



Dual Interface, Contact and Contactless FLASH Based Smart Card Integrated Circuit

Power modes

- On-chip power switch allowing to power device from contact or contactless interface
- Energy harvesting capability in contactless mode to supply external devices

Contact Interface

- Voltage Supply Class A, B: 3V to 5.0V ± 10%
- ISO 7816-3 compliant electrical interface
- ISO 7816-3 compliant reset and response T=0 and T=1

Contactless Interface

- ISO/IEC 14443 Type A / Type B
- Supported data rates from 106kbs to 847 kbps
- Minimum activation field down to 0.5 A/m

CPU

- Software compatible CMOS 80X51 industry standard
- Accelerated architecture
- Up to 30 MHz internal CPU clock
- Far pointers extended address space support

Low Power Modes

- Selectable Idle and Stop modes
- NVM update operation with CPU in Idle mode
- IO Transmission and Reception with CPU in Idle mode
- Max Idle current / Clock stopped: 100 uA

Security

- Hardware DES/3DES supporting ECB/CBC/MAC modes
- Hardware Random Number Generator(FIPS140-2 tested)
- Unique identification number
- Secure contact, contactless NVM Manager to upload OS

DMA

- Fast memories/peripheral transfers independent of CPU
- CRC, DES, COMPARE operations over transferred data

Peripherals

- 2 x Universal 8/16 bits Timers/Counters
- CRC16 Module ISO3309 and ISO13239 compatible

Memory Control

- General Purpose Non Volatile Memory (GPNVM)
- Secure Memory Management Mechanism
- Fast Byte programming
- GPNVM Page Smart Erase mechanism

Memories

- 2816B RAM (256B local RAM + 2560B XRAM)
- 128k GPNVM FLASH User 128 kB
- GPNVM FLASH System Area 4kB
- GPNVM FLASH Attribute memory 1056 B
- 10 years data retention GPNVM
- GPNVM Endurance > 100 K cycles

Chip Forms

- 8" Wafer sawn or unsawn
- SO8 plastic package

Typical Applications:

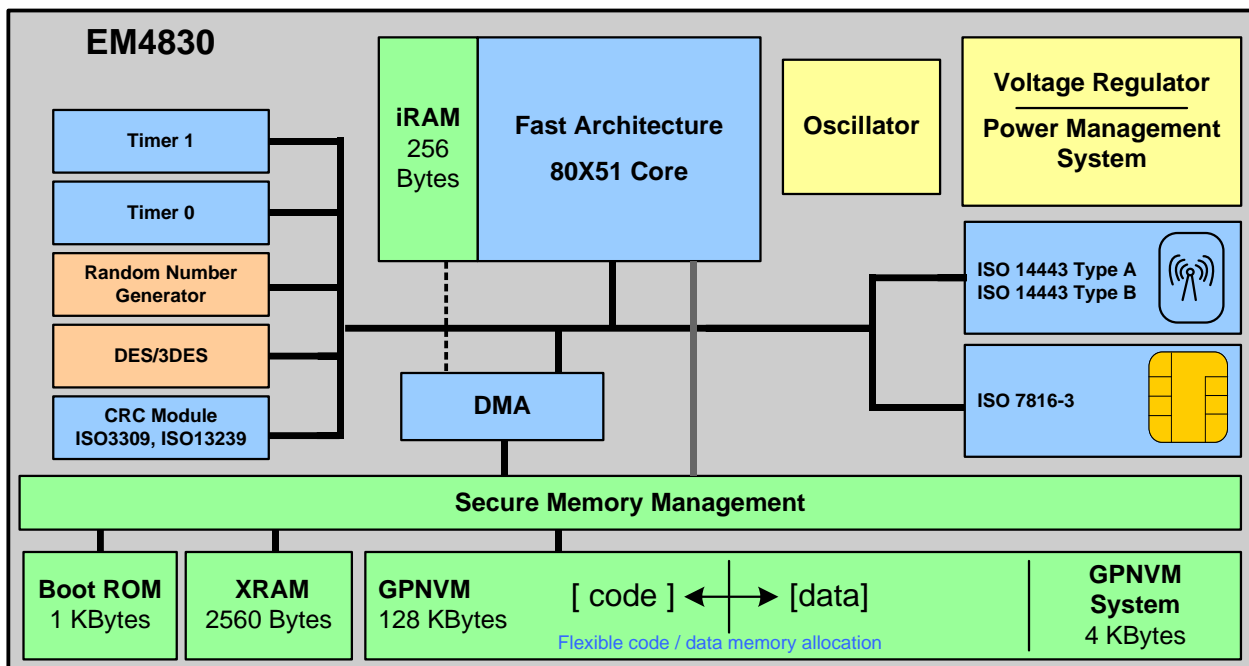
- Public transportation
- Access control, ticketing, loyalty programs
- e-government, closed loop micro-payment

Parameters

- Resonant capacitor 14pF
- Temperature range -25°C to + 85°C
- >3 kV ESD Protection HBM

Development tools

- Development tools fully integrated within Keil uVision3/4
- EMX4830 emulator
- ISO14443-3/4 Type A&B Low Level Library



Introduction

EM4830 integrated circuit is designed specifically for multi-application cards in access control, transportation and ticketing. It offers dual multiprotocol interfaces to support the largest range of applications, thus combining contact and contact-less interface technologies.

Due to integrated on-chip power switch EM4830 can be powered from contact or contactless interface. In contact power mode, the device can communicate with both interfaces ISO7816 or ISO14443. In contactless mode, the device can provide energy, extracted from the RF field, to external devices like CPUs or sensors.

The FLASH based architecture offers a very high degree of flexibility. A solution based on EM4830 can be rapidly and safely deployed in the field offering a fast time to market. The need to support the emerging multifunction and dual interface cards requires that the device can download an application under software control and run it when the device is in the field embedded in a plastic card. This application can be in the form of a script to be executed by an interpreter or as raw binary code directly executed by the processor.

Compatibility with the industry standard 8051 micro-controller guarantees the maximum availability of qualified software. The hardware implementation of the core is a modern design not relying on microcode, with an increase of up to 4 times that of a standard 8051's clocks per instruction.

GPVM Memory

The GPVM FLASH based memory has total size of 132kB. The memory is organized in pages of 256B. It can be erased by 256B pages or 2kB sectors and it is written by bytes.

The memory is divided into User area, System Area.

The GPVM User area size is 128kB and hosts code and application data. GPVM User offers best fit for code data partitioning with flexible allocation only limited by the total amount of GPVM. Secure memory protection mechanism is relying on a flexible border between code and data space.

GPVM System is area with an extended protection mechanism and typically hosts the device boot loader, Secure contact and contactless NVM Manager, as well as some device related parameters such as Unique ID + logistics information.

NVM Manager is erasable for augmented security.

GPVM Attributes are additional 2 bytes per page to store a page CRC, page related attributes such as Logical Address, indicator of cycling or erase/write protection for every page.

ISO14443 Interface

Multiprotocol RF interface is configurable by software and it supports ISO/IEC 14443 Type A and Type B data encoding and decoding. This high speed interface sustains data transfer rates up to 848kbps. It offers the high level of flexibility in order to use symmetric or asymmetric data rates between reader and device. The data integrity in ISO/IEC 14443 Type A is handled by hardware using parity bits.

Low power contactless interface allows reaching minimum activation field down to 0.5 A/m with ISO reference ID1 antenna and resonant frequency 14.2MHz.

Serial interface

EM4830 offers a serial interface compliant with the ISO7816-3 and featuring a high speed baud rate faster than 8 clk/etu.

EM4830 supports both T=0 and T=1 protocols as well as direct and inverse conventions.

DMA

The DMA block is essential for contactless applications. It permits to transfer data from and to RF interface in low power mode without CPU involvement.

The DMA block significantly improves the performance for large memory operations. DMA is up to 8 times faster than CPU in memory transfers. It can also be used to transfer data from/to peripherals in parallel with CPU operation or in low power mode when CPU is in IDLE state.

The DMA supports several operations in parallel over transferred data to be even more efficient.

- CRC checksum
- DES encryption/decryption
- Fill memory, compare memory places

DES/3DES

Symmetric encryption / decryption algorithm can be achieved using DES and Triple DES on chip HW Accelerator. This engine could be used as well in EBC, CBC and MAC modes.

Random Number Generator

The on chip random number generator is tested according to FIPS140-2. This allows for using random numbers beyond just randomizing transmissions or generating keys.

UID size

The device supports up to 10 bytes of Unique Identifier as it is defined in ISO14443 Type A. UID0 holds the manufacturer ID for EM Marin (16h) according to ISO/IEC 14443-3 and ISO/IEC 7816-6 AMD 1.

ISO14443-3/-4 Type A&B support

EM Microelectronic delivers with the device a Low Level Library which supports all transport layers of ISO14443-3/4 in Type A and Type B. The library functions allow easy and fast porting of customer software to the EM4830 device.

Development tools

Powerful development tools fully integrated into Keil uVision3/4 environment provide an efficient and user friendly development platform. An emulator EMX4830 with RF extension allows fast and efficient development and debugging directly in the customer application

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RATP/Innovatron Technology 

Technical Data

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power supply VCC-VSS	V _{CC}		-0.3		+5.7	V
Voltage at remaining pin	V _{pin}	except L1, L2	V _{SS} -0.3		V _{CC} +0.3	V
Storage temperature	T _{store}	R.H. < 20 %	-55		+ 125	°C
ESD ISO pins	V _{ESDISO}	HBM reference to substrate VSS, I _{leak} = +/-100nA at 5.5V, 25°C	-3000		3000	V
ESD Coil pins	V _{ESDCOIL}	HBM reference to substrate VSS	-3000		3000	V
Maximum AC current induced on L1, L2	I _{coil_RMS}				50	mA

Standard Operating Conditions and characteristics

Parameter	Symbol	Conditions	Min.	Typical	Max.	Unit
Supply Voltage Class A	V _{CC}	on VCC pin	2.7	5	5.5	V
Supply Voltage Class B	V _{CC_MV}	on VCC pin	2.7	3	3.3	V
Operating temperature	T _{OP}		-25	+25	+85	°C
External clock frequency	F _{ISOCLK}	At CLK pin 25 °C	1	3.57	5	MHz
AC peak current induced on L1, L2	I _{coil_OP}				30	mA

Power Consumption Characteristics

Parameter	Symbol	Conditions	Min.	Typical	Max.	Unit
Supply current	I _{CC}	CPU = 30MHz, ISO = 5MHz			2.6	mA
Supply current idle	I _{CC_IDLE}	ISO = 1MHz			150	uA
Supply current stopped	I _{CC_STOP}				100	uA

Contactless Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Resonant capacitor	C _{RES}	f = 100kHz U = 100 mVpp	12.3	14	15.7	pF
Coil limiting voltage	V _{LIM}	I _{COILDC} = 10mA	4.05	5	5.75	V
Receive coil limiting voltage Type A	V _{LIM_REC_A}	I _{COILDC} = 10mA	3.7	4.8	5.7	V
Receive coil limiting voltage Type B	V _{LIM_REC_B}	I _{COILDC} = 10mA	3.9	4.75	5.5	V
Modulator voltage drop, high current	V _{MOD}	I _{COILDC} = 10mA	1.2	1.65	2.1	V
Non regulated voltage on VPOS pad	V _{POS}	I _{COILDC} = 10mA	3.0		3.85	V

FLASH Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Mass erase time	T _{GPNVM_MER}	Software controlled	20			ms
Byte Write Time	T _{GPNVM_WR}	Hardware controlled		20		us
Page Erase time	T _{GPNVM_PER}	256 bytes/page Hardware controlled		2		ms
Endurance Page Erase Byte Program	END _{GPNVM}	25C with page erase retry	100			K cycles
Cumulative program	CUM _{GPNVM}	Number of writes per byte without erase			1	# of writes