MULTI-STANDARD FULLY INTEGRATED 13.56-MHz RADIO FREQUENCY IDENTIFICATION (RFID) ANALOG FRONT END AND DATA-FRAMING READER SYSTEM

FEATURES

- **Completely Integrated Protocol Handling**
- **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**
- **Reader-to-Reader Anti-Collision**
- **High Integration Reduces Total BOM and Board Area**
  - **Single External 13.56-MHz Crystal Oscillator**
  - **MCU-Selectable Clock-Frequency Output of RF, RF/2, or RF/4**
  - **Adjustable 20-mA, High-PSRR LDO for Powering External MCU**
- **Easy to Use With High Flexibility**
  - **Auto-Configured Default Modes for Each Supported ISO Protocol**
  - **11 User-Programmable Registers**
  - **Selectable Receiver Gain and AGC**
  - **Programmable Output Power (100 mW or 200 mW)**
  - **Adjustable ASK Modulation Range (8% to 30%)**
  - **Built-In Receiver Band-Pass Filter With User-Selectable Corner Frequencies**
- **Wide Operating Voltage Range of 2.7 V to 5.5 V**
- **Ultra-Low Power Modes**
  - **Power Down < 1 μA**
  - **Standby 120 μA**
  - **Active (Rx only) 10 mA**
- **Parallel 8-Bit or Serial 4-Pin SPI Interface With MCU Using 12-Byte FIFO**
- **Ultra-Small 32-Pin QFN Package (5 mm × 5 mm)**
- **Available Tools**
  - **Reference Design / EVM With Development Software**
  - **Source Code Available for MSP430**

APPLICATIONS

- **Secure Access Control**
- **Product Authentication**
  - **Printer Ink Cartridges**
  - **Blood Glucose Monitors**
- **Contactless Payment Systems**

DESCRIPTION

The TRF7960/61 is an integrated analog front end and data-framing system for a 13.56-MHz RFID reader system. Built-in programming options make it suitable for a wide range of applications for proximity and vicinity RFID systems.

The reader is configured by selecting the desired protocol in the control registers. Direct access to all control registers allows fine tuning of various reader parameters as needed.

Table 1. PRODUCT SELECTION TABLE

DEVICE	PROTOCOLS					
	ISO14443A/B				ISO15693 ISO18000-3	Tag-it™
	106 kbps	212 kbps	424 kbps	848 kbps		
TRF7960	X	X	X	X	X	X
TRF7961					X	X

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

DESCRIPTION (CONTINUED)

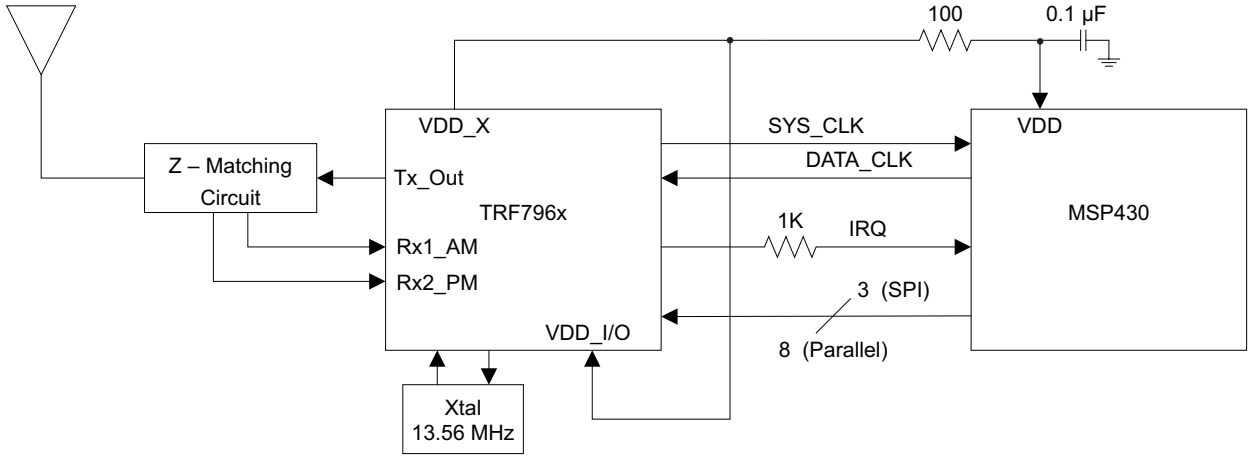

Figure 1. Typical Application

A parallel or serial interface can be used for communication between the MCU and reader. Transmit and receive functions use internal encoders and decoders with a 12-byte FIFO register. For direct transmit or receive functions, the encoders / decoders can be bypassed so the MCU can process the data in real time. The transmitter has selectable output power levels of 100 mW (20 dBm) or 200 mW (23 dBm) into a 50 ohm load (5-V supply) and is capable of ASK or OOK modulation. Integrated voltage regulators ensure power supply noise rejection for the complete reader system.

Data transmission comprises low-level encoding for ISO15693, modified Miller for ISO14443-A, high-bit-rate systems and Tag-it coding. Included with the data encoding is automatic generation of SOF, EOF, CRC, and/or parity bits.

The receiver system enables AM and PM demodulation using a dual-input architecture. The receiver also includes an automatic gain control option and selectable gain. Also included is a selectable bandwidth to cover a broad range of input sub-carrier signal options. The received signal strength for AM and PM modulation is accessible via the RSSI register. The receiver output is a digitized sub-carrier signal among three selectable protocols (ISO15693 with 8 selectable bit rates, ISO14443A/B with 4 selectable bit rates, & Tag-it at 26.48 kbps). A selected decoder delivers bit stream data and a data clock as outputs.

The receiver system also includes a framing system. This system performs the CRC and/or parity check, removes the EOF and SOF settings, and organizes the data in bytes. Framed data is then accessible to the MCU via a 12-byte FIFO register and MCU interface. The framing supports the ISO14443 and ISO15693 protocols.

The TRF7960/61 supports data communication levels between 1.8 V and 5.5 V for the MCU I/O interface while also providing a data-synchronization clock. An auxiliary 20-mA regulator (pin 32) is available for additional system circuits.

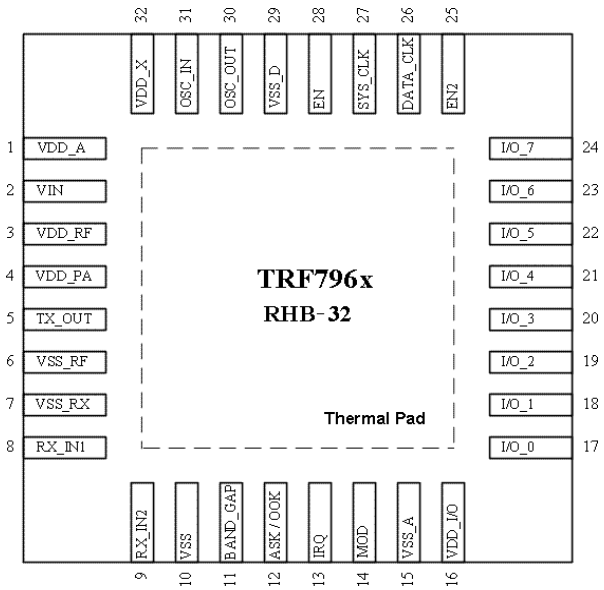

Figure 2. TRF796x Pin Assignments (Top View)

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted)(1)

			VALUE	UNIT
VIN	Supply voltage		6	V
I_O	Output current		150	mA
	Continuous power dissipation		See Dissipation Rating Table	
T_J	Maximum junction temperature, any condition(2)		140	°C
	Maximum junction temperature, continuous operation, long-term reliability(2)		125	°C
T_{stg}	Storage temperature range		–55 to 150	°C
	Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds		300	°C
	ESDS rating	HBM (human body model)	2	kV
		CDM (charged device model)	500	V
		MM (machine model)	200	

(1) The absolute maximum ratings under any condition are limited by the constraints of the silicon process. Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only and functional operation of the device at these or any other conditions beyond those specified are not implied.
(2) The maximum junction temperature for continuous operation is limited by package constraints. Operation above this temperature may result in reduced reliability and/or lifetime of the device.

TABLE 5. PACKAGING/ORDERING INFORMATION(1)

PACKAGED DEVICES	PACKAGE TYPE(2)	TRANSPORT MEDIA	QUANTITY
TRF7960RHBT	RHB-32	Tape and reel	250
TRF7960RHBR		Tape and reel	3000
TRF7961RHBT	RHB-32	Tape and reel	250
TRF7961RHBR		Tape and reel	3000

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI Web site at www.ti.com.
(2) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

DISSIPATION RATINGS TABLE PER PACKAGE

PACKAGE	θ_{JC} (°C/W)	θ_{JA} (1) (°C/W)	POWER RATING (2)	
			$T_A \leq 25°C$	$T_A = 85°C$
RHB (32)	31	36.4	2.7 W	1.1 W

(1) This data was taken using the JEDEC standard High-K test PCB.
(2) Power rating is determined with a junction temperature of 125°C. This is the point where distortion starts to increase substantially. Thermal management of the final PCB should strive to keep the junction temperature at or below 125°C for best performance and long-term reliability.

RECOMMENDED OPERATING CONDITIONS

over operating free-air temperature range (unless otherwise noted)

		MIN	TYP	MAX	UNIT
VIN	Supply voltage	2.7	5	5.5	V
T_J	Operating virtual junction temperature range	–40		125	°C
T_A	Operating ambient temperature range	–40	25	110	°C
	Load impedance at TX OUT (pin 5)		10		Ω

PRODUCT INFORMATION

Full product information is available by contacting TI's Product Information Center (PIC) as shown herein:

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