

RADIO MODULE

MRX-011

UHF AM RECEIVER MODULE

PRELIMINARY

DATA SHEET

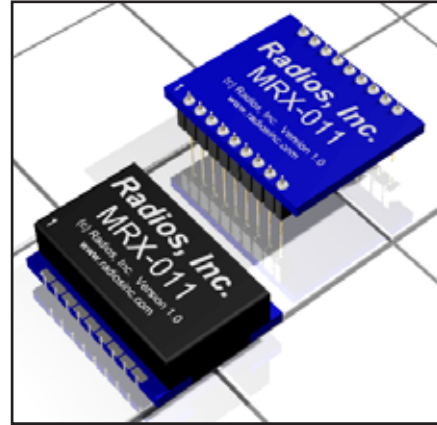
Radios, Inc.

November 7, 2007 Preliminary Data Sheet

MRX-011

UHF AM RECEIVER MODULE

The MRX-011 is an on-off keyed (OOK) high performance receiver for remote wireless applications. The MRX-011 is an enhanced version of the MRX-001. The receiver operates at 315, 390, 418, and 433 MHz and is primarily intended for use in part 15.231 systems. Because all tuning is automatic and the receiver functions are completely integrated, this module is both a highly reliable and low cost solution for high volume wireless applications. An external antenna is the only component required, therefore the MRX-001 can be easily integrated into other applications, which has the benefit of eliminating design and production costs and improving time to market. The MRX-011 is a functional and pin equivalent upgrade to the MRX-001, providing improved range, lower power consumption, and higher data rate support when in FIX mode.



The MRX-011 comes in two versions: FIX and SWP. In FIX mode, the receiver operates like a conventional superheterodyne receiver with an internal local oscillator fixed at a single frequency. The transmit frequency is accurately controlled by a crystal. In SWP mode, the receiver sweeps the internal local oscillator at rates greater than the baseband data rate, which broadens the RF bandwidth and allows the MRX-011 to operate with less expensive transmitters without additional components or tuning. Post-detection data filtering is internal to the receiver, and any one of four bandwidths can be selected by the user. Bandwidths range in binary steps from .625kHz to 5kHz (SWP mode) or 1.25kHz to 10kHz (FIX mode). The MRX-011 is a well-designed receiver suitable for a variety of RF applications, particularly OEM applications.

Key Features

- Low cost
- Wide supply voltage range
- Commonly employed RKE frequencies
- Wide operating temperature range
- Easily integrated
- Typical range over 200 meters with monopole antenna
- Low power consumption
- Compact surface-mount packages
- 5V operation
- Data rates to 2.5 kbps (SWP), 10kbps (FIX)
- Small size
- 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

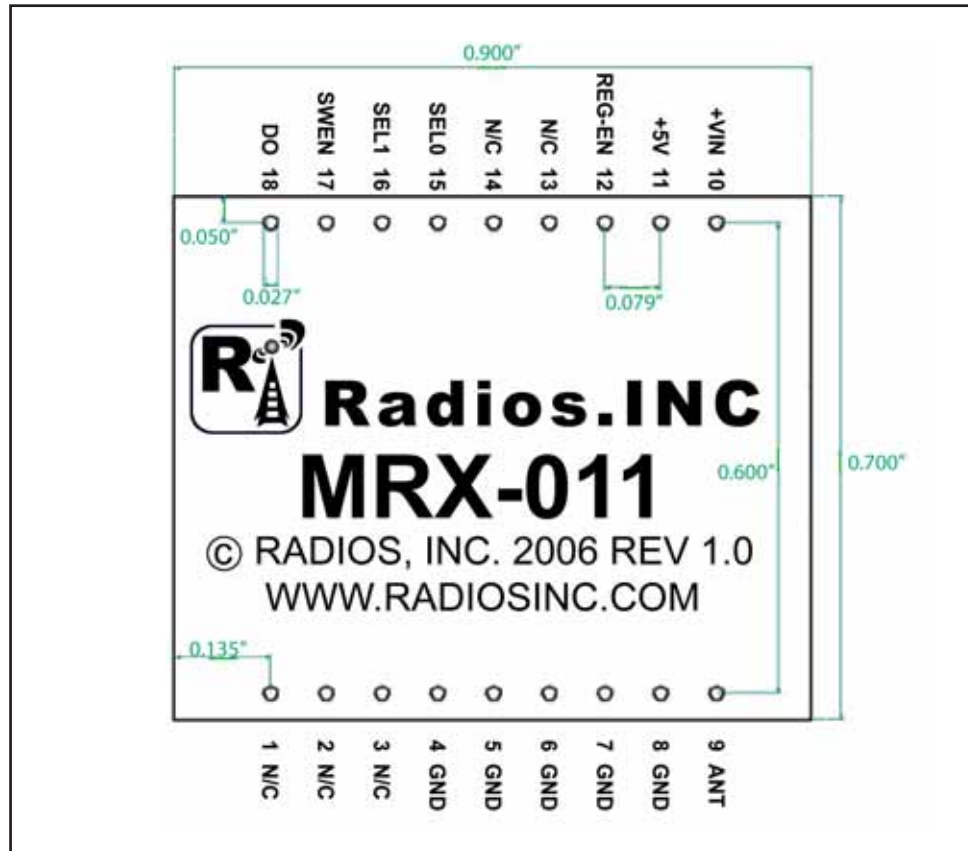
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Mechanical and Pin Diagram DIP Package

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

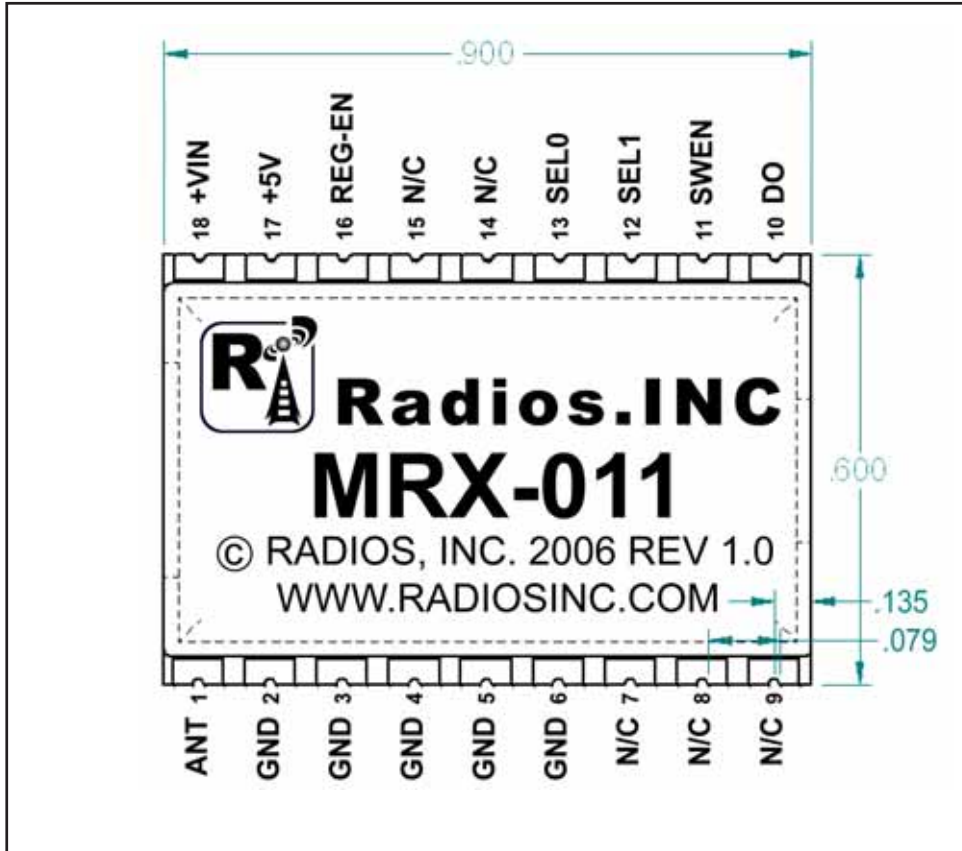
** Verify pin configurations are correct before connecting power or resulting damage may occur.

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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 10 | DO | Data Output (0-5V) |
| Pin 2 | Gnd | Ground | Pin 11 | SWEN | Sweep Enable (0-5V) |
| Pin 3 | Gnd | Ground | Pin 12 | SEL1 | Bandwidth Select Bit 1 (0-5V) |
| Pin 4 | Gnd | Ground | Pin 13 | SEL0 | Bandwidth Select Bit 0 (0-5V) |
| Pin 5 | Gnd | Ground | Pin 14 | N/C | No Connect |
| Pin 6 | Gnd | Ground | Pin 15 | N/C | No Connect |
| Pin 7 | N/C | No Connect | Pin 16 | REG-EN | Regulator Enable (2-VCC) |
| Pin 8 | N/C | No Connect | Pin 17 | +5V | Regulated Output (5V) |
| Pin 9 | N/C | No Connect | Pin 18 | +VIN | Positive Supply Pin (5-16V) |

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

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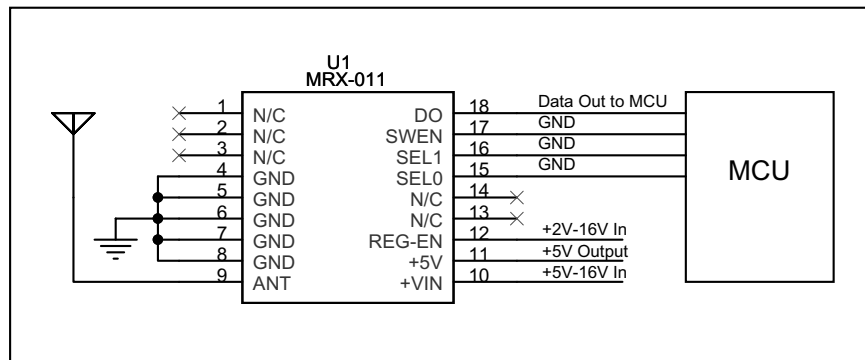
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| Pin Detail | | | |
|-------------|---------------|----------|--|
| Pin Number | | Pin Name | Description |
| DIP | Surface Mount | | |
| 9 | 1 | Ant | This is the receive RF input, internally ac-coupled. Connect this pin to the receive antenna. |
| 4,5,6,7,8 | 2,3,4,5,6 | Gnd | Ground |
| 1,2,3,13,14 | 7,8,9,14,15 | N/C | No Connect |
| 18 | 10 | DO | Output data pin. CMOS level compatible. |
| 17 | 11 | 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. |
| 16 | 12 | SEL1 | Programs desired Demodulator Filter Bandwidth. This pin is internally pulled-up to VCC. See Table 1. |
| 15 | 13 | SEL0 | Programs desired Demodulator Filter Bandwidth. This pin is internally pulled-up to VCC. See Table 1. |
| 12 | 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. |
| 11 | 17 | +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. |
| 10 | 18 | +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 | SEL1 | Sweep Bandwidth (bps) | Fixed Bandwidth (bps) |
| 1 | 1 | 5000 | 10,000 |
| 0 | 1 | 2500 | 5000 |
| 1 | 0 | 1250 | 2500 |
| 0 | 0 | 625 | 1250 |

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

Typical Application Schematic



MRX-011, 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 | Ta=25°C; 433.92 MHz | | 2 | | mA |
| Quiescent Current | REG-EN <= 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, 2 | | -103 | | dBm |
| IF Bandwidth | Note 3 | | 0.43 | | MHz |
| Receive Data Rate | | 0.1 | | 10 | kbps |
| RF Input Range | | 300 | | 440 | MHz |
| Maximum Receiver Input | Rs = 50Ω | | -20 | | dBm |
| Spurious Reverse Isolation | ANT pin, Rs = 50Ω Note 2 | | 30 | | µVrms |
| AGC Attack / Decay ratio | T(Attack) / T(Decay) | | 0.1 | | |
| Oscillator Turn-on Time | | | TBD | | s |
| Digital Section | | | | | |
| Output Current | DO pin, Push-Pull | | 10 | | µA |
| Output High Voltage | DO pin, I _{out} = 1µA | 0.9VCC | | | V |
| Output Low Voltage | DO pin, I _{out} = 1µA | | | 0.1VCC | V |
| Output Tr, Tf | DO pin, Cload=15pF | | | 10 | 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.

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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.

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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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