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Issue 2, 13 November 2012 **RX3G**

UHF FM receiver module with RSSI

The RX3G is a PLL synthesiser based miniature PCB mounting UHF radio data receiver.

With the matching TX3B-869-64 transmitters, RX3G allows the simple implementation of wireless data links at speeds up to 64kbps and distances up to 75 metres in-building or 300 metres over open ground.

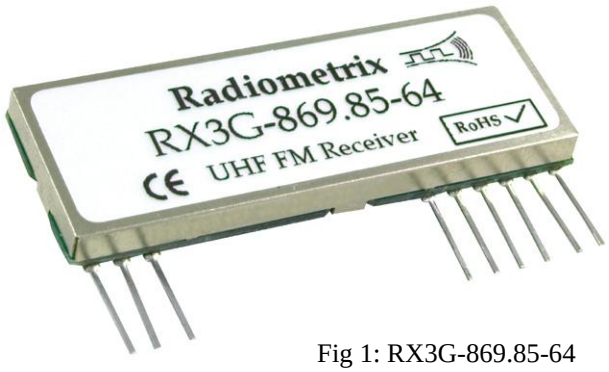


Fig 1: RX3G-869.85-64

Features:

- Designed to comply with harmonised radio standard EN 300 220-3
- Designed to comply with harmonised EMC standard EN 301 489-3
- North American version conforms to FCC part 15.249
- Data rates up to 128kbps
- Usable range up to 300m
- Versions available on 868.3MHz, 869.5MHz, 869.85MHzn and
- Regulated and Unregulated versions available
- Fully screened
- Improved blocking performance
- Fast data settling time

Available for operation at 868.3MHz, 869.5MHz and 869.85MHz in Europe, the RX3G combines full screening with internal filtering to ensure EMC compliance by minimising spurious radiation and susceptibility. The module suits one-to-one and multi-node wireless links in applications including car and building security, EPOS and inventory tracking, remote industrial process monitoring and computer networking. Because of the small size and low power requirements, the RX3G is ideal for use in portable, battery-powered wireless applications such as hand-held terminals.

Technical Summary

- Single conversion FM superhet
- SAW front end filter gives >50dB image rejection
- Supply: +5V (± 10%)
- Current consumption: 10mA (typ.)
- -102dBm sensitivity @ 1ppm BER, 64kbps version
- -108dBm sensitivity @ 1ppm BER, 15kbps version
- RSSI output with 50dB range
- Extremely low LO leakage, -125dBm typical

Evaluation platforms: Universal Evaluation Kit, NBEK + SIL carrier

Pin description

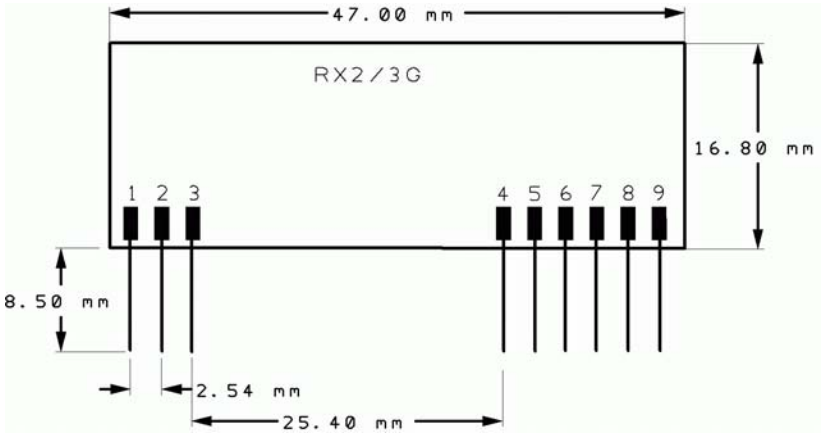


Fig 2: physical dimensions & pin outs

RF IN *(pin 1)*
50Ω input from the antenna, DC isolated.

RF GND *(pin 2)*
RF ground pin, internally connected to the module screen and pin 6 (0V). This pin should be connected to the RF return path (coax braid, main PCB ground plane etc.)

RF GND *(pin 3)*
Not fitted on non-regulator 5V variant

En (Regulator version) *(pin 4)*
Rx enable. <0.15V shuts down module (current <1uA). >1.7V enables the receiver. Impedance ~1Mohm. Observe slew rate requirements (see apps notes).
Not fitted on non-regulator 5V variant.

RSSI *(pin 5)*
Received signal strength indicator with 60dB range. See page 4 for typical characteristics.

0V *(pin 6)*
DC supply ground. Internally connected to pin 2/3 and module screen.

Vcc (5V variant) *(pin 7)*
Externally regulated 5V DC supply. Max ripple content $0.1V_{p-p}$.

Vcc (for regulator variant) *(pin 7)*
5.1V to +16V DC supply. Max ripple content 0.1Vp-p. Decoupling is not generally required.

AF out *(pin 8)*
Buffered and filtered analogue output from the FM demodulator. Standing DC bias 2V approx. External load should be >10kΩ // <100pF.

RXD *(pin 9)*
This digital output from the internal data slicer is a squared version of the signal on pin 8 (AF). It may be used to drive external decoders. The data is true data, i.e. as fed to the transmitter.

Absolute maximum ratings

Exceeding the values given 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)	-0.1V to +5.5V
RSSI, AF, RXD (pins 5,8,9)	-0.1V to +3V
RF IN (pin 1)	±50V DC, +10dBm RF

Performance specifications

(Vcc = 5.0V / temperature = 20 °C unless stated)

	pin	min.	typ.	max.	units	notes
DC supply						
Supply voltage	5	4.5	5.0	5.5	V	
Supply voltage (regulator ver.)	5	4.5	5.0	16	V	
Supply current	5	9	15	18	mA	1
RF/ IF						
RF sensitivity for 10dB (S+N/N)	1,2	-	-113	-	dBm	
RF sensitivity for 1ppm BER	1,2	-	-108	-	dBm	15kbps version
RF sensitivity for 1ppm BER	1,2	-	-102	-	dBm	64kbps version
RSSI range	1,2	-	50	-	dB	
IF bandwidth	-	-	180	-	kHz	
Image rejection	1	50	54	-	dB	
IF rejection (10.7MHz)	1	100	-	-	dB	
LO leakage, conducted	1	-	-125	-110	dBm	
Baseband						
Baseband bandwidth @ -3dB	8	0	-	7.8	kHz	15kbps version
Baseband bandwidth @ -3dB	8	0	-	50	kHz	64kbps version
AF level	8	200	250	350	mV_{P-P}	2
DC offset on AF out	8	1.5	2	2.5	V	3
Distortion on recovered AF	8	-	1	5	%	3
Load capacitance, AFout/RXD	3,8	-	-	100	pF	
DYNAMIC TIMING						
Power up with signal present						
Power up to valid RSSI	3,5	-	0.5	1	ms	
Power up to stable data	3,9	-	6		ms	3, 15kbps version
Power up to stable data	3,9	-	1.5		ms	3, 64kbps version
Power up to stable data	3,9	-	10		ms	3, -DS version
Signal applied with supply on						
RSSI response time (rise/fall)	1,5	-	100	-	µs	
Signal to stable data	1,9	-	0.5	1	ms	3, 15kbps
Signal to stable data	1,9	-	5			3, 15kbps DS
Signal to stable data	1,9	-	0.2	0.5	ms	3, 64kbps
Signal to stable data						3, 64kbps DS
Time between data transitions	9	0.066	-	1.5	ms	4, 15kbps
		0.066		75	ms	4, 15kbps DS
Time between data transitions	9	0.015	-	0.2	ms	4, 64kbps
		0.015		3	ms	4, 64kbps DS
Mark:space ratio	9	20	50	80	%	5

Notes:

1. Current increases at higher RF input levels (>-20dBm and above).
2. For received signal with ±30kHz FM deviation.
3. Typical figures are for signal at centre frequency, max. figures are for ±50kHz offset.
4. For 50:50 mark to space ratio (i.e. squarewave).
5. Average over 10ms (15kbps version) or 3ms (64kbps version) at maximum data rate.

Power supply requirements

The standard RX3G requires a regulated 5V supply with ripple content <100mV$_{pk-pk}$

However, built-in regulator in the regulator version RX3G delivers a constant 5V to the module circuitry when the external supply voltage is 5V or greater, with 40dB or more of supply ripple rejection. This ensures constant performance up to the maximum permitted supply rail (16V max.) and removes the need for external supply decoupling except in cases where the supply rail is extremely poor (ripple/noise content >0.1V$_{p-p}$).

Note, however, that for supply voltages lower than 5V the regulator is effectively inoperative and supply ripple rejection is considerably reduced. Under these conditions the ripple/noise on the supply rail should be below 10mV$_{p-p}$ to avoid problems. If the quality of the supply is in doubt, it is recommended that a 10µF low-ESR tantalum or similar capacitor be added between the module supply pin (Vcc) and ground, together with a 10Ω series feed resistor between the Vcc pin and the supply rail.

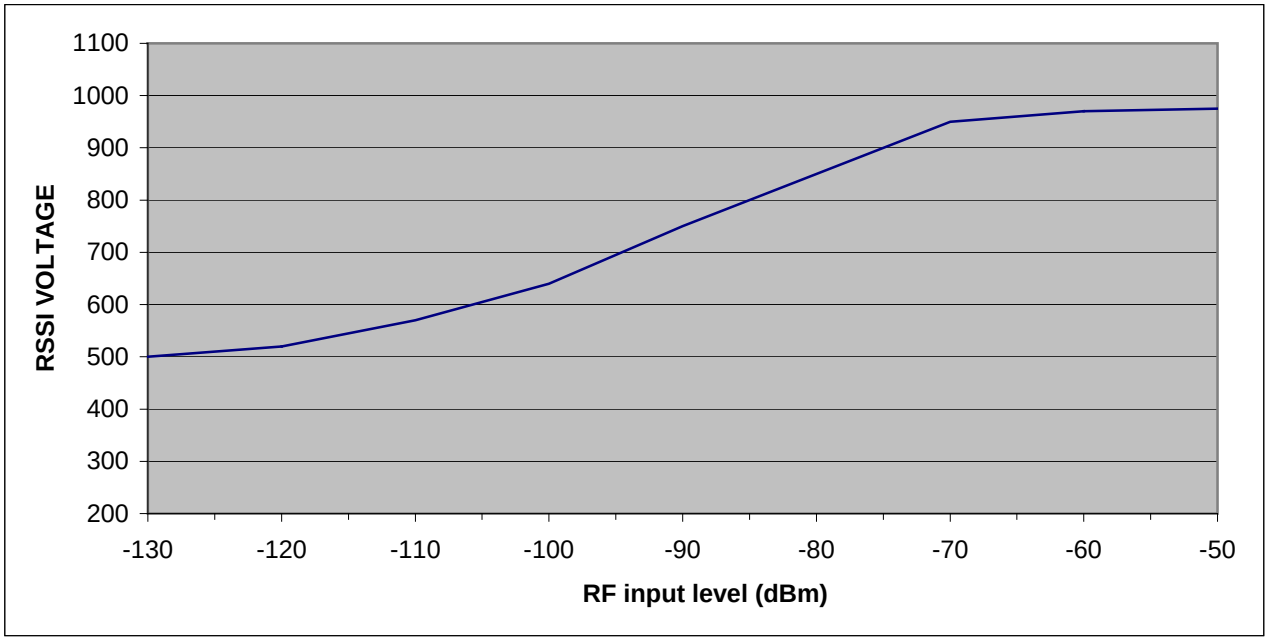
Received Signal Strength Indicator (RSSI)

The module incorporates a wide range RSSI which measures the strength of an incoming signal over a range of approximately 50dB. This allows assessment of link quality and available margin and is useful when performing range tests.

The output on pin 5 of the module has a standing DC bias in the region of 0.5V with no signal, rising to around 1V at maximum indication. The RSSI output source impedance is high (~100kΩ) and external loading should therefore be kept to a minimum.

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

Typical RSSI characteristic is as shown below:



Module mounting considerations

The module may be mounted vertically or bent horizontal to the motherboard. Good RF layout practice should be observed – in particular, any ground return required by the antenna or feed should be connected directly to the RF GND pin at the antenna end of the module, and not to the 0V pin which is intended as a DC ground only. All connecting tracks should be kept as short as possible to avoid any problems with stray RF pickup.

If the connection between module and antenna does not form part of the antenna itself, it should be made using 50Ω microstrip line or coax or a combination of both. It is desirable (but not essential) to fill all unused PCB area around the module with ground plane.

The module may be potted if required in a viscous compound which cannot enter the screen can.

Warning: *DO NOT wash the module. It is not hermetically sealed.*

Variants and ordering information

The RX3G receivers are manufactured in several variants:

Data rate:	Slower version:	7.8kHz baseband B/W, (suffix -15)	data rate up to 15kb/s
	Faster version:	50kHz baseband B/W, (suffix -64)	data rate up to 64kb/s
		50kHz baseband B/W, (suffix -128)	data rate up to 128kb/s

Frequency:	868.30MHz	(suffix –868.30)
	869. 50MHz	(suffix -869.50)
	869.85MHz	(suffix –869.85)
	914.50MHz	(suffix –914.50)

The following data rate variants are standard:

RX3G-869.85-15-5V-DS	869.85MHz, 15kb/s	Data Slicer for Non-bit balanced data
RX3G-869.85-64-5V-DS	869.85MHz, 64kb/s	Data Slicer for Non-bit balanced data
RX3G-869.85-15-5V	869.85MHz, 15kb/s	Manchester Encoded data packet with preamble
RX3G-869.85-64-5V	869.85MHz, 64kb/s	Manchester Encoded data packet with preamble
RX3G-869.85-128-5V	869.85MHz, 128kb/s	

Regulator version:

RX3G-869.85-15-DS	869.85MHz, 15kb/s
RX3G-869.85-64-DS	869.85MHz, 64kb/s
RX3G-869.85-128	869.85MHz, 128kb

Matching Transmitters:

TX3B-869.85-64	869.85MHz

For other variants please contact the sales department

Evaluation platforms:

1. Universal Evaluation Kit
2. NBEK + SIL carrier

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The Intrastat commodity code for all our wireless 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/radiocomms/ifi/

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