# 32-BIT MCU FAMILY
## RENESAS RA4M2 GROUP

**100MHz High Integration Arm® Cortex®-M33 with TrustZone®**

The Renesas RA4M2 group uses the high-performance Arm® Cortex®-M33 core with TrustZone®. In concert with the Secure Crypto Engine, it offers Secure Element functionality. It offers rich connectivity with USB 2.0 Full-Speed, SDHI, QSPI, and advanced analog.

The RA4M2 is built on a highly efficient 40nm process and is supported by an open and flexible ecosystem concept—the Flexible Software Package (FSP), built on FreeRTOS—and is expandable to use other RTOSes and middleware. The RA4M2 is suitable for IoT applications requiring Ethernet, future proof security, large embedded RAM, and low active power consumption down to 81µA/MHz running the CoreMark® algorithm from Flash.

### Target Applications
- Enhanced Security (fire detection, burglar detection, panel control)
- Metering (electricity, automated meter reading)
- Industry (robotics, door openers, sewing machines, vending machines, UPS)
- HVAC (heating, air conditioning, boiler control)
- General purpose

### Key Features
- **100MHz Arm® Cortex®-M33 with TrustZone®**
- Secure element functionality
- 256kB - 512kB Flash memory and 64kB SRAM with Parity and 64kB SRAM with ECC
- 8kB Data Flash to store data as in EEPROM
- 1kB Stand-by SRAM
- Scalable from 48-pin to 100-pin packages
- Capacitive touch sensing unit
- **USB 2.0 Full Speed**
- **CAN 2.0B**
- **QuadSPI**
- **SCI (UART, Simple SPI, Simple I²C)**
- **SPI/ I²C multimaster interface**
- **SDHI and MMC**

### Block Diagram

**RA4M2 100MHz 32-Bit Arm® Cortex®-M33 Core**

<table>
<thead>
<tr>
<th>Memory</th>
<th>Timers</th>
<th>System</th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code Flash (256kB, 384kB, 512kB)</td>
<td>GPT 32-bit (4ch)</td>
<td>DMA (8ch)</td>
<td>USB 2.0 FS x1</td>
</tr>
<tr>
<td>SRAM (64kB) Parity</td>
<td>GPT 16-bit (4ch)</td>
<td>DTC</td>
<td>CAN x1</td>
</tr>
<tr>
<td>SRAM (64kB) ECC</td>
<td>Low-Power GPT (4ch)</td>
<td>Clock Generation</td>
<td>I2C x7</td>
</tr>
<tr>
<td>Data Flash (94kB)</td>
<td>RTC</td>
<td>On-Chip Oscillator</td>
<td>SCI x8</td>
</tr>
<tr>
<td>Standby SRAM (148kB)</td>
<td>Calendar, Vbat, 128kB SRAM</td>
<td>HOCO (16,18,20MHz), LOCO (32kHz), ILOCO (15kHz)</td>
<td>SPI x1</td>
</tr>
</tbody>
</table>

**Other Features**

- Capacitive Touch Sensing Unit (12ch)
- Security
  - Unique ID
  - AES (128/192/256)
  - TrustZone
  - RSKA / ECC / GSA
  - SHA256 / SHA224
  - Tamper Resistance
  - SPAXPA Enhanced Resistance

**Security**

- Memory Protection Unit
- SRAM Parity Check
- ECC e SRAM
- Clock Frequency
- Accuracy Measurement
- CRC Calculator
- RNG
- Data Operation Circuit
- Flash Area Protection
- ADC Self Test

**Package**

- LQFP 48, 64, 100
- QFN 48
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Benefits

- Secure element functionality providing better performance, unlimited secure key storage, key management, and lower BOM cost
- High-performance and low-power with 81μA/MHz while running CoreMark from flash at 100 MHz
- High-integration up to 512 kB code flash memory with background operation and SWAP operation, 8 kB Data flash memory, and 128 kB SRAM with Parity/ECC
- Rich connectivity with USB 2.0 Full-Speed, SDHI, QSPI, and advanced analog

Tools and Support

<table>
<thead>
<tr>
<th>IDE</th>
<th>Renesas e-studio</th>
<th>Keil MDK</th>
<th>IAR EWARM</th>
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<tbody>
<tr>
<td>Compiler</td>
<td>GCC</td>
<td>Arm Compiler</td>
<td>IAR Arm Compiler</td>
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<tr>
<td>Debugger</td>
<td>Renesas E2/E2 Lite</td>
<td>SEGGER J-Link</td>
<td>IAR I-Jet</td>
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<tr>
<td>Programmer</td>
<td>Renesas PG-FP6</td>
<td>SEGGER J-Flash</td>
<td>Third party solutions</td>
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</tbody>
</table>

Evaluation Kit

- Full MCU evaluation including On-Chip debugger
- Part name: RTK7EKA4M2S00001BE

Evaluation Kit: RTK7EKA4M2S00001BE

Ordering References

<table>
<thead>
<tr>
<th>Part Name</th>
<th>Flash</th>
<th>R7FA4M2AD3CFP</th>
<th>R7FA4M2AD3CFM</th>
<th>R7FA4M2AD3CFL</th>
<th>R7FA4M2AD3CNE</th>
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<tbody>
<tr>
<td>RAM</td>
<td>512KB</td>
<td>128KB</td>
<td>128KB</td>
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<tr>
<td>DataFlash</td>
<td>384KB</td>
<td>8KB</td>
<td>8KB</td>
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<tr>
<td>Operating Temperature</td>
<td>256KB</td>
<td>-40/+105°C</td>
<td>-40/+105°C</td>
<td>-40/+105°C</td>
<td>-40/+105°C</td>
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<tr>
<td>Package</td>
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<tr>
<td>Package Dimensions</td>
<td></td>
<td>14x14mm body; (16x16mm)</td>
<td>10x10mm body; (12x12mm)</td>
<td>7x7mm body; (9x9mm)</td>
<td>7x7mm</td>
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<tr>
<td>Pin Pitch</td>
<td></td>
<td>0.5mm</td>
<td>0.5mm</td>
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