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RX3D

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Frequency Programmable FM UHF Receiver

The RX3D is a frequency programmable wideband FM receiver module, which is an enhanced replacement for the crystal controlled RX3B series receivers.

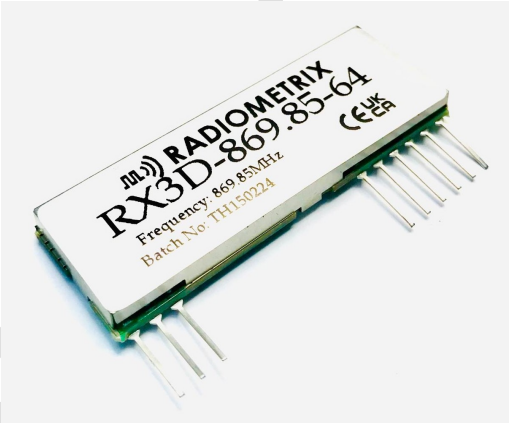

Figure 1: RX3D-869-64

Features

- Complies with European harmonised standards EN 300 220 and EN 301 489
- Data rates: up to 10kbps or 64kbps
- Crystal controlled PLL Frequency Synthesiser based FM circuitry
- SAW front end filter and full screening
- 869.85MHz and 868.30 MHz (EU) or 914.50MHz (North America) as standard
- Receiver Sensitivity: -111dBm for 12dB SINAD @64kbps,
  -114dBm for 12dB SINAD @10kbps
- Supply: 2.9V - 16V @ 18mA Rx
- Received Signal Strength Indicator (RSSI)
- Analogue and digital baseband
- Low profile with small footprint
- 48 x 17.5 x 4.5mm

Applications

- Industrial or Commercial Telemetry and Telecommand
- Wireless Queue Management System
- Wheel Balancing
- Sports Scoreboard Display
- Wireless Battery Monitor.
- Temperature & Pressure Monitoring in Industrial process

***Evaluation platforms**: Narrow Band Evaluation Kit (NBEK) + SIL carrier board*

Functional overview

The RX3D receiver is a single conversion FM superhet with an IF of 10.7MHz. A SAW bandpass filter in the receiver front-end provides image rejection and suppression of other unwanted out-of-band signals. Like the transmitter, the receiver is controlled by its own active low RX select line. A post-detection lowpass filter establishes the signal bandwidth and ensures clean operation of the subsequent adaptive data slicer. The slicer is optimised for balanced data such as bi-phase code. A received signal strength (RSSI) output with 60dB of range is provided.

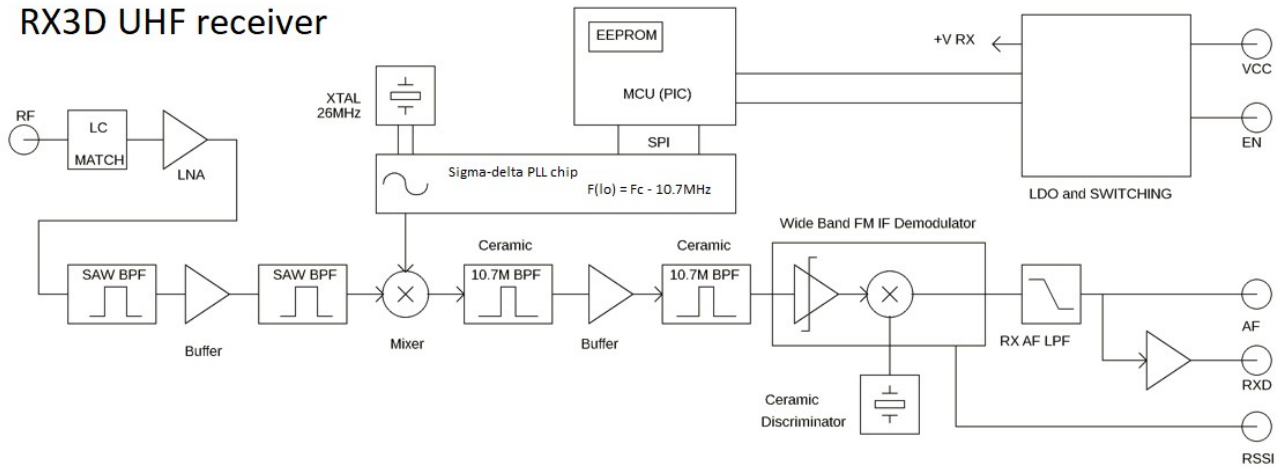

Fig. 2: Block diagram

Pin description

Antenna *pin 1*
50Ω RF connection to the antenna, DC-isolated.

RF GND *pins 2 & 3*

RF ground pins, internally connected to the module screen and to pin 6 (0V). These pins should be connected directly to the RF return path (e.g. coax braid, main PCB ground plane etc).

EN (Enable pin version) *pin 4*
Active high RX enable pin
<0.5V shuts down module (current <3uA). >2V enables the receiver.

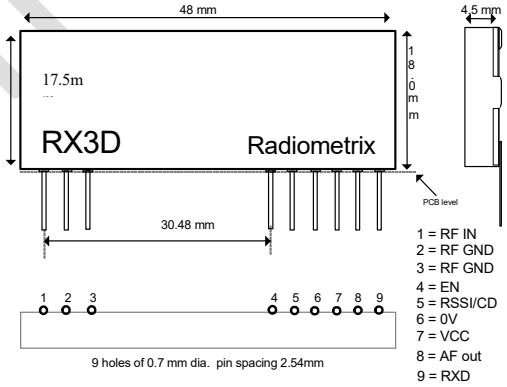

Fig. 3: Physical dimensions (Weight: 7g typ.)

RSSI *pin 5*
Received Signal Strength Indicator with 60dB range, operational when Rx is enabled. Output voltage nominally 200mV (no RF signal), 1.25V (maximum). See page.4 for typical characteristics.

0V (GND) *pins 6*
Supply ground connection and screen.

Vcc *pin 7*
DC +ve supply pin. +2.9 to +16.0 volts. The supply should be clean, <20mV$_{P-P}$ ripple.

AF *pin 8*
Filtered analogue output from FM demodulator. Standing DC bias of 0.8V approx. Useful for test purposes or for driving external decoders. External load should be >10kΩ // <100pF

RXD *pin 9*
Digital output from internal data slicer. The output is a squared version of the signal on pin 13 (AF) and may be used to drive a decoder directly. The data is true data, i.e. as fed to the transmitter. Output is "open-collector" format with internal 10kΩ pullup to VCC (pin 7).

Absolute maximum ratings

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

Operating temperature	-20°C to +70°C
Storage temperature	-40°C to +100°C
Vcc (pin 7)	-0.3V to +16V
EN (pins 4)	-9V to +16V
All other pins	-0.3V to +Vcc
Antenna (pin 1)	±50V DC, +10dBm RF

Performance specifications

Figures apply to standard version @ Vcc=3.0V, temperature +20°C, unless stated.

	pin	min.	typ.	max.	units	notes
Supply voltage	7	2.9	3.0	16	V	
Idele current	4, 7			3	µA	
Rx supply current	4, 7		17		mA	Note 1
RF centre frequency (EU)	1	-	869.85/ 868.30	-	MHz	
RF centre frequency (N-America)	1	-	914.50	-	MHz	
Antenna port impedance		-	50	-	Ω	Tx or Rx
EN high *(deselect)*	4	2	-	Vcc	V	
low *(select)*	4	0	-	0.5	V	
Balanced code bit rate	9	-	-	64	kbps	-64 version
Balanced code bit rate	9	-	-	10	kbps	-10 version
RF sensitivity, 12dB SINAD	8		-111		dBm	-64 version
RF sensitivity, 12dB SINAD	8		-114		dBm	-10 version
RSSI output, no signal	5		200		mV	
RSSI output, max indication	5		1.25		V	-50dBm RF input
RSSI range	5		60		dB	
IF bandwidth	8		180		kHz	
Adjacent channel @ ±300kHz	1		51		dB	
Blocking @ ±2MHz	1		65		dB	
Blocking @ ±10MHz	1		88		dB	
Image rejection	1		64		dB	
IF/2 rejection	1		50		dB	
IF rejection (10.7MHz)	1	better than 70dB			dB	
Local osc. leakage, conducted	1			-75	dBm	
Baseband bandwidth @ -3dB	8	0		50	kHz	-64 version
Baseband bandwidth @ -3dB	8	0		7	kHz	-10 version
AF output signal level	8		370		mV p-p	Note 2
DC offset on AF output	8		0.8		V	Note 3
Distortion on recovered AF	8	-		6	%	Note 4
Ultimate (S+N)/N	8	30		40	dB	-50dBm RF input
Load capacitance, AF & RXD	8, 9	-	-	100	pF	
Dynamic Timing						
Rx power up with signal present - 3kHz (= 6kbit/sec) modulation						
RXE active to stable RSSI, $t_{PU-RSSI}$	5	-	2.5	-	ms	-10 version
RXE active to stable RXD, $t_{PU-data}$	9	-	3		ms	-10 version
RXE active to good RX AF, t_{PU-AF}	8	-	2		ms	-10 version
Rx power up with signal present - 15kHz (= 30kbit/sec) modulation						
RXE active to stable RSSI, $t_{PU-RSSI}$	5	-	2.5	-	ms	-64 version
RXE active to stable RXD, $t_{PU-data}$	9	-	3		ms	-64 version
RXE active to good RX AF, t_{PU-AF}	8	-	2		ms	-64 version
Signal applied with Rx on						
Signal to stable data, $t_{sig-data}$ 3kHz modulation (6kbit/sec NRZ)	9	-	1	-	ms	-10 version (Note 5)
Signal to stable data, $t_{sig-data}$ 15kHz modulation (30kbit/sec NRZ)	9	-	200	-	µs	-64 version (Note 5)

Time between data transitions	12	15.6	-	1000	µs	-64 version
Time between data transitions	12	0.1	-	10	ms	-10 version
Averaged code mark:space	12	40	50	60	%	Note 6

Note: 1. Increases at high RF input level (>-20dBm)
2. For received signal with ±30kHz FM deviation.
3. Min/max After stabilisation
4. Max at ±50kHz offset
5. for 50:50 mark space stable data
6. Average, at max. data rate

Received Signal Strength Indicator (RSSI)

The RX3D receiver incorporates a wide range RSSI which measures the strength of an incoming signal over a range of approximately 60dB. This allows assessment of link quality and available margin and is useful when performing range tests.

Please note that the actual RSSI voltage at any given RF input level varies somewhat between units. The RSSI facility is intended as a relative indicator only - it is not designed to be, or suitable as, an accurate and repeatable measure of absolute signal level or transmitter-receiver distance.

The output on pin 5 of the module has a standing DC bias in the region of 200mV with no signal, rising to around 1.25V at maximum indication (RF input levels of -50dBm and above). For any given RF input level, absolute RSSI voltage is likely to vary somewhat between individual units - please refer to specifications table on p3.

Typical RSSI characteristic is shown below (this is for indicative purposes only and is not a guarantee of actual RSSI characteristics):

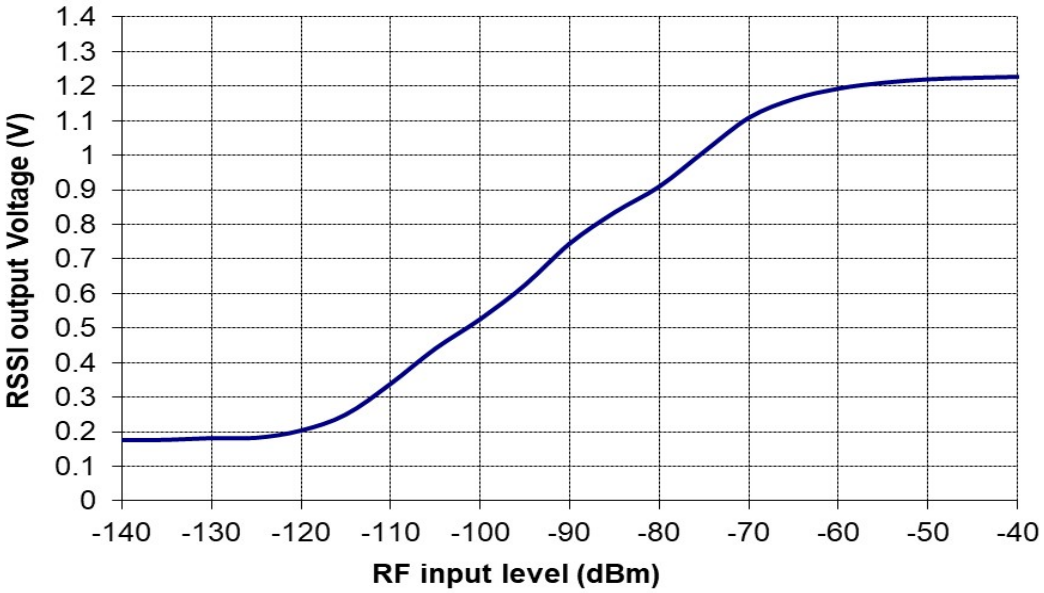

Fig.4: Typical RSSI response curve

To ensure a reasonably fast response the RSSI has limited internal decoupling of 10nF to ground. This may result in a small amount of audio ripple on the DC output at pin 5 of the module. If this is a problem further decoupling may be added at the expense of response speed, in the form of a capacitor from pin 5 to ground.

Variants and ordering information

RX3D modules are manufactured in the following variants as standard:

Part number RSSI versions	**Frequency** MHz	**Data rate** kbps
RX3D-869-64	869.85	64
RX3D-869-10	869.85	10
RX3D-914-64	914.50	64
RX3D-914-10	914.50	10

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

Radio Equipment Directive (RED)

Before it can be placed on the UK market, radio control equipment must first comply with the provisions of the Radio Equipment Directive 2014/53/EU.

To comply, all equipment must meet a set of Essential Requirements that are based on voluntary Harmonised European Standards. Manufacturers can meet the essential requirements by ensuring equipment meets the applicable harmonised standards or by seeking the opinion of a Radio Equipment Directive Notified Body. Once this assessment has been carried out, the manufacturer can declare compliance, affix the CE mark to the equipment and then place it on the market anywhere in the European Community.

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