

Near Field Communication



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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® 8, 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 an NCI standard-based interface to Android, Linux and Windows® 7/8 operating systems which simplifies and streamlines the development of all NFC operation modes across TI's entire embedded processing portfolio of MSP430™ microcontrollers (MCUs), Tiva™ C Series ARM® MCUs and OMAP™ 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):

**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 ISO/IEC 15693 and ISO/IEC 18000-3 (Mode 1) global open standards recognized by Android-based systems as NFC Tag Type V. 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). The Tag-it HF-I transponder inlays are manufactured with TI's patented laser-tuning process to provide consistent read performance. Prior to delivery, the transponders undergo complete functional and parametric testing to provide the highest product quality. 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.

**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 devices provide NFC functionality with an optimized power management architecture either through scavenged 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 configuration information is handled through the NDEF (NFC data exchange format) message via the SRAM, initialized during start-up.

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 is the newest addition to the TRF79xxA HF Transceiver IC family and 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 (2.7V – 5.5V), 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.

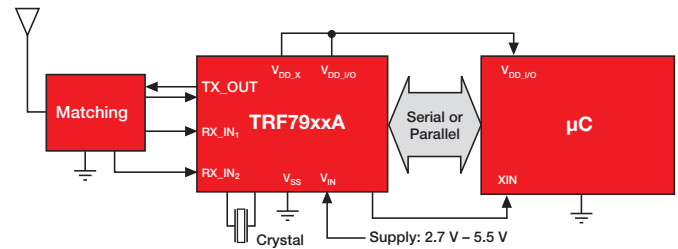
The devices also offer unparalleled flexibility via the various direct communication modes on the device to allow implementations of custom protocols as well as other 13.56MHz standards. The receiver system enables AM and PM demodulation using a dual-input architecture to maximize communication robustness.

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

- Access control
- POS contactless payment
- Prepaid eMetering
- Medical equipment
- Product identification/authorization (consumables)

Development tools and software

- TRF7960AEVM, TRF7960ATB target board
- TRF7970AEVM, TRF7970ATB target board
- Target board for MSP-EXP430F5529 board or any other TI embedded microcontroller platform with the EM socket headers populated.

ti.com/product/trf7960a

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 or use the NFC-enabled mobile phone/tablet as a bridge (transport carrier for the pairing parameters) between the consumer device (e.g., printer) and an access point. After the NFC pairing process has taken place, the alternative carrier takes over and the application proceeds. Beside the ‘Tap and pair’ use case, the RF430CL330H can also be used as a general NFC interface / service interface to enable different end equipments to communicate with the fast-growing infrastructure of NFC-enabled smart phones, tablets and notebooks.

Key features

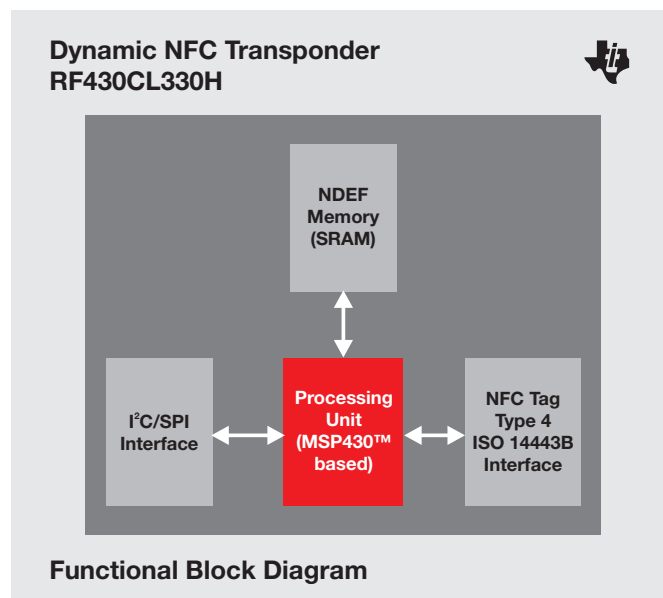
- NFC Tag Type 4
- ISO 14443B RF protocol
- Data rate supported up to 848kbps
- I²C and SPI interface
- Fixed-function ROM code
- 3-kByte SRAM for NDEF messages
- Interrupt register and output pin to indicate NDEF read/write completion
- Automatic checking of NDEF structure
- RF wake up
- 14-pin TSSOP

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



End equipment

- Printer
- Speakers
- Headsets
- Remote controls
- Router
- Wireless keyboard, mouse
- Wireless switches, sensors

Development tools and software

- RF430CL330HTB target board
- Target board for MSP-EXP430FR5739 board or any other TI embedded microcontroller platform with the EM socket headers populated

www.ti.com/product/rf430cl330h

Part Number	RF430CL330H
Operating frequency	13.56 MHz
Supported protocols	NFC Tag Type 4 / ISO 14443B
Communication interface <ul style="list-style-type: none"> • Wired • Wireless 	I ² C or SPI 13.56 MHz / ISO 14443B
Operating voltage <ul style="list-style-type: none"> • During program execution no RF field present • During program execution with RF field present 	3.0 to 3.6 V 2.0 to 3.6V
Operating temperature	–40°C to +85°C
Storage temperature	–40°C to +125°C
Package	14-pin TSSOP
Packing / delivery	Tape-on Reel, 2,000 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 slow-acquisition 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.

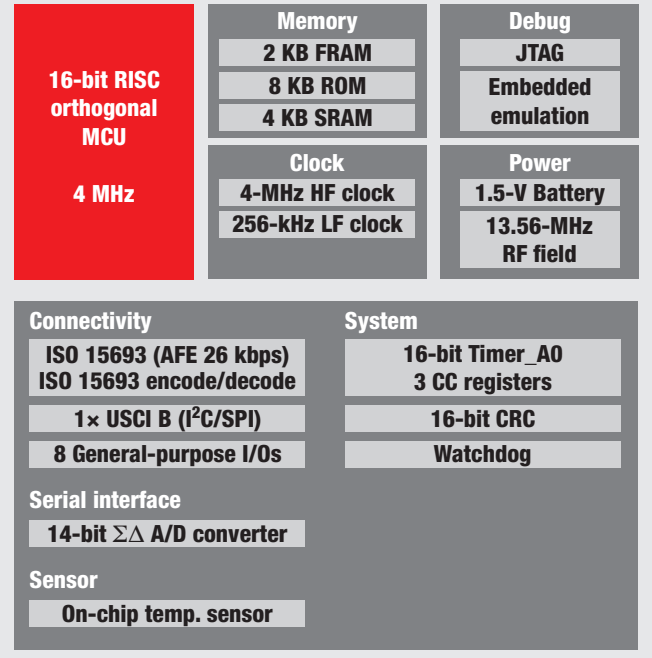
Key features

- 2 KB FRAM
- 8 KB of ROM code developed and built in
- Low-supply voltage range: 1.45 V to 1.65 V
- Low power consumption
- Wake-up from LPM3 in less than 5 μ s
- 4MHz high-frequency clock
- 16-bit timer_A with three capture/compare
- Full 4-Wire JTAG debug interface
- ISO 15693 compliant RF interface
- Power supply system with either battery or 13.56MHz H-field supply
- Internal temperature sensor
- Resistive sensor bias

Key benefits

- Collect data from up to three analog and one digital sensor all with just a few register configurations
- Wired and wireless interfaces allow device configuration and stored data retrieval
- Collect temperature measurements using an automatically calibrated high-accuracy thermistor with minimal setup
- Choose between an I²C or SPI communication interface configurable in master or slave mode for use with a digital sensor or with a host controller respectively
- Collect over 500 samples of sensor data
- Highly configurable collection period that is easy to setup
- Transfer data from an NFC-enabled phone to a host controller
- 2 KB of programmable FRAM memory space for storing data collection
- Device features an internal battery-off switch allowing ultimate power saving by turning power off to the device after data collection has been completed

Smart Sensor Tag IC



- Optimized for operation in fully passive (battery-less) or single-cell battery-powered (semi-active) mode to achieve extended battery life in portable and wireless sensing applications
- Customize the device operation by adding code to FRAM
- Industry's only programmable NFC wireless sensor node offering standalone solution not requiring host controller
- Configurable alarm option allows interrupting the host controller when a threshold has been exceeded

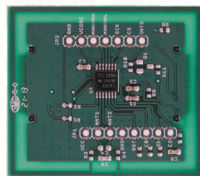
Applications

- Industrial wireless sensors
- Medical wireless sensors

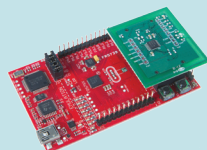
www.ti.com/product/rf430frl151h

Device	RAM (kB)	FRAM (kB)	USCI	SD 14
RF430FRL151H	1	2	Yes	Yes
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

**Dynamic NFC Transponder Target Board – RF430CL330HTB**

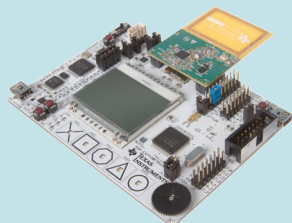
Developers can begin evaluating their NFC designs using the Dynamic NFC Transponder Interface RF430CL330H with the **RF430CL330HTB Target Board**. The target board features an on-board PCB antenna and can be used with many different TI microcontroller development platforms which use the Samtec EM headers.

**Dynamic NFC Transponder Evaluation Kit**

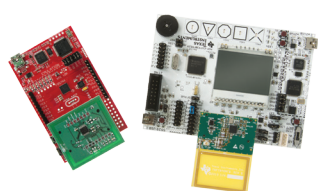
Available through TI's eStore is a bundled evaluation solution, the Dynamic NFC Transponder Evaluation Kit, which contains the **RF430CL330HTB Target Board** and the **MSP-EXP430FR5739 Experimenter Board**.

**NFC Transceiver IC Target Board – TRF7970ATB**

The **TRF7970ATB Target Boards** allow the software application developer to get familiar with the functionalities of the TRF7970A NFC Transceiver IC on their Texas Instruments embedded microcontroller platform of choice without having to worry about the RF design. The target board features an on-board PCB antenna with antenna matching and a connector for customer-developed antennas.

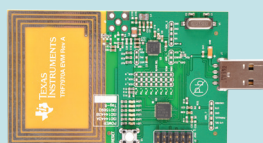
**NFCLink Evaluation Kit**

When evaluating the **NFCLink software**, designers can utilize the TRF7970ATB Target Board. This board, in combination with TI MSP430™ MCU, Tiva™ C Series MCU and OMAP™ Processor development kits, provides a complete evaluation solution. For creating MSP430-based solutions, customers can purchase a bundled solution containing the **TRF7970ATB Target Board** and the **MSP-EXP430F5529 USB Experimenter's Board**.

**All-in-One NFC Evaluation Kit**

Contains

- **TRF7970ATB Target Board**
- **MSP-EXP430F5529 USB Experimenter's Board**
- **RF430CL330HTB Target Board**
- **MSP-EXP430FR5739 Experimenter Board**

**TRF7970AEVM Standalone Demo**

The **TRF7970AEVM** is a self-contained development platform which can be used to independently evaluate/test the performance of the TRF7970A RFID/Near Field Communications (NFC) Transceiver IC, custom firmware, customer-designed antennas and/or potential transponders for a customer-defined RFID/NFC application.

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