

## High security 16-bit smart card microcontroller



### AE41R

#### Features

2kB EEPROM, 36kB ROM, 1.5kB RAM

#### Applications

The AE41R fulfils the requirement of Smart Card applications with high security, data encryption and contactless data transmission. The integrated contactless interface is well suited for quick and convenient payment applications avoiding the need for cash or swiping a payment card. It is ideal for use in applications like quick service restaurants, movie theatres, supermarkets or parking facilities.

The AE41R contains a Renesas Technology high speed CPU core that offers superior performance for contactless applications. It is manufactured in specially controlled and ISO certified silicon factories located in Germany and Japan using a highly reliable 0.18µm CMOS process technology that allows integration of large memory blocks (EEPROM, RAM,ROM) into a smart card.

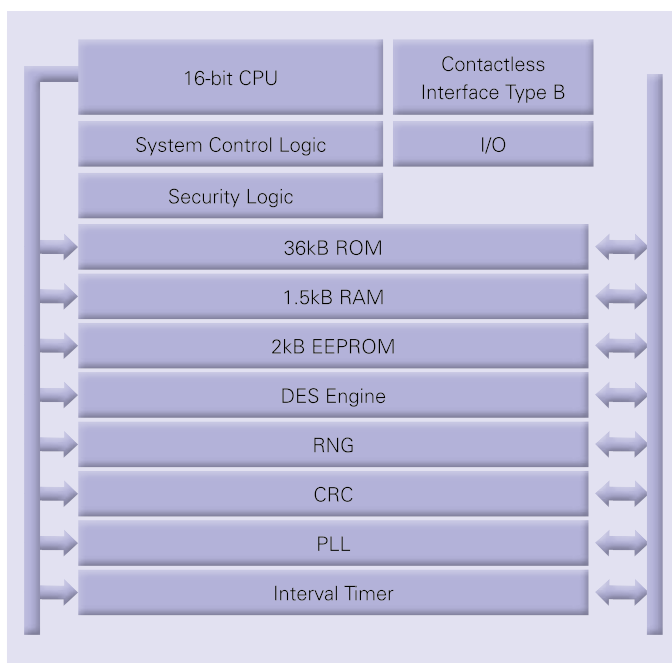
In contactless mode the power supply and bi-directional data transmission is implemented via an antennae connected to the AE41R. The antennae is tuned to an operating frequency of 13.56 MHz, and is compatible with a proximity-based contactless system as defined by ISO14443. The AE41R contains optimised circuits that can provide a high data transfer rate of up to 847Kbit/s and it fulfils the requirements of today's contactless smart card applications in terms of performance and cost.

#### Integrated Security Concept (ISC)

The AE41R designed under Renesas' Integrated Security Concept is ideally suited for high security applications. The ISC means that security is not just an add-on feature to standard modules or cores, rather security has been built-in from the start, forming an integral part of the whole smart card design concept. The whole ISC process e.g. secure chip design environment, secured production facilities and secure handling during shipment to the customer are constantly reviewed in order to maximise the effectiveness of the overall security package.

Many security features such as integrated sensors, distributed layout, random number generation, environmental protection, DES engine, and power analysis attack protection are included providing a strong on-chip hardware security structure.

Uniquely, Renesas smart card devices are fabricated using MONOS (Metal Oxide Nitride Oxide Silicon) EEPROM structure. MONOS advantages compared to standard EEPROM structures are high resistance to radiation disturbance, high reliability and endurance.



## Specification

### CPU

#### Two-way general register configuration

- Sixteen 8-bit registers + eight 16-bit registers, or
- Eight 32-bit registers

#### High speed operation

- Max clock rate: internal clock 10MHz
- AddSubtract: 0.25µs
- MultiplyDivide: 1.75µs

#### Streamlined, concise instruction set

- Instruction length: 2 or 10 bytes
- Register-register arithmetic and logic operations
- MOV instruction for data transfer between registers and memory

#### Instruction set features

- Multiply instruction (8-bits x 8-bits and 16-bits x 16-bits)
- Divide instruction (16-bits / 8-bits and 32-bits / 16-bits)
- Bit accumulator instructions
- Register indirect specification of bit positions
- EEPROM write instruction (EEPMOV.B instruction)
- High-speed block transfer instruction (EEPMOV.W instruction)

#### On chip memory

##### EEPROM

- MONOS (Metal Oxide Nitride Oxide Silicon) EEPROM Process
- 2kB EEPROM
- Easy EEPMOV write by single instruction
- Read, write and erase of EEPROM Byte by Byte
- 1 to 64bytes programming with one instruction
- Protected against accidental writing and erasing
- Data retention minimum 10 years
- EEPROM programming voltage generated onchip
- Endurance: greater than 100,000 times
- Erase time: 2ms max
- Write time: 4ms max
- Overwrite time: 2ms max

##### ROM

- 36kB user ROM

##### RAM

- 1kB

##### DES Engine

- Yes

##### 16-bit Timers

- 1ch

##### Peripherals

- Random Number Generator
- Integrated Sensors

##### RF Interface

- ISO/IEC 14443 Type-B, 512 Bytes RAM

##### Operating temperature range

- Standard -25 to +85°C

##### Process

- 0.18µm CMOS process

##### Shipping Form

- Wafer and COT (Chip On Tape)

