

# DATA SHEET

# **mifare**<sup>®</sup>

## **Standard Card IC**

## **MF1 IC S50**

## **Functional Specification**

Product Specification

November 1999

Revision 5.0

Philips  
Semiconductors



# **PHILIPS**

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# Functional Specification

# Standard Card IC MF1 IC S50

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MIFARE® is a registered trademark of Philips Electronics N.V.

## 1 FEATURES

### 1.1 MIFARE<sup>®</sup> RF Interface (ISO/IEC 14443 A)

- Contactless transmission of data and supply energy (no battery needed)
- Operating distance: Up to 100mm (depending on antenna geometry)
- Operating frequency: 13.56 MHz
- Fast data transfer: 106 kbit/s
- High data integrity: 16 Bit CRC, parity, bit coding, bit counting
- True anticollision
- Typical ticketing transaction: < 100 ms (including backup management)

### 1.2 EEPROM

- 1 Kbyte, organized in 16 sectors with 4 blocks of 16 bytes each (one block consists of 16 byte)
- User definable access conditions for each memory block
- Data retention of 10 years.
- Write endurance 100.000 cycles

### 1.3 Security

- Mutual three pass authentication (ISO/IEC DIS9798-2)
- Data encryption on RF-channel with replay attack protection
- Individual set of two keys per sector (per application) to support multi-application with key hierarchy
- Unique serial number for each device
- Transport key protects access to EEPROM on chip delivery

**2 GENERAL DESCRIPTION**

Philips has developed the MIFARE<sup>®</sup> MF1 IC S50 to be used in contactless smart cards according to ISO/IEC 14443A. The communication layer (MIFARE<sup>®</sup> RF Interface) complies to parts 2 and 3 of the ISO/IEC 14443A standard. The security layer sports the field-proven CRYPTO1 stream cipher for secure data exchange of the MIFARE<sup>®</sup> Classic family.

**2.1 Contactless Energy and Data Transfer**

In the MIFARE<sup>®</sup> system, the MF1 IC S50 is connected to a coil with a few turns and then embedded in plastic to form the passive contactless smart card. No battery is needed. When the card is positioned in the proximity of the Read Write Device (RWD) antenna, the high speed RF communication interface allows to transmit data with 106 kBit/s.

**2.2 Anticollision**

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.

**2.3 User Convenience**

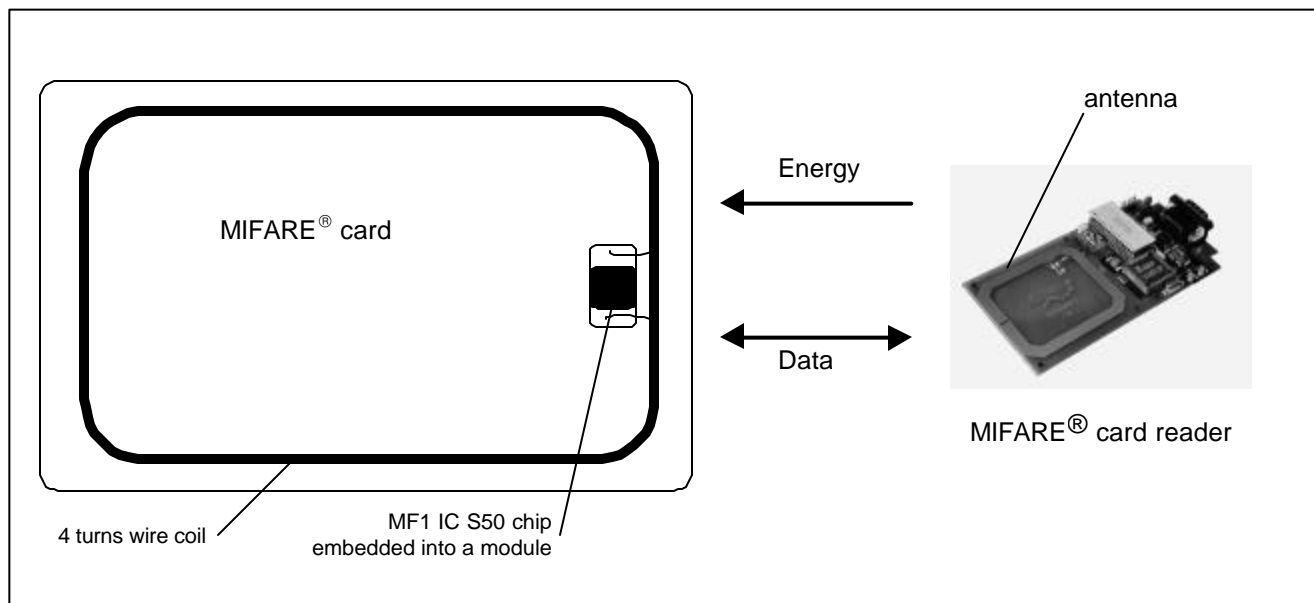
The MIFARE<sup>®</sup> system is designed for optimal user convenience. The high data transmission rate for example allows complete ticketing transactions to be handled in less than 100 ms. Thus, the MIFARE<sup>®</sup> card user is not forced to stop at the RWD antenna leading to a high throughput at gates and reduced boarding times onto busses. The MIFARE<sup>®</sup> card may also remain in the wallet during the transaction, even if there are coins in it.

**2.4 Security**

Special emphasis has been placed on security against fraud. Mutual challenge and response authentication, data ciphering and message authentication checks protect the system from any kind of tampering and thus make it attractive for ticketing applications. Serial numbers, which can not be altered, guarantee the uniqueness of each card.

**2.5 Multi-application Functionality**

The MIFARE<sup>®</sup> system offers real multi-application functionality comparable to the features of a processor card. Two different keys for each sector support systems using key hierarchies.



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