SIEMENS

ICs for Chip Cards

SLE 44R35/Mifare®

Intelligent 1-Kbyte EEPROM with Interface for Contactless Transmission, Security Logic and Anticollision according to the MIFARE®-System

Preliminary Short Product Information 07.97, Version 2.0

Edition 07.97

Published by Siemens AG, Bereich Halbleiter,
Balanstraße 73, 81541 München

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Important: Further information is confidential and on request. Please contact:
Siemens Semiconductor Group in Munich, Germany,
Key Account Service Chip Card ICs

Mifare® Contactless Remote Coupling Smart Card System
System Overview

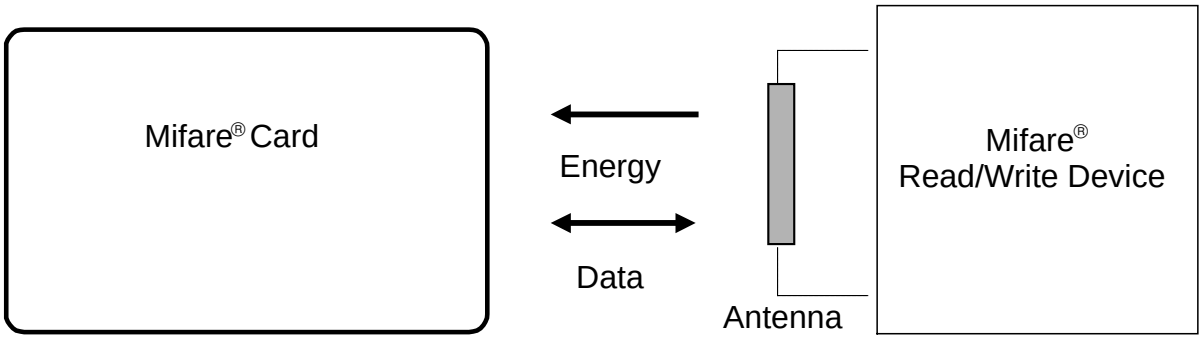
The SLE 44R35 is designed to operate in the Mifare® system, a contactless proximity smart card system. The system consists of a smart card on the one hand and a card reader together with an antenna on the other hand.

Contactless Energy and Data Transfer
In the Mifare® system, the operating distance between card and reader antenna can vary from 0 cm up to 10 cm. The card's antenna consists of a simple coil with a few turns embedded in plastic. Mifare® cards are passive and work batteryless. The high speed RF communication interface allows to transmit data with 106 Kbit/s.

Mifare® - The User-Friendly Contactless System
The Mifare® system is designed for optimal user-friendliness. The high data transmission rate permits short transaction times. For example, a ticketing transaction can be handled in less than 100 ms so that the Mifare® card user needs not to stop at the reader target (antenna). The Mifare® card even may remain in the wallet of the user even if there are coins in it.
An intelligent anticollision function allows to operate more than one card in the field simultaneously. The anticollision algorithm selects each card individually and ensures that the execution of a transaction with a selected card is performed correctly without data corruption resulting from other cards in the field.

Multi-Application Functionality
The Mifare® system is especially suited as well for the use in payment systems as in ticketing systems, e.g. public transport applications. Both kinds of applications can be performed with the same card. The Mifare® system offers real multifunctionality comparable to the features of a processor card. Two different key sets for each memory sector support systems using key hierarchies.

High System Security
In the Mifare® system design, special emphasis has been placed on security against fraud. An access to the card memory is only possible after a three pass authentication. The serial number is unique for each card and can never be changed. Each data transmission is enciphered.
Configurable access conditions protected by secret keys for memory operations as read or write protect from misuse.



Intelligent 1-Kbyte EEPROM with Interface for Contactless Transmission, Security Logic and Anticollision according to the MIFARE®-System

SLE 44R35/Mifare®

CMOS

PRELIMINARY DATA

Features

EEPROM

- 1 Kbyte, organized in 16 sectors with 4 blocks of 16 bytes each
- User definable access conditions for each memory block
- Erasing and writing of one block (16 bytes) in one shot at 5 ms
- Minimum of 100.000 write/erase cycles
- Data retention for minimum of ten years

Contactless Interface (complying to the Mifare® System)

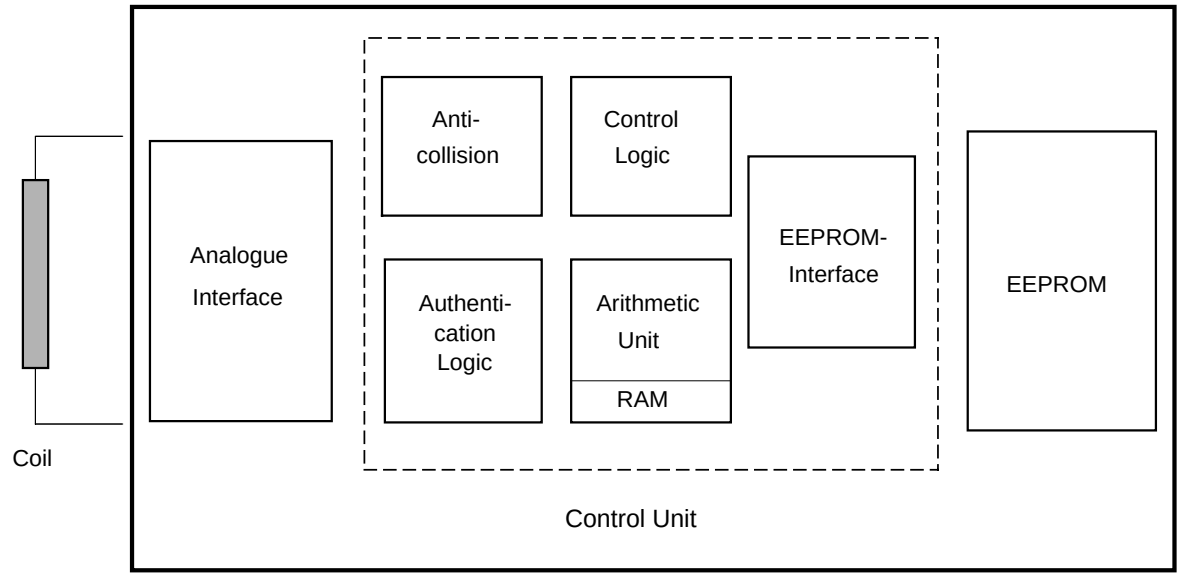
- Contactless transmission of data and supply energy (batteryless operation)
- Read and write distance from 0 cm up to 10 cm (with Mifare® Read/Write Device))
- Fast data transfer (106 Kbit/s)
- Anticollision logic: Several cards may be operated in the field simultaneously
- Operating frequency 13.56 MHz
- Short transaction times: Typical ticketing transaction < 100 ms (including backup); transaction possible with moving card

Security

- Mutual three pass authentication between card and reader
- Data encryption for RF channel
- Data integrity supported by several mechanisms: Anticollision, 16 bit CRC, parity check, bit count checking and channel monitoring
- Suited for multifunctional applications by individual key sets per each EEPROM sector
- Access to EEPROM protected by transport code on chip delivery
- Unique serial number for each circuit

SLE 44R35/Mifare® Circuit Description

The SLE 44R35 contains on a single chip a 1 Kbyte EEPROM, an analogue interface for contactless energy and data transmission and a control unit. The power supply and data are transferred to the SLE 44R35 via an antenna which consists of a coil with a few turns directly connected to the chip. No further external components are necessary.The circuit is designed to communicate with a card reader at an operating distance between 0 cm and 10.0 cm.

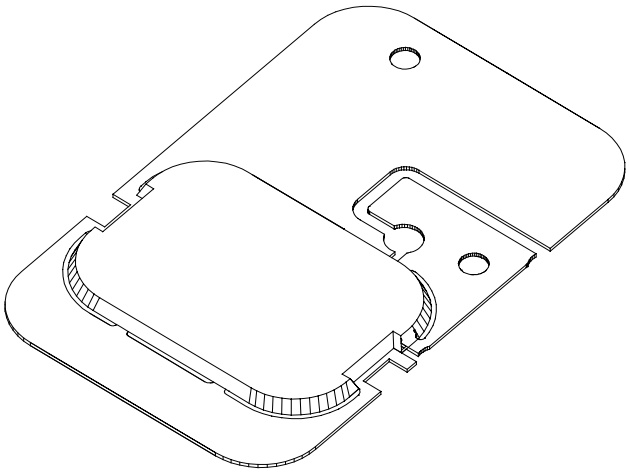


SLE 44R35 Block diagram of the chip

- Analogue Interface, consisting of
  - Modulator / Demodulator
  - Rectifier
  - Clock Separator
  - Power on Reset
  - Voltage Regulator
- Anticollision
  Internal logic of the SLE 44R35 ensures the recognition of several cards in the field which may be selected and operated simultaneously.
- Authentication Control
  Preceding any memory operation the authentication procedure with specific keys for each sector ensures permitted memory access only.
- Control Logic
  The memory can only be accessed according to the access conditions programmed for every block in a sector individually.
- Arithmetic Unit / RAM
  Arithmetic capability: Increase and decrease of values. Values are stored in a special redundant format.
- EEPROM-Interface
- EEPROM: 1 Kbyte organized in 16 sectors with 4 blocks each. One block contains 16 bytes. Last block of each sector is called "trailer" and used for a pair of secret keys and programmable access conditions for each block.

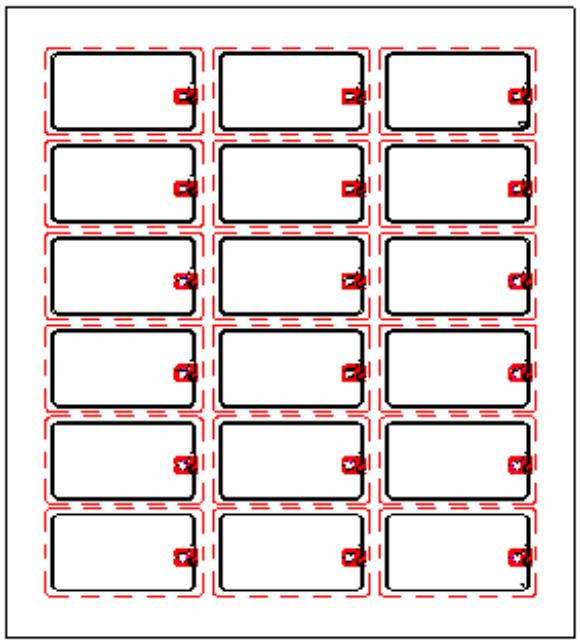
Ordering and Packaging Information

The SLE 44R35 is available as die for customer packaging, as module and as transponder comprising the module with coil on a plastic foil. The transponders are delivered on sheets containing 3 x 6 systems.



Leadframe Module

Module cobined with antenna on foil (inlay)



Inlay-Sheet with 3 x 6 Transponders

Type	Ordering Code	Package
SLE 44R35 C	Q67100H3354	Die (on wafer)
SLE 44R35 LM	Q67100H3358	Leadframe Module (on reel)
SLE 44R35 TF	Q67100H3357	Inlay Foil (sheet format 3 x 6)

Mifare® Core Module (MCM) - The Kernel of a Mifare® Reader

The Mifare® Core Module (MCM) is the kernel of Mifare® read/write units which covers all the necessary functions to access Mifare® cards. The MCM offers the versatility to be applied in Mifare® card readers installed in a lot of different systems such as bus terminals, metro gate controllers, handheld devices or even PCs.

The Mifare® Core Module consists of two circuits, a RF circuit and an interface circuit, which are mounted on a PCB. The RF circuit which is shielded by metal housing performs energy and data transmission to the card and receives the card's responses. The security management for the data communication, the anticollision logic and the 16 byte receive/transmit buffer are part of the interface circuit. It offers furthermore an interface for controlling the MCM with a standard microprocessor via a parallel 8 bit bus.

Features of the Mifare® Core Module

	Mifare® Core Module
Power supply	5 V / 15 mA and 12 V / 180 mA [1)]
Mechanical dimensions	54 x 100 x 19 mm as 52 pin-plug in module
Interface MCM-Host	CMOS parallel µP bus
Interface MCM-Antenna	Triax cable

1) A special handheld version of the MCM operated with only 5V supply voltage is available

Mifare® Demonstration System

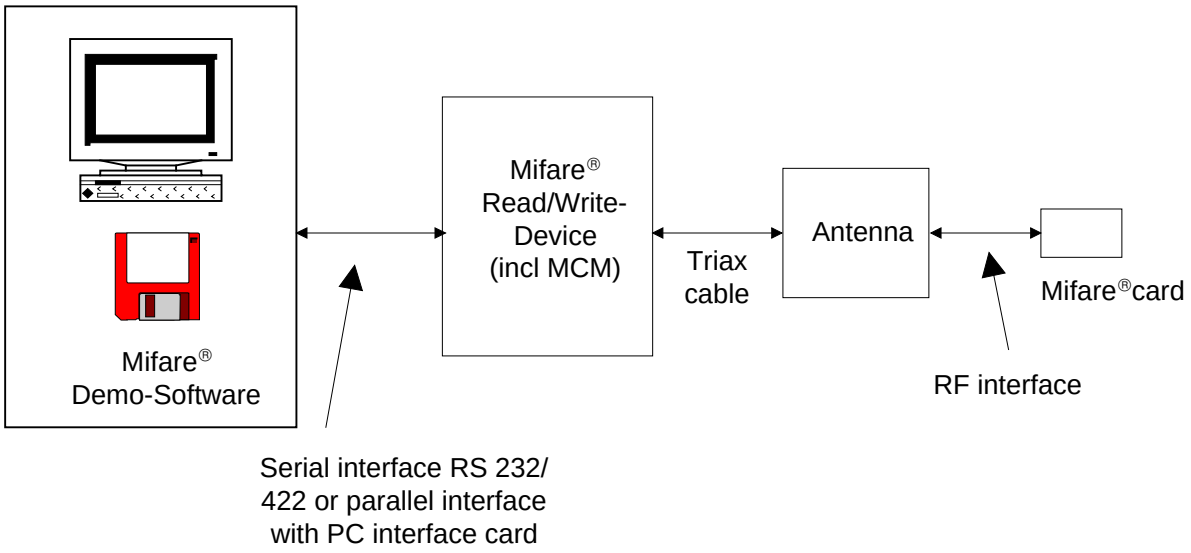
For evaluating the performance of the Mifare® system, a demonstration kit is available. It operates with the serial PC port and via parallel control by a PC. The demonstration kit makes it possible to

- give demonstrations and presentations of the Mifare® system with the supplied demonstration software.
- get familiar with the Mifare® system in order to shorten the phase for system integration of products.
- start the system integration.
- develop applications based on the supplied libraries.

The demonstration system can be used in two modes:

Serial mode: Default mode where the Read/Write Device can be accessed via a RS232 or RS422 serial interface. An internal microprocessor converts the serial bit protocol to the parallel MCM interface. In this mode a 12V (300 mA) external power supply is necessary.

Parallel mode: In this mode, a PC plug-in board is used for controlling the parallel interface of the MCM directly with the µP bus of a PC. The RWD is connected with a parallel 37 pin flat cable. No external power supply is needed.



Mifare® Demonstration System

The Mifare® Demonstration Kit package includes

- Mifare® Read/Write Device based on a standard Mifare® Core Module (MCM)
- Antenna (+ cable)
- PC plug-in board for controlling the parallel interface of the MCM directly with the µP bus of a PC. The RWD is connected with a parallel 37 pin flat cable in this operation mode.
- Mifare® cards according to ISO dimensions
- Software on 3.5" diskette
- Documentation set

The demonstration system fulfills the requirements for the CE sign if operated in the serial mode.

Ordering information:

Product Name	Ordering Code
Mifare® Demonstration Kit	Q67100Z3028