

RADIO MODULE
MRX-219S

UHF AM RECEIVER MODULE

PRELIMINARY

DATA SHEET

Radios, Inc.

June 8, 2010 Preliminary Data Sheet

MRX-219S

UHF AM RECEIVER MODULE

The MRX-219S is a 300MHz to 450MHz super-heterodyne, image-reject, RF receiver with Automatic Gain Control, OOK/ASK data and analog RSSI output. The module integrates Auto-Poll, Valid Bit-Check, Squelch and Desense features. It is ideal for low-cost, low-power, RKE, TPMS, and remote actuation applications.

The MRX-219S achieves -110dBm sensitivity at a data rate of 1kbps (Manchester encoded). Four demodulator filter bandwidths are selectable in binary steps from 1625Hz to 13kHz at 433MHz, allowing the device to support data rates to 10kbps. The module operates from a supply voltage of 3.3V to 16.0V, and consumes 4.0mA of supply current at 315MHz and 6.0mA at 433.92MHz. A shutdown mode reduces supply current to 0.5uA. The Auto-Polling feature allows the MRX-219S to sleep and poll for user defined periods, thus further reducing supply current. The Valid Bit-Check feature, when enabled in Auto-Poll mode, fully awakes the receiver and sends bits to the microcontroller once a valid number of bits are detected. During normal operation an optional Squelch feature disables the data output until valid bits are detected. An optional Desense feature reduces gain by 6dB to 42dB, distancing the receiver from distantly placed, undesired transmitters.



Key Features

- -110dBm sensitivity at 1kbps with BER 10E-02
- Supports data rates up to 10kbps at 433.92 MHz
- 25dB Image-Reject Mixer
- 60dB Analog RSSI Output
- 3.0V to 16.0V Supply Voltage Range
- 4.0mA supply current at 315MHz (continuous RX)
- 6.0mA supply current at 434MHz (continuous RX)
- 0.5uA supply current in Shutdown Mode
- Optional Auto-Polling (sleep mode, current < 0.1mA)
- Optional Valid Bit-Check in Auto-Poll Mode
- Optional Programmable 6dB to 42dB Desense
- Optional Data Output Squelch until valid bits detected
- 2kV HBM ESD Rating

Typical Applications

- Remote controls
- Garage openers / Gate controls
- Keyless entry
- Lighting control
- Periodic data transfer
- Remote access
- Guard patrol / Lone worker protection
- Domestic / Commercial security
- Fire / Security alarms
- General wire elimination



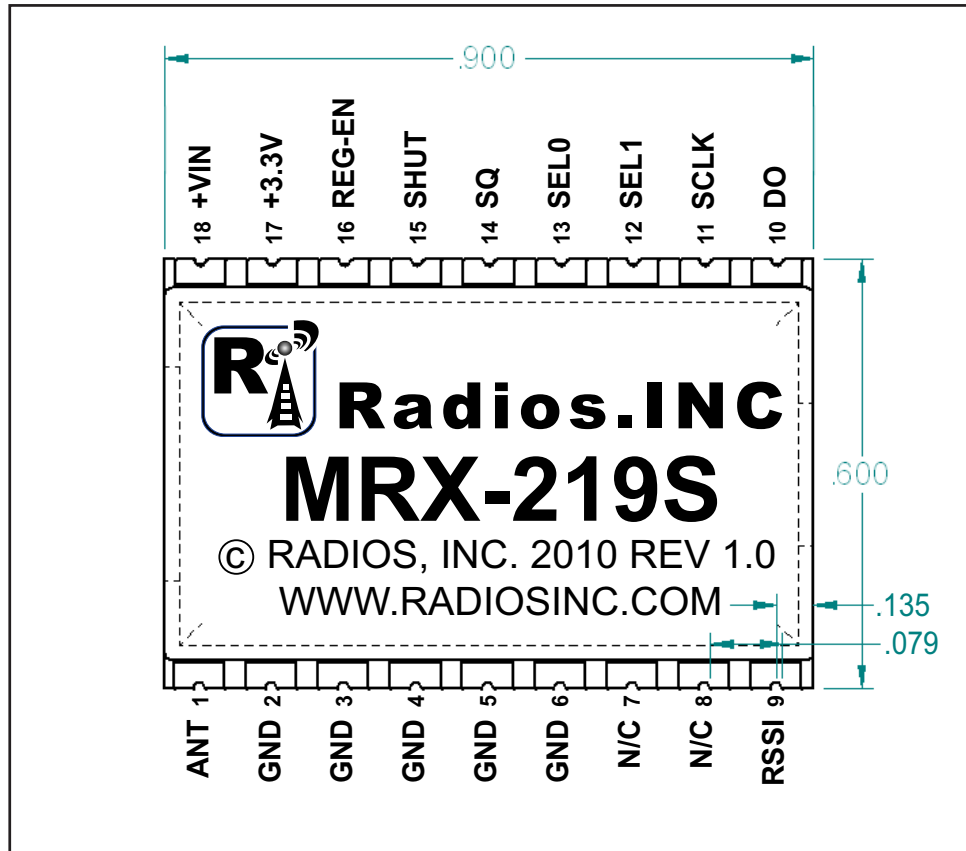
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Mechanical and Pin Diagram Surface Mount Package



Surface Mount Package

Pin Description

Pin Num	Pin Name	Description	Pin Num	Pin Name	Description
Pin 1	Ant	RF Input (50 Ohms)	Pin 10	DO	Data Output (0-3.3V)
Pin 2	Gnd	Ground	Pin 11	SCLK	Serial interface input clock
Pin 3	Gnd	Ground	Pin 12	SEL1	Bandwidth Select Bit 1 (0-3.3V)
Pin 4	Gnd	Ground	Pin 13	SELO	Bandwidth Select Bit 0 (0-3.3V)
Pin 5	Gnd	Ground	Pin 14	SQ	Squelch control logic input
Pin 6	Gnd	Ground	Pin 15	SHUT	Shutdown Control Input (0-3.3V)
Pin 7	N/C	No Connect	Pin 16	REG-EN	Regulator Enable (2-VCC)
Pin 8	N/C	No Connect	Pin 17	+3.3V	Regulated Output (3.3V)
Pin 9	RSSI	Receive Signal Strength Indicator (0-3.3V)	Pin 18	+VIN	Positive Supply Pin (3.3-16V)

** Verify pin configurations are correct before connecting power or resulting damage may occur.

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Pin Detail

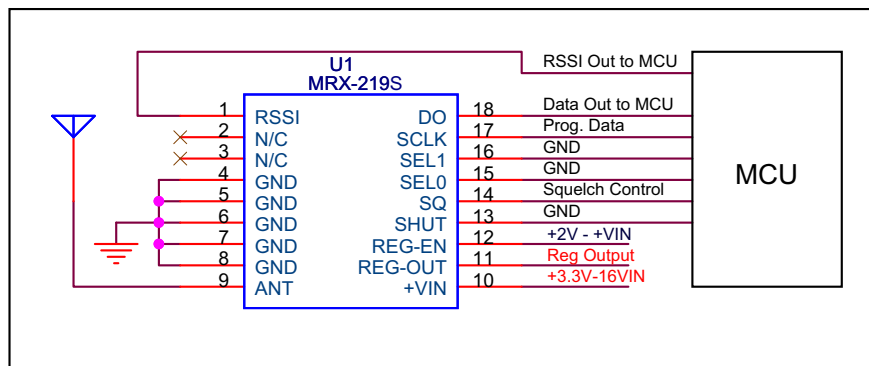
Pin Number	Pin Name	Description
1	Ant	This is the receive RF input, internally ac-coupled. Connect this pin to the receive antenna.
2,3,4,5,6	Gnd	Ground
7,8	N/C	No Connect
9	RSSI	Received signal strength indication output.
10	DO	Data Input and Output. This pin is also used as a CMOS Schmitt input for serial interface data.
11	SCLK	Serial interface input clock. CMOS Schmitt input. A 25kOhm pull-down is present when the device is in shutdown mode.
12	SEL1	Programs desired Demodulator Filter Bandwidth. This pin is internally pulled-up to VCC. See Table 1.
13	SEL0	Programs desired Demodulator Filter Bandwidth. This pin is internally pulled-up to VCC. See Table 1.
14	SQ	Squelch Control Logic-Level Input. An internal pull-up pulls the logic-input HIGH when the device is enabled. Bit D17 sets whether squelch is enabled or disabled when a logic-level signal is applied the SQ pin.
15	SHUT	Shutdown-mode logic-level control input. Pull low to enable the receiver. Internally pulled-low to GND.
16	REG-EN	In a regulated module, this pin powers on the module with a 2-16V supply input. Pulling this pin low disables module. In a non-regulated module, this is a no connect.
17	+3.3V	In a regulated module, this is a 3.3V output from the onboard regulator when REG-EN is high (2-16V). In a non-regulated module, this is the 3.0V to 3.6V power supply input.
18	+VIN	In a regulated module, this is the power supply pin of the module. Input 3.3-16V to power a regulated module. In a non-regulated module, this is a no connect.

Table 1

Programmable Bandwidth Configurations		
SEL0	SEL1	Bandwidth (bps)
0	0	1625
1	0	3250
0	1	6500
1	1	13000

**Note: 1=VCC, 0=GND*

Typical Application Schematic



MRX-219S, 433.92MHz Fixed, 1625bps Bandwidth

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Electrical Limits

Sym	Parameters	Min	Typ	Max	Unit	Notes
Absolute Maximum Ratings						
VCC	Supply Voltage - Regulated	3.3		16	V	
	Supply Voltage - Not Regulated	3.0		3.6	V	
	Storage Temperature Range	0		70	°C	
V _{EN}	Enable Input Voltage	0		16	V	
Operating Ratings						
V _{EN}	Enable Input Voltage	0		VCC	V	
TA	Ambient operating temperature	0		70	°C	

Electrical Characteristics

This device is ESD sensitive. Do not operate or store near strong electrostatic fields. Use appropriate ESD precautions. All voltages are with respect to Ground.

Parameters	Test Conditions	Min	Typ	Max	Unit
Power Supply					
Operating Supply Current	Continuous operation, 433.92MHz		6		mA
Shut Down Current			0.15		µA
Operating Voltage	Regulated	3.3		16	V
	Not Regulated	3.0		3.6	V
RF/IF Section					
Image Rejection			25		dB
1st IF Center Frequency	433.92MHz		1.20		MHz
Receiver Sensitivity@1kbps	433.92MHz, BER=10e-2		-110		dBm
IF Bandwidth	433.92MHz		330		kHz
Antenna Input Impedance	433.92MHz		19 - j174		Ohms
Receive Modulation Duty Cycle	Note 2	20		80	%
AGC Attack / Decay Ratio	T(Attack) / T(Decay)		0.1		
AGC Pin Leakage Current	T _A =25°C		+/- 30		nA
	T _A =+105°C		+/- 800		nA
AGC Dynamic Range	RF _{IN} @ -40dBm		1.15		V
	RF _{IN} @ -100dBm		1.70		V
Demodulator					
CTH Source Impedance	F _{REFOSC} = 13.52127MHz		120		kOhms
CTH Leakage Current	T _A =25°C		+/- 2		nA
	T _A =+105°C		+/- 800		nA
Demodulator Filter Bandwidth	434MHz, programmable	1625		13000	Hz
Digital/Control Functions					
Data Pin Output Current	source @ 0.8VDD		260		µA
	sink @ 0.2VDD		600		µA
Output Rise and Fall Times	Cl = 15pF, pin Data, 10-90%		2		µsec

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Electrical Characteristics - CONT.

RSSI					
RSSI DC Output Voltage Range			0.4-2.0		V
RSSI Response Slope	-110dBm to -40dBm		25		mV/dB
RSSI Output Current			400		μA
RSSI Output Impedance			250		Ohms
RSSI Response Time	50% data duty cycle, input power to antenna=-20dBm		0.3		sec
Regulator Enable Input					
Input Low Voltage	Regulator OFF			0.6	V
Input High Voltage	Regulator ON	2.0			V
Enable Input Current	REG-EN = 0.6V; Regulator OFF		0.01		μA

Note 1: Sensitivity is defined as the average signal level measured at the input necessary to achieve 10e-2 Bit Error Rate (BER). The input signal is defined as a return-to-zero (RZ) waveform with 50% average duty cycle at a data rate of 1kbps.

Note 2: When data burst does not contain preamble, duty cycle is defined as total duty cycle, including any "quiet" time between data bursts. When data bursts contain preamble sufficient to charge the slice level on capacitor C_{TH} , then duty cycle is the effective duty cycle of the burst alone. [For example, 100msec burst with 50% duty cycle, and 100msec "quiet" time between bursts. If burst includes preamble, duty cycle is $T_{ON}/(T_{ON}+T_{OFF})=50\%$; without preamble, duty cycle is $T_{ON}/(T_{ON}+T_{OFF}+T_{QUIET})=50\text{msec}/(200\text{msec})=25\%$. T_{ON} is the (Average number of 1's/burst) * bit time, and $T_{OFF} = T_{BURST} - T_{ON}$.]

Auto-Polling

The auto-poll block (Figure 3) contains a low power oscillator that drives the sleep timer when the rest of the device is powered down. It also contains circuits to check whether the received bits are good. Auto-polling is controlled by bit D15 in the serial register, in conjunction with bits D12, D13, D14 to set the sleep timer period. Bits D7, D8, are used for control of the bit-check operation and bits D9, D10, D11 are used to adjust the sensitivity of the bit-check action.

Auto-Polling without Bit-Checking

For simple auto-polling without bit-checking, send a serial command with bit D15 set high and bits D12, D13, D14 set to the desired sleep time. The device will go to sleep for the programmed timer duration then wake up to receive data if it is present. The device will stay awake until serial bit D15 is set low, then set high again, to enable a further sleep period. The sleep duty cycle may be controlled by the timing of serial commands.

Auto-Polling with Bit-Checking

For auto-polling with bit-checking, the serial register bits D7 and D8 need to be set for the number of bits to

be checked as good, before the receiver outputs data at the DO pin. The bit-check window bits D9, D10, D11 must also be set to match the data period. The shortest default window time gives the least critical bit check action. For better discrimination, the window setting may be increased up towards the normal minimum time expected between data edges. Note that a window time set longer than this will result in all bits being tested as bad and the device will remain in sleep polling mode. Now, when the serial command sets bit D15 high, the device will go to sleep for the timer period and will then awake to receive and check bits. The device will output data again at DO as soon as the programmed numbers of good RTZ bits have been received. If a bad bit is seen, the device will return to sleep mode and poll again for good bits after the timeout period. Both high and low periods are checked for each RTZ bit. If data transitions are not received, the device will return to sleep after the bit-check watchdog timeout period unless bit D18 has been sent. In this case the device will continue to check bits until sufficient good bits enable the device to wake up, or bad bits return the device to sleep.

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Any questions dealing with interpretations of the rules relating to testing or compliance should be addressed to:

FCC
Equipment Authorization Division
Customer Service Branch, MN 1300F2
7435 Oakland Mills Road
Columbia, MD 21046

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