RENESAS

RX21A
The Power Analyzer and Electric Energy Meter MCU

Renesas Electronics' RX21A microcontroller family is the ideal solution for compact electricity meters, offering compatible and optimized devices for 3-phase and single-phase electricity meter applications. The RX21A offers 50 MHz MONOS Flash performance, full 1.8 – 3.6 V Flash operation, DSP functions, seven separate 24-bit ADC modules, RTC, memory protection, AES hardware encryption, temperature sensor, up to 9 serial communications interfaces, and includes up to 512 Kbytes of Flash memory, 8 kbytes of data Flash and 64 kbytes of on chip SRAM in 64- to 100-pin packages.

In combination with dedicated metrology firmware this all enables the design of compact electricity meters at lowest investment. The RX21A is supported by a complete suite of tools including software, debugger, and a meter evaluation platform that allows IEC type tests to be performed.
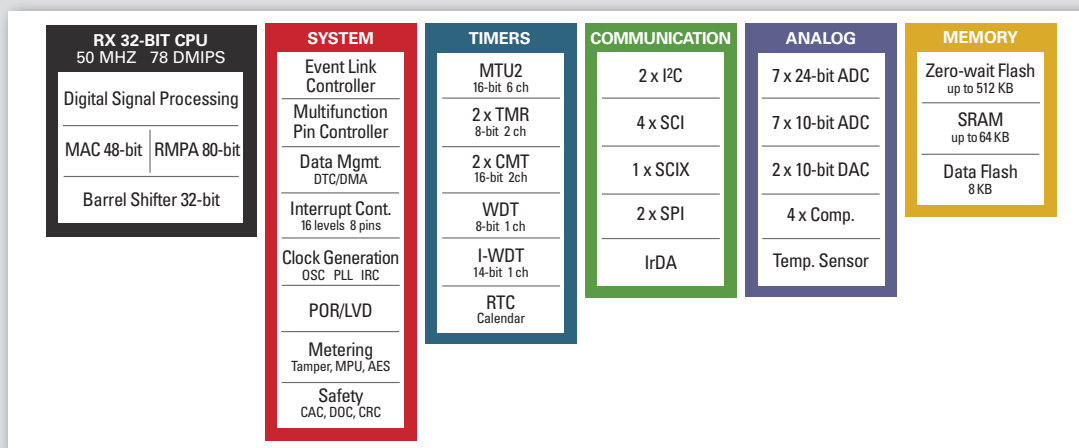
Applications

- High accuracy electric energy meters
- Power Analyzer

Key Benefits

- Full single-chip concept providing flexible software-defined metrology architecture, and application MCU
- True RX family concept that saves software investment thus future-proof
- Integration of dedicated meter features to reduce system cost and to make the design ultra-compact
- Same platform for both single-phase and 3-phase meters to ensure cost effective meter design
- Up to seven separate 24-bit $\Delta\Sigma$ ADC modules with PGA to realize featured 3-ph meter
- Factory calibrated variant (G specification) available that allows for super-high < 0.1 % accuracy over a greater than 6600 : 1 dynamic range, plus a 10 ppm/°C bandgap temperature coefficient
- Full RTC with alarm, calibration, binary count mode, and anti-tamper function
- Calibrated temperature sensor to ease adjustments
- Various communication interfaces that allow easy connection of various modems
- Complete metrology firmware provided, enabling the design of precision single and multi-phase e-meters featuring true single-point calibration, active and reactive power calculation, harmonic content calculation, and energy pulse output generation. Extended dynamic range and higher accuracy automatically achieved through detection of G specification devices

RX21A Block Diagram

RX 32-BIT CPU — 50 MHZ 78 DMIPS
- Digital Signal Processing
- MAC 48-bit | RMPA 80-bit
- Barrel Shifter 32-bit

SYSTEM
- Event Link Controller
- Multifunction Pin Controller
- Data Mgmt. DTC/DMA
- Interrupt Cont. 16 levels 8 pins
- Clock Generation OSC PLL IRC
- POR/LVD
- Metering Tamper, MPU, AES
- Safety CAC, DOC, CRC

TIMERS
- MTU2 16-bit 6 ch
- 2 x TMR 8-bit 2 ch
- 2 x CMT 16-bit 2ch
- WDT 8-bit 1 ch
- I-WDT 14-bit 1 ch
- RTC Calendar

COMMUNICATION
- 2 x I²C
- 4 x SCI
- 1 x SCIX
- 2 x SPI
- IrDA

ANALOG
- 7 x 24-bit ADC
- 7 x 10-bit ADC
- 2 x 10-bit DAC
- 4 x Comp.
- Temp. Sensor

MEMORY
- Zero-wait Flash up to 512 KB
- SRAM up to 64 KB
- Data Flash 8 KB

RX21A – The Power Analyzer and Electric Energy Meter MCU

Key Features

32-bit RX CPU core

- Enhanced Harvard Architecture
- 50 MHz operating frequency (max.) ~ 165 DMIPS (1.8 – 3.6 V)
- DSP functions (MAC, RMPA, Barrel shifter)
- Memory protection unit (MPU)

Memory Line-up

- 256 kbytes to 512 kbytes zero wait-state Flash
- 8 kbytes data Flash with background operation (BGO) function
- 32 kbytes to 64 kbytes SRAM

Low-power design and architecture

- 1.62 to 5.5 V operation (program and erase)
- 200 µA/MHz Operation, all peripherals active
- 0.9 µA Deep standby with RTC running
- 0.45 µA Standby mode

Optimized System & Peripherals

- System
  - » 4 channel DMA, Data Transfer Controller (DTC)
  - » Interrupt Controller
  - » Power On Reset (POR), Low Voltage Detection (LVD)
  - » AES Hardware encryption
  - » 50 MHz High speed oscillator, 125 kHz low speed oscillator, 32 kHz sub-system oscillator
  - » Event Link Controller (ELC)
  - » Safety functions (CAC, DOC, CRC)

- Real-time clock
  - » Full calendar with leap year; Alarm, calibration, binary count mode; 3 Time stamps for anti-tamper
- General Purpose Timers
  - » 6 channel 16-bit MTU2, 2x 2ch 16-bit CMT, 2 x 2ch 8-bit TMR
- Watchdog Timers
  - » 1 channel 14-bit, 1 channel 8-bit
- Communications
  - » 5 x SCI (simple SPI, simple I²C), 2 x RSPI interfaces with CS, 1 x IrDA, 2 x Multi-Master I²C bus interface, GPIO
- Analog functions
  - » 2.7 to 3.6 V operation
  - » Up to seven 24-bit $\Delta\Sigma$ ADC channels with PGA
  - » Up to 85 dB SINAD
  - » Bandgap with guaranteed 30 ppm/°C temp co. (typ. 10 ppm/°C for G specification)
  - » Up to seven channels 10-bit ADC
  - » 4 channel comparator
  - » Temperature sensor for measuring temperature within the chip

Operating temperature range

- -40°C to +105°C (G specification)
- -40°C to +85°C (D specification)

Package line-up

- 64-pin to 100-pin

Ordering Information

Pin Count	Flash ROM	Data Flash	RAM	Package	Part Number
100-pin	512 K	8 K	64 K	PLQP0100KB-A (14 x 14 mm, 0.5 mm pitch)	R5F521A8BGFP
80-pin	512 K	8 K	64 K	PLQP0080KB-A (14 x 14mm, 0.5 mm pitch)	R5F521A8BGFN
64-pin	512 K	8 K	64 K	PLQP0064KB-A (14 x 14mm, 0.5 mm pitch)	R5F521A8BGFM
100-pin	384 K	8 K	64 K	PLQP0100KB-A (14 x 14 mm, 0.5 mm pitch)	R5F521A7BGFP
80-pin	384 K	8 K	64 K	PLQP0080KB-A (14 x 14mm, 0.5 mm pitch)	R5F521A7BGFN
64-pin	384 K	8 K	64 K	PLQP0064KB-A (14 x 14mm, 0.5 mm pitch)	R5F521A7BGFM

Note: The number of available 24-bit ADC modules depends on package (100-pin: 7 modules, 80-pin: 4, 64-pin: 3)

Note: G-specified versions listed here. For less demanding applications a D-specified version including a 256 K Flash/32 K RAM option is available