my-d™ NFC

SLE 66RxxP

Intelligent EEPROM with
Contactless Interface compliant to
ISO/IEC 14443-3 Type A and support of
NFC Forum™ Type 2 Tag Operation

Short Product Information

2011-11-16

Chip Card & Security

Revision History - Short Product Information - my-d™ NFC	
Previous Release	**2008-12-11**
Page or Item	**Subjects (major changes since previous revision)**
2011-11-16	
All	Editorial changes
	Updated Ordering Information and Delivery Forms
	Added information about NFC configuration and initialization
	Technical product update: pre-configured NFC memory map (INITIALIZED state)

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Last Trademarks Update 2010-10-26

Features

Intelligent EEPROM with Contactless Interface compliant to ISO/IEC 14443-3 Type A and support of NFC Forum™ Type 2 Tag Operation

Contactless Interface

- Physical interface and Anticollision compliant to ISO/IEC 14443-3 Type A
    - Operation frequency 13.56 MHz
    - Data rate up to 848 kbit/s from PICC to PCD, 106 kbit/s from PCD to PICC
    - Contactless transmission of data and supply energy
    - Anticollision logic: Several cards may be operated in the field simultaneously
- Unique IDentification number (7-byte double-size UID)
- Read / write distance up to 10 cm and more (influenced by external circuitry i.e. reader and inlay design)

Up to 5120 bytes EEPROM

- Organized in up to 512 pages
- Each page organized in 8 bytes for data storage + 2 bytes for administrative purposes
- Up to 509 pages of user memory (user page size 8 byte)
- EEPROM programming time per page < 4 ms
- EEPROM endurance minimum 100,000 erase/write cycles[1]
- Data retention minimum 10 years[1]

NFC Tag Operation

- Support of NFC Forum™ - Type 2 Tag Operation Specification
- Up to 2048 bytes NFC memory available
    - organized in static or dynamic memory structure
    - pre-defined memory size for NFC Forum™ Type 2 Tag Operation (up to two 1 kByte sectors)
- Pre-configured NFC memory with empty NDEF message (INITIALIZED state)

Value Counters: up to 65536 (value range from 0 to 2^{16} - 1)

- Each page in the User Area is configurable as a Value Counter
- Support of Anti-Tearing

Electrical characteristics

- ESD protection minimum 2 kV
- Ambient temperature -25℃ ... +70℃ (for the chip)

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1) Values are temperature dependent

1 Ordering and packaging information

Table 1-1   Ordering information

Type	Package[1]	Total / User Memory[2]	Total / User Pages[2]	Ordering code
SLE 66R04P[3]		780 / 600 bytes	78 / 75	on request
SLE 66R16P NB	NiAu Bumped (sawn wafer)	2560 / 2024 bytes (1024 bytes of NFC Memory	256 / 253	SP000953288
SLE 66R16P MCC2	P-MCC2-2-1			on request
SLE 66R16P MCC8	P-MCC8-2-6			SP000953280
SLE 66R32P NB	NiAu Bumped (sawn wafer)	5120 / 4072 bytes (2048 bytes NFC Memory)	512 / 509	SP000953292
SLE 66R32P MCC2	P-MCC2-2-1			on request
SLE 66R32P MCC8	P-MCC8-2-6			SP000953284

1) MCC is short for Module Contactless Card
2) Total memory size and page count includes the service area and the two administrative bytes per page whereas user memory size and page count is freely programmable for user data.
3) The SLE 66R04P does not support NFC Forum™ Type 2 Tag functionality.

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

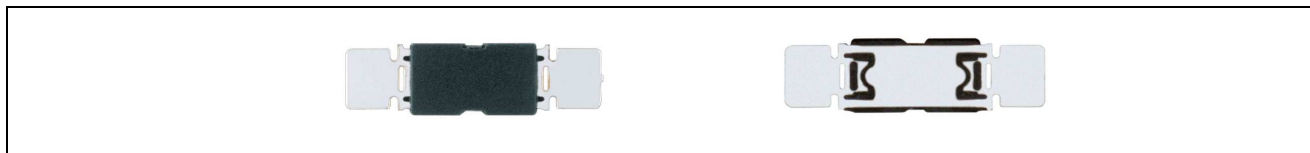## Pin description

Figure 1-1   Pin configuration Module Contactless Card - MCC2-2-1 (top / bottom view)
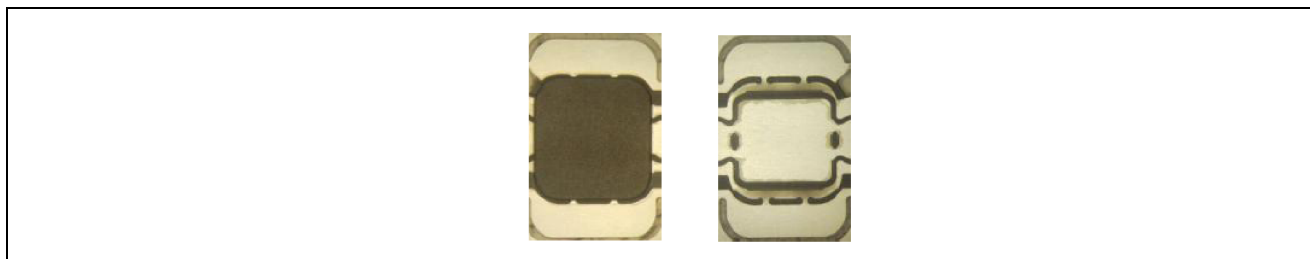

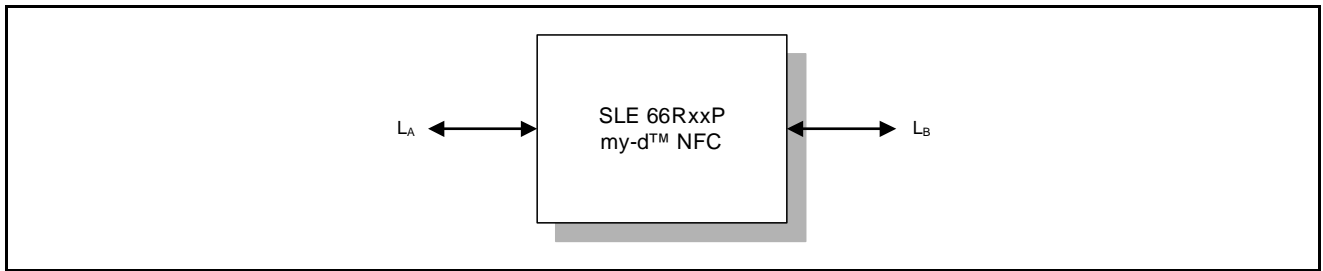**Figure 1-2   Pin configuration Module Contactless Card - MCC8-2-6 (top / bottom view)**

Figure 1-3   Pad configuration die

Table 1-2   Pin description and function

Symbol	Function
L_A	Antenna connection
L_B	Antenna connection

2   my-d™ Product Family

my-d™ products are available both in plain mode with open memory access and in secure mode with memory access controlled by authentication procedures. The family of contactless memory my-d™ provides users with different memory sizes and incorporates security features to enable considerable flexibility in the application design.

Flexible controls within the my-d™ devices start with plain mode operation featuring individual page locking; for more complex applications various settings in secure mode can be set for multi user / multi application configurations.

In plain mode access to the memory is supported by both 4-byte block as well as 8-byte page structure.

In secure mode a cryptographic algorithm based on a 64-bit key is available. Mutual authentication, message authentication codes (MAC) and customized access conditions protect the memory against unauthorized access.

The functional architecture, meaning the memory organization and authentication of my-d™ products is the same for both my-d™ proximity (ISO/IEC 14443) and my-d™ vicinity (ISO/IEC 18000-3 mode 1 or ISO/IEC 15693). This eases the system design and allows simple adaptation between applications.

Configurable Value Counters featuring anti-tearing functionality are suitable for value token applications, such as limited use transportation tickets.

Architectural interoperability of all my-d™ products enables an easy migration from simple to more demanding applications.

In addition, the my-d™ light (ISO/IEC 18000-3 mode 1 or ISO/IEC 15693) is part of the my-d™ family. Its optimized command set and memory expands the range of applications to cost sensitive segments.

2.1   my-d™ NFC

The my-d™ NFC products are members of the my-d™ family. Once designed-in a migration to different memory sizes can be done easily. my-d™ NFC products are designed especially for the increasing NFC market demanding smart memories.

Infineon's my-d™ NFC family convinces with fast communication speed and high robustness. Furthermore, the SLE 66RxxP family can be operated as NFC Forum™ Type 2 Tag. Up to 2 kBytes of memory can be arranged in a dynamic memory structure for NFC applications. my-d™ NFC products also feature configurable Value Counters which support anti-tearing protection.

my-d™ NFC products are suited for a broad range of applications like smart posters, ringtones, data logging, public transport, event ticketing, access control or consumer good information.

2.2 Application Segments

my-d™ products are optimized for personal and object identification. Please find in the following table some dedicated examples

Table 2-1   my-d™ family product overview

Product	Application
my-d™ move - SLE 66R01P	Public Transport, Smart Posters, NFC Device Pairing
my-d™ move NFC - SLE 66R01PN	Public Transport, Smart Posters, NFC Device Pairing, NFC INITIALIZED state
my-d™ move lean - SLE 66R01L	Public Transport, Smart Posters, NFC Device Pairing
my-d™ NFC - SLE 66RxxP	Smart Posters and Maps, NFC Device Pairing, Loyalty Schemes, Consumer Good Information, Healthcare Monitoring
my-d™ proximity 2 - SLE 66RxxS	Access Control, Entertainment, Public Transport, Customer Loyalty Schemes, Micro Payment
my-d™ proximity enhanced - SLE 55RxxE	Access Control, Gaming, Entertainment, Customer Loyalty Schemes
my-d™ light - SRF 55V01P	Libraries, Laundry, Factory Automation, Media Management, Event Ticketing, Leisure Park Access
my-d™ vicinity plain - SRF 55VxxP	Factory Automation, Healthcare, Ticketing, Access Control
my-d™ vicinity plain HC - SRF 55VxxP HC	Ticketing, Brand Protection, Loyalty Schemes, Ski passes
my-d™ vicinity secure - SRF 55VxxS	Ticketing, Brand protection, Loyalty Schemes, Access Control

3 my-d™ NFC - SLE 66RxxP

The my-d™ NFC products are based on the ISO/IEC 14443 Type A standard for contactless proximity cards. The my-d™ NFC family features both my-d™ commands and NFC Forum™ Type 2 Tag commands. The products are targeting particular high memory applications such as Smart Posters and Maps, Loyalty Schemes, Healthcare Monitoring as well as NFC Device Pairing applications.

They are fulfilling the requirements of state of the art contactless memory ICs with respect to compatibility to the ISO/IEC 14443 standard part 1-3, operating range and command as well as feature set.

Furthermore, the SLE 66RxxP family can be operated as NFC Forum™ Type 2 Tag.

3.1 Circuit Description

The my-d™ NFC is made up of an EEPROM memory unit, an analog interface for contactless energy and data transmission and a control unit.
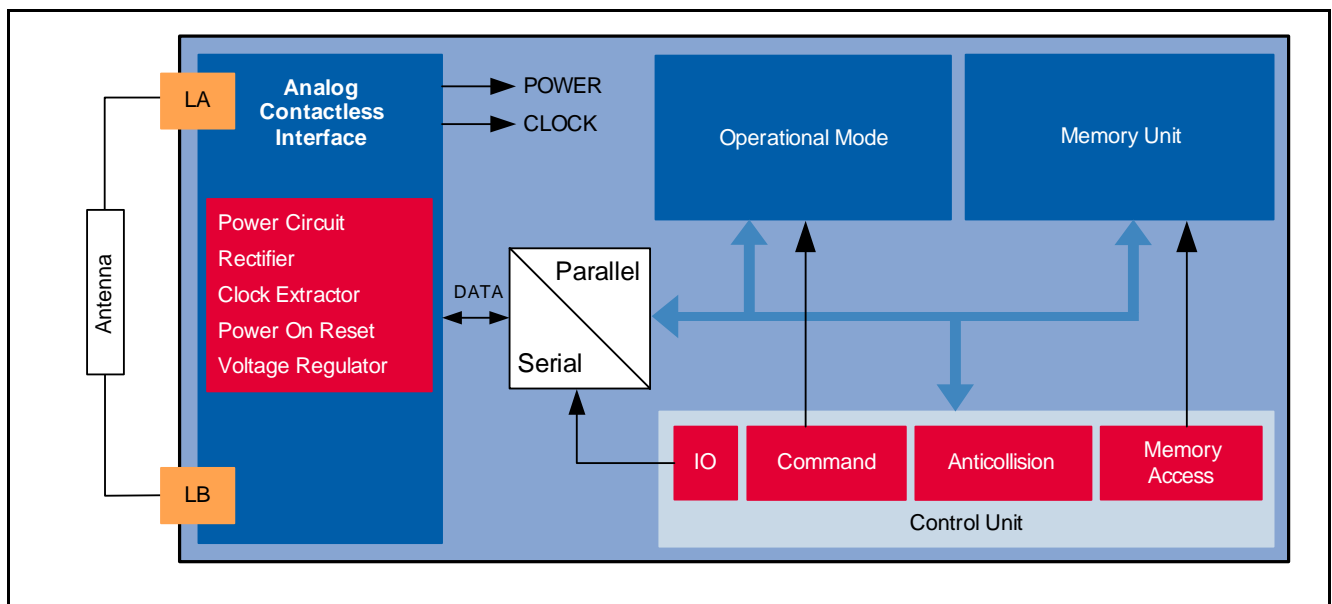

Figure 3-1 Block Diagram of the my-d™ NFC

- 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.
- Operational mode
  - The access to the memory depends on the actual configuration of the my-d™ NFC.
- Memory Unit
  - The Memory Unit consists of up to 5120 bytes memory organized in up to 512 pages each of 8 user and two administration bytes.
- Control Unit
  - The Control Unit decodes and executes all commands. Additionally the control unit is responsible for the correct anticollision flow.

3.2   Memory Principle

The memory is organized in 3 areas:

• User Area
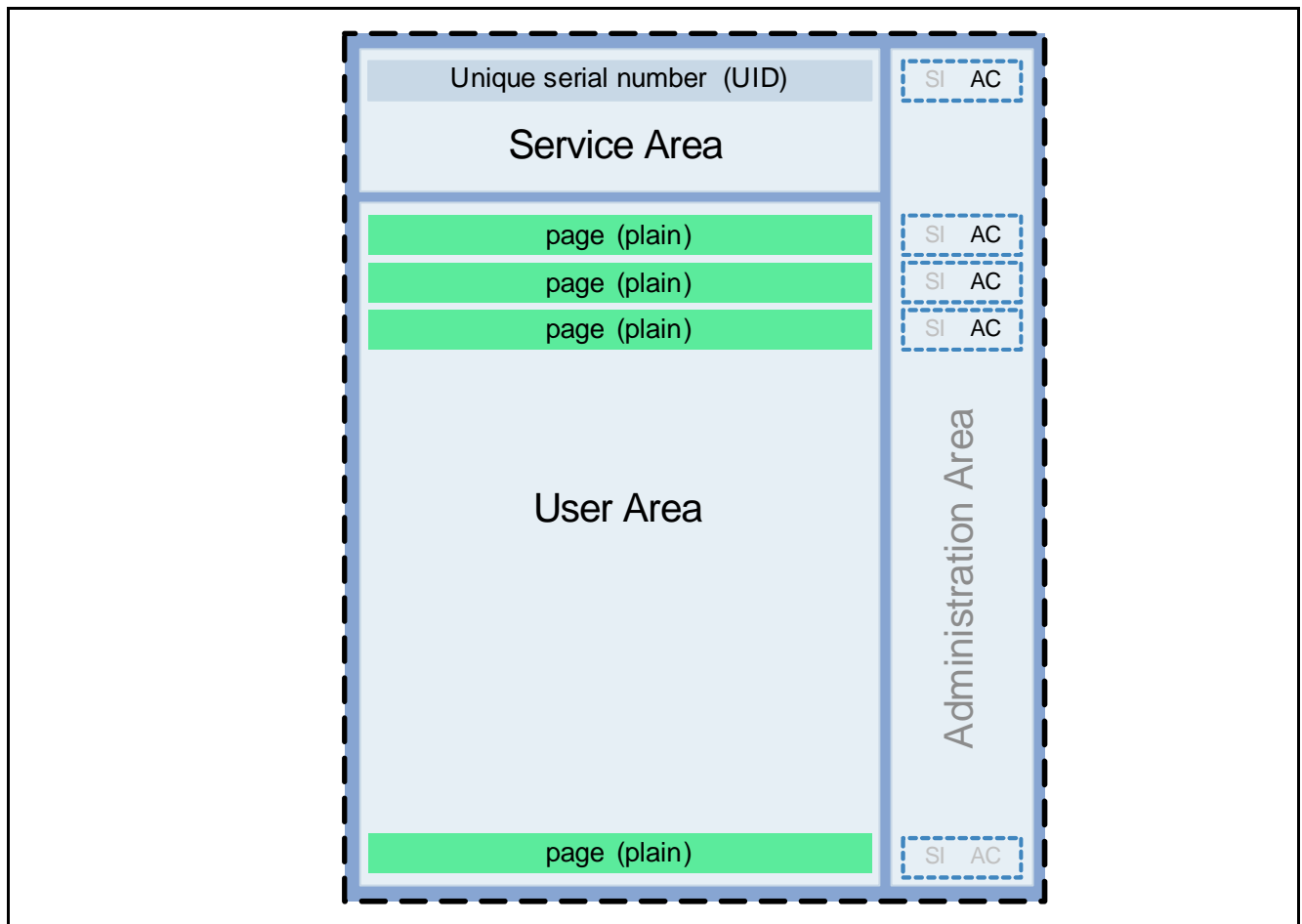• Service Area
• Administration Area

Figure 3-2   my-d™ Memory Organization

The Service Area stores the 7-byte UID, manufacturer data and configuration data. This information is programmed at manufacturing of the chip and cannot be changed.

The User Area stores User Data in up to 509 pages. The whole NFC memory portion is mapped into the User Area.

The Administration Area stores two bytes of information about page administration (SI - Sector Index and AC - Access Condition). The Access Condition and Sector Index byte are corruption protected.

3.3 Memory Principle for a NFC Forum™ Type 2 Tag

Some parts of the my-d™ NFC memory are configured to be accessible with NFC Forum™ Type 2 Tag commands. Static or a dynamic memory structures are configurable. The principle of the memory structure is shown in **Figure 3-3**.
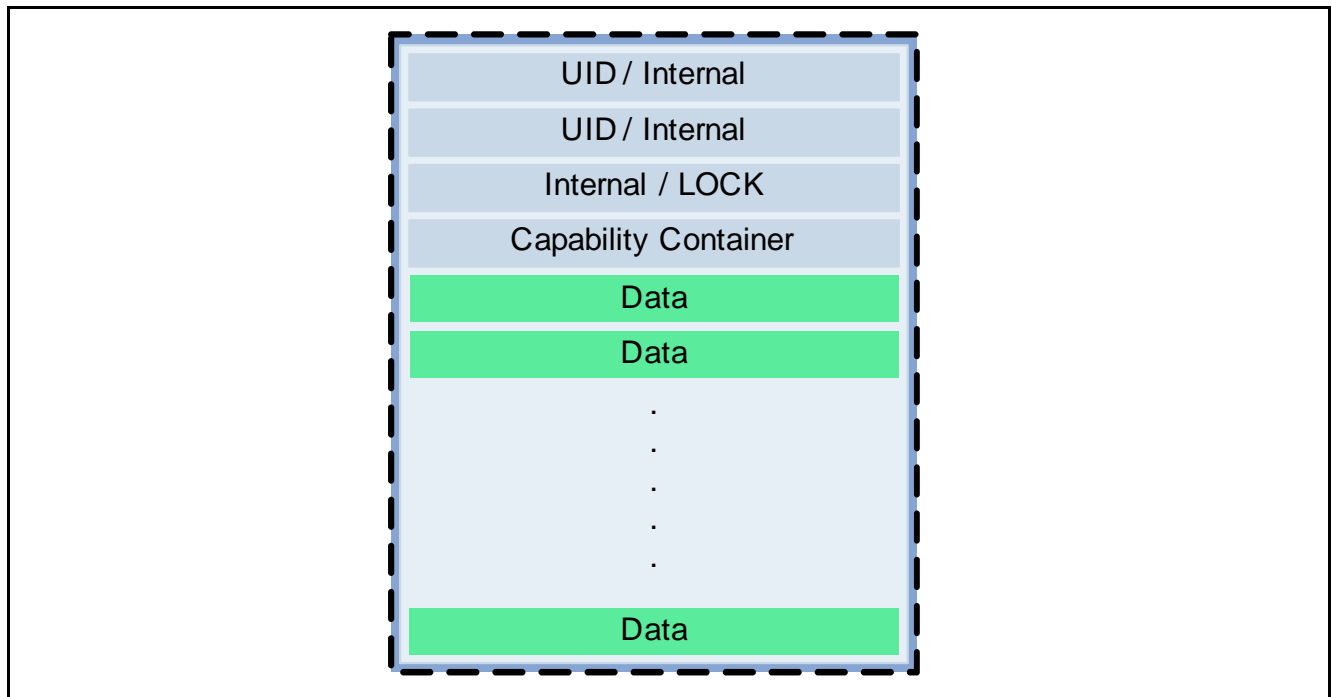

Figure 3-3   NFC Memory Organization

The block size in the NFC memory organization is 4 bytes. These blocks are accessible with NFC Forum™ Type 2 Tag commands as well as with my-d™ commands.

The my-d™ NFC are delivered with pre-configured NFC memory; the Capability Container bytes are programmed and the data area holds an empty NDEF message; this represents the NFC Forum™ Type 2 Tag INITIALIZED state within the tag life cycle. With this pre-configuration the my-d™ NFC can be immediately used in NFC infrastructures.

For further details regarding the NFC initialization of my-d™ NFC please refer to the Data Book and the Application Note "How to operate my-d™ devices in NFC Forum™ Type 2 Tag infrastructures" available at Chip Card & Security security.chipcard.ics@infineon.com.

Attention: This pre-configuration can be over-written to any value. Initial shipments of the my-d™ NFC devices have been delivered without this configuration.

3.4 System Overview

The system consists of a host system, one or more my-d™ NFC or other ISO/IEC 14443-3 compliant cards and an ISO/IEC 14443-3 compatible contactless reader with an antenna. Alternatively, since the my-d™ NFC is configured to hold a NFC Forum™ Type 2 Tag memory structure, a NFC Forum™ Device in card reader/writer mode can be used to operate the chip.
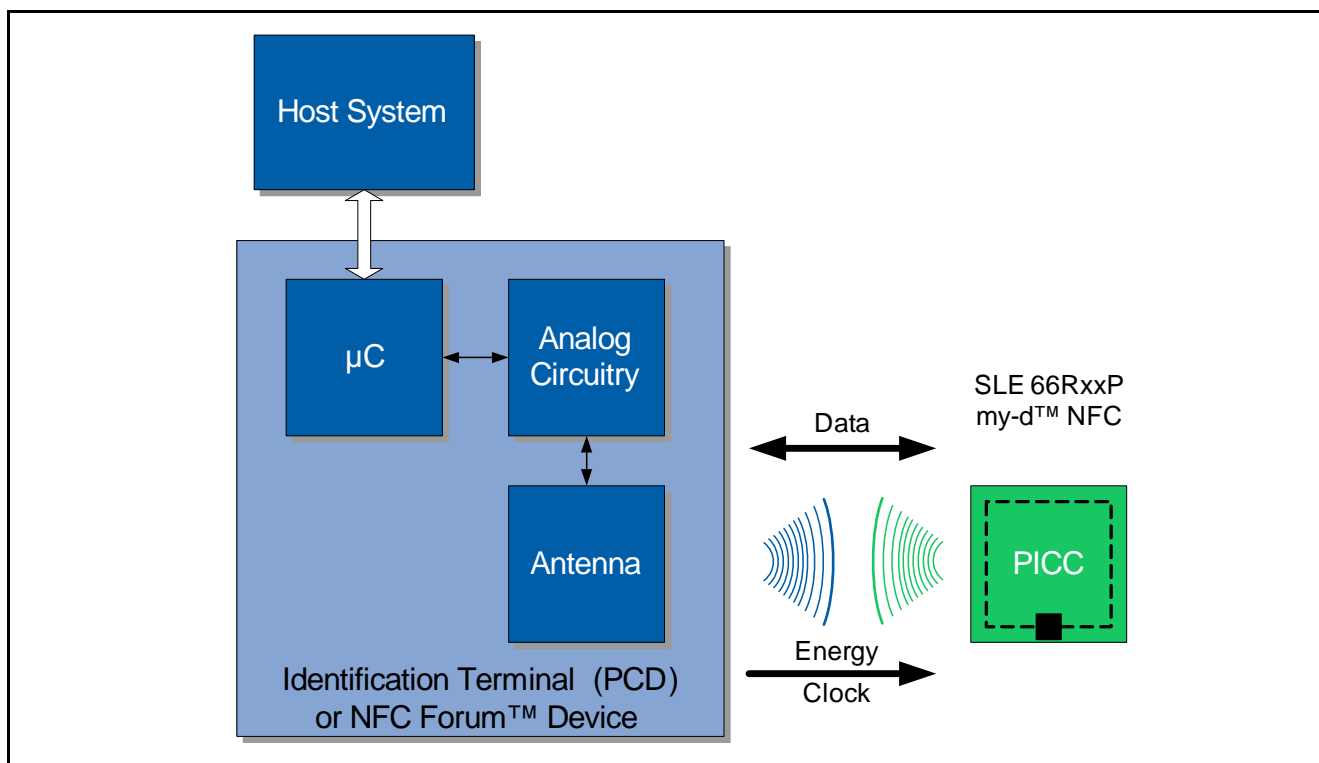

Figure 3-4   my-d™ NFC System

3.5   Product Versions

To identify the different types of my-d™ NFC contactless memories special chip type information is coded into the manufacturer page (Service Area, page 0002_H, byte 00_H). The table below briefly describes the values of this byte for the different chip versions.

Table 3-1   Chip information for different product variants

Sales Code	Chip Information Byte[1]
SLE 66R04P[2]	11xx 0010_B
SLE 66R16P	11xx 0100_B
SLE 66R32P	11xx 0101_B

1)   Bit [5:3] should not be evaluated as their value may be changed for future revisions.

2)   The SLE 66R04P does not support NFC Forum™ Type 2 Tag functionality.

In addition to the chip type information, the manufacturer ID and a chip family identifier are coded into the 7-byte UID (Service Area, page 0000_H) as described in Table 3-2. The chip family identifier can be used to determine the basic command set for the chip.

Table 3-2   Manufacturer ID and Chip Family Identifier

UID field	Value	Description
uid0	05_H	Manufacturer ID according to ISO/IEC 7816-6/AM1
uid1	$x0_H$	The higher nibble of uid1 is the chip family identifier coded as: 1_H ... my-d™ command set 2_H ... my-d™ command set and NFC Forum™ Type 2 Tag commands The lower nibble is RFU and set to 0_H. The lower nibble shall not be checked for chip family determination.

3.6   Supported Standards

Following standards are supported:

- ISO/IEC 14443 Type A (Parts 1, 2 and 3)
  tested according to ISO/IEC 10373-6 (PICC Test and Validation)
- Support of NFC Forum™ Type 2 Tag Operation

3.7   Command Set

The my-d™ NFC chip is compliant to the ISO/IEC 14443-3 Type A standard. A set of standard ISO commands is implemented to operate the chip. Additional to the ISO/IEC 14443 commands, NFC Forum™ Type 2 Tag commands and a my-d™ specific command set is implemented. This facilitates the access to the on-chip integrated memory.