



## **NFC Forum Type 4 Dual Interface Contact - Contactless 8kB / 32kB / 64kB Flash Based Memory IC**

### **General Description**

The NF4 chip is an NFC Forum Type 4 dual interface tag IC. It is intended for use in applications requiring a dual communication interface, contact and contactless, read/write memory with optionally security features to protect data privacy and integrity.

The contactless interface is based on ISO/IEC14443 standard Type A. The chip supports all protocol layers. The robust and sensitive contactless interface permits complete transactions at minimum operating field strength of 0.7A/m. The NFC reader device can select any communication data rates from 106k bps up to 848k bps.

The 2-wires serial contact interface is composed by a bi-directional IO data line and a slave clock (1 clock per bit).

The chip security features are based on AES-128 cryptography. In order to enforce the confidentiality level of the data exchanged between the reader and the NF4 chip, the contactless communication can be optionally encrypted including also a Message Authentication Code (MAC). The chip maximizes flexibility in terms of access conditions to memory data.

The IC supports all the ISO/IEC14443 -3/-4 commands and a transport layer based on an optimized ISO/IEC 7816-4 command set.

Each NF4 chip has a 7 byte unique serial number, programmed at wafer level, which guaranties the uniqueness of each device.

An optional Random ID feature according to ISO/IEC14443-3 can be enabled in the application or during the product personalization.

In case of a passive application, without battery assistance, the NF4 chip offers energy harvesting capabilities in order to power supply an external device like a microcontroller or a digital sensor

### **Features**

- | NFC Forum Type 4 compliant tag IC
- | Supports ISO/IEC14443 Type A
- | RF data rates from 106kbps up to 848kbps
- | 8kB, 32kB or 64kB user's data NVM memory
- | 7 Byte Unique Identifier number (UID)
- | Optional Random ID to enhance security and product privacy
- | Chip security based on AES-128 crypto algorithm
- | Optional Secure Messaging (SM). Encryption of the RF communication channel
- | Optional Message Authentication Code (MAC)
- | 2-wires serial interface (clock and data).
- | Serial interface data rates up to 1MHz
- | RF Busy line indicates presence of an on-going contactless communication
- | RF field detector available on VPOS
- | Energy harvesting capability – extracting energy from the electromagnetic field (up to 2mA)
- | Possibility to create proprietary application files
- | ISO/IEC7816-4 optimized command set
- | On-chip resonant capacitor: 14pF
- | Optimized resonant frequency of 14.5MHz
- | Minimum operating field strength of 0.7A/m
- | -25 °C to +85 °C temperature range
- | Available in S08 package or standard or bumped wafers form

### **Applications**

- | Healthcare market segment
- | NFC pairing
- | Smart and Secure metering
- | Product personalization and diagnostic tool
- | Smart Sensors – Data logger
- | NFC tags with large memory capabilities
- | Consumer
- | Home appliance
- | Automation, Industrial



### NF4 IC Integration Use Case

The NF4 IC provides a flexible array of use cases depending on different application needs. Some examples are highlighted in the sections below.

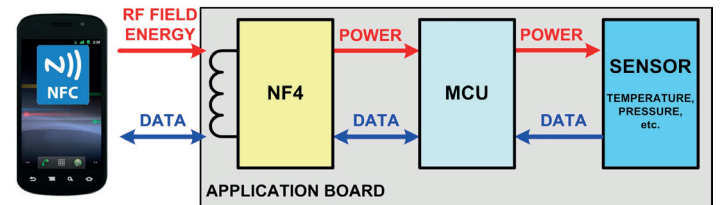
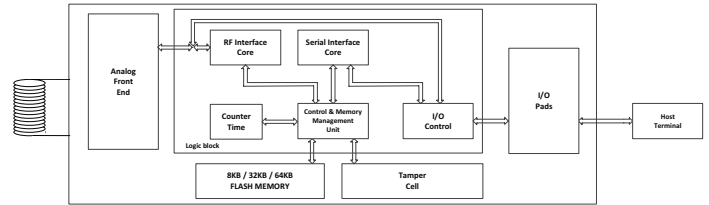
### Configuration and personalization of consumer electronics

Most household appliances, industrial appliances and consumer electronics have their own built in display as a human interface device. The NF4 IC can provide a new alternative interface to supersede this using any NFC compatible Smartphone as shown in figure below.

In this situation, it would be possible for modern consumer appliances to have Smartphone based applications enabling user functions like

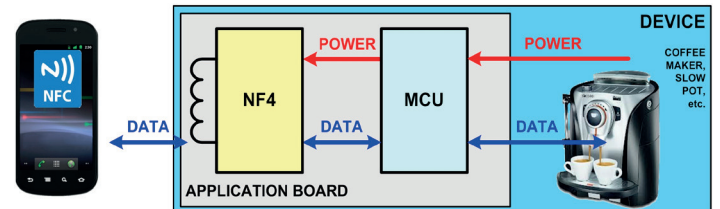
- Synchronisation of firmware updates via telephone network.
- Programming of any regional or language settings and warranties at time of first installation.
- Selecting every day personal preferences, for example in the case of coffee machine, preferred recipes

In such applications the NF4 IC is powered from the power supply of the appliance. The microcontroller in the consumer appliance communicates with NF4 IC using two wire Serial Contact interface. The status of RF communication between Smartphone and NF4 IC can be monitored on IO line.



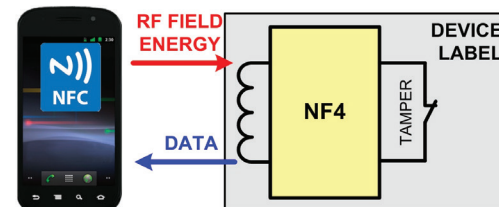
### Energy Harvesting (DUAL mode only)

A key feature of the NF4 IC is its Energy Harvesting capability. This allows passive applications, without battery assistance, to be powered only from the RF field of an NFC compatible Smartphone or dedicated reader. Typical applications where this could be implemented could be any kind of measurement or sensor systems (thermometers, barometers, electronic meters). The sensor system can be connected to NF4 IC and when in an RF field, the NF4 IC can power up the sensor, record a measurement and transfer the result to a handheld reader or smartphone.



### Tamper Feature – (DUAL mode only)

In a DUAL configuration mode only, the device supports a tamper detection feature that checks the continuity of a loop connected between IO/CLK/RST and GND. Pads RST, CLK and IO have to be connected together. Such application of NF4 can detect a broken seal of a packaged product, or any kind of security label or ticket. Tamper detection can be implemented using a simple continuity loop, with heat sensitive fuse wire, with sensors having both high and low impedance states, or with external devices controlling an electronic switch such as a MOSFET.



### RF labels, Smart posters

The NF4 IC can be used in RF and DUAL mode as contactless label for NF4 applications like Smart Posters and ID cards. There is up to 64kB of user programmable FLASH that can be used for storing information, which could be read by Smartphone based applications.



## Power management

The NF4 is able to operate from two power sources – contact and contactless interfaces.

- The contact interface is powered from VCC.
- The contactless interface extracts energy from the RF field received on the antenna coil inputs.

Power from the serial contact interface on VCC has priority over RF. If VCC drops below VCC min, the NF4 goes to power-on-reset mode. If there is an RF field present at this moment, the NF4 switches to RF field and restarts the device. When there is insufficient or no power supply on VCC, and the NF4 enters inside an RF field, the device is powered from the RF field.

## Memory organization – File system structure

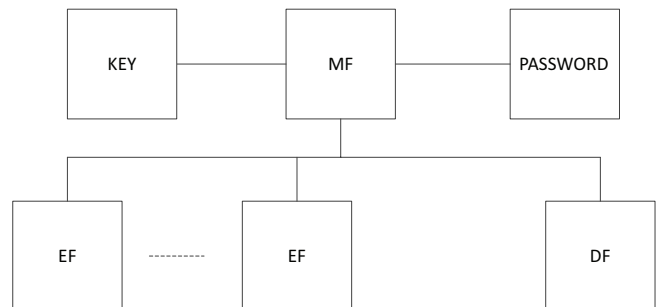
The file system is implemented on a non-volatile and writable flash based memory.

The logical structure conforming to ISO/IEC7816-4 is a hierarchical file system based on three file types:

- MF (Master File)
- NFC Application Dedicated File (DF) compliant with NFC tag type 4 format
- Optional Elementary File (EF) to store application or proprietary data
- Password File containing a 4-8 bytes password for user authentication
- Key File hosting 2 master keys used for mutual authentication and optional secure messaging

The number of optional elementary files is only limited by the available memory. At delivery, the NF4 chip memory is composed by the MF, the NFC Dedicated File, the Password File and the Key File.

The MF is the root of the file system and is the one that is selected at start-up or after a reset. NFC DF and EFs reside under the MF. MF also contains a KEY file, a Password File and default system configuration settings.



## Development Kit

EM Microelectronic-Marín S.A. provides a development kit to accelerate the integration of NF4 into target applications. Please contact [EMDirect@emmicroelectronic.com](mailto:EMDirect@emmicroelectronic.com) for availability.

Kit contents :

- l NF4-EMDB415+ Development Board which includes 2 development boards with NF464DUAL with PICC Class1 and Class 3 antenna sizes and 5 x NF464RF credit card size RF cards.
- l Support Package which includes
  - NF4 Product Family Datasheet
  - Card Studio for Windows for RF communicate via contactless reader, and example scripts.
  - NF4 Android application
  - Application note with a C code library to emulate 2 wire serial interface using GPIO on a generic external CPU
  - and more ..