NTX0 / NRX0

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27MHz HF Narrow Band FM TX & RX

The 10kHz channel NBFM NTX0 transmitter and NRX0 receiver operate on the licence exempt 27MHz SRD HF allocation. These modules offer a low power, reliable data link in a Radiometrix SIL standard pin out and foot print. This makes the NTX0/NRX0 pair ideally suited to those low power applications where existing single frequency wideband UHF modules have insufficient range, and in parts of the world where other frequency bands are not appropriate

Figure 1: NRX0-27.095-5   NTX0-27.095-5

Features

- Conforms to ETSI EN 300 220-3 (radio) and EN 301 489-3 (EMC) and FCC 95.201-95.225
- Standard frequency: 27.095MHz
- Data rates up to 5kbps
- Usable range over 1km @ 10mW
- 10/12.5kHz Channel spacing
- Feature-rich interface (RSSI, analogue and digital baseband)
- Longer range compared to Wide Band FM modules

Applications

- Radio Control (R/C) Radio Service under FCC Part 95 subpart C
- Radio model control
- Telemetry and telecommand
- Wireless door entry systems
- Simple On/Off switching
- In-building environmental monitoring and control
- Security and fire alarms
- Vehicle/machinery controls

Technical Summary

Transmitter – NTX0

- 3 stage crystal controlled VCXO
- Supply 2.9V - 15V @ 20mA (10mW)
- Data bit rate: 5kbps max.
- Transmit power: +10dBm (10mW), 50mW (+17dBm) or100mW (+20dBm)
- Size: 43 x 15 x 8mm

Receiver – NRX0

- Double conversion FM superhet
- Supply range: 2.9V - 15V @ 12mA
- Data bit rate: 5kbps max.
- Receiver sensitivity: -115dBm (for 12dB SINAD)
- Adjacent Channel: -60dBm
- Blocking: -85dB
- Size: 47 x 17 x 8mm

Evaluation platforms: NBEK + SIL carrier

Functional description

The NTX0 transmitter consists of a Frequency Modulated (FM) Voltage Controlled Crystal Oscillator (VCXO) feeding a two stage amplifier and RF filter. Operation can be controlled by the EN (Enable) line, the transmitter achieving full RF output typically within 5ms of this line being pulled high. The RF output is filtered to ensure compliance with the appropriate radio regulations and fed to the 50Ωantenna pin.

The NRX0 module is a double conversion NBFM superhet receiver capable of handling data rates of up to 5kbps. It will operate from a supply of 2.9V to 15V and draws 12mA when receiving. A signal strength (RSSI) output with greater than 60dB of range is provided. The SIL style NRX0 measures 47 x 17 x 8 mm excluding the pins.
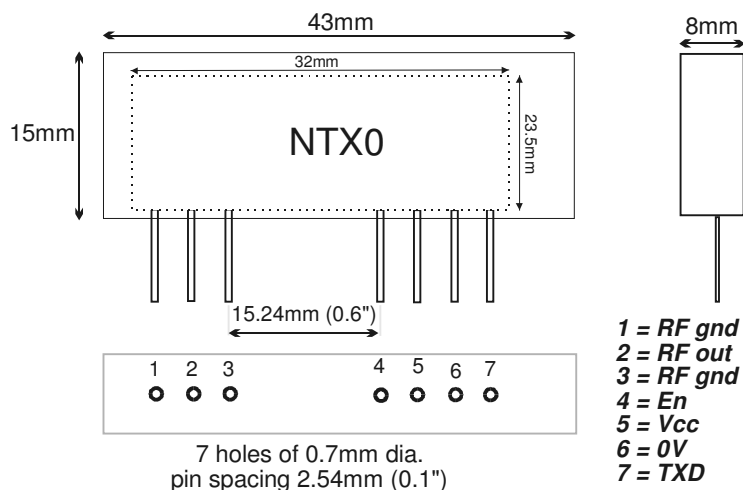
NTX0 Transmitter

1 = RF gnd
2 = RF out
3 = RF gnd
4 = En
5 = Vcc
6 = 0V
7 = TXD

Figure 2: NTX0 pin-out and dimension

User interface

NTX0 pin	Name	Function
1, 3	RFGND	RF ground is internally connected to the module screen and pin 6 (0V). These pins should be directly connected to the RF return path - e.g. coax braid, main PCB ground plane etc.
2	RF out	50Ω RF output to the antenna
4	EN	Pull high to enable Transmitter (3V CMOS logic)
5	Vcc	2.9 – 15V DC power supply
6	0V	Ground
7	TXD	DC coupled input (3V CMOS logic). R_{in} = 100kΩ

Notes:
1. EN must not be left floating
2. Pinout footprint is as NTX2. (Like a TX1, but pcb is longer)
3. Compatible with LMR0 and NRX0.
4. TXD is actually a linear input, with self bias to 1.5V
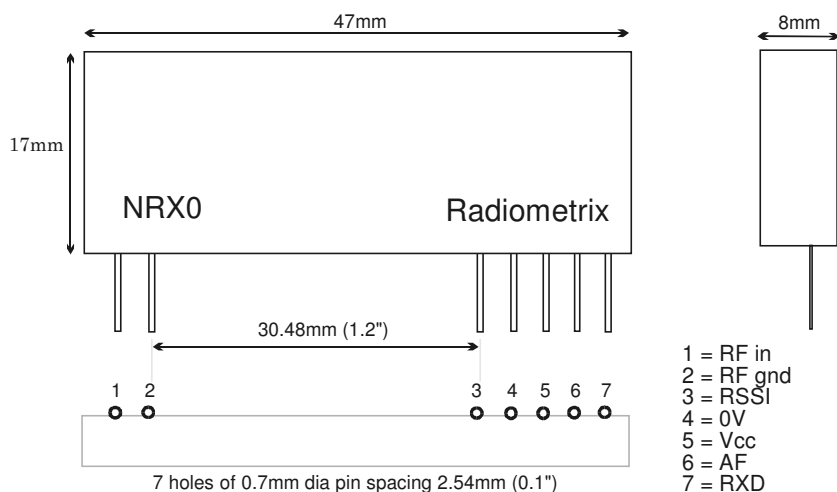5. 27.095MHz is the default channel.

NRX0 receiver

1 = RF in
2 = RF gnd
3 = RSSI
4 = 0V
5 = Vcc
6 = AF
7 = RXD

7 holes of 0.7mm dia pin spacing 2.54mm (0.1")

Figure 3: NRX0 pin-out and dimension

User interface – NRX0

NRX0 pin	Name	Function
1	RF in	50Ω RF input from the antenna
2	RF gnd	RF Ground is internally connected to the module screen and pin 4 (0V). These pins should be directly connected to the RF return path - e.g. coax braid, main PCB ground plane etc.
3	RSSI	Received Signal Strength Indicator with >60dB range. DC level between 0.5V and 2V
4	0V	Ground
5	Vcc	2.9 – 15V DC power supply (4.1 – 15V for 50 and 100mW version)
6	AF	500mV$_{pk-pk}$ audio. DC coupled, approx 0.8V bias
7	RXD	Received Data output from the internal data slicer. The data is squared version of the Audio signal on pin 6 and is true data, i.e. as fed to the transmitter. Output is "open-collector" format with internal 10kΩ pull-up to Vcc (pin 5). Suitable for bi-phase codes

Notes:
1. Pinout is as NRX1, NRX2 and RX2A receivers
2. Unlike other NRX family radios, the sense of AF, relative to transmitter input, is NOT inverted
3. 27.095MHz is the default channel.

Absolute maximum ratings

Exceeding the values given below may cause permanent damage to the module.

Operating temperature   -10°C to +60°C
Storage temperature   -30°C to +70°C

NTX0
Vcc, TXD (pins 5,7)   -0.3V to +16.0V
En (pin 4)   -0.3V to +Vcc V
RF out (pin 2)   ±50V @ <10MHz, +20dBm @ >10MHz

NRX0
Vcc, RXD (pins 7,9)   -0.3V to +16.0V
En, RSSI, AF (pins 4,5,8)   -0.3V to +Vcc V
RF in (pin 1)   ±50V @ <10MHz, +13dBm @ >10MHz

Performance specifications: NTX0 transmitter
(Vcc = 3V / temperature = 20℃ unless stated)

General	pin	min.	typ.	max.	units	notes
DC supply						
Supply voltage for 10mW	5	2.9	3.0	15	V	
TX Supply current @ 10mW	5		20	-	mA	
Supply voltage for 50mW	5	4.1	5.0	15	V	
TX Supply current @ 50mW	5		50	-	mA	
Supply voltage for 100mW	5	4.1	5.0	15	V	
TX Supply current @ 100mW	5		70	-	mA	
Antenna pin impedance	2	-	50	-		
RF						
RF centre frequency		-	27.095	-	MHz	1
Channel spacing		-	10	-	kHz	
Number of channels		-	1	-		
RF power output	2	+9	+10	+11	dBm	2
RF power output	2	+16	+17	+18	dBm	2, 8
RF power output	2	+19	+20	+21	dBm	2, 8
Spurious emissions	2	-	-	-40	dBm	7
Adjacent channel TX power		-	-37	-	dBm	
Frequency accuracy		-	±1.5		kHz	3
FM deviation (peak)		-	±2.0	-	kHz	4
Baseband						
Modulation type		-	FSK	-		F3D
Modulation bandwidth @ -3dB		0	-	3	kHz	
Data rate		-	-	5	kbps	NRZ
TXD input level (logic low)	7	-	0	-	V	5
TXD input level (logic high)	7	-	3.0	-	V	5
Dynamic timing						
TX Enable to full RF		-	-	5	ms	

Notes:
1. Available in 25kHz channel steps on other custom frequencies in the 27MHz band
2. Measured into 50Ω resistive load.
3. Total over full supply and temperature range.
4. With 0V – 3.0V modulation input.
5. To achieve specified FM deviation.
6. For $1V_{pk-pk}$ signal biased at 1.4V
7. Complies with spurious emission limits of ETSI EN 300 220-1
8. For use in USA, Australia, NZ and only for model control in Europe.
   The 100mW version is limited to 9v or 25% duty cycle

Performance specifications: NRX0 receiver
(Vcc = 3V / temperature = 20°C unless stated)

	pin	min.	typ.	max.	units	notes
DC supply						
Supply voltage	7	2.9	3.0	15	V	
Supply current	7	-	12	-	mA	
RF/IF						
RF centre frequency	1,6	-	27.095	-	MHz	
Frequency accuracy	1, 6	-	±1.5	-	kHz	
Channel spacing	1, 6	-	10	-	kHz	
RF sensitivity @ 12dB SINAD	1, 6	-	-115	-	dBm	1
RSSI range	1, 4	-	60	-	dB	2
Blocking	1	-	85	-	dB	
Image rejection	1	-45	-	-	dB	
Adjacent channel rejection	1	-	-70	-	dB	
Spurious response rejection	1	-45	-	-	dB	
LO re-radiation	1	-65	-	-	dBm	3
Baseband						
Baseband bandwidth @ -3dB	6	0	-	3	kHz	2
Data rate		-	-	5	kbps	NRZ
AF level	6	-	500	-	mV_{P-P}	4
DC offset on AF out	6	-	0.8	-	V	
Distortion on recovered AF	6	-	5	-	%	
Dynamic timing						
Power up with signal present						
Power up to valid RSSI	5, 3	-	3	-	ms	
Power up to valid AF	5,6	-	2	-	ms	
Power up to stable data	5, 7	-	TBA	10	ms	
Signal applied with supply on						
Signal to valid RSSI	1, 3	-	2	-	ms	
Signal to valid AF	1,6	-	1		ms	
Signal to stable data	1, 7	-	TBA	5	ms	5
Time between data transitions	7	0.1	-	TBA	ms	

Notes:
1. For 12 dB SINAD, 1KHz mod, 2KHz dev
2. See applications information for further details.
3. Exceeds EN/EMC requirements at all frequencies.
4. For received signal with ±2kHz FM deviation
5. For 50:50 mark to space ratio (i.e. squarewave).

Applications information

Power supply requirements

Both modules have built-in regulators which deliver a constant 2.8V (4V in 50mW and 100mW version) to the module circuitry when the external supply voltage is 2.9V or greater (4.1V in 50mW and 100mW version), with 40dB or more of supply ripple rejection. This ensures constant performance up to the maximum permitted rail, and removes the need for external supply decoupling except in cases where the supply rail is extremely poor (ripple/noise content >100mV$_{pk-pk}$).

Continuous operation of 100mW version above 9V supply is not recommended.

The Enable pin allows the TX module to be turned on or off under 3V logic control with a constant DC supply to the Vcc pin. The module current in power-down mode is less than 1µA.

The Enable pin should be tied directly to the Vcc pin if this facility is not required.

NTX0 modulation requirements

The module is factory-set to produce the specified FM deviation with a TXD input to pin 7 of 3V amplitude, i.e. 0V "low", 3V "high

If the data input level is greater than 3V, a resistor must be added in series with the TXD input to limit the modulating input voltage to a maximum of 3V on pin 7. TXD input resistance is 100kΩ to ground, giving typical required resistor values as follows:

Vcc	Series resistor
≤3V	-
3.3V	10 kΩ
5V	68kΩ
9V	220kΩ

NRX0 Received Signal Strength Indicator (RSSI)

The NRX0 receiver incorporates a wide range RSSI which measures the strength of an incoming signal over a range of 55dB or more. This allows assessment of link quality and available margin and is useful when performing range tests.

The output on pin 3 of the module has a standing DC bias of <0.5V with no signal, rising to 2V at maximum indication.

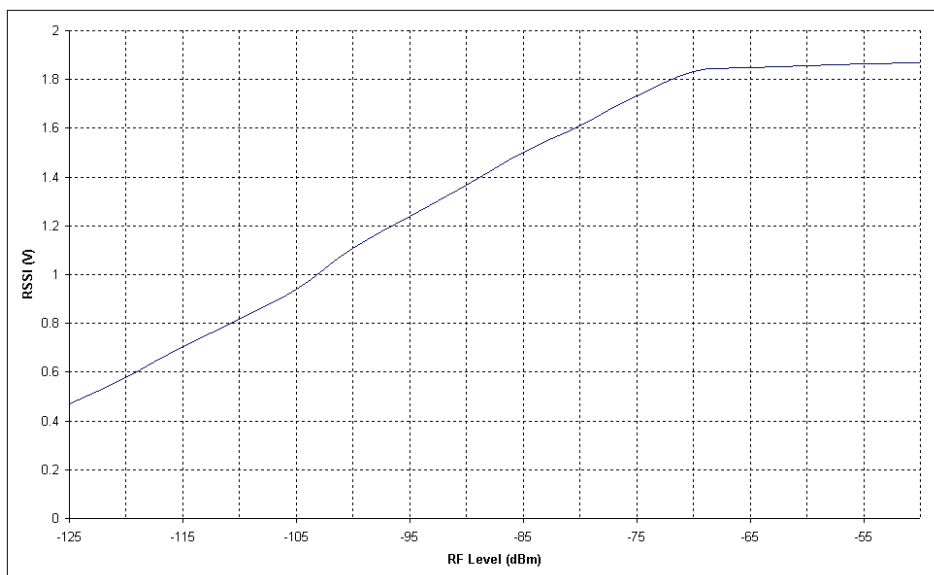*Typical RSSI characteristic is as shown below:*

Fig.6: Typical RSSI response curve

Module mounting considerations

The modules may be mounted vertically or bent horizontal to the motherboard. Note that the components mounted on the underside of the NTX0 and NRX0 are relatively fragile – avoid direct mechanical contact between these and other parts of the equipment if possible, particularly in situations where extreme mechanical stresses could routinely occur (as a result of equipment being dropped onto the floor, etc).

Good RF layout practice should be observed. 50Ω microstrip line or coax or a combination of both should be used to connect RF pin of the module to RF connector or antenna. It is desirable (but not essential) to fill all unused PCB area around the module with ground plane.

Variants and ordering information

The NTX0 transmitters and NRX0 receivers are manufactured on 27.095MHz as standard:

NTX0-27.095-5	10mW Transmitter
NTX0-27.095-5-50mW	50mW Transmitter
NTX0-27.095-5-100mW	100mW Transmitter
NRX0-27.095-5	Receiver

Subject to MOQ, other frequency variants can be supplied to individual customer requirements in the 27MHz licence exempt SRD / model control band. i.e.

10mW	*26.957 - 27.283MHz Non-specific Short Range Devices (SRD)*
100mW	*26.995, 27.045, 27.095, 27.145, 27.195 MHz Model Control*

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The Intrastat commodity code for all our modules is: 8542 6000

R&TTE Directive

After 7 April 2001 the manufacturer can only place finished product on the market under the provisions of the R&TTE Directive. Equipment within the scope of the R&TTE Directive may demonstrate compliance to the essential requirements specified in Article 3 of the Directive, as appropriate to the particular equipment.
Further details are available on The Office of Communications (Ofcom) web site:
http://www.ofcom.org.uk/

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