller
- Low-power modes

Safety
- SRAM parity error check
- Flash area protection
- ADC self-diagnosis function
- Clock frequency accuracy measurement circuit
- CRC calculator
- IWDT
- GPIO readback level detection
- Register write protection
- Illegal memory access detection
- PWM forced shutdown (POEG)

Security
- Unique ID

Package
- HWQFN: 24, 32, 48 pin
- LQFP: 32, 48 pin

Renesas Electronics
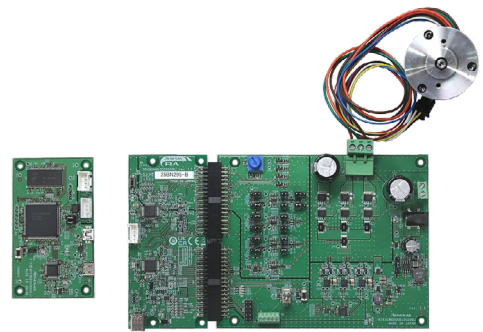
RENESAS RA2T1 GROUP

Software Package

The Renesas Flexible Software Package (FSP) is designed to provide easy-to-use, scalable, high-quality software for embedded system designs using RA MCUs.

ARM TrustZone			
Azure RTOS	**FreeRTOS**	Storage	Capacitive Touch
Connectivity / USB	Connectivity / USB		
Security / File System	Security / File System	Security	Controls & Sensors
Graphics / Trace	Graphics		
Real Time OS		**Hardware Abstraction Layer (HAL) Drivers**	
Azure RTOS ThreadX / FreeRTOS			
Board Support Package (BSP)			

The FSP is based on an open software ecosystem of production-ready drivers, supporting Azure® RTOS, FreeRTOS™ or bare-metal programming. It also includes a selection of other middleware stacks, providing great flexibility for migrating code from older systems or developing new applications from scratch.

Tools and Support

The e²studio IDE provides support with intuitive configurators and intelligent code generation to make programming and debugging easier and faster.

IDE	Renesas e²studio	Keil MDK	IAR EWARM
Compiler	■ GCC ■ LLVM ■ Arm Compiler* ■ IAR Arm Compiler*	■ Arm Compiler*	■ IAR Arm Compiler*
Debug Probe	■ Renesas E2/E2 Lite ■ SEGGER J-Link	■ SEGGER J-Link ■ Keil ULINK / CMSIS-DAP**	■ IAR I-jet ■ SEGGER J-Link ■ Renesas E2/E2 Lite ■ CMSIS-DAP**
Production Programmer	■ Renesas PG-FP6 ■ SEGGER J-Flash ■ Partner solutions		

* Compiler must be purchased and licensed directly from third party
** limited support

Evaluation Kit

- MCK-RA2T1 Renesas Flexible Motor Control Kit for RA2T1 Group including CPU board, inverter board, communication board, PMSM motor and accessories
- MCB-RA2T1 CPU board for RA2T1, enables stand-alone evaluation and motor control evaluation when connected to existing MCK platform boards
- On-board debugging using SEGGER J-Link®
- Order the kit and download documentation, design package, development tools,and software at: renesas.com/mck-ra2t1 or renesas.com/mcb-ra2t1
- Orderable part number:
  - RTK0EMA810S00020BJ (MCK-RA2T1)
  - RTK0EMA810C00000BJ (MCB-RA2T1)

Ordering References

Flash/RAM	Ta					
64KB/8KB	-40 to 125 °C	R7FA2T1074CNK	R7FA2T1074CFJ	R7FA2T1074CNH	R7FA2T1074CFL	R7FA2T1074CNE
64KB/8KB	-40 to 105 °C	R7FA2T1073CNK	R7FA2T1073CFJ	R7FA2T1073CNH	R7FA2T1073CFL	R7FA2T1073CNE
Pin Count		24-pin	32-pin	32-pin	48-pin	48-pin
Package		HWQFN	LQFP	HWQFN	LQFP	HWQFN
Package size (body)		4 x 4 mm	7 x 7 mm	5 x 5 mm	7 x 7 mm	7 x 7 mm
Pitch		0.5 mm	0.8 mm	0.5 mm	0.5 mm	0.5 mm

For more details, please visit: **renesas.com/ra2t1**

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