

MFEV710

Pegoda EV710

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Product short data sheet
COMPANY PUBLIC

1 General description

The Pegoda MFRD710 reader is a reference design and evaluation reader for secure applications based on MIFARE and NTAG products. The MFEV710 evaluation kit is built around proven, well-established MIFARE products and a powerful Arm Cortex-M3 processors.

The MFEV710 design in kit includes the MFRD710 contactless smartcard reader, a design based on the MFRC523 contactless reader IC. The kit supports the entire MIFARE and NTAG product portfolio: MIFARE Classic, MIFARE DESFire, MIFARE Plus, and MIFARE Ultralight C, NTAG, including SAM AV2 (in x- and non-x modes). The kit also offers full support of RFIDDiscover, with a reader library for all the MIFARE and NTAG products.

It uses an open software concept and PC-based tools. The software code and hardware architecture are reusable, and each kit includes a sample SAM-based, secure reader architecture that implements multiple protocols. For added flexibility in development, the flash-based microcontroller supports custom application development based on Pegoda hardware. The microcontroller is open for customer code implementations, and the design's hardware interfaces are open for customer extensions.

The kit includes native support for USB. An optional hardware extension board, available on request, provides additional support for RS232, RS485, and Ethernet. The extension board also has a JTAG interface, for debugging functionality directly on the microcontroller, and is accompanied by a free embedded toolchain for firmware customization.

The GUI supplied with each kit uses the familiar Windows look and feel and offers a range of features, including history, log, timing profile management, key management and show cards.

Minimum system requirements: The minimum system requirements for running either evaluation kit are as follows: Intel Pentium 166 MHz or equivalent, 32 Mbytes RAM, 20 Mbytes free hard disk space, USB support, and Windows 7 in 32- or 64-bit version.



2 Features and benefits

2.1 Features

- Multiprotocol ISO/IEC 14443 and MIFARE Classic operation
- PC/SC-based architecture on widely deployed hardware solutions
- Full support for entire MIFARE and NTAG product portfolio and RFIDDiscover
- SAM support in standard or x-mode
- Arm Cortex-M3 microcontroller with integrated flash memory
- Firmware in source code and binaries
- USB host interface to PC and Windows-based user interface
- Optional support for RS232, RS485, JTAG, Ethernet

2.2 Benefits

- Fast, flexible development of SAM-based, secure reader systems
- Quick embedded development with portable code
- Easy customization with flash-based microcontroller
- Custom firmware and JTAG debugging with optional hardware extension board

3 Applications

- Public transport ticketing
- Access management
- Event management / micro-payment
- NFC tagging
- PC peripheral terminal
- and many others

4 Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V _{DD}	supply voltage	-		4.75	5.0	5.25	V
T _{amb}	ambient temperature	-		-10	+25	70	V

5 Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
MFEV710	-	Package containing: MFRD710, Pegoda contactless smartcard reader, based on MFRC523 contactless reader IC USB cable MIFARE product sample cards Quick startup instructions with links to documentation and software	-

6 Block diagram

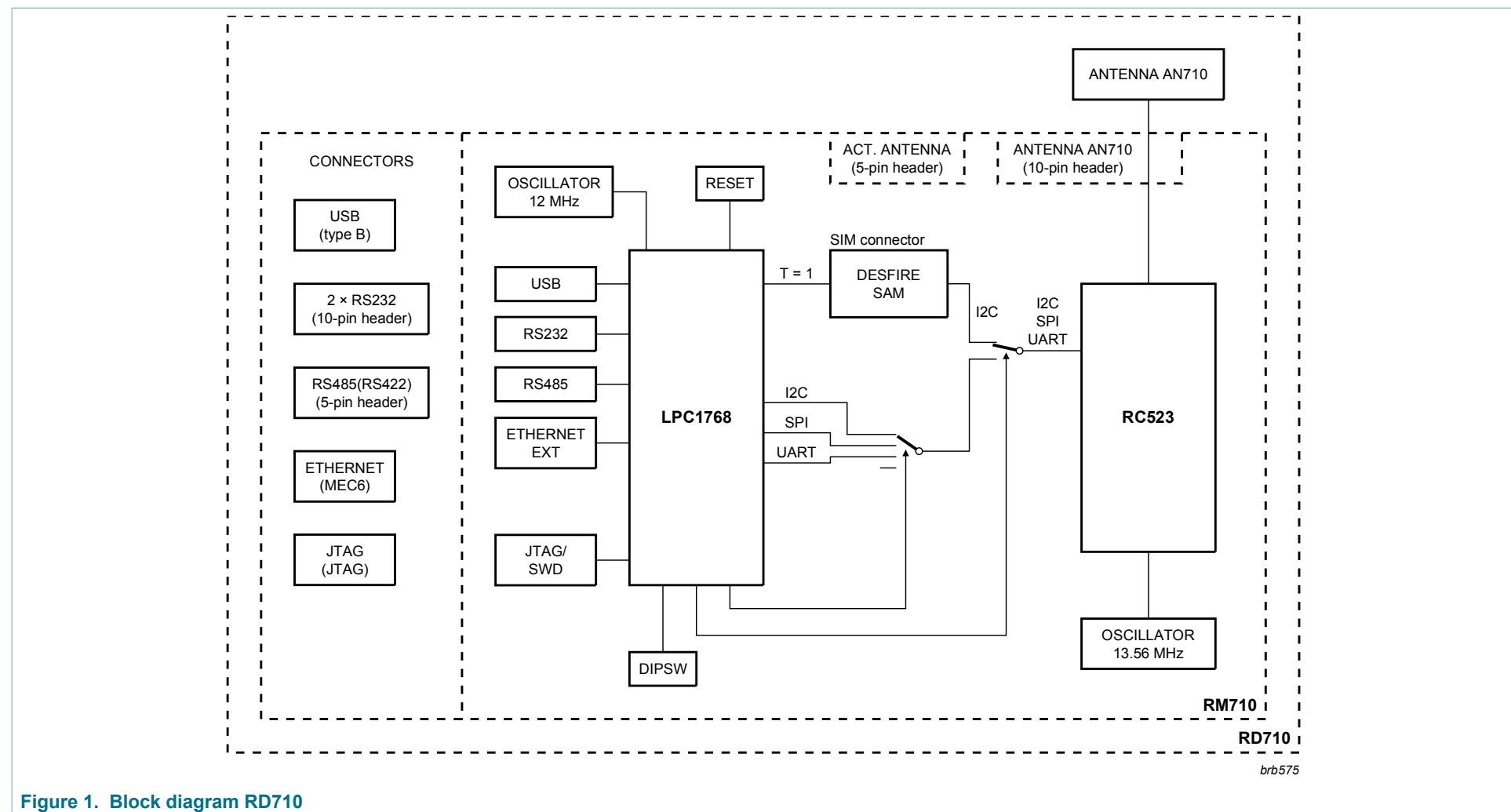


Figure 1. Block diagram RD710

7 Functional description

7.1 Content

The kit includes the following items:

- MFRD710, Pegoda contactless smartcard reader, based on MFRC523 contactless reader.
- 1 USB cable
- 3 MIFARE product sample cards
- Quick startup instructions with links to documentation and software

The following paragraphs describe the Hardware and Software Architecture related to the MFRD710.

7.2 Hardware architecture CLRD710

The reader CLRD710 is a contactless Reader/Writer compliant to the ISO/IEC 14443 standard and is able to handle contactless data rates of 106 kBit, 212 kBit, 424 kBit and 848 kBit.

It is based on NXP reader-IC MFRC523, see [1]; which is a highly integrated reader IC solution for contactless communication purposes at 13.56 MHz. The MFRC523 is connected to an LPC1768 μ Controller that executes the firmware. The LPC1768 implements flash memory and allow downloading and debug the firmware with a JTAG interface.

The CLRD710 implements an external amplifier driven by the MFRC523 which is connected to the antenna to achieve an optimum reader/writer performance for contactless applications.

The MIFARE SAM AV2 module, see [2]; can be used for key storage and enhanced crypto operation to increase the security level.

The reader provides several communication interfaces on board such as: USB, RS232, RS485 (RS422), Ethernet (via LPC_ extension board) and JTAG (a JTAG IEEE 1149.1 compliant interface for debugging).

The Hardware Design is described in more detail in [4].

7.3 Software architecture

The software of the CLRD710 consist of 3 components.

- CLRD710 firmware based on an Arm CortexM3 implementation as well as the driver
- Reader library
- Graphical User Interface RFIDDiscover

7.3.1 Firmware and driver

The reader firmware can perform contact and contactless communication.

The contact part of the reader firmware is used to communicate with a SAM, e.g. the MIFARE SAM AV2, see [2]. The contactless part performs the polling and activation sequence according to PC/SC part 2, ISO/IEC 14443-3 and 14443-4 standards.

The polling and activation sequence can be turned off and on with the use of escape (PC/SC part 3) commands. The polling and activation sequence is automatically disabled if escape commands are executed that would interfere with the normal operations. The firmware also interprets the ADPU's for MIFARE Classic which are defined in PC/SC part 3.

The main modes of operation are being set by DIP switches which are located on the reader. Some configuration parameters can be set with the escape commands. The reader will store them in non-volatile memory. The user will be able to reset the configuration back to default state.

The firmware constructs the product name – which is returned by USB descriptor – to easily identify the reader/SAM configuration. Depending on the DIP switches, there are three possible configurations:

- No SAM (Pegoda N)
- SAM in X-Mode (Pegoda X)
- SAM in S-Mode (Pegoda S)

The user is able to flash the board with customized or original firmware with three methods:

- Over USB (IAP)
- Over serial port (ISP)
- Over JTAG with the use of an external program

For more information, please refer to [6]. The implementation of the driver is described in [7].

7.3.2 NXP Reader Library

The Reader Library is a layered software library that contains all components to operate MIFARE and NTAG products as well as a MIFARE SAM AV2 using a flexible API. The desired functionality can be selected by the user and compiled dependent on application requirements. On the CLRD710, the Reader library is implemented to be executed on the Host PC.

The NXP reader library is encapsulated into Layers and Components written in ANSI C. The library structure provides a modular way of programming and setting up the reader interface.

For easy portability, the reader library consists of 4 layers:

- BAL (Bus Abstraction Layer)
- HAL (Hardware Abstraction Layer)
- PAL (Protocol Abstraction Layer)
- AL (Application Layer)

The reader library requires a dedicated build for a usage of the CLRD710 functionality in No -SAM, SAM "X-mode" or SAM "Direct-mode".

Building the software stack for a specific reader mode requires therefore different software models to be generated. The three types of operating modes within the PC/SC mode are:

- No SAM mode
The most important aspect of this mode is performing activation and polling sequence for ISO 14443 A type cards as defined in PC/SC part 3. Selected cards are put in slot

manager and notification is sent to PC/SC driver. There can be only one ISO 14443-3 card or multiple (maximum 14) ISO 14443-4 cards in the field.

- SAM in non X-mode
The most important aspect of this mode is performing activation and polling sequence for ISO 14443 A type cards as defined in PC/SC part 3. Selected cards are put in slot manager and notification is sent to PC/SC driver. There can be only one ISO 14443-3 card or multiple (maximum 14) ISO 14443-4 cards in the field.
- SAM in X-mode
In this mode communication is only through SAM (slot 0). Only limited number of proprietary commands can be executed

There are two versions of the NXP reader library. The publicly available version can be obtained from the MFEV710 documentation pages on nxp.com. It contains all NTAG products and all MIFARE products besides MIFARE DESFire, MIFARE Plus and the MIFARE SAM. The full version of the NXP reader library is available from the NXP DocStore, refer to [9]. An application note, see [3], provides an overview how to create your own application as a project within the NXP reader library.

7.3.3 RFIDDiscover

RFIDDiscover is the Graphical User Interface of the CLRD710 software package. It supports easy and fast application development for ISO/IEC 14443 type NXP products by providing multiple views to the content and protocols of the cards. There are two versions of RFIDDiscover. The publicly available version can be obtained from the MFEV710 documentation pages on nxp.com. It contains all NTAG products and all MIFARE products besides MIFARE DESFire, MIFARE Plus and the MIFARE SAM. The full version is supplied from DocStore, refer to [8]. A very first guideline to install all necessary parts and do the first steps with this Graphical User Interface is given in [5].

7.4 Certification

The CLRD710 went successfully through the following certification processes:

- EMC, certification to comply with EN 301 489-1 V1.6.1 (2005-09); EN 301 489-3 V1.4.1(2002-08); IEC 60950-1:2005; EN 60950-1:2006
- FCC, certification to comply with FCC Part 15, Subpart C
- MIFARE terminal certification to comply with Test plan for MIFARE Air-Interface Compatibility Certification of Terminals Qualification of Readers Single and Double UID Version 2.4 Date of Issue: 29.03.2010
- CE

8 Limiting values

Table 3. Limiting values ^[1]

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to VSS (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{DD}	supply voltage	active reader	4.75	5.00	5.25	V
T _{amb}	ambient temperature	-	-25	+25	+85	°C
I _{DD}	supply current	active, RF on	-	170	-	mA

- [1] Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

9 Abbreviations

Table 4. Abbreviations

Acronym	Description
AL	Application Layer
APDU	Application Protocol Data Unit
BAL	Bus Abstraction Layer
EEPROM	Electrically Erasable Programmable Read Only Memory
HAL	Hardware Abstraction Layer
IAP	In-Application Programming
ISP	Internet service provider
JTAG	Joint Test Action Group
PAL	Protocol Abstraction Layer
PCD	Proximity Coupling Device
PICC	Proximity Integrated Circuit Card

10 References

- [1] Data sheet MFRC523 Contactless reader IC, available from DocStore, Doc. no.: 1152**¹
- [2] Short data sheet P5DF081 MIFARE SAM AV2, available on NXP web, see <https://www.nxp.com/products/:P5DF081>**
- [3] Application Note Example Project Pegoda, available on NXP web, see <https://www.nxp.com/products/:MFEV710>
- [4] Application Note Hardware Design Guide Pegoda, available on NXP web
- [5] Application Note Quick Start Up Guide Pegoda, available on NXP web
- [6] Application Note Software Design Guide Pegoda, available on NXP web
- [7] Application Note Pegoda RD710/RD852 Implementation of the USB drive, available on NXP web
- [8] Software RFIDDiscover available from DocStore, Doc. no.: 1866**
- [9] Software NXP Reader library including Sample Projects, available from DocStore, Doc.no.: 1717**

¹ ** ... document version number

11 Revision history

Table 5. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
MFEV710_SDS v. 3.1	20190115	Product short data sheet	-	MFEV710_SDS v. 3.0
Modifications:	• added NTAG as supported product • removed reference to CD, • updated MIFAREDiscover to RFIDDiscover • updated document references			
MFEV710_SDS v. 3.0	20110214	Product short data sheet	-	-

12 Legal information

12.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL <http://www.nxp.com>.

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12.4 Licenses

Purchase of NXP ICs with ISO/IEC 14443 type B functionality



RATP/Innovatron Technology

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The license includes the right to use the IC in systems and/or end-user equipment.

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