Revision

1.1.0

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RoHs Compliant

RCT-433-UTR
DATASHEET

RADIOTRONIX, INC.

RCT-433-UTR DATASHEET

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Chapter 1

1. Description

The RCT-433-UTR is ideal for remote control applications, where low cost and longer range is required. The transmitter operates from a 3-12V supply, making it ideal for battery-powered applications. The transmitter employs a SAW-stabilized oscillator, ensuring accurate frequency control for best range performance. Output power and harmonic emissions are easy to control, making FCC and ETSI compliance easy. The manufacturing-friendly tape-and-reel packaging and low cost make the RCT-433-UTR suitable for high volume applications.

Important: RCT-433-UTR is RoHS Compliant!

1.1. Features

- 433.92 MHz Versions
- Low Cost
- 3 – 12 V Operation
- Small Size
- 0 dBm Output Power at 3 V
- 4800 Baud Operation

1.2. Applications

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

Chapter 2

2. Theory of Operation

2.1. OOK Modulation

OOK modulation is a binary form of amplitude modulation. When a logical 0 (data line low) is being sent, the transmitter is off, fully suppressing the carrier. In this state, the transmitter current is very low, less than 1mA. When a logical 1 is being sent, the carrier is fully on. In this state, the module current consumption is at its highest, about 4.5mA with a 3V power supply.

OOK is the modulation method of choice for remote control applications where power consumption and cost are the primary factors. Because OOK transmitters draw no power when they transmit a 0, they exhibit significantly better power consumption than FSK transmitters.

OOK data rate is limited by the start-up time of the oscillator. High-Q oscillators which have very stable center frequencies take longer to start-up than low-Q oscillators. The start-up time of the oscillator determines the maximum data rate that the transmitter can send.

Design Hint (Using the RCT-433-UTR with a microcontroller UART*)*: Data should be inverted when using the transmitter with a UART. The normal marking state of a UART is a logic 1, which will cause constant transmission. By inverting the data, the transmitter will be off in a marking state and on in a spacing state (logical 0), ensuring that the transmitter is on only when data is being sent. The output of the receiver would also need to be inverted to properly recover data.

2.1.1. SAW Stabilized Oscillator

The transmitter is basically a negative resistance LC oscillator whose center frequency is tightly controlled by a SAW resonator. SAW (Surface Acoustic Wave) resonators are fundamental frequency devices that resonate at frequencies much higher than crystals. The output of the oscillator is derived directly from the collector of the oscillator transistor. It is, therefore, very sensitive to VSWR. The module is designed to work with a 50 ohm load, which exhibits a VSWR of 1. The designer must ensure that the antenna exhibits no more than a VSWR of 2 to guarantee operation. This is particularly true for PCB trace antennas. If the module does not appear to have any output at the antenna port, it is likely that the antenna does not meet this requirement.

Troubleshooting Hint: If the module appears to have no output at the antenna port, try the following: disconnect the antenna and put a 1000pF cap in series with a 51 ohm resistor to ground. This will ensure that the transmitter is properly loaded. Then look at the output with a scope and you should see the oscillator working. If it is working, the antenna is not properly tuned and that is the reason that the module is not working properly. If not, then check the power supply and data input for proper voltage levels.

2.1.2. Data Rate

The oscillator start-up time is on the order of 40uSec, which limits the maximum data rate to 4.8 kbit/sec.

Troubleshooting Hint: If the module appears to have a good output, but your data rate is corrupted, that could be a sign that the start-up time of the oscillator is too long. The load on the antenna affects oscillator start-up time. To determine the start-up time of the oscillator, use a 2 channel digital storage oscilloscope. Attach channel 1 to the data input and channel 2 to the antenna output (don't worry; it won't affect the antenna VSWR). Trigger the scope on a rising edge on channel 1. Now, toggle the data pin from low to high and capture the resulting waveform. You should see a square edge on channel 1 and the oscillator ring-up on channel 2. Measure the time between the rising edge on channel 1 and when the oscillator waveform is at its full voltage swing, and you have the start-up time. To determine if the antenna is the problem, remove it and place a 1000pF cap in series with a 51-ohm resistor to ground and repeat the test. If the start-up time is correct with the test load, the problem is the antenna.

2.1.3. Power Supply

The RCT-433-UTR is designed to operate from a 3 -12V 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 4.7uF ceramic capacitor. These capacitors should be placed as close to the power pins as possible.

2.1.4. Antenna Output

Pin 1 is a 50 ohm antenna output. It will support most antenna types, including printed antennas integrated directly onto the PCB. The performance of the different antennas varies. There are many good application notes available that describe external and PCB trace antennas. We maintain a list in the technical support section of our website.

Design Hint (Antenna traces): Any time a trace is longer than 1/8th the wavelength of the frequency it is carrying, it should be a 50 ohm micro strip. This ensures that a proper match is maintained between the transmitter output and the antenna.

Design Hint (Harmonic Filters): The impedance at the antenna power affects the VSWR, power output, and harmonic output of the transmitter. In most cases, the output of the transmitter may need a low-pass LC filter to reduce harmonic emissions. A good calculator is available on line at http://www-users.cs.york.ac.uk/~fisher/lcfilter/. Calculate the filter for a 3dB cut-off of the module's center frequency plus 10%. For example, the cut-off for a 433.92 MHz module would be about 470 MHz.

Design Hint (T-Pad): The RCT-433-UTR transmitter can be sensitive to unbalanced or unmatched loads and could fail to operate or operate intermittently in this condition. Try to match your antenna load as close to 50 ohms as possible. Use a T-pad if necessary to give the transmitter a close 50 ohm match before your antenna. A T-pad will also act as an attenuator. See figure 6 below, for a T-pad match/attenuator circuit.

Chapter

3

3. Pin Out Diagram

3.1. Pin Description

PIN NO.	PIN NAME
1	ANT
2	GND
3	DATA
4	VCC

Table 1, Pin Descriptions

3.2. Mechanical Drawings

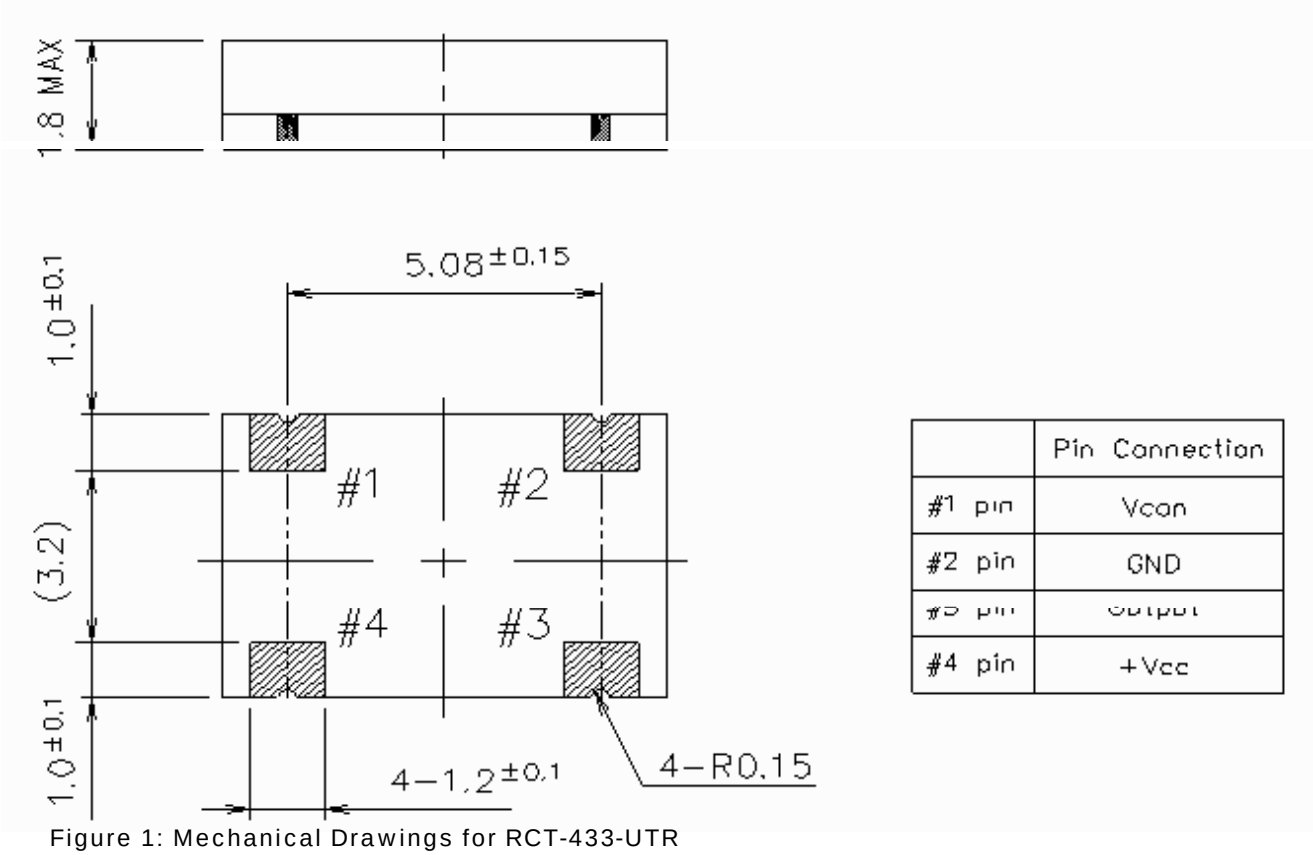

Figure 1: Mechanical Drawings for RCT-433-UTR

3.3. Pin Identification

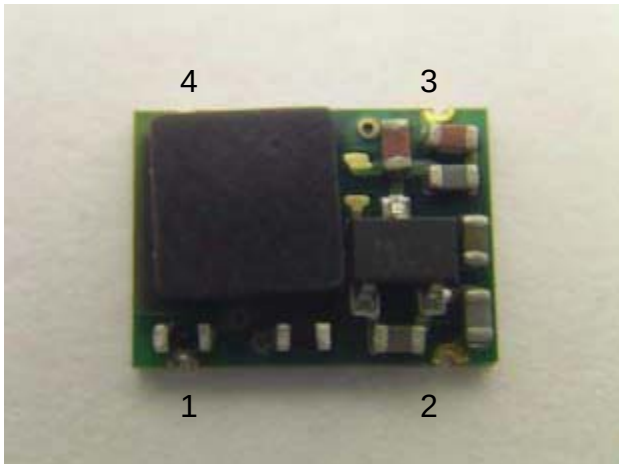

Figure 2: Pin Identification

3.4. Typing Test Circuit

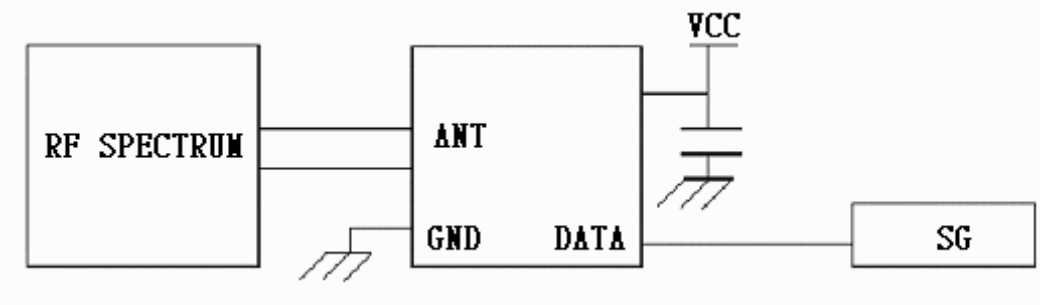

Figure 3: Typing Test Circuit

3.5. Typical Transmitter Application

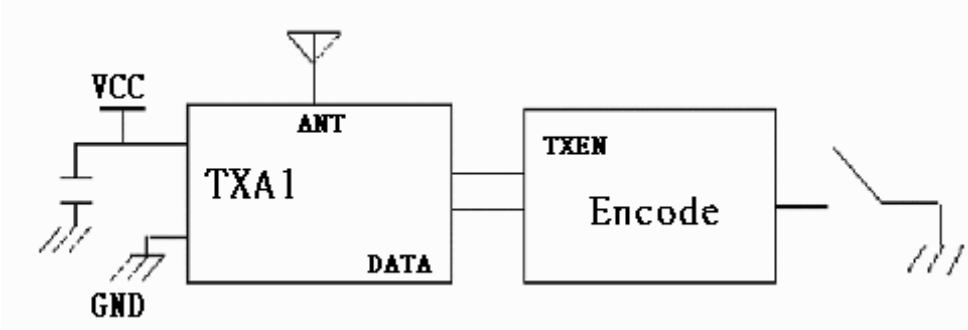

Figure 4: Typical Transmitter Application

Notes: (1) Encoder: HT12D/F, PTC (2262) (2) Antenna : Length = 17.2cm for 433MHz

3.6. Part Orientation

3.6.1. Tape and Reel

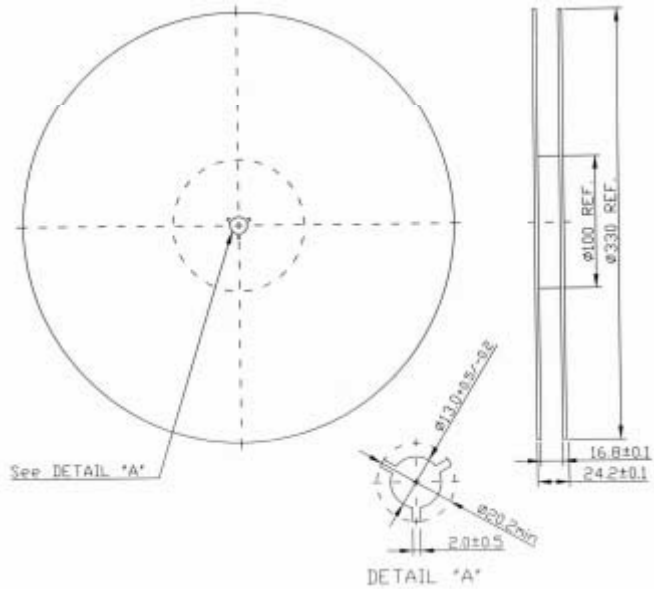

Figure 5: Part Orientation

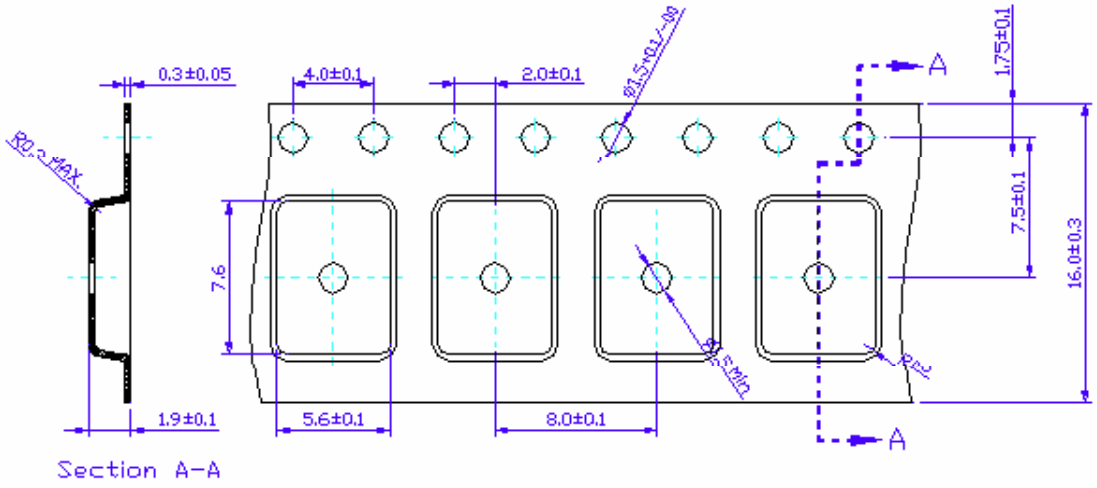

Figure 6: Tape and Reels

Notes: (1) Unit: mm. (2) Unless otherwise specified tolerance on dim. +/- 0.1mm. (3) Material: conductive polystyrene. (4) Color: black (5) 10 Pitch Cumulative Tolerance +/- 0.2mm.

Chapter 4

4. Reflow Profile

Steps are: First, preheating shall be fixed at 140 – 160 degrees Celsius for 60 - 90 seconds. Then ascending time to preheating temperature 150 degrees Celsius shall be 30 seconds minimum. Last, heating shall be fixed at 200 degrees Celsius for 50 – 60 seconds and at 230 +/-10 degrees Celsius.

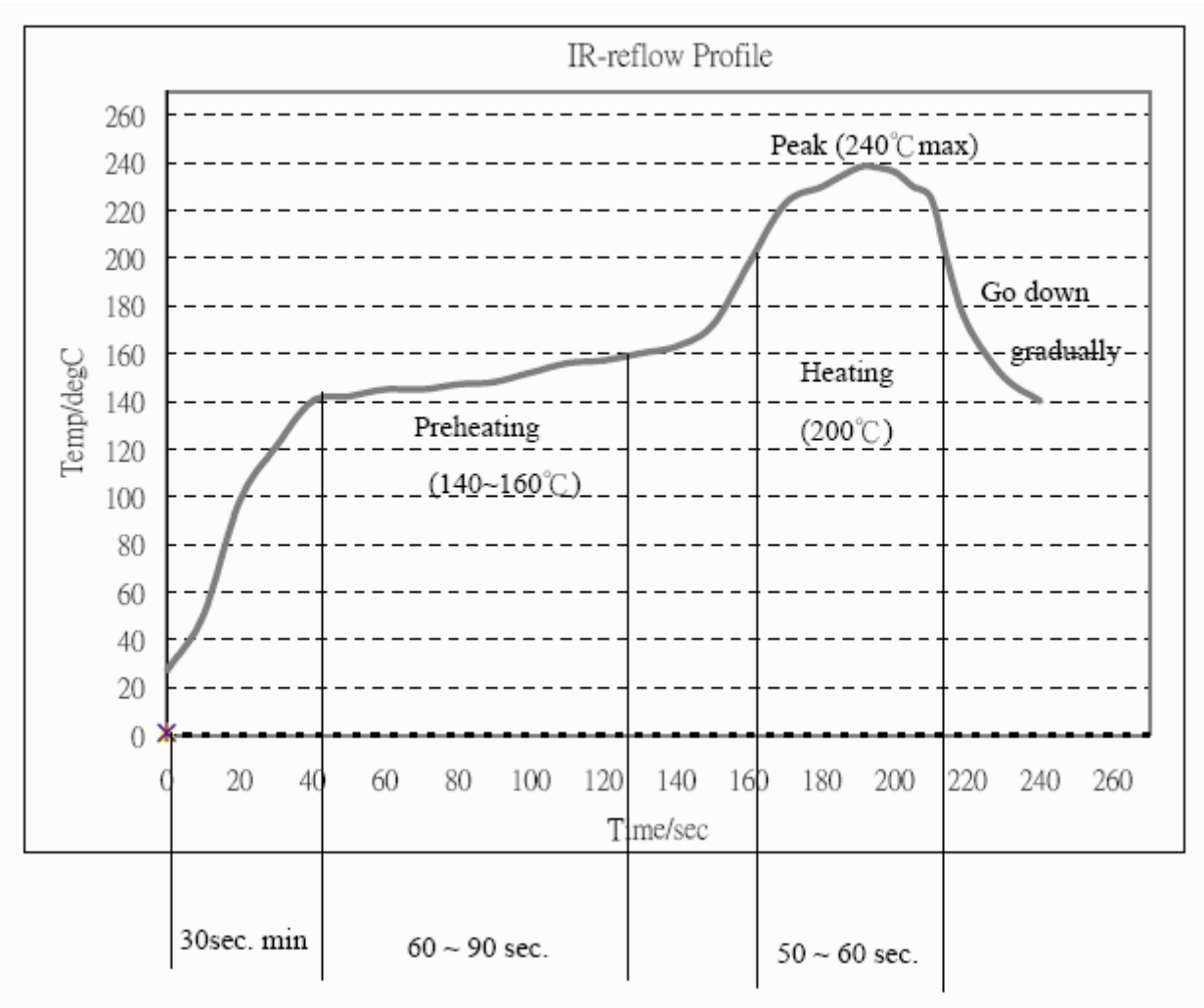

Table 2, Reflow Profile

Chapter 5

5. Electrical Specifications

5.1. Absolute Maximum Ratings

Parameter	Min	Max	Units
Power Suppy and All Input Pins	-0.3	+15	VDC
Storage Temperature	-50	100	^{o}C
Operating Temperature	-40	+85	^{o}C

Table 3, Absolute Maximum Ratings

5.2. Detailed Electrical Specifications

Parameter (General)	Symbol	Min	Typ	Max	Units	Notes
Operating Voltage	V_{CC}	3.0		12	Volts DC	
Modulation			ASK/OOK			
Power Consumption		8	10	12	mA	@ 12V
Frequency Accuracy	TOL_{fc}	-120		+120	kHz	
Center Frequency	F_C		433		MHz	RCT-433-UTR
Output Power		9	10	12	dBm	@ 12V/ Data: 3V
Data Rate		1		3	kHz	

Table 4, Detailed Electrical Specifications

Chapter 6

6. Custom Applications

For cost-sensitive applications, such as wireless sensors and AMR, Radiotronix can embed the application software directly into the microcontroller built into the module. For more information on this service, please contact Radiotronix.

Chapter 7

7. Ordering Information

Product Part Number	Description
RCT-433-UTR	ASK/ OOK RF Transmitter (433 MHz)

7.1. Contact Information

Corporate Headquarters:
905 Messenger Lane
Moore, Oklahoma 73160
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website: www.radiotronix.com
support: support@radiotronix.com

7.1.1. Technical Support

Radiotronix has built a solid technical support infrastructure so that you can get answers to your questions when you need them. Our primary technical support tools are the support forum and knowledge base found on our website. We are continuously updating these tools. To find the latest information about these technical support tools, please visit http://www.radiotronix.com/support. Our technical support engineers are available Mon-Fri between 9:00 am and 5:00 pm central standard time. The best way to reach a technical support engineer is to submit a Webcase. Webcase submissions can be made at http://www.radiotronix.com/support/webcase.asp. For customers that would prefer to talk directly to a support engineer, we do offer phone support free of charge.

7.1.2. Sales Support

Our sales department can be reached via e-mail at sales@radiotronix.com or by phone at 405-794-7730. Our sales department is available Mon-Fri between 8:30 am and 5:00 pm central standard time. Visit our web site at http://www.radiotronix.com/corpsales.asp for information on where to buy our products.

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