

# RCR-XXX-HP

Low cost 315/418/433.92 MHz Super-Het ASK/OOK Receiver

# **Typical Applications**

- Remote Keyless Entry (RKE)
- Remote Lighting Controls
- On-Site Paging
- Asset Tracking
- Wireless Alarm and Security Systems
- Long Range RFID
- Automated Resource Management

#### Features

- Low Cost
- 150kHz receiving bandwidth
- 5V operation
- 4.5mA current drain
- No External Parts are required
- Small Size: 1.98" x 0.72"
- 4800 baud operation



### Description

The RCR-XXX-HP is ideal for remote control applications where low cost and longer range are required. The receiver module requires no external RF components except for the antenna. It generates virtually no emissions, making FCC and ETSI approvals easy.

The super-heterodyne design exhibits exceptional sensitivity and selectivity. A SAW filter can be added to the antenna input to improve selectivity for applications that require robust performance.

The manufacturing-friendly SIP style package and low-cost make the

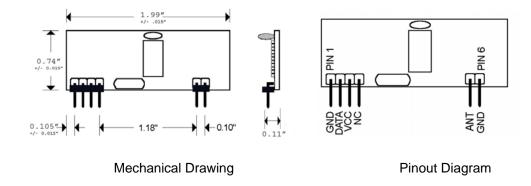
RCR-433-HP suitable for high volume applications.

### **Document Control**

| Created By                  | Steve Montgomery | 5/21/01 |
|-----------------------------|------------------|---------|
| <b>Engineering Review</b>   |                  |         |
| Marketing Review            |                  |         |
| Approved - Engineering      |                  |         |
| <b>Approved - Marketing</b> |                  |         |

# **Revision History**

| Revision | Author | Date     | Description      |
|----------|--------|----------|------------------|
| 1.0      | SJM    | 5/21/01  | Document Created |
| 1.1      | GWH    | 7/29/03  | Updated.         |
| 1.2      | SJM    | 11/22/04 | Updated          |
|          |        |          |                  |
|          |        |          |                  |
|          |        |          |                  |
|          |        |          |                  |



Notes:

1). When designing products with the module, the designer should account for tolerances in the dimensions of the circuit board.

2). Component location and spacing are subject to change. The designer should not place any components inside the footprint of the module.

# Absolute Maximum Ratings

| Rating                          | Value       | Units |
|---------------------------------|-------------|-------|
| Power Supply and All Input Pins | -0.3 to +12 | VDC   |
| Storage Temperature             | -50 to +100 | °C    |
| Soldering Temperature (10 sec)  | 350         | °C    |

# **Electrical Characteristics**

| Characteristic                      | Symbol           | Min  | Тур    | Max  | Units | Notes      |
|-------------------------------------|------------------|------|--------|------|-------|------------|
| Operating Voltage                   | V <sub>cc</sub>  | 4.5  | 5.0    | 5.5  | VDC   | None       |
| Operating Current                   | I <sub>cc</sub>  |      | 4.5    |      | MA    | None       |
| Reception Bandwidth                 | BW <sub>rx</sub> |      | 150    |      | KHz   | None       |
|                                     | F <sub>c</sub>   |      | 315    |      | MHz   | RCR-315-HP |
| Center Frequency                    | F <sub>c</sub>   |      | 418    |      | MHz   | RCR-418-HP |
|                                     | F <sub>c</sub>   |      | 433.92 |      | MHz   | RCR-433-HP |
| Sensitivity                         | None             |      | -109   |      | dBm   | None       |
| Baud Rate – NRZ                     | None             | 1200 |        | 4800 | bps   | None       |
| Baud Rate – PWM                     | None             | 120  |        | 2400 | Bps   | None       |
| Audio Bandwidth BW <sub>audio</sub> |                  | .15  |        | 2.8  | KHz   | None       |
| Selectivity                         | None             | TBD  |        | TBD  | TBD   |            |
| Operating Temperature               | T <sub>op</sub>  | -20  |        | +70  | ٥°    | TBD        |

#### RCR-XXX-HP Super-Het ASK/OOK Receiver

### Pin Description

| Pin | Name                 | Description   |
|-----|----------------------|---|
| 1   | GND                  | Receiver Ground. Connect to ground plane.   |
| 2   | DATA                 | Digital data output. This output is capable of driving one TTL or CMOS load. It is a CMOS compatible output.  |
| 3   | V <sub>cc</sub> (5v) | Provides operating voltage for the receiver. VCC should be bypassed with a $.01\mu$ F ceramic capacitor and filtered with a $4.7\mu$ F tantalum capacitor. Noise on the power supply will degrade receiver sensitivity. |
| 4   | NC                   | Do Not Connect.   |
| 5   | ANT                  | 50 Ω antenna input.   |
| 6   | GND                  | Receiver Ground. Connect to ground plane.   |

### Theory of Operation

#### Super-Heterodyne AM Detection

The RCR-XXX-HP is a super-heterodyne AM receiver with a built-in data slicer. The incoming AM carrier is amplified and downconverted to an intermediate frequency (IF) of 10.7MHz. This IF is filtered using a ceramic bandpass filter with a 150kHz 3dB bandwidth.

The output of the IF filter is then amplified and demodulated using diode detector. The output of the diode detector is the demodulated AM envelope of the carrier. This signal is applied to the data slicer to generate the TTL/CMOS output.

#### Data Slicer

The data slicer converts the baseband analog signal from the diode detector to a CMOS/TTL compatible output. Because the data slicer is AC coupled to the audio output, there is a minimum data rate. AC coupling also limits the minimum and maximum pulse width. Typically, data is encoded on the transmit side using pulse-width modulation (PWM) or non-return-to zero (NRZ).

The most common source for NRZ data is from a UART embedded in a micro-controller. Applications that use NRZ data encoding typically involve microcontrollers. Refer to the RCR-XXX-HP designer's guide for more information on using NRZ data encoding.

The most common source for PWM data is from a remote control IC such as the HC-12E from Holtek.

Data is sent as a constant rate square-wave. The duty cycle of that square wave will generally be either 33% (a zero) or 66% (a one). The data slicer on the RCR-XXX-HP is optimized for use with PWM encoded data, though it will work with NRZ data if certain encoding rules are followed. The data slicer is designed to drive one(1) TTL or CMOS load. A buffer must be used if the data output is going to drive more than one TTL/CMOS load or if the load is a lower-impedence (<100K).

#### **Power Supply**

The RCR-XXX-HP is designed to operate from a 5V power supply. It is crucial that this power supply be very quiet. The power supply should be bypassed using a 0.01uF low-ESR ceramic capacitor and a 4.7 $\mu$ F tantalum capacitor. These capacitors should be placed as close to the power pins as possible. The RCR-XXX-HP is designed for continuous duty operation. From the time power is applied, it can take up to 100mSec for the data output to become valid.

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#### Antenna Input

Pin 1 is a 50 ohm antenna input. It will support most antenna types, including printed antennas integrated directly onto the PCB.

If a trace is longer than  $1/8^{th}$  the wavelength of the frequency it is carrying, it should be a 50 ohm microstrip.

### **Ordering Information**

| PRODUCT    | ORDER CODE |
|------------|------------|
| RCR-315-HP | RCR-315-HP |
| RCR-418-HP | RCR-418-HP |
| RCR-433-HP | RCR-433-HP |

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