

RADIO MODULE
MRX-009S

UHF AM RECEIVER MODULE

PRELIMINARY

DATA SHEET

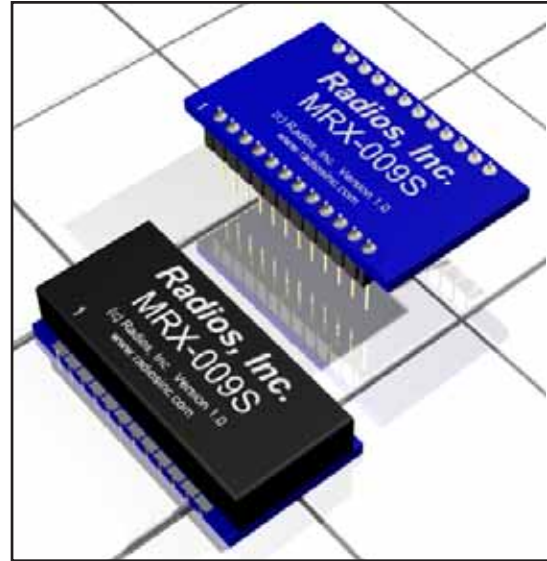
Radios, Inc.

November 7, 2007 Preliminary Data Sheet

MRX-009S

UHF AM RECEIVER MODULE

The MRX-009S is an on-off keyed (OOK) high performance, ultra compact, long range receiver for remote wireless applications. The receiver operates at 315, 390, 418, and 433 MHz, and is primarily intended for use in part 15.231 systems. The MRX-009S is an enhanced version of other MRX receivers with key performance upgrades such as higher sensitivity (typically 6dB higher than the MRX-002) and faster recovery from Shutdown (typically 1ms). Because an external antenna is the only component required, the receiver can be easily integrated with other applications. The MRX-009S operates at low power consumption, generates low harmonic emissions and is a highly reliable wireless link. The MRX-009S is a well designed receiver suitable for a variety of RF applications, particularly high volume OEM applications.



The MRX-009S contains two features that are not found in the MRX-009. The MRX-009S contains a SAW filter and/or a low noise amplifier, which reduce noise and increase selectivity and sensitivity. The MRX-009S has post-detection data filtering internal to the receiver. Additionally, one of two filter bandwidths may be selected externally by the user. The MRX-009S comes in two versions: fixed-mode (FX), which functions as a conventional, superhet receiver and increases selectivity and sensitivity performance, and sweep mode (SWP), which sweeps a wider RF spectrum and allows the receiver to be used with low cost, LC transmitters.

Key Features

- Low cost
- Commonly employed RKE frequencies
- Wide operating temperature range
- Supports On-Off Keying
- Low power consumption
- Compact surface-mount packages
- Data rate up to 2.0 kbps (fixed-mode, Manchester encoding)
- Small size
- Power down pin
- No production tuning
- Fast enable time

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

Contact Information

Radios, Inc.
1408 Center Avenue
Oostburg, WI 53070

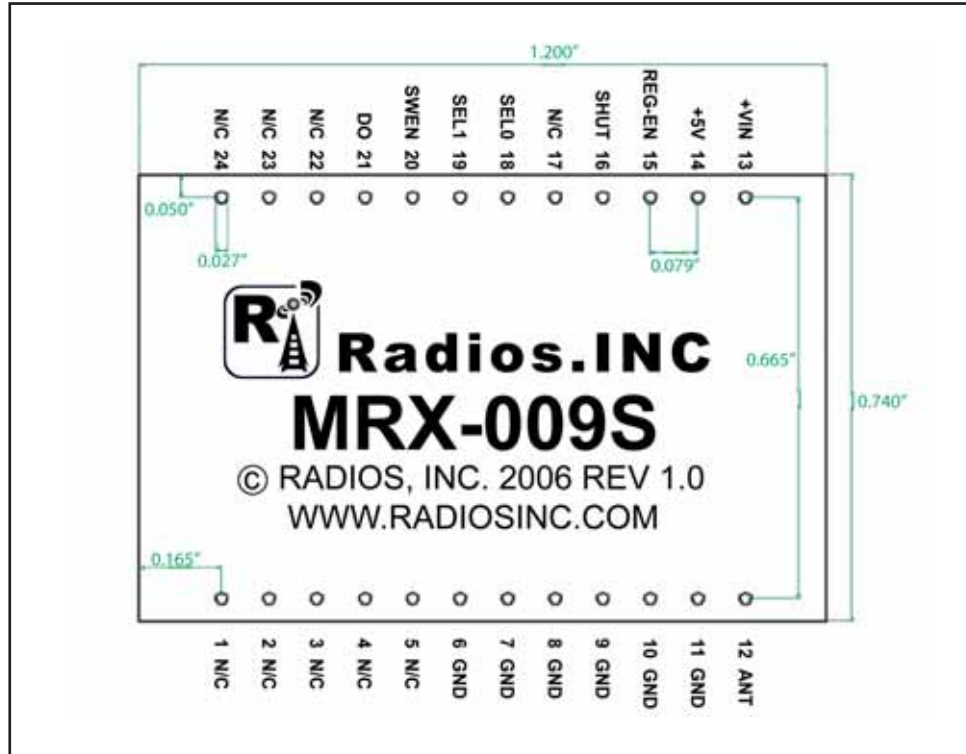
Phone: 920-564-6622
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Mechanical and Pin Diagram DIP Packaged

* Note: Pinouts of surface mount and through-hole packages are mirrored



DIP Package

Pin Description

Pin Num	Pin Name	Description	Pin Num	Pin Name	Description
Pin 1	N/C	No Connect	Pin 13	+VIN	Positive Supply Pin (5-16V)
Pin 2	N/C	No Connect	Pin 14	+5V	Regulated Output (5V)
Pin 3	N/C	No Connect	Pin 15	REG-EN	Regulator Enable (2-VCC)
Pin 4	N/C	No Connect	Pin 16	SHUT	Shutdown (0-5V)
Pin 5	N/C	No Connect	Pin 17	N/C	No Connect
Pin 6	N/C	No Connect	Pin 18	SEL0	Bandwidth Select Bit 0 (0-5V)
Pin 7	Gnd	Ground	Pin 19	SEL1	Bandwidth Select Bit 1 (0-5V)
Pin 8	Gnd	Ground	Pin 20	SWEN	Sweep Enable (0-5V)
Pin 9	Gnd	Ground	Pin 21	DO	Data Output (0-5V)
Pin 10	Gnd	Ground	Pin 22	N/C	No Connect
Pin 11	Gnd	Ground	Pin 23	N/C	No Connect
Pin 12	Ant	RF Input (50 Ohms)	Pin 24	N/C	No Connect

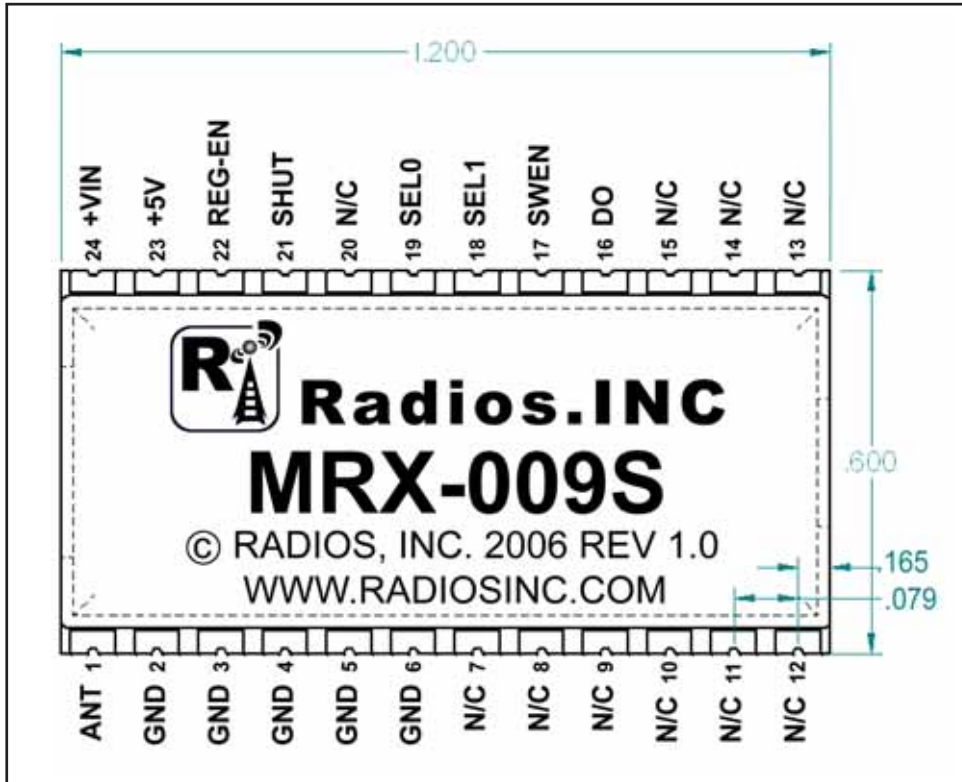
** Verify pin configurations are correct before connecting power or resulting damage may occur.

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Mechanical and Pin Diagram Surface Mount Package

* Note: Pinouts of surface mount and through-hole packages are mirrored



Surface Mount Package

Pin Description

Pin Num	Pin Name	Description	Pin Num	Pin Name	Description
Pin 1	Ant	RF Input (50 Ohms)	Pin 13	N/C	No Connect
Pin 2	Gnd	Ground	Pin 14	N/C	No Connect
Pin 3	Gnd	Ground	Pin 15	N/C	No Connect
Pin 4	Gnd	Ground	Pin 16	DO	Data Output (0-5V)
Pin 5	Gnd	Ground	Pin 17	SWEN	Sweep Enable (0-5V)
Pin 6	Gnd	Ground	Pin 18	SEL1	Bandwidth Select Bit 1 (0-5V)
Pin 7	N/C	No Connect	Pin 19	SEL0	Bandwidth Select Bit 0 (0-5V)
Pin 8	N/C	No Connect	Pin 20	N/C	No Connect
Pin 9	N/C	No Connect	Pin 21	SHUT	Shutdown (0-5V)
Pin 10	N/C	No Connect	Pin 22	REG-EN	Regulator Enable (2-VCC)
Pin 11	N/C	No Connect	Pin 23	+5V	Regulated Output (5V)
Pin 12	N/C	No Connect	Pin 24	+VIN	Positive Supply Pin (5-16V)

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

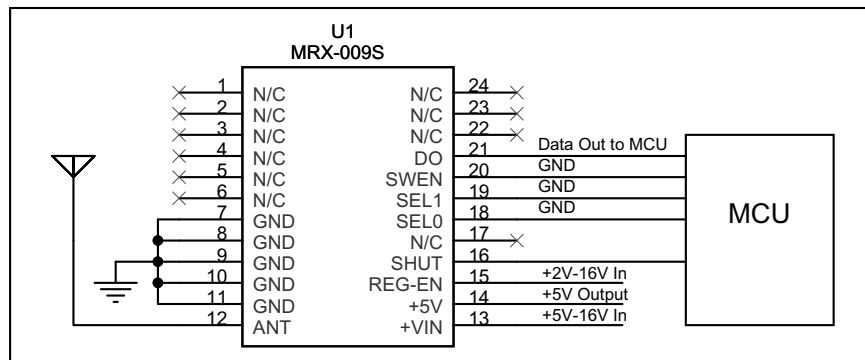
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Pin Detail			
Pin Number		Pin Name	Description
DIP	Surface Mount		
12	1	Ant	This is the receive RF input, internally ac-coupled. Connect this pin to the receive antenna.
7,8,9,10,11	2,3,4,5,6	Gnd	Ground
1,2,3,4,5,6,17,22,23,24	7,8,9,10,11,12,13,14,15,20	N/C	No Connect
21	16	DO	Output data pin. CMOS level compatible.
20	17	SWEN	Controls the operating mode of the receiver. When high, the receiver is in sweep mode. When low, the module operates as a conventional single-conversion superheterodyne receiver (fixed mode) - this is the recommended mode of operation. This pin is internally pulled-up to VCC.
19	18	SEL1	Reserved for future use. Must tie to ground.
18	19	SEL0	Programs desired Demodulator Filter Bandwidth. This pin is internally pulled-up to VCC. See Table 1.
16	21	SHUT	Shutdown mode logic-level input. Pull low to enable receiver. This pin is internally pulled-up to VCC.
15	22	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.
14	23	+5V	In a regulated module, this is a 5V output from the onboard regulator when REG-EN is high (2-16V). In a non-regulated module, this is the 4.75V to 5.5V power supply input.
13	24	+VIN	In a regulated module, this is the power supply pin of the module. Input 5-16V to power a regulated module. In a non-regulated module, this is a no connect.

Table 1		
Programmable Bandwidth Configurations		
SEL0	Sweep Bandwidth (bps)	Fixed Bandwidth (bps)
1	1250	2500
0	625	1250
*Note: 1=VCC, 0=GND		

Typical Application Schematic



MRX-009S, 433.92 MHz, Fixed Bandwidth, 1250bps

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Electrical Limits

Sym	Parameters	Min	Typ	Max	Unit	Notes
Absolute Maximum Ratings						
VCC	Supply Voltage - Regulated	5		16	V	
	Supply Voltage - Not Regulated	4.75		5.5	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 Current	433.92 MHz		27		mA
Quiescent Current	REG-EN $\leq 0.4V$ (shutdown)		0.01		μA
Operating Voltage	Regulated	5		16	V
	Not Regulated	4.75		5.5	V
RF/IF Section					
Receiver Sensitivity (Note 1, 3)	315MHz		-102		dBm
	433.92MHz		-104		dBm
IF Bandwidth	Note 3		0.68		MHz
Receive Data Rate		0.1		2	kbps
RF Input Range		300		440	MHz
Maximum Receiver Input	Rs = 50 Ω		-20		dBm
Spurious Reverse Isolation	ANT pin, Rs = 50 Ω Note 2		30		μV_{rms}
AGC Attack / Decay ratio	T(Attack) / T(Decay)		0.1		
Oscillator Turn-on Time			TBD		s
Digital Section					
Output Current	DO pin, Push-Pull		45		μA
Output High Voltage	DO pin, I _{out} = 1 μA	0.9VCC			V
Output Low Voltage	DO pin, I _{out} = 1 μA			0.1VCC	V
Output Tr, Tf	DO pin, Cload=15pF			4	μsec
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

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Electrical Characteristics - CONT.

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 2400bps. The RF input is assumed to be matched into 50 ohms.

Note 2: Spurious reverse isolation represents the spurious components which appear on the RF input (ANT) pin measured into 50 ohms with an input RF matching network.

Note 3: Sensitivity, a commonly specified Receiver parameter, provides an indication of the Receiver's input referred noise, generally input thermal noise. However, it is possible for a more sensitive receiver to exhibit range performance no better than that of a less sensitive receiver, if the "ether" noise is appreciably higher than the thermal noise. "Ether" noise refers to other interfering "noise" sources, such as FM radio stations, pagers, etc.

A better indicator of receiver range performance is usually given by its Selectivity, often stated as Intermediate Frequency (IF) or Radio Frequency (RF) bandwidth, depending on receiver topology. Selectivity is a measure of the rejection by the receiver of "ether" noise. More selective receivers will almost invariably provide better range. Only when the receiver selectivity is so high that most of the noise on the receiver input is actually thermal will the receiver demonstrate sensitivity-limited performance.

Note 4: Exceeding the absolute maximum ratings may damage the device.

Note 5: The device is not guaranteed to function outside its operating ratings.

PRELIMINARY

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Technical Support:

Radios, Inc. is committed to providing its customers with excellent technical support and the resources necessary to assist them with their product development. All technical support is provided free of charge. Customers have several options to obtain assistance. First, any questions or concerns can be e-mailed to Radios, Inc. at information@radiosinc.com. We monitor our e-mail daily, and will respond to all questions promptly. Additionally, to speak directly to a technical support representative, customers can call Radios, Inc. at 920-564-6622.

Compliance:

Embedded wireless modules are intended for use as component devices which require peripheral elements to operate. Radios, Inc.'s modules are intended to be used in products requiring compliance. They are, however, not pre-approved by the FCC or any other agency worldwide unless so stated. The user or customer understands that regulatory compliance may be required prior to the sale or operation of the module or development system, and agrees to abide by all laws governing the module's or development system's use in the country of operation.

The approval process of embedded wireless modules in the United States is relatively uncomplicated. The Federal Communications Commission (FCC) is the governing body in the US that specifies its requirements in the Code of Federal Regulations (CFR), Title 47. Title 47 consists of several volumes and it is necessary to first identify the correct section that applies to your application. These rules require that a device which intentionally creates RF emissions be FCC compliant; i.e., pre-tested for compliance and assigned an identification number. Radios, Inc. offers pre-screening at one of our affiliate test sites. Final certification is then accomplished by an independent test laboratory. After passing compliance testing, you will be issued a unique ID number which must be placed on each product manufactured.

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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Returns:

Products may be returned directly to Radios, Inc. for evaluation. Returns, without exception, must have a valid RMA number attached. RMA numbers can be obtained by calling a customer service representative at Radios, Inc. If a product is found to be defective and is returned within 90 days of purchase, Radios, Inc. may repair or replace, at its option, said defective product. The warranty does not apply to any products which have been disassembled, modified or subjected to conditions exceeding the application specifications. Under no circumstances will Radios, Inc. be responsible for losses, financial or other, arising from the use or failure of a device in an application or for losses arising from failure to meet delivery requirements, other than the repair, replacement, or refund limited to the original product purchase price. No other warranties, express, implied, or statutory, including warranty of fitness for a particular purpose, apply.

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Editorial Information:

(Date)
Last Updated November 7, 2007 PRELIMINARY

Product Ordering Information:

MRX-009S L - 433 D 600 SW SQ R A - B

Packaging:	B - Bulk TB - Tube TR - Tape and Reel
Antenna:	A - Antenna - No Antenna
Voltage Regulation:	R - Regulated - Not Regulated
Squelched:	SQ - Squelched - Not Squelched
Sweep/Fixed:	SW - Sweep - Fixed
Baud Rate:	600 = 600 bps = 1200 bps
Package:	D - Through-hole S - Surface Mount SC - Surface Mount with Cap
Frequency: (based on module's frequency range)	310 = 310 MHz 315 = 315 MHz 390 = 390 MHz 418 = 418 MHz 433 = 433.92 MHz XXX = Custom Frequency
LNA:	L - Low Noise Amplifier - No Low Noise Amplifier