H8/3164

High Security Smart Card microcontroller

- **32.5 kbytes EEPROM**
- **48 kbytes ROM**
- **3 kbytes RAM**

Security

As with every Smart Card microcontroller from Hitachi, the H8/3164 has been designed with the most demanding of security-conscious applications in mind. The design includes many safeguards to ensure that the device only operates in the way intended. For example, a distributed layout for critical areas makes physical attack methods more difficult, and an illegal address detector ensures that only valid memory addresses can be accessed. A true hardware random number generator provides inputs for key generation and software randomisation techniques, and a watchdog timer protects against software runaway.

The H8/3164 has many other advanced security features to protect it against both attacks and system faults. For example, it contains hardware features specifically designed to protect data processing on the device from power analysis attacks (such as DPA).

Uniquely, Hitachi devices are fabricated using a MONOS EEPROM structure which is significantly more resistant to radiation disturbance than standard EEPROM structures. This design feature further protects the data on the device from illegal or accidental alteration.

Applications

The H8/3164 fulfils the requirements of all Smart Card applications with high memory demand, such as GSM-SIM cards, electronic banking, multi-application cards, JavaCard and access control.

For GSM-SIM cards the large EEPROM available on the H8/3164 means it can support many of the advanced applications stipulated by communications service providers. These include SIM Application Toolkit, Wireless Application Protocol and JavaCard.

The SIM Application Toolkit (SAT) in today's GSM-SIM card standard allows network operators to offer value-added services to the end-users of mobile phones. These applications include up-to-date traffic reports, weather or sports information and stock market data, making the H8/3164 highly suitable for these new services.

The Wireless Application Protocol (WAP) allows Internet-like access to information, data access, and the ability to use e-mail via a mobile phone. To store additional user information such as e-mail addresses, more memory integration is needed on the SIM card.

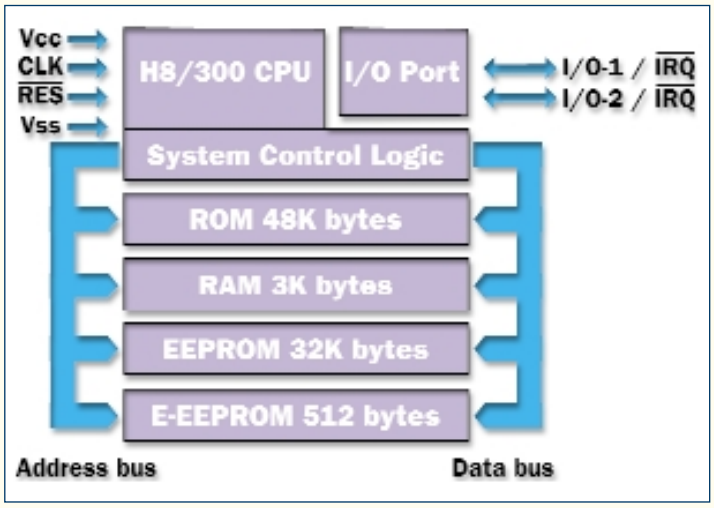
JavaCard is commonly used as a standard API for many Smart Card applications, but is especially successful in GSM SIM applications. The size of ROM and RAM in the H8/3164 make it easy to implement the Java Virtual Machine. The H8 8/16 bit CPU with up to 16 general-purpose registers, is well suited for high level languages like JavaCard.

HITACHI

H8/3164 is a high security Smart Card microcontroller fabricated in an advanced 0.35µm CMOS technology and built around the high speed 8/16 bit H8 CPU core.

The memory integration includes 32 kbytes EEPROM, 512 bytes Extra EEPROM, 48 kbytes ROM and 3 kbytes RAM. The device operates from either a 3V or 5V power supply.

Operating at a maximum of 10MHz external clock rate at 5V, the H8/3164 rapidly execute bit manipulation instructions, arithmetic and logic instructions, and data transfer instructions.



Specification

Item	Specification
CPU	**two-way general register configuration**
	• Sixteen 8-bit registers, or
	• Eight 16-bit registers
	High Speed Operation
	• Max clock rate: 10MHz (with 10MHz external clock at 5V)
	• Add/Subtract: 0.2µs
	• Multiply/Divide: 1.4µs
	Streamlined, concise instruction set
	• Instruction length: 2 or 4 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)
	• Divide instruction (16 bits / 8 bits)
	• Bit accumulator instructions
	• Register indirect specification of bit position
On Chip Memory	**EEPROM**
	• MONOS EEPROM Process
	• 32 kbytes EEPROM
	• 512 byte EXTRA EEPROM
	• Easy EEPMOV write by single instruction
	• Read, write and erase of EEPROM byte by byte
	• 1 to 64 byte programming with one instruction
	• Protected against accidental writing and erasing

Item	Specification
	• 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
	• 48 kbytes User ROM
	RAM
	• 3 kbytes
Peripherals	• Watchdog Timer
	• True Random Number Generator
Power	**Single voltage power supply**
	• 4.5V to5.5V,2.7V to3.3V
	Power consumption
	• max 10mA in operation
	• max 100µA sleep mode (clock stopped)
Clock Frequency Range	
	External Clock Input
	• f_{CLK} = 1MHz to 10MHz (Vcc = 4.5V to 5.5V)
	• f_{CLK} = 1MHz to 5MHz (Vcc = 2.7V to 3.3V)
	Internal Clock
	• application can select external clock frequency or half external clock frequency as internal operation frequency.
Operating temperature range	
	• standard -25 to + 85°C

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The vital component