



## Chip Card & Security ICs

Mifare<sup>®</sup> NRG

SLE 66R35

Intelligent 1 Kbyte Memory Chip  
with Interface for Contactless Transmission  
according to the Mifare<sup>®</sup>-System

**Revision History: Current Version 2007-04-16**

Previous Releases: 2006-11-03

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|------|--|
| Page | Subjects (changes since last revision) |
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| All | Editorial updates |
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**To our valued customers**

We constantly strive to improve the quality of all our products and documentation. We have spent an exceptional amount of time to ensure that this document is correct. However, we realise that we may have missed a few things. If you find any information that is missing or appears in error, please use the contact section above to inform us. We appreciate your assistance in making this a better document.

**Attention please!**

The information herein is given to describe certain components and shall not be considered as warranted characteristics.

Terms of delivery and rights to technical change reserved.

We hereby disclaim any and all warranties, including but not limited to warranties of non-infringement, regarding circuits, descriptions and charts stated herein.

Infineon Technologies is an approved CECC manufacturer.

**Information**

For further information on technology, delivery terms and conditions and prices please contact your nearest Infineon Technologies Office in Germany or our Infineon Technologies Representatives world-wide (see address list).

**Warnings**

Due to technical requirements components may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies Office.

Infineon Technologies components may only be used in life-support devices or systems with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system, or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body, or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

## **Intelligent 1 Kbyte Memory Chip with Interface for Contactless Transmission, Security Logic and Anticollision according to the Mifare®-System <sup>1)</sup>**

### **Features**

#### **Contactless Mifare® Interface**

- Physical Interface and Anticollision compliant to ISO/IEC 14443-2 and -3, Type A
  - Operating frequency 13.56 MHz; data rate 106 kbit/s
  - Contactless transmission of data and supply energy
  - Anticollision logic: Several cards may be operated in the field simultaneously
- Read and write distance up to 10 cm and more (influenced by external circuitry i.e. reader and inlay design)
- Short transaction times: Typical ticketing transaction < 100 ms (including backup); transaction possible when card is moving

#### **1 Kbyte EEPROM**

- Block organization of memory, 16 sectors with fixed 4 blocks of 16 bytes each
- EEPROM updating time per block less than 4 ms
- Endurance > 100.000 erase / write cycles / bit<sup>2)</sup>
- Data retention > 10 years<sup>2)</sup>
- User definable access condition for each memory block

#### **Security Features**

- Unique chip identification number
- Mutual three-pass authentication between card and reader
  - 48-bit key length
  - 2 keys per sector enabling key management
  - Transport key at chip delivery
- Data encryption for RF channel
- Data integrity supported by several mechanisms:
  - 16-bit CRC
  - parity check
  - bit count checking
  - channel monitoring
- Selective memory access control secured by authentication and access conditions
- Secure value counters for prepaid values
- Suited to multifunctional applications: Individual key sets are available for each EEPROM sector

#### **Electrical characteristics**

- ESD protection typical 4 kV
- Ambient temperature –25 ... +70°C for chip

<sup>1)</sup> Mifare® is a registered trademark of Philips Electronics N.V.

<sup>2)</sup> Values are temperature dependent

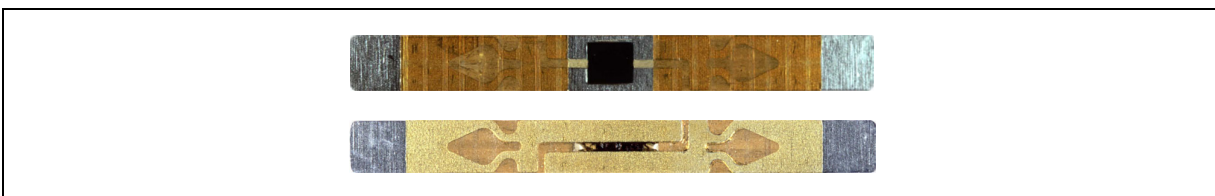
## 1 Ordering and Packaging information

**Table 1 Ordering Information**

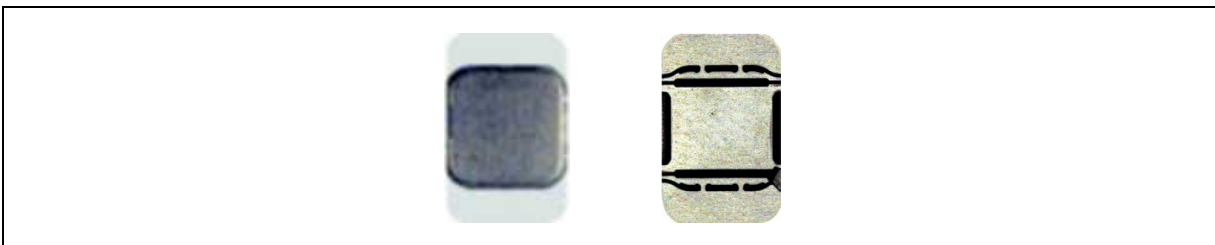
| Type            | Package <sup>1)</sup> | Remark              | Ordering Code |
|-----------------|-----------------------|---------------------|---------------|
| SLE 66R35 C     | Die (on Wafer)        | sawn / unsawn       | on request    |
| SLE 66R35 NB    | Die (on Wafer)        | NiAu-Bump, sawn     | on request    |
| SLE 66R35 MFCC1 | S-MFCC1-2-1           | FCoS™ <sup>2)</sup> | on request    |
| SLE 66R35 MCC2  | P-MCC2-2-1            |                     | on request    |
| SLE 66R35 MCC8  | P-MCC8-2-3            |                     | on request    |

For more ordering information (wafer thickness and height of NiAu-Bump) please contact your local Infineon sales office.

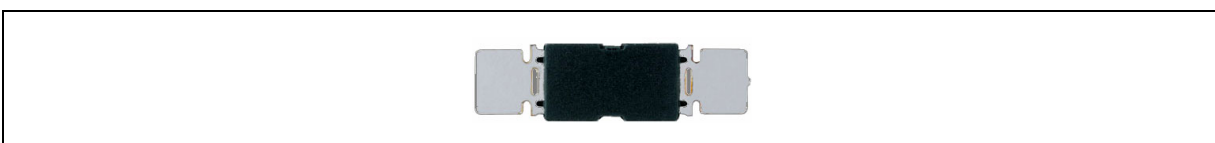
### Pin Description



**Figure 1 Pin Configuration Module Contactless Card MFCC1 (top / bottom view)**



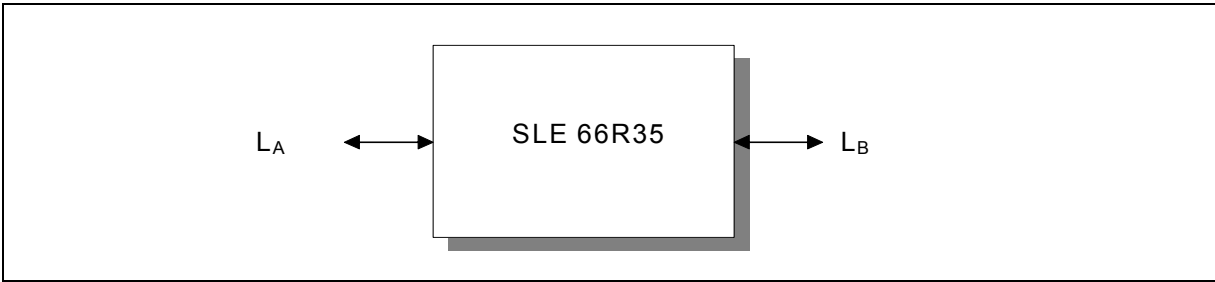
**Figure 2 Pin Configuration Module Contactless Card MCC8 (top / bottom view)**



**Figure 3 Pin Configuration Module Contactless Card - MCC2 in (top view)**

<sup>1)</sup> Available as a Module Flip Chip Contactless (MFCC1), Module Contactless Card (MCC) for embedding in plastic cards, as NiAu-bump version (NB) or as a die on sawn / unsawn wafer for customer packaging

<sup>2)</sup> FCoS™ Flip Chip on Substrate



**Figure 4 Pad Configuration Die**

**Table 2 Pin Definitions and Functions**

| Symbol         | Function           |
|----------------|--------------------|
| L <sub>A</sub> | Antenna Connection |
| L <sub>B</sub> | Antenna Connection |

## 2 Mifare® System Overview

SLE 66R35 is designed to operate in the Mifare® system. Mifare® is a contactless proximity smart card system compliant to ISO/IEC 14443-2 and -3. The system consists of a smart card and a card reader together with an antenna.

### Contactless Energy and Data Transfer

In the Mifare® system the operating distance between card and reader antenna is up to 10 cm and more (influenced by external circuitry i.e. reader-antenna configuration). The card's antenna consists of a simple coil with a few turns embedded in plastic. Mifare® cards are passive - they do not contain a battery. The high speed RF communication interface transmits at up to 106 kbit/s.

### Mifare® - The User-Friendly Contactless System

The Mifare® system is designed to be user-friendly. High data transmission rate results in short transaction times, the effect being that a Mifare® card user can move freely through a reader gate with minimum disruption. A typical ticketing transaction can be handled in less than 100 ms. Robust contactless transmission means that the Mifare® card may also remain in the wallet of the user even if there are coins in it.

An intelligent anticollision function enables more than one card in the field to operate 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 for the use in multi-application schemes, for example combining transportation revenue collection scheme and a ticketing system, for example stadium ticketing. Both applications can be performed with the same card, as hierarchical key management is supported. This means that two different keys for each memory sector can be assigned to enable authentication to that sector.

### System Security

In the Mifare® system design, emphasis has been placed on security against fraud. Access to the card memory is only allowed 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.

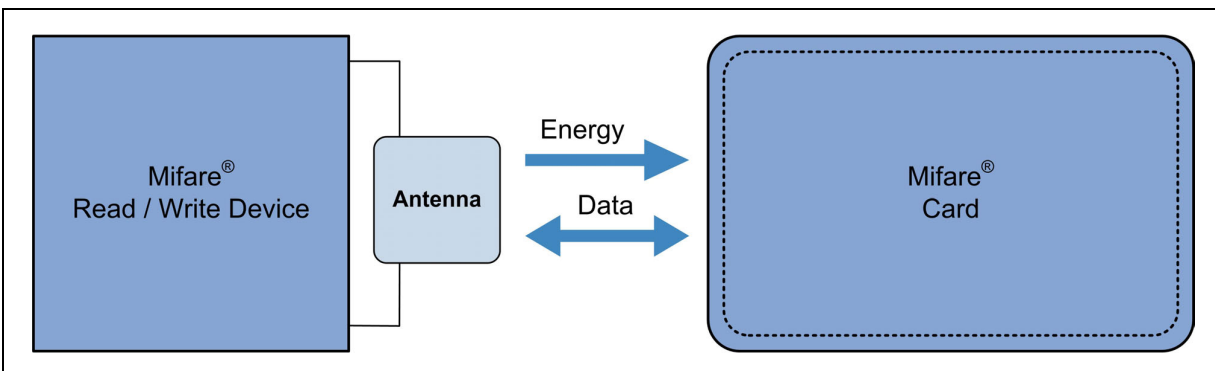
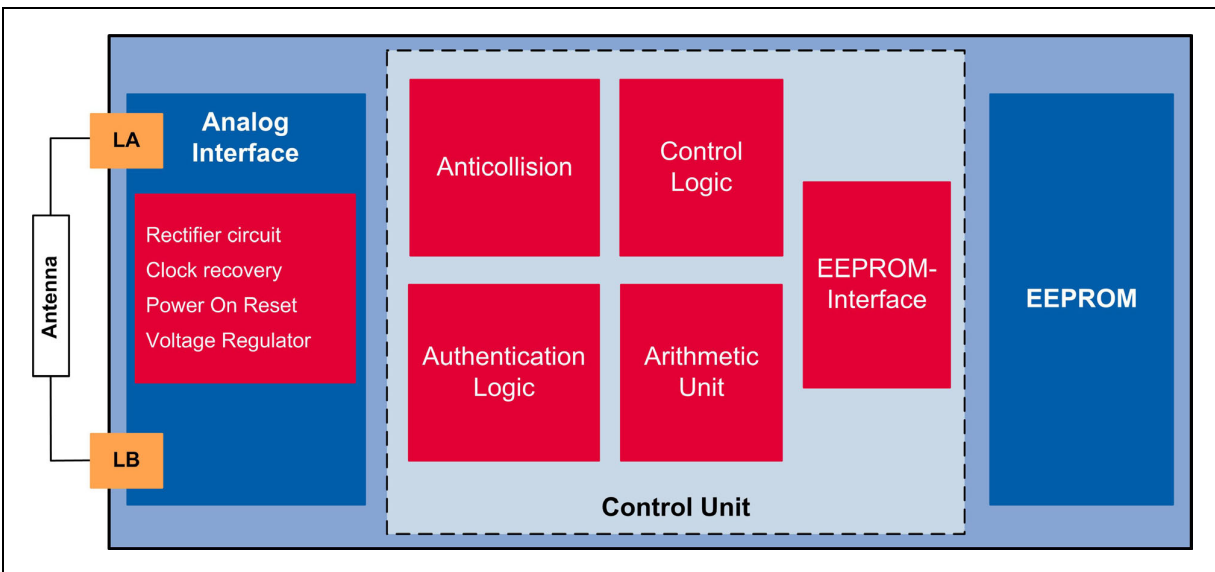


Figure 5 Mifare® System Overview

### 3 Circuit Description

SLE 66R35 consists of an EEPROM memory of 1 Kbyte organized in 16 sectors with 4 blocks each containing 16 bytes, an analog interface for contactless energy and data transmission and a control unit. The power supply and data are transferred to SLE 66R35 via an antenna, which consists of a coil with few turns directly connected to the module. No further external components are necessary. The circuit is designed to communicate with a card-reader at an operating distance of up to 10 cm (or more) depending on the reader-antenna configuration.



**Figure 6 Block Diagram**

- **Analog Contactless Interface:**  
The Analog Contactless Interface comprises the voltage rectifier, voltage regulator and system clock to supply the IC with appropriate power. Additionally the data stream is modulated and demodulated.
- **Anticollision**  
Internal logic of SLE 66R35 ensures the recognition of several cards in the field, which may be selected and operated in sequence.
- **Authentication Logic**  
Correct execution of any memory operation can only occur after the authentication procedure with a specific key.
- **Control Logic**  
Access to a block is defined by the associated access conditions for that block. These are programmed individually for each block in a sector.
- **Arithmetic Unit**  
Arithmetic Capability: Increase and decrease of values stored in a special redundant format.
- **EEPROM:** 1 Kbyte organized in 16 sectors with 4 blocks by 16 bytes each. Last block of each sector is called "Sector Trailer" and used for a pair of secret keys and programmable access conditions for each block.