

nRF903 Single Chip RF Transceiver Information

430MHz-950MHz Single Chip RF Transceiver

nRF903

FEATURES

- Single chip GFSK multi-channel transceiver
- 433MHz, 868MHz and 915MHz ISM/LPRD-bands compatible
- 76.8kbit/s data rate
- High bandwidth efficiency
- Easy 14-bit configuration
- Reliable communication due to superior adjacent channel selectivity
- Full output power in all ISM-bands
- Few external components required
- Standby- and power down-mode

APPLICATIONS

- Alarm and Security Systems
- Automotive
- Home Automation
- Automatic Meter Reading (AMR)
- Wireless Handsfree
- Remote Control
- Surveillance
- Wireless Communications
- Telemetry
- Toys

GENERAL DESCRIPTION

nRF903 is a true single chip multi-channel UHF transceiver designed to operate in the unlicensed 433MHz, 868MHz and 915MHz ISM-/LPRD- (Industrial Scientific Medical / Low Power Radio Device) bands. Multi-channel operation, excellent receiver selectivity and sensitivity, high bandwidth efficiency and blocking performance make the nRF903 suitable for wireless links where high reliability is a key requirement.

The device features GFSK (Gaussian Frequency Shift Keying) modulation and demodulation capability at an effective bit rate of 76.8kbit/s in 153.6kHz channel bandwidths. Transmit power can be adjusted to a maximum of 10dBm which is available for all frequency bands and channels. Antenna interface is differential and suited for low cost PCB-antennas. All necessary configuration data is programmed by a 14-bit configuration word via a Serial Peripheral Interface (SPI). nRF903 operates from a single +3V DC supply and features power down- and standby-modes which makes power saving easy and efficient.

QUICK REFERENCE DATA

Parameter	Value	Unit
Frequency bands	433.05 - 434.87 868 - 870 902-928	MHz
Datarate	76.8	kbit/s
Sensitivity (@ 300Ω, BR=76.8kbit/s, BER<10 ⁻³)	-104	dBm
Modulation	GFSK	
Blocking performance (>1 MHz from carrier)	>50	dB
Max. RF output power @ 300Ω, 3V	10	dBm
Supply voltage	2.7 - 3.3	V
Number of available channels	433.05 - 434.87 MHz 868 - 870 MHz 902-928 MHz	10 7 169

Table 1. nRF903 quick reference data.



nRF903 Single Chip RF Transceiver

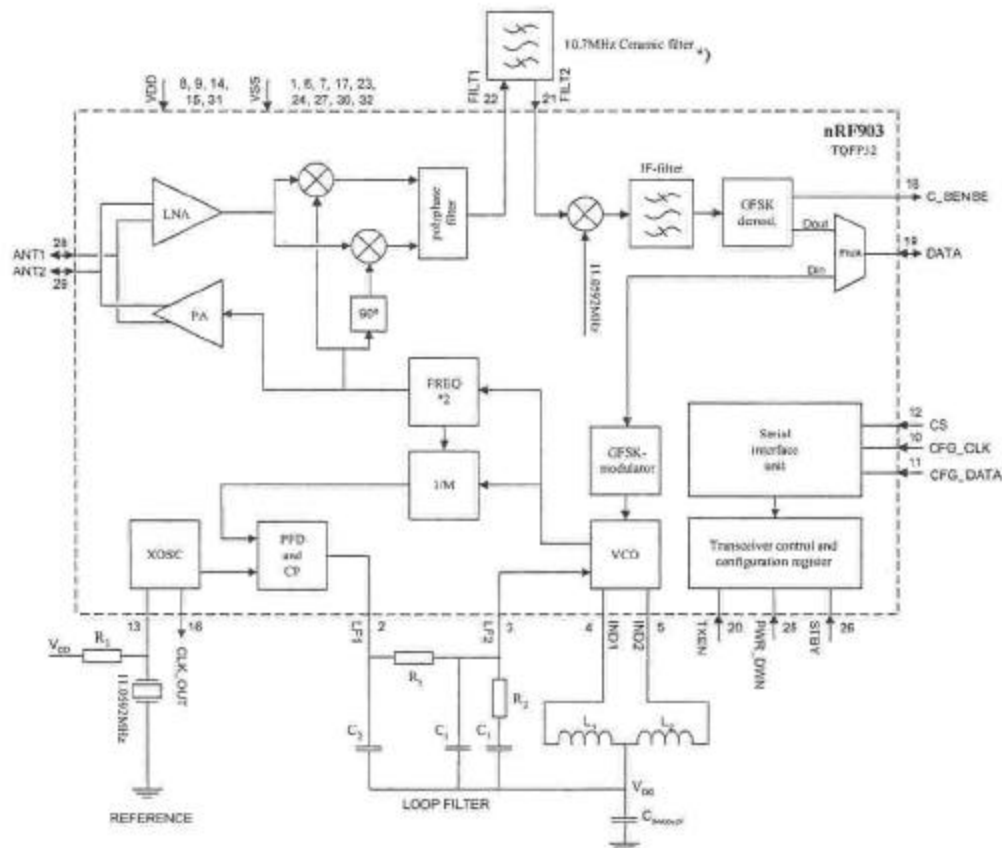
As a primary application, the transceiver is intended for UHF radio equipment in compliance with the European Telecommunication Standard Institute (ETSI) specification EN 300 220-1 and the US Federal Communications Commission (FCC) standard CFR47, part 15.

ORDERING INFORMATION

Type number	Description	Version
nRF903-IC	32 pin TQFP	A
nRF903-EVKIT-433	Evaluation kit (2 test PCBs)	1.0
nRF903-EVKIT-868	Suffix designate frequency band	1.0
nRF903-EVKIT-915		1.0
nRF903-DEMO	Demonstration kit (4 transceiver units)	1.0

Table 2. nRF903 ordering information.

BLOCK DIAGRAM



*) The external filter may be replaced with a 10nF capacitor at the expense of receiver performance (see page 18)

Figure 1. nRF903 block diagram with external components.



PIN FUNCTIONS

Pin	Name	Pin function	Description
1	VSS	Ground	Ground (0V)
2	LF1	Output	Frequency synthesiser PLL loopfilter connection #1
3	LF2	Input	Frequency synthesiser PLL loopfilter connection #2
4	IND1	Input	External inductor for VCO
5	IND2	Input	External inductor for VCO
6	VSS	Ground	Ground (0V)
7	VSS	Ground	Ground (0V)
8	VDD	Power	Power supply (+3.0V DC)
9	VDD	Power	Power supply (+3.0V DC)
10	CFG_CLK	Input	Clock for programming mode
11	CFG_DATA	Input	Serial input for transceiver configuration data
12	CS	Input	Chip select CS = "0" ⇒ transceiver normal operating mode CS = "1" ⇒ transceiver programming mode/test mode Refer to Table 5. for mode setup
13	XC1	Input	Crystal oscillator input (11.0592MHz)
14	VDD	Power	Power supply (+3.0V DC)
15	VDD	Power	Power supply (+3.0V DC)
16	CLK_OUT	Output	Full swing clock for external microcontroller Output frequency is set by 2 bits in the configuration word $f_{CLK_OUT} = 11.0592MHz/n$, where n is 1,2,4 or 8
17	VSS	Ground	Ground (0V)
18	C_SENSE	Output	Receiver carrier sense
19	DATA	Bidirectional	Transmitted/received data
20	TXEN	Input	Select transmit/receive mode TXEN = "0" ⇒ Receive mode TXEN = "1" ⇒ Transmit mode
21	FILT2	Input	Input from external 10.7MHz IF filter
22	FILT1	Output	Output to external 10.7MHz IF filter
23	VSS	Ground	Ground (0V)
24	VSS	Ground	Ground (0V)
25	PWR_DWN	Input	Power down mode Refer to Table 5. for mode setup
26	STBY	Input	Standby mode Refer to Table 5. for mode setup
27	VSS	Ground	Ground (0V)
28	ANT1	Bidirectional	Antenna terminal
29	ANT2	Bidirectional	Antenna terminal
30	VSS	Ground	Ground (0V)
31	VDD	Power	Power supply (+3.0V DC)
32	VSS	Ground	Ground (0V)

Table 3. nRF903 pin functions.



ELECTRICAL SPECIFICATIONS

Conditions: VDD = +3V DC, VSS = 0V, T_A = -40°C to +85°C

Symbol	Parameter (condition)	Min.	Typ.	Max.	Units
VDD	Supply voltage	2.7	3	3.3	V
t	Operating temperature range	-40	27	+85	°C
I _{DD}	Total current consumption: Receive mode : 433MHz : 868-928MHz Transmit mode @ -8 dBm RF power : 433MHz : 868-928MHz Transmit mode @ 10 dBm RF power : 433MHz : 868-928MHz Standby mode Power-down mode		18.5 22.5 12.5 15.5 24 29.5 600		mA mA mA mA mA mA μA μA
#CH	Number of available channels with fixed inductor ¹⁾	169			
	Modulation type		GFSK		
Δf	Frequency deviation	±19	±23	±27	kHz
BR	Bit rate		76.8		kbit/s
P _{RF}	Max. RF output power @ 300Ω load		10		dBm
	Sensitivity @ 300Ω, BR=76.8kbit/s, BER < 10 ⁻³		-104		dBm
CH _{BW}	Channel spacing		153.6		kHz
f _{res}	Frequency synthesizer resolution		153.6		kHz
ACS	Adjacent channel selectivity ²⁾ : upper channel (+2): upper channel (+1): lower channel (-1): lower channel (-2):		42 32 21 42		dB dB dB dB
MIA	Mirror image attenuation	15	30		dB
BLCK	Blocking level (f _{blocking signal} > 1MHz from carrier)		53		dB
ACP _{GMSK}	Adjacent channel power (76.8kbit/s)		-37	-35	dBc
DR	Dynamic range		90		dB
P _{C_SENSE}	Carrier sense input power level; stable '0': Carrier sense input power level; stable '1':		-105 -92		dBm
f _{IF1}	1 st IF frequency		10.7136		MHz
f _{IF2}	2 nd IF frequency		345.6		kHz
BW _{IF}	IF noise bandwidth		130		kHz
f _{XTAL}	Crystal frequency		11.0592		MHz
	Crystal reference frequency stability requirement @ 433MHz, BR = 76.8kbit/s @ 868-928MHz, BR = 76.8kbit/s			±40 ±20	ppm ppm
f _{UP_CLK}	External microcontroller clock output frequency ³⁾	1.3824		11.0592	MHz
V _{IH}	Logic "1" input voltage	0.7·V _{DD}		V _{DD}	V
V _{IL}	Logic "0" input voltage	0		0.3·V _{DD}	V
V _{OH}	Logic "1" output voltage (I _{OH} = -1.0mA)	0.7·V _{DD}		V _{DD}	V
V _{OL}	Logic "0" output voltage (I _{OL} = 1.0mA)	0		0.3·V _{DD}	V
I _H	Logic "1" input current (V _i = VDD)			+20	μA
I _L	Logic "0" input current (V _i = VSS)			-20	μA
Z _i	Recommended antenna port differential impedance		300		Ω
	Spurious emission ⁴⁾	Compliant with ETSI EN 300-220-1 And FCC CFR47, part 15			

1): Use must be according to ETSI- and FCC frequency regulations. Table 7, page 9, lists the available channels for the three different frequency bands.

2): Refer to the *Adjacent channel selectivity (ACS)* section on page 24

3): f_{UP_CLK} may be set to 1.3824MHz, 2.7648MHz, 5.5296MHz or 11.0592MHz depending on configuration word (see Table 6)

4): Antenna and matching network must be according to recommendations

Table 4. nRF903 electrical specifications.