

Near Field Communication



Near Field Communication

Texas Instruments provides one of the industry's most differentiated **Near Field Communication (NFC)** product portfolios enabling lower-power solutions to meet a broad range of NFC connectivity needs. Low-cost, easy-to-use hardware and software solutions lower the barrier for entry into NFC designs for added connectivity, flexibility and faster time to market. With a complete line of ultra-low-power transceiver devices and broad range of dynamic and static tag offerings, TI's solutions cover the entire NFC ecosystem. *NFCLink*, a TI stack offering, provides a highly modular and feature-rich embedded firmware and software library along with support for Windows®, Linux® and Android™ for the TRF79xx product line enabling easy integration across TI's embedded MCU/MPU platforms. www.ti.com/nfc

NFC and RFID Device Families:



TRF796xA / TRF7970A

Transceiver devices

The TRF79xxA family of NFC/RFID transceivers support all the popular 13.56MHz air-interface-based protocols, standards and specifications commonly in use today, around the world. The devices can also be used in AFE mode for non-standard applications.

Initial device choice would be based on the application or end equipment NFC/RFID requirements. This family of devices allows for true scalable platform development as they are pin-to-pin compatible.

The TRF796xA devices provide High-Frequency (HF) RFID reader/writer functionality for proximity and vicinity applications while the TRF7970A device brings the superset functionality of NFC to the TRF79xxA family, adding the features of card emulation (using NFC-A or NFC-B) and peer-to-peer communications (using NFC-A or NFC-F, as initiator or target) to the reader/writer functionality for ISO 14443A/B, FeliCa and ISO 15693. Device configuration is register based, which allows an end application microcontroller to fine tune parameters or change protocols/modes, as required.



NFCLink Library

Firmware / Software solution

The *NFCLink* is an industry-proven modular firmware/software solution from hardware level up to operating system (OS) API to support TI's family of TRF79xx NFC transceiver devices. With *NFCLink*, TI provides embedded standalone firmware and NCI standard-based interface to Android, Linux and Windows operating systems which simplifies and streamlines the development of all NFC operation modes across TI's entire embedded processing portfolio of MSP430™ microcontrollers (MCUs) and ARM®-based MCUs and processors. From highly energy-efficient systems to high-performance devices, *NFCLink* provides the developer/integrator a complete and proven high-quality NFC firmware/software bundle to use with TI's broad portfolio of embedded processing products to accelerate customers time to market by minimizing the in-depth protocol and device knowledge required for NFC applications. Offered as a standalone library for download, the modular software architecture enables selection of features and functions based on the application requirements. This professionally maintained NFC stack also supports extended functionalities above the ISO standard for non-standard, proprietary card systems through the flexibility of the TRF79xxA.

NFC and RFID Device Families (continued):

**RF430***Dynamic transponders*

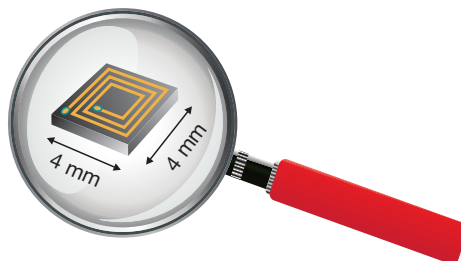
The RF430 family of dynamic transponder devices offers unique support for high-performance, feature-rich NFC wireless sensor applications and cost-optimized NFC interface applications like NFC connection handover for an alternative carrier like *Bluetooth*® and Wi-Fi® for a broad range of consumer electronics, white goods and medical devices. Both product lines provide NFC functionality with an optimized power management architecture either through harvesting RF energy or powered through a separate battery power source for ultra-low-power applications.

The **RF430FRL152H** is a fully programmable device providing an NFC RF front-end and an I²C/SPI interface along with a sigma-delta ADC, high-performance instrumentation amplifier and on-board non-volatile FRAM memory for true data logging applications. Unlike other fixed-function devices currently in the market, the built in 16-bit MSP430™ microcontroller allows a programmable option through the universal FRAM capability for handling a variety of sensors and external memory as well as custom processing of the sensor-collected data. The unique capability of the RF430FRL152H device enables stand-alone applications without the need for an external host processor.

The **RF430CL330H** device is a cost-optimized Dynamic NFC Tag Type 4 device supporting the NFC connection handover requirements for Bluetooth and Wi-Fi pairing and authentication through an optimized serial interface. The **RF430CL331H** enables data streaming and transfer of large data files limited only by the memory capacity of the host controller. Read caching, prefetching, and write automatic acknowledgment features allows for greater data throughput so that it can be used as a general NFC interface / service interface for configuration and FW updates.

**Tag-it™ HF-I***Static transponders*

Texas Instruments Tag-it HF-I family of transponder products (inlays, encapsulated devices and wafers) consist of 13.56MHz HF devices that are compliant with NFC Tag Type 5 ISO/IEC 15693 and ISO/IEC 18000-3 (Mode 1) global open standards. Data like text or uniform resource identifier can be stored in the tag memory according to the NFC Forum specified NFC Data Exchange Format (NDEF). With the **RF37S114** a 4 mm × 4 mm transponder with integrated antenna Texas Instruments is offering one of the smallest transponders in the market. The Tag-it HF-I transponder product offerings are well suited for a variety of applications including but not limited to: product authentication, supply chain management, asset management and ticketing.



TRF796xA / TRF7970A – 13.56MHz NFC / RFID transceiver ICs

The **TRF796xA** and **TRF7970A** are high-performance 13.56MHz analog front end (AFE) ICs with integrated data-framing system for ISO/IEC 15693, ISO/IEC 18000-3, ISO/IEC 14443A and B. The TRF7970A supports **Near Field Communication (NFC)** standards NFCIP-1 (ISO/IEC 18092) and NFCIP-2 (ISO/IEC 21481) which define the selection of any of the three possible communication modes (NFC peer-to-peer, card emulation, proximity reader/writer – ISO 14443A/B or FeliCa and Vicinity reader/writer – ISO 15693).

Integrated encode, decode and data framing capability for data rates up to 848 kbits, wide supply voltage range support (2.7 V – 5.5 V), large FIFO buffer for RF communication, relevant NFC software stack libraries and an innovative RF field detector allow for easy development efforts and robust, cost-effective designs. Finally, eight selectable power modes and ultra-low-power operation enable the longest battery life in the industry.

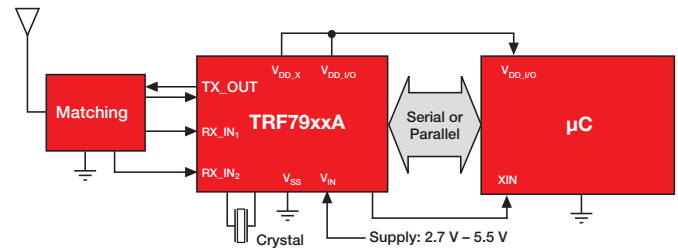
The devices also offer unparalleled flexibility via the various direct communication modes on the device to allow implementations of custom protocols as well as other 13.56MHz standards. The receiver system enables AM and PM demodulation using a dual-input architecture to maximize communication robustness.

Key features

- ISO 14443A, ISO 14443B, ISO 15693, ISO/IEC 18000-3 (Mode 1)
- Supply voltage range: 2.7 – 5.5 V
- Parallel data communication or serial 4-pin SPI interface
- Integrated data framing, CRC and/or parity checking
- Multiple sub-carrier receiving and decoding compatibility
- Data rates supported up to 848 kHz
- Integrated voltage regulators for MCU supply (20 mA)
- Clock output for MCU
- Selectable receive gain with AGC
- Antenna driver using OOK or ASK modulation
- Programmable output power, 100 mW and 200 mW
- Seven user-selectable power modes

Key benefits

- Easy to use with high flexibility
- Completely integrated protocol handling
- Auto-configured default modes for each supported ISO protocol
- Separate internal High-PSRR power supplies for analog, digital, and PA sections provide noise isolation for superior read range and reliability
- Dual receiver inputs with AM and PM demodulation to minimize communication holes
- Receiver AM and PM RSSI
- High integration reduces total BOM and board area
- Ultra-low-power modes
- Power down < 1 μ A
- Standby 120 μ A



TRF79xxA block diagram.

Applications

- Industrial: NFC-enabled access, M2M communication
- Medical: Product identification, authorization consumables
- Smart-meter: Pre-payment, device configuration
- Automotive: Communication interface to smartphone
- Consumer electronics: Pairing via NFC, peripherals, toys
- Retail: POS contactless payment

Development tools and software

- **TRF7960AEVM, TRF7960ATB** target board*
- **TRF7970AEVM, TRF7970ATB** target board*
- **DLP-7970ABP** BoosterPack#

* Target board for TI embedded MCU platform with populated EM socket headers.

BoosterPack for TI microcontroller LaunchPad™ evaluation kits.

www.ti.com/product/trf7960a

www.ti.com/product/trf7970a

Part Number	TRF7960A TRF7964A	TRF7962A	TRF7963A	TRF7970A
Operating frequency	13.56 MHz			
Supported protocols	Reader / Writer			
	ISO 14443A ISO 14443B Felica ISO 15693 ISO 18000-3	ISO 15693 ISO 18000-3	ISO 14443A ISO 14443B Felica	ISO 14443A ISO 14443B Felica ISO 15693 ISO 18000-3
	Peer to Peer			
				ISO 18092 NFCIP-1
	Card Emulation			
				ISO 14443A ISO 14443B
Operating voltage	2.7 to 5.5 VDC			
Current consumption	Transmit:	200 mW at 120 mA, typ. 100 mW at 70 mA, typ.		
	Power down:	<1 µA		
Transmitter power	Adjustable power, 100 mW or 200 mW at 5 VDC			
Transmitter modulation	ASK, adjustable 8% to 30% OOK			
Communication interface	Parallel 8-bit or 4-wire SPI			
Operating temperature	-40°C to +110°C			
Storage temperature	-55°C to +150°C			
Package	32-pin QFN, (5 mm × 5 mm)			
Packing/delivery	Tape-on Reel, 250 or 3000 per reel			

The Texas Instruments Dynamic NFC Transponder Interface **RF430CL330H** is a NFC Tag Type 4 device which combines a wireless NFC interface and a wired SPI/I²C interface to connect the device to a host.

The integrated SPI/I²C serial communication interface allows reading and writing of NDEF messages stored in the integrated SRAM. The NDEF message can be accessed wirelessly via the integrated ISO 14443B compliant RF interface supporting up to 848 kbps. This allows NFC connection handover for an alternative carrier like Bluetooth, Bluetooth Low Energy (BLE), RF4CE and Wi-Fi® as easy, intuitive pairing process or authentication process with only a tap. No keys/parameters have to be typed in, simply touch the two devices together for a direct pairing. After the NFC pairing process has taken place, the alternative carrier takes over and the application proceeds. The **RF430CL331H** enables data streaming and transfer of large data files limited only by the memory capacity of the host controller. Read caching, prefetching and write automatic acknowledgment features allow for greater data throughput so that it can be used as a general NFC interface / service interface for configuration and FW updates and enables different end equipments to communicate with the fast-growing infrastructure of NFC-enabled smart phones, tablets and notebooks.

Key features

- NFC Tag Type 4
- ISO 14443B RF protocol
- Data rate supported up to 848kbps
- I²C and SPI interface
- Fixed-function ROM code
- 3-kByte SRAM for NDEF messages
- Interrupt register and output pin to indicate NDEF read/write completion
- Automatic checking of NDEF structure
- RF wake up

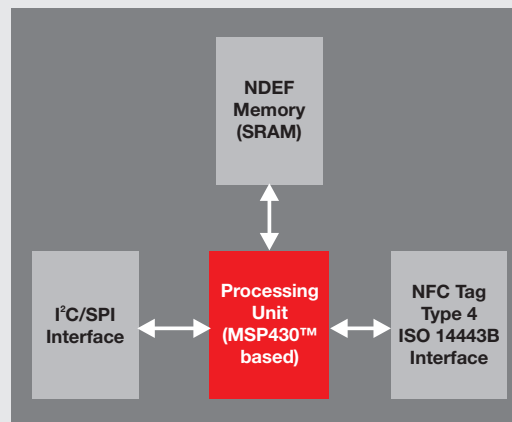
Key benefits

- Combines a wireless NFC interface and wired SPI/I²C interface
- Dynamic update of data content supports update of pairing parameters
- With RF wake up – only current consumption when the device is active
- Very small firmware requirements for µC

Applications

- Bluetooth Secure Simple Pairing using NFC
- Pairing process of alternative carrier using NFC (Wi-Fi, BT, BLE, RF4CE)
- NFC as service interface for diagnostic data and firmware updates

Dynamic NFC Transponder RF430CL330H



Functional Block Diagram

End equipment

- Printer
- Speakers, headsets
- Remote controls
- Routers
- Wireless keyboard, mouse
- Wireless switches, sensors

Development tools and software

- **RF430CL330HTB** Target Board*
- **DLP-RF430BP**#
- **DLP-RF430CL331BP**#

* Target board for TI embedded MCU platform with populated EM socket headers.

BoosterPack for TI microcontroller LaunchPad Evaluation Kits.

www.ti.com/product/rf430cl330h

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Part Number	RF430CL330H	RF430CL330H-Q1	RF430CL331H
Operating frequency	13.56 MHz		
Supported protocols	NFC Tag Type 4 / ISO 14443B		
Communication interface	I ² C or SPI	I ² C or SPI	I ² C
	13.56 MHz / ISO 14443B		
Operating voltage	3.0 to 3.6 V		
	2.0 to 3.6 V		
Operating temperature	–40°C to +85°C	–40°C to +105°C	–40°C to +85°C
Storage temperature	–40°C to +125°C		
Package	14-pin TSSOP, 16-pin QFN	14-pin TSSOP	14-pin TSSOP, 16-pin QFN
Packing / delivery	Tape-on Reel, 2,000 / 3,000 units per reel		

RF430FRL15xH – 13.56MHz NFC ISO 15693 sensor transponder

The Texas Instruments **RF430FRL15xH** is a 13.56MHz NFC ISO 15693 sensor tag with a programmable 16-bit MSP430™ low-power microcontroller. It features embedded non-volatile FRAM for storage of program code or user data like sensor calibration and measurement data. Sensor measurements are supported by the internal temperature sensor, optional thermistor and analog sensors using the onboard 14-bit sigma-delta analog-to-digital converter. The RF430FRL15xH supports communication, parameter setting and configuration via the ISO/IEC 15693, ISO 18000-3 compliant interface and the I²C/SPI serial interface. Optimized for operation in fully passive (battery-less) or single-cell battery-powered mode to achieve extended battery life in portable and wireless sensing applications. FRAM is a new non-volatile memory technology that combines the speed, flexibility and endurance of SRAM with the stability and reliability of flash, all at lower total power consumption.

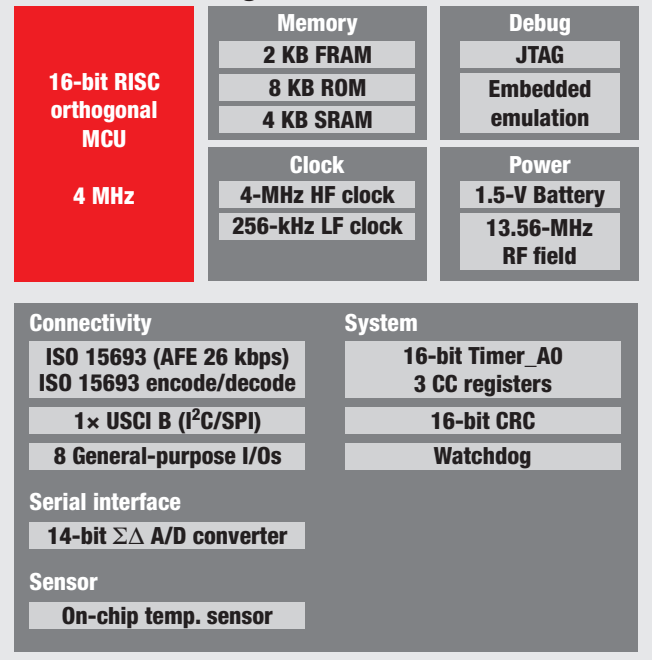
Key features

- ISO 15693-compliant RF interface
- Power supply system with either single-cell battery or 13.56-MHz H-field supply
- 14-bit Sigma-Delta analog-to-digital converter
- Internal temperature sensor
- 16-bit MSP430 microcontroller core
- 2 KB FRAM
- 8 KB of embedded ROM code
- Supply voltage range: 1.45 V to 1.65 V
- Wake-up from LPM3 in less than 5 μ s
- 4-MHz high-frequency clock
- 16-bit timer with three capture/compare registers
- SPI/ I²C interface
- Full 4-wire JTAG debug interface

Key benefits

- Supports wireless communication via the ISO/IEC 15693, ISO/IEC 18000-3 compliant RFID interface.
- Optimized for 1.5-V single-cell-battery-powered designs or battery-less designs that harvest energy from the RF field generated from an NFC reader at the same reading distance.
- Intelligent power management includes a battery switch to ensure long battery life.
- 14-bit sigma-delta ADC with ultra-low input current, low noise and ultra-low offset enables developers to connect up to three additional external sensors in addition to the integrated temperature sensor.
- SPI or I²C interface configurable in master or slave mode can support digital sensors or connect the device to a host system.
- Application code embedded in ROM manages RF communication and sensor readings to provide the ultimate flexibility in

Smart Sensor Tag IC



configuring the device. Developers can configure sampling rates, measurement thresholds and alarms.

- Universal non-volatile memory (FRAM) allows data storage as well as extension and adjustment of application code.
- Integrates a 16-bit ultra-low-power programmable MSP430 CPU core that is supported by a robust ecosystem of development tools.
- Fully integrated into TI's Code Composer Studio™ (CCStudio) and IAR's Embedded Workbench® integrated development environments (IDEs).

Applications

- Industrial wireless sensors
- Medical wireless sensors

Development tools and software

- **RF430FRL152HEVM**

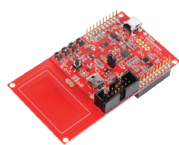
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Device	RAM (kB)	FRAM (kB)	USCI	SD 14
RF430FRL152H	4	2	Yes	Yes
RF430FRL153H	4	2	No	Yes
RF430FRL154H	4	2	Yes	No

Find the perfect tool or kit to begin your NFC design

**NFC Sensor Transponder Evaluation Module – RF430FRL152HEVM**

The **RF430FRL152HEVM** is in the style of a LaunchPad, a self-contained development platform to evaluate the features and performance of the **RF430FRL15xH** NFC ISO 15693 Sensor Transponder. The evaluation board includes an analog temperature sensor and light sensor and for further expansion, it is compatible with the BoosterPack ecosystem, such as the Sensor Hub BoosterPack offering connectivity for additional digital sensors. The evaluation board can be powered with a battery, USB or harvested RF energy from an NFC device.

**Dynamic NFC Transponder Target Board – RF430CL330HTB**

The **RF430CL330HTB** – Dynamic NFC Transponder Target Board includes the **RF430CL330H** and features an on-board PCB antenna. This target board can be used with many different TI microcontroller development platforms which use the Samtec EM headers.

**Dynamic NFC Transponder Evaluation Kit – DYNAMICNFCBUNDLE**

As a bundled evaluation solution, the **DYNAMICNFCBUNDLE** – Dynamic NFC Transponder Evaluation Kit – contains the **RF430CL330HTB** Target Board and the **MSP-EXP430FR5739** Experimenter Board.

**Dynamic NFC Transponder BoosterPack – DLP-RF430BP**

The **DLP-RF430BP**, from third-party provider DLP Design, is an add-on board designed to fit TI's MCU LaunchPads and incorporates the **RF430CL330H** and a PCB antenna.

**Dynamic NFC Transponder BoosterPack/MSP430 LaunchPad Bundle – NFCT4BTVALUE**

As a bundled evaluation solution, the **NFCT4BTVALUE** contains the **DLP-RF430BP** – Dynamic NFC Transponder BoosterPack, from third-party provider DLP Design, and the **MSP-EXP430G2** – MSP430 LaunchPad Value Line Development Board.

**NFC Transceiver IC Evaluation Module – TRF7970AEVM**

The **TRF7970AEVM** is a self-contained development platform which can be used to independently evaluate/test the performance of the **TRF7970A** NFC Transceiver IC. The EVM features an on-board PCB antenna with antenna matching and connection points for customer-developed antennas.

**NFC Transceiver IC Target Board – TRF7970ATB**

The **TRF7970ATB** Target Boards include the **TRF7970A** NFC Transceiver IC and allows the evaluation of all NFC operation modes (reader/writer, peer-to-peer and card emulation). The target board features an on-board PCB antenna with antenna matching and a connector for customer-developed antennas. This target board can be used with many different TI microcontroller development platforms which use the Samtec EM headers.

**NFC Transceiver IC BoosterPack – DLP-7970ABP**

The **DLP-7970ABP**, from third-party provider DLP Design, is an add-on board designed to fit TI's MCU LaunchPads and incorporates the **TRF7970A** NFC Transceiver IC and a PCB antenna to allow the evaluation of all NFC operation modes (reader/writer, peer-to-peer and card emulation).

**TRF7970A LaunchPad Evaluation Kit Bundle – TRF7970A-BNDL**

As a bundled evaluation solution, the **TRF7970A-BNDL** contains the **DLP-7970ABP** – NFC Transceiver IC BoosterPack from third-party provider DLP Design and the **MSP-EXP430G2** – MSP430 LaunchPad Value Line Development Board.

More than 25 TI Designs for NFC are available to jump start system design and speed time to market



- **Battery-less NFC/RFID Temperature Sensing Patch Reference Design**



- **Near Field Communication (NFC) Reader/Writer Reference Design**



- **Ultra-low Power Multi-sensor Data Logger with NFC Interface Reference Design**

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