SHORT FORM SPECIFICATION

mifare® pro

MF2 ICD8x

Dual Interface Smart Card IC

Short Form Specification
Revision 1.0

July 2000

Philips
Semiconductors

PHILIPS

Dual Interface Smart Card IC MF2 ICD8x

CONTENTS

Note: Specification may be changed without further notice.

1 DESCRIPTION

The MIFARE® PRO card IC is a microprocessor based chip combining contactless smart card technology based on the MIFARE® contactless system and standard contact smart card technology on a single chip (dual interface). This chip is compatible with the MIFARE® architecture platform. Compatibility with existing MIFARE® reader modules and the optional emulation modes of MIFARE® S and MIFARE® PLUS enable fast system integration of MIFARE® PRO based cards.

Physical construction and dimensions of the MIFARE® PRO IC allows the production of ISO cards (ISO 7816-1). Compared to a contact only card an antenna has to be added in the peripheral zone of the card (see Figure 1). The antenna consists of a few turns of a printed, etched or wired coil which is directly connected to the two contactless interface pins of the MIFARE® PRO module.

The 80C51 micro-controller operates both in contact and in contactless mode. Thus, in both interface modes users define the final function of the card with their operating system. This allows the same level of security and flexibility for both the contact (ISO 7816) interface as well as the contactless (MIFARE®; ISO 14443/Type A) interface. For the development of the card operating systems all necessary tools are available based on the Ashling tool platform.

The Triple-DES co-processor together with the fast MIFARE® interface offer high security and speed in contactless and contact smart card applications. The field proven MIFARE® modulation and communication technique provides reliable communication and secure processing, even in electro-magnetically harsh environments like in buses or train stations.

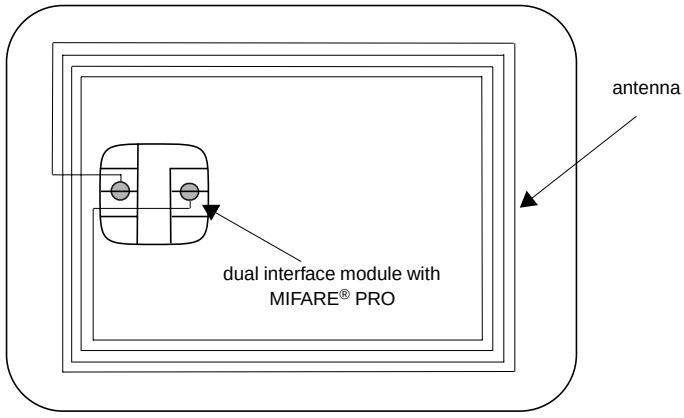

Fig.1 MIFARE® PRO card.

1.1 Different Configurations of the MF2 ICD8x

Depending on the application requirements the MIFARE® PRO can be configured in two different ways. The configuration has impact on the memory organization of the ROM and on the access conditions for the EEPROM and influences the user OS development. The selected configuration is part of the user ROM mask, that contains also the user OS code. Three different configurations (A, B1, B4) are possible and shown in Table 1.

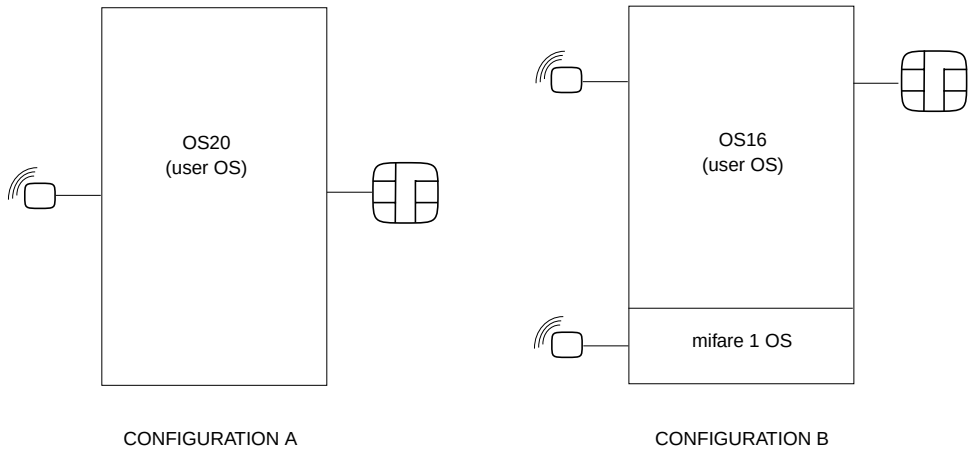

Fig.2 ROM mapping in different configurations of MF2 ICD8x.

1.1.1 CONFIGURATION A

In configuration A the full 20 Kbytes ROM memory is available for a dual interface user operating system (OS20). The EEPROM management and configuration is fully up to the user OS (OS20). The MIFARE® PRO type number MF2 ICD8**0.....** defines configuration A.

1.1.2 CONFIGURATION B

In configuration B the lower 4 Kbytes of the user ROM memory are used for the contactless MIFARE® 1 operating system provided by Philips. With this MIFARE® 1 OS the MIFARE® S and MIFARE® PLUS functionality may be emulated on the MIFARE® PRO. Here different hardware secured configurations of the EEPROM memory are supported. This flexibility allows to combine the new features of MIFARE® PRO with the requirements of existing applications and infrastructure.

The remaining 16 Kbytes ROM are available for a dual interface user operating system (OS16). For secure separation of both operating systems the dedicated built in hardware protection controls access to the EEPROM and 4 Kbytes MIFARE® ROM. For detailed explanation of MIFARE® S and MIFARE® PLUS functionality please refer also to the following documents:

- MIFARE® MF CM500 Product Specification
- MIFARE® Standard IC MF1 ICS50 Functional Specification
- MIFARE® PLUS, MF1 P60 General Description, Smart Card IC for Contact and Contactless Operation.

The MIFARE® PRO type number MF2 ICD8**1.....** defines configuration B1 with emulation of MIFARE® S and 1 Kbyte EEPROM with MIFARE® mapping.

The MIFARE® PRO type number MF2 ICD8**4.....** defines configuration B4 with emulation of MIFARE® PLUS and 4 Kbytes EEPROM with MIFARE® mapping.

Table 1

CONFIGURATION	PART NUMBER	ROM	EEPROM	RAM
A	MF2 ICD8**0**...	20 Kbytes for user OS	8 Kbytes for access with user OS	256 bytes
B1	MF2 ICD8**1**...	16 Kbytes for user OS 4 Kbytes for MIFARE1 OS	7 Kbytes for access with user OS 1 Kbyte for access with MIFARE1 OS and user OS, configurable	
B4	MF2 ICD8**4**...	16 Kbytes for user OS 4 Kbytes for MIFARE1 OS	4 Kbytes for access with user OS 4 Kbytes for access with user OS and MIFARE OS, configurable	

2 BLOCK DIAGRAM

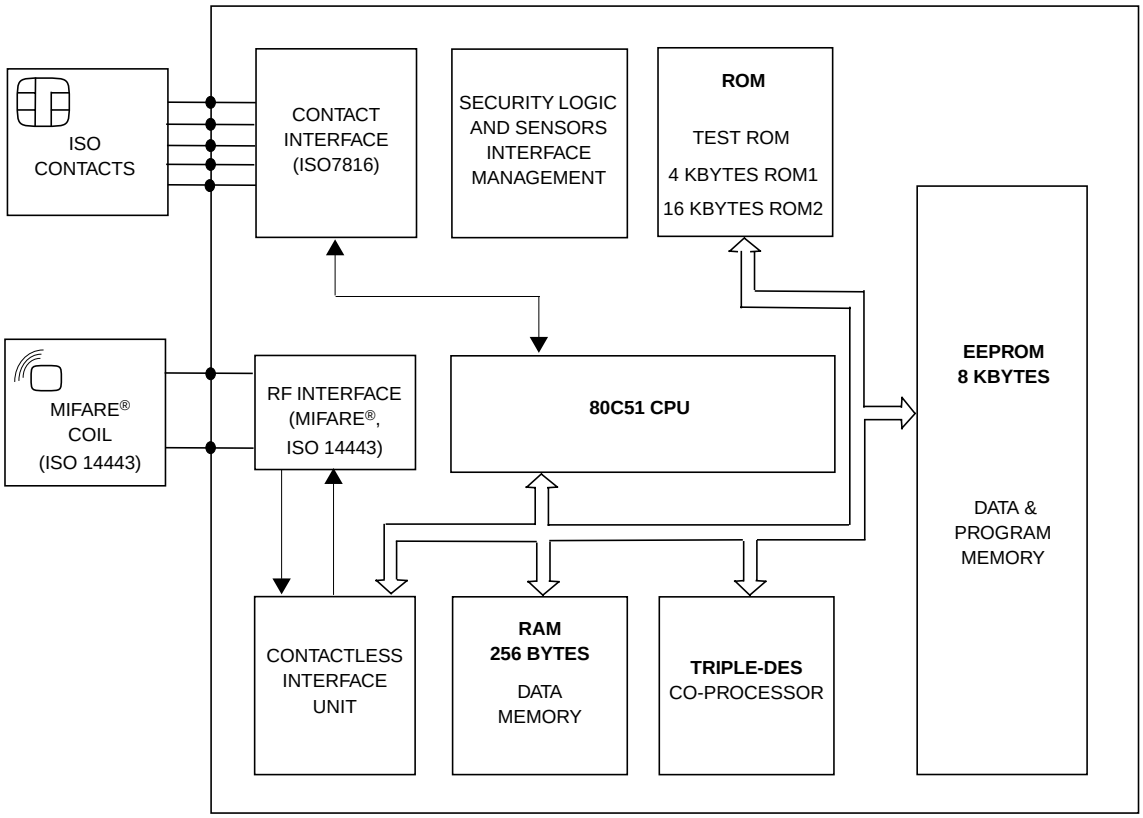

Fig.3 Block diagram of MF2 ICD8x.

3 FEATURES

- 80C51 8-bit micro-controller core operating in contact and contactless mode on a single chip
- Low power, high speed Triple-DES co-processor for contactless and contact operation
  - Triple-DES calculation speed (with keys loaded): 175 µs in contactless mode
  - Single DES calculation speed (with keys loaded): 125 µs in contactless mode
- Low power / low voltage design
- 20 (16) Kbytes user ROM
- 256 bytes RAM
- 8 Kbytes EEPROM
  - Stores data or program code
  - 32 byte pages
  - 8 bytes security area (write once memory)
  - Minimum of 100.000 write/erase cycles
  - Data retention for minimum of 10 years
  - EEPROM programming voltage generated on chip
- Power saving modes
  - Power-down and Idle mode
- 2 vectorised interrupt sources from
  - EEPROM
  - IO transition
- Clock frequency range 1 to 5 MHz
- Contact configuration and serial interface according to ISO 7816
- MIFARE® RF contactless interface as suggested by ISO/IEC 14443 Type A
  - 13.56 MHz operating frequency
  - Reliable communication
  - High speed (106 kBaud, efficient frame support)
  - True anticollision
  - High speed CRC co-processor according to CCITT
- MIFARE® reader module compatibility
- MIFARE® S and MIFARE® PLUS emulation modes
- Advanced security features
  - ROM code not visible due to implantation
  - Low supply voltage sensor (LVS)
  - High supply voltage sensor (HVS)
  - Low clock frequency sensor (LFS)
  - High clock frequency sensor (HFS)
  - High temperature sensor (HTS)
  - Unique serial number (hardware protected)
  - FabKey per individual die
- Custom specific EEPROM initialisation
- Supply voltage: 2.7 V - 5.5 V
- Operating temperature: -25 to + 70 °C
- 3.5 kV ESD protection on ISO pads according to MIL Standard 883-C, method 3015

4 ORDERING INFORMATION

TYPE NUMBER(1)	PACKAGE			TEMPERATURE RANGE (°C)
	NAME	DESCRIPTION	VERSION	
MF2 MOC1 D8**0**/D0xxyy	Module	Dual Interface Modules on super 35 mm film (8-contact)	SOT507AA1	-25 to +70
MF2 MOC1 D8**1**/DMxxyy				
MF2 MOC1 D8**4**/DMxxyy				
MF2ICD8000W/P5Dxxyy	FFC	sawn wafer on film frame carrier	–	
MF2ICD8101W/P5Dxxyy				
MF2ICD8401W/P5Dxxyy				

5 PINNING INFORMATION

5.1 Smart Card contacts

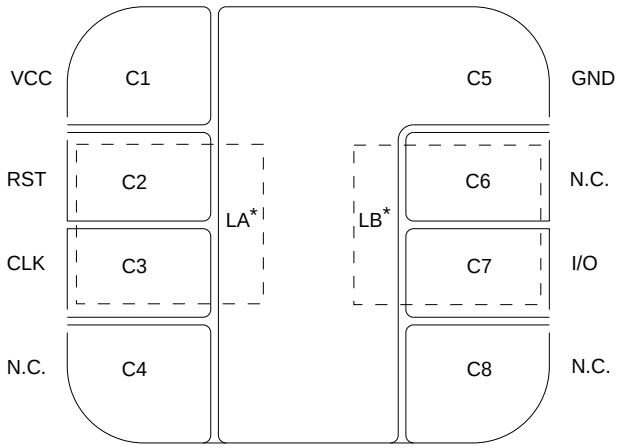

Fig.4 ISO contact assignments for SOT507AA1

Table 2 Pin description

ISO 7816		MF2 ICD8x	
CONTACTS	SYMBOL	SYMBOL	DESCRIPTION
C1	VCC	VDD	Power supply voltage input
C2	RST	$\overline{RST}$	Reset input, active LOW
C3	CLK	CLK	Clock input
C4	reserved	N.C.	not connected
C5	GND	VSS	Ground (reference voltage) input
C6	reserved	N.C.	not connected
C7	I/O	I/O	Input/Output for serial data
C8	reserved	N.C.	not connected
–	–	LA	antenna coil connection
–	–	LB	antenna coil connection

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