

UHF Narrow band radio data module

CDP-TX-05M-R 434/869 MHz

CDP-RX-05M-R 434/869 MHz



Operation Guide

Version 4.1 (Nov. 2018)

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CONTENTS

| | |
|--|----|
| GENERAL DESCRIPTION & FEATURES..... | 3 |
| SPECIFICATIONS..... | 4 |
| PIN DESCRIPTION..... | 6 |
| OPERATING INSTRUCTIONS..... | 8 |
| BLOCK DIAGRAM | 10 |
| DIMENSIONS..... | 12 |
| TEST DATA | 14 |
| REGULATORY COMPLIANCE INFORMATION..... | 15 |
| IMPORTANT NOTICE | 16 |
| CAUTIONS..... | 16 |
| WARNINGS..... | 16 |

GENERAL DESCRIPTION & FEATURES

Features

- Low power narrow band FSK - 25 kHz channel spacing
- Preprogrammed 4 RF channels
- Low voltage operation
- Wide operating temperature range (-20°C to +65 °C) / TCXO built in
- High receiver sensitivity for long range applications - 600 m or more at line of sight
- High reliability for industrial applications - robust metal housing, high selectivity and shock resistance
- Compact size
- RSSI (Received Signal Strength) output
- RoHS / RED compliant

Applications

- Industrial remote control
- Security / Alarms
- Telemetry / Monitoring systems
- Tracking systems

General description

The CDP-TX-05M-R and CDP-RX-05M-R are low power narrow band FSK transmitter and receiver modules and include nearly all the parts necessary for industrial-use radio transmission in a small and robust shielding case. The RF channel is fixed but selectable within 4 preprogrammed channels.

Using a TCXO as the reference oscillator circuit of the radio component ensures high frequency stability and a wide operating temperature range from -20°C to +65°C.

The double superheterodyne receiver with high receiver sensitivity provides stable and long range communication.

The frequency table can be customized according to the customer's requirement.

SPECIFICATIONS

All ratings at 25°C +/- 5°C unless otherwise noted

General

| Item | Specification | | | |
|--|---|------------|------------|------------|
| | 434MHz | 869MHz A | 869MHz B | |
| Applicable standard | EN 300 220 | | | |
| Communication form | One way | | | |
| Oscillation system | Crystal based PLL oscillation | | | |
| Number of channels | 4 | | | |
| Frequencies [MHz] | CH 3* | 434.0750 * | 869.7500 * | 868.6625 * |
| | CH 2 | 433.9200 | 868.3000 | 869.2125 |
| | CH 1 | 434.6000 | 869.8000 | 869.2750 |
| | CH 0 | 434.7000 | 869.9250 | 869.3625 |
| * Factory default frequency channel setting. For frequency setting, the internal Jumper 1 and 2 are used. (For details, refer to PIN DESCRIPTION) | | | | |
| Frequency stability | < +/- 2.5 ppm (-10 to + 60 °C, reference frequency = 25 °C) | | | |
| Aging rate | < +/- 1 ppm / Year | | | |
| Initial frequency tolerance at delivery | < +/- 1.5 ppm (within 1 year after the final adjustment) | | | |
| Pulse width | 208 us - 20 ms | | | |
| Data rate (FSK) | 100 - 4,800 bps | | | |
| Operating temp. range | -20 °C to + 65 °C | | | |

CDP-TX-05M-R Transmitter

| Item | Specification | | |
|-----------------------------------|---|-----------|----------|
| | 434MHz | 869MHz A | 869MHz B |
| RF output power (e.r.p., 50 ohms) | 10 mW | 5 mW | |
| Transmitter start up time | < 20 ms | | |
| Modulation | FM narrow | | |
| Modulation polarity | Positive | | |
| Deviation | +/- 3 kHz | | |
| Spurious emission | < 862 MHz | < -54 dBm | |
| | 862MHz-1GHz | < -36 dBm | |
| | > 1GHz | < -30 dBm | |
| Adjacent channel power | < -37 dBm (200 nW) (4800PN code CH=25kHz) | | |
| Supply voltage | 2.2 to 5.5 V | | |
| Supply current (Typ. at 3.0V) | 20 mA | 16.5 mA | |
| I/O terminals | RFout, Gnd, Vcc, Datain | | |
| Dimension | 22 x 12 x 6 mm 1.6cc | | |
| Weight | 3 g | | |

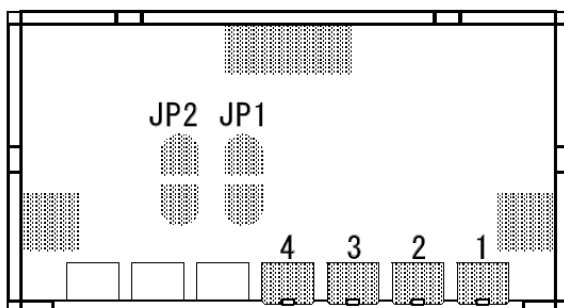
CDP-RX-05M-R Receiver

| Item | Specification | | |
|--|---|----------|----------|
| | 434MHz | 869MHz A | 869MHz B |
| Demodulation | FM Narrow | | |
| Sensitivity (12dB/SINAD at CCITT filter) | -120 dBm | -116 dBm | |
| Sensitivity (BER <0.1 %) | -115 dBm | -111 dBm | |
| Selectivity | +/-5 kHz at -6 dB point | | |
| Adjacent CH selectivity | 45 dB | | |
| Spurious radiations | < -60 dBm | | |
| Distortion (AF output) | < 5 % at 1 kHz | | |
| S/N ratio (AF output) | 45 dB | 40 dB | |
| AF Output level (Fm=1KHz) | -10.5 dBm (Fmod=+/- 3 KHz) | | |
| Data output | Digital output, pulled up to Vcc (22 k ohm) | | |
| Other outputs | RSSI, AF | | |
| Supply Voltage | 3.0 to 14 V DC | | |
| Supply current (Typ. at 3.0V) | 28 mA | | |
| I/O terminals | Ant, Gnd, Vcc, Dataout, AFout, RSSIout, Power Control | | |
| Dimensions | 36 X 26 X 8 mm 7.5cc | | |
| Weight | 13 g | | |

PIN DESCRIPTION

CDP-TX-05M-R Transmitter

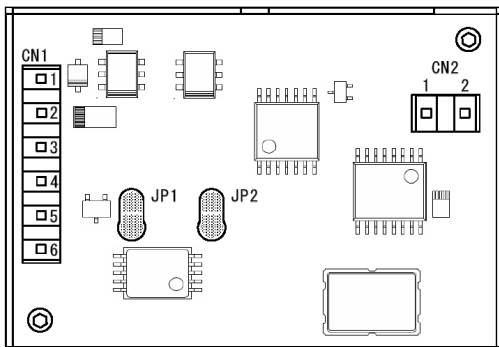
| Pin-No. | Pin-Name | I/O | Description | Equivalent internal circuit |
|---------|----------|-----|---|-----------------------------|
| 1 | RFOUT | O | Z=50 ohm The RF output power is 10 mW for 434 MHz and 5 mW for 869 MHz. 1/4 lambda whip antenna is recommended. The antenna length is 17.3 cm for 434 MHz and 8.6 cm for 869 MHz. | |
| 2 | GND | - | The ground Please connect to the widest GND on the PCB. | |
| 3 | VCC | - | The power supply terminal Operates on DC 2.2 V to 5.5 V. If the voltage becomes lower than 2.2 V, RF characteristics such as frequency stability will be affected. | |
| 4 | DATAIN | I | The data input terminal Digital input. Hi level = VCC Lo level = 0V Stable transmission will be obtained 20 ms (max.) after VCC is fed to the terminal. The maximum time for continuous High or Low signals must be within 20 ms. When this pin is open, the frequency has an offset drift. Once a standard code such as 511PNCODE has been input, the frequency will be within specifications. | |
| | JP1/JP2 | I | Solder jumpers for frequency channel setting. This terminal is pulled-up to the VCC. Ch3 (JP1-Open JP2-Open) Ch2 (JP1-Short JP2-Open) Ch1 (JP1-Open JP2-Short) Ch0 (JP1-Short JP2-Short) | |



CDP-TX-05M-R

CDP-RX-05M-R Receiver

| Pin-No. | Pin-Name | I/O | Description | Equivalent internal circuit |
|---------|----------|-----|---|-----------------------------|
| CN1-1 | DATA | O | The data signal output The terminal is pulled up with a resistor. | |
| CN1-2 | AF | O | The AF signal output terminal The signal output level is -10.5dBm typ. (Fm=1 kHz /Fmod=+/-3 kHz, 100 k ohm) | |
| CN1-3 | RSSI | O | The receiving level output The level indicates the strength of RF level. | |
| CN1-4 | CTRL | I | The power on/off control terminal (Low active). A voltage of Vcc - 1.8 V or lower voltage makes the circuit active. Please control this terminal with an open-collector or open-drain output. | |
| CN1-5 | VCC | - | The power supply terminal Operates on 3.0 to 14 V. | |
| CN1-6 | GND | - | The ground. Connect to the ground of the control board. | |
| CN2-1 | ANT | - | The antenna terminal Connect an antenna with 50 ohm impedance. | |
| CN2-2 | GND | - | The ground terminal for the antenna. | |
| | JP1/JP2 | I | Solder jumpers for frequency channel setting. This terminal is pulled-up to the internal power supply. Ch3 (JP1-Open JP2-Open) Ch2 (JP1-Short JP2-Open) Ch1 (JP1-Open JP2-Short) Ch0 (JP1-Short JP2-Short) | |



CDP-RX-05M-R

OPERATING INSTRUCTIONS

Supply voltage

The CDP-TX-05M-R and CDP-RX-05M-R contain a voltage regulator to guarantee stable performance in the given range of supply voltage. The design was made for operation with a battery. The supply voltage must be within the specified voltage range. The module shows unstable function with a voltage lower than specified

If a higher supply voltage is available, a simple diode can be inserted in the connection line to the Vcc terminal to prevent damage due to incorrect polarity. The diode must be rated for the maximum supply current detailed in the technical specifications.

DATA IN

Digital input. The voltage of the data signal should be between 0 V and Vcc.

When High (Vcc level) is input in DATAIN, High will be output from DO of the CDP-RX-05M-R, and when Low (GND level) is input, Low will be output. DATAIN is pulled-up to the VCC. If the data level is lower or higher than the Vcc level, it can be driven by an open-collector transistor /device.

It is not necessary to synchronize the data signal of the transmitter, but the data signal should be fed to the transmitter 20 ms after the transmitter power is turned on.

Data format

Long intervals of HIGH or LOW bits should be avoided. Succeeding bits can be distorted in their pulse width. If the sequence of HIGH or LOW bits is too long then there is a possibility that the logic level of the data output will change. The maximum pulse width for continuous High and Low signal is 20 ms (96 bits) at 4800 bps. The minimum pulse width is 208 us. Maximum data rate is 4800 bps.

It is good to have a 20bit preamble (1010...) in front of the data to ensure communication reliability.

In general, at higher data rates (4800 Baud) the internal signal is shaped into a slope and jitter at the receiver data output increases.

Further advice can be given if the precise format of the data and system requirements are notified to the dealer or directly to Circuit Design, Inc. Your inquiries and comments are welcome.

Outputs

At the receiver side 3 output (AF, DATA and RSSI) signals and one control terminal are available.

AF output is the analog output from the FM detector circuit.

The DATA output is a digital output. This is the signal after AF signals pass through a band pass filter and comparator. For simple FSK modulation of digital data, the DATA out terminal can be used. The signal can be easily connected to other digital circuits.

The receiver has no internal mute circuit to avoid delays and achieve maximum sensitivity. The AF and DATA output will show noise on the output when no signal is received. Valid data signals can be detected by utilizing the RSSI output.

The third output is called RSSI. It is an indicator of the received signal strength. It can be used to drive an external mute circuit. The control terminal can be used to control Vcc supply for the internal circuit.

Antennas

The most important factors for safe data transmission are a good antenna and RF grounding, both for the transmitter and the receiver. Without an antenna it is impossible to transmit data over a long distance.

The standard antenna is a lambda/4 wire protected by a plastic cover.

The receiver has a simple antenna input pin. Any suitable UHF antenna can be connected to it.

The easiest way to connect an antenna to the CDP-RX-05M-R is to solder a 17.3 / 8.6 cm (434 MHz/869 MHz) wire directly to the antenna input. A 50 ohm coaxial cable can be used to extend the distance between the antenna and the receiver. The shielding of the antenna wire should be soldered to the case near the antenna input of the CDP-RX-05M-R.

It is possible, but not recommended to connect the receiver module and the antenna by a connection on the PCB. This will decrease the receiver performance in most cases.

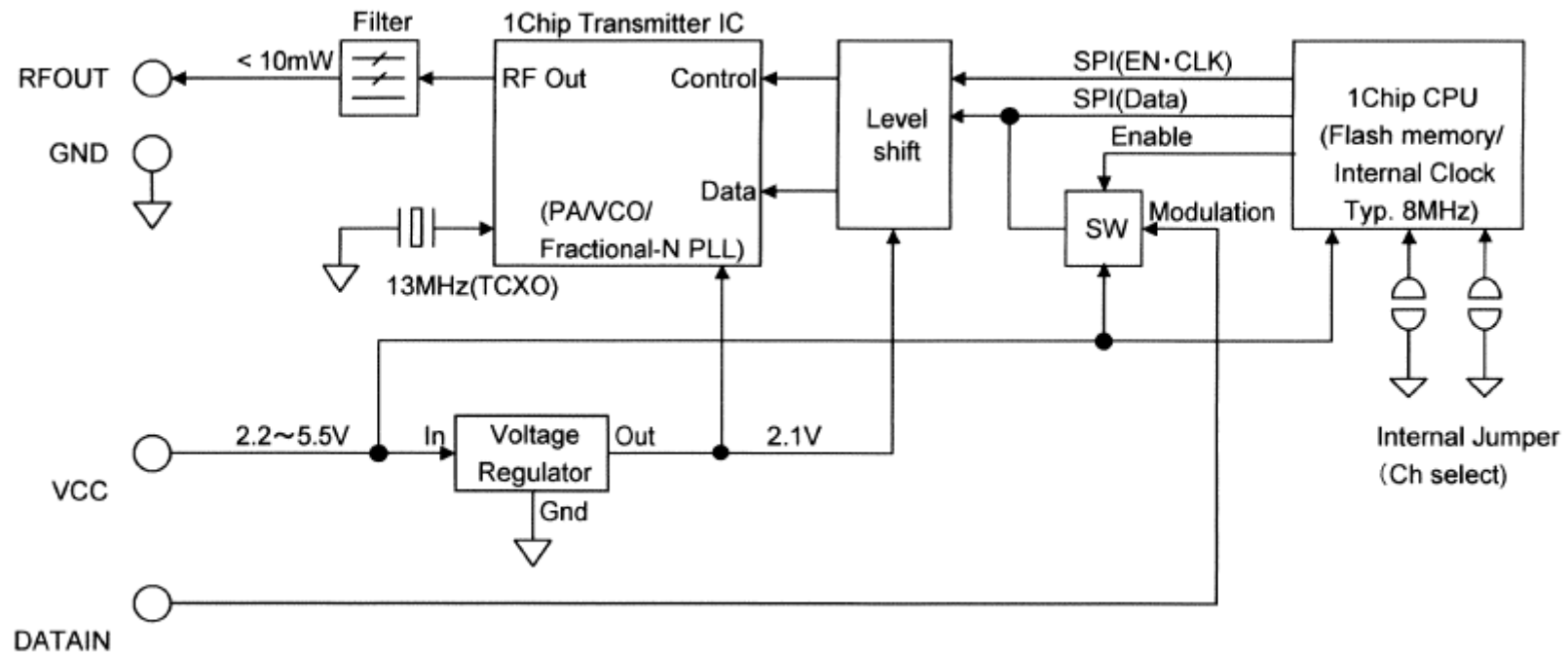
To find the best method of installation for the transmitter and receiver, many things should be considered and tested. It is recommended that you read specialized literature on antennas and radiation characteristics to gain a better understanding of these fields. A detailed explanation cannot be given here.

In most cases the following basic rules will help you.

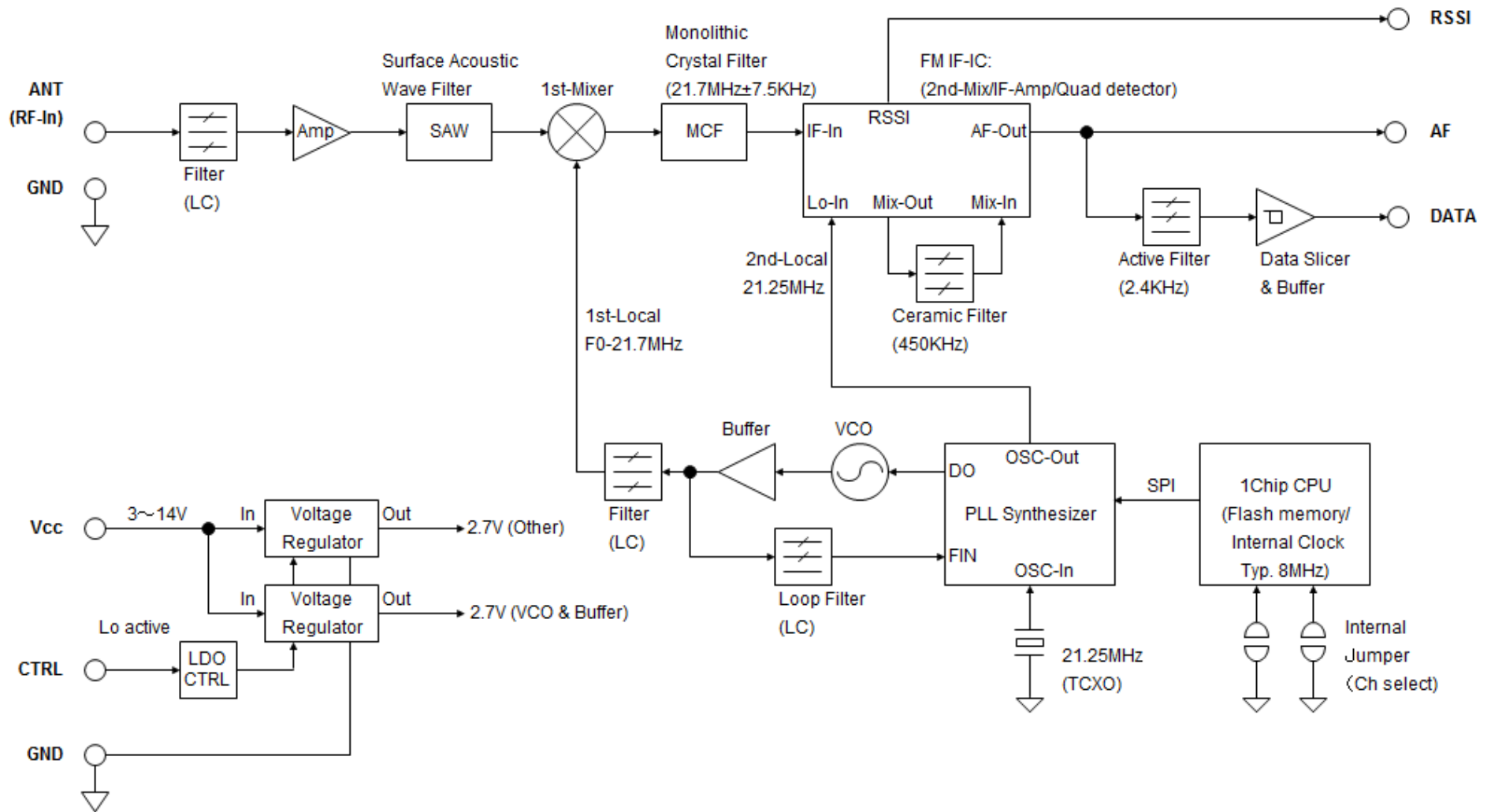
- Connect an antenna with 50 Ohm impedance.
- The easiest construction is a wire of approximately 17.3 cm for 434 MHz and 8.6 cm for 869MHz.
- Place the antenna vertically, straight up or down from the transmitter and receiver module.
- Do not cover the antenna with metal parts.
- The connection of the metal surface of the transmitter and receiver case to a larger metal part (ground plane) will increase radiation and reception efficiency. These metal parts should not be placed near the antenna.
- The best range is achieved if the transmitter and receiver antenna are in direct line of sight. Any object in between the transmitter and receiver antenna, and metallic objects in particular, will decrease the range.
- The transmission is influenced by reflections of the transmitter signal on metallic surfaces. By overlaying the direct and reflected signal with a 180 degree phase shift the signal can almost fade out. These reflections and fade-outs can result in data drop-outs in mobile applications.
- The human body can have a similar effect as metal objects. Pocket transmitters should be held in your hand, held in a position away from the body and pointed in the direction of the receiver.

BLOCK DIAGRAM

<CDP-TX-05M-R>

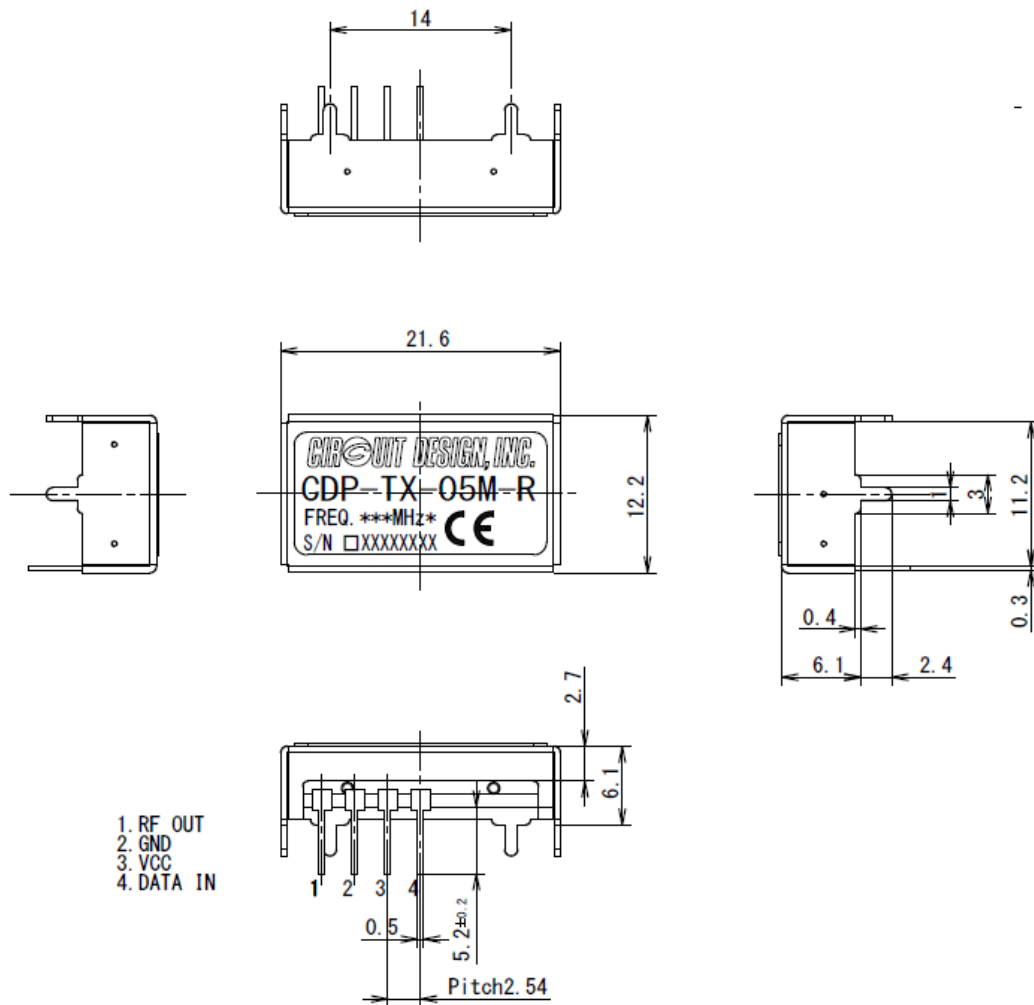


BLOCK DIAGRAM
 <CDP-RX-05M-R>

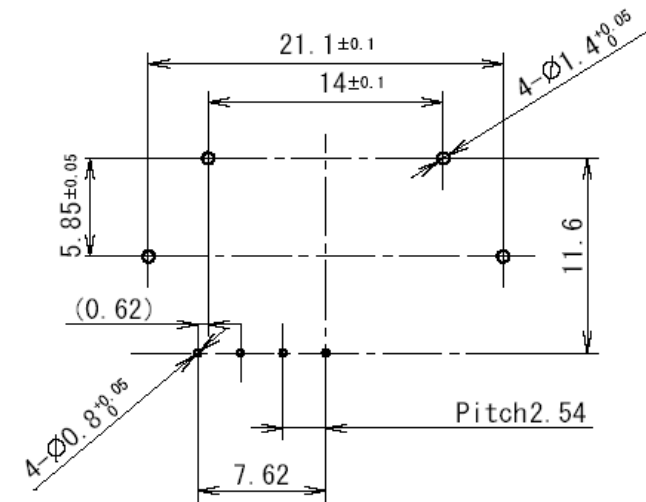


DIMENSIONS

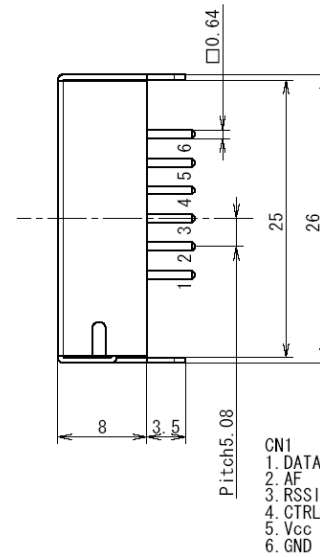
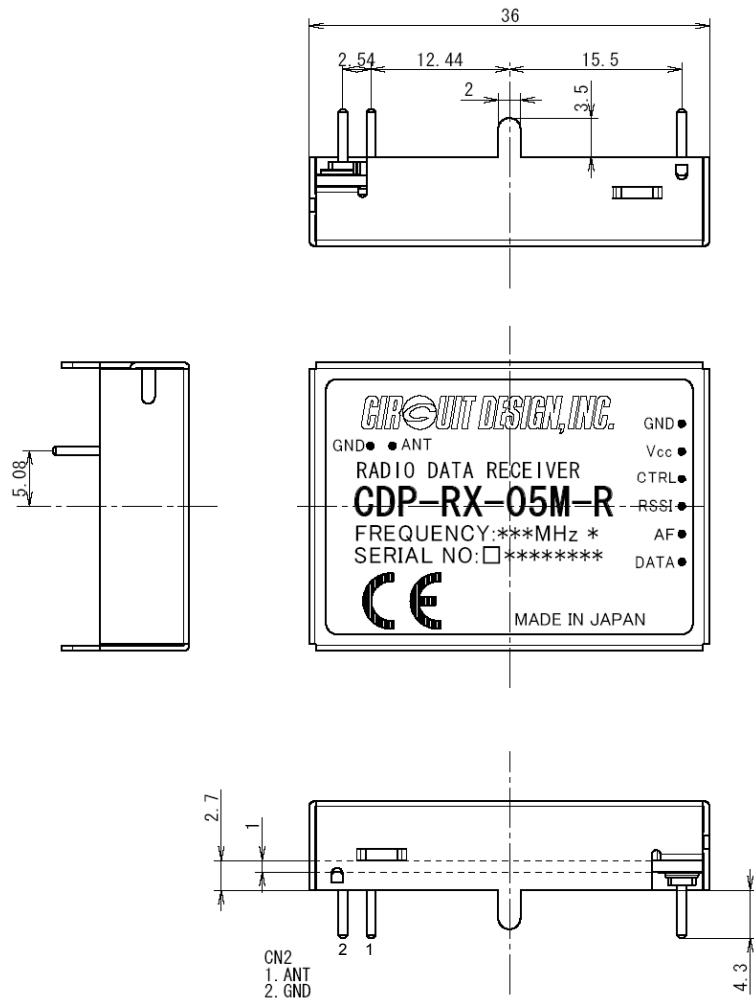
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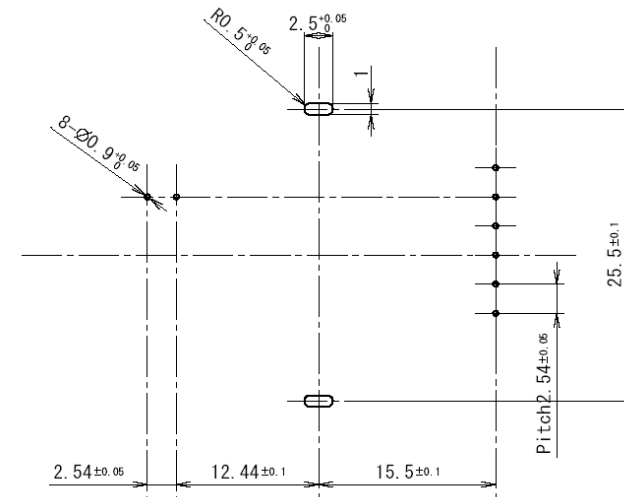
Reference hole position for PCB mounting
(Top view)



DIMENSIONS
<CDP-RX-05M-R>

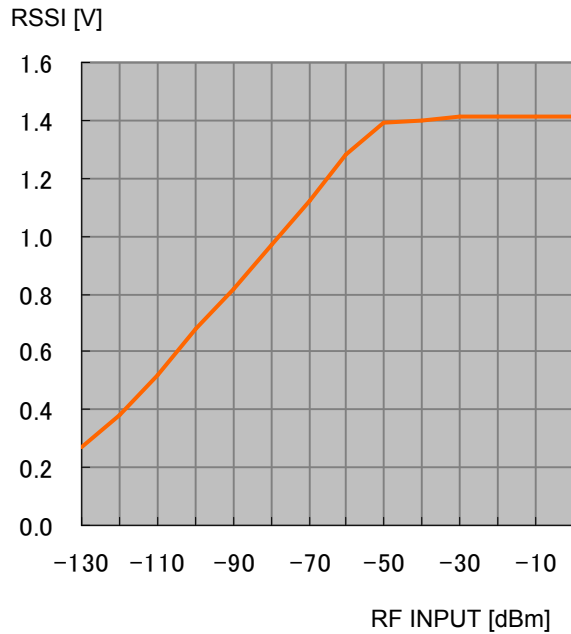


Reference hole position for PCB mounting (Top view)

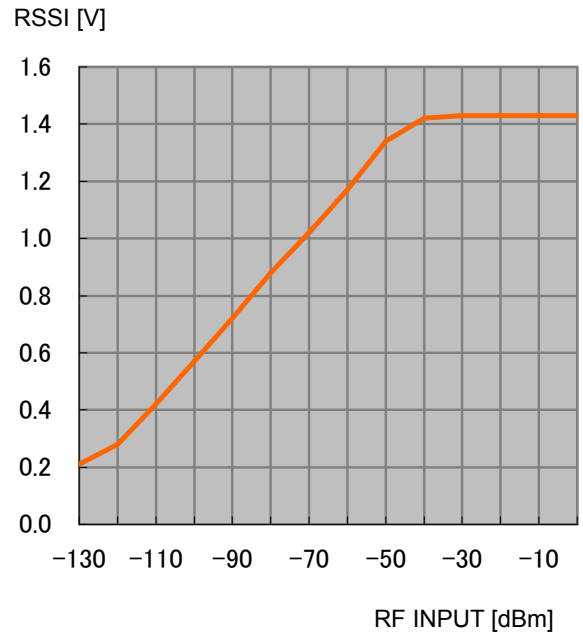


TEST DATA

RSSI rising

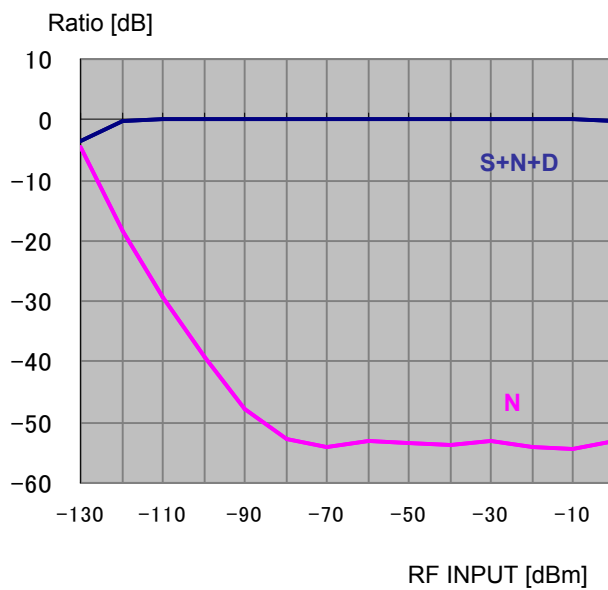


434 MHz

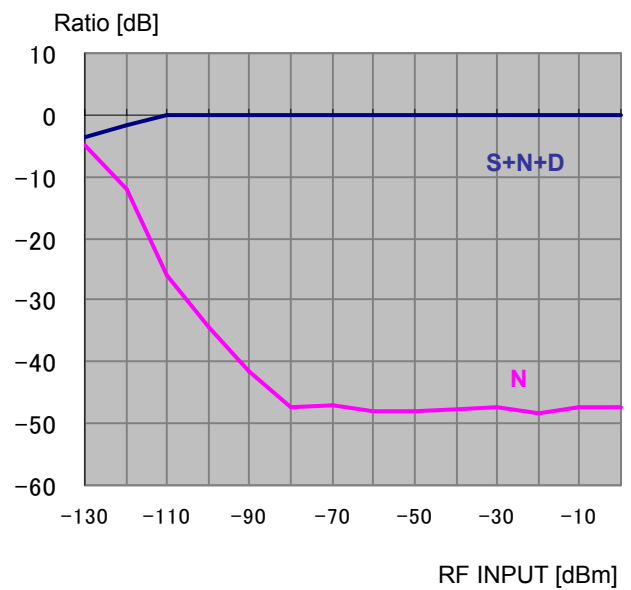


869 MHz

S/N ratio



434 MHz



869 MHz

Regulatory compliance information

Declaration of Conformity

Hereby, Circuit Design, Inc. declares that the CDP-TX-05M-R and CDP-RX-05M-R are in compliance with RE Directive (2014/53/EU).

The full text of the EU Declaration of Conformity is available at www.circuitdesign.jp.

Cautions related to regulatory compliance when embedding the CDP-TX-05M-R and CDP-RX-05M-R

1. Duty cycle

The CDP-TX-05M-R and CDP-RX-05M-R are designed to be used in the EU wide harmonised frequency bands for short range devices. The CDP-TX-05M-R continuously emits carrier signals when power is supplied. The user must design the final product to meet the relevant duty cycle requirement (For more details, refer to the EN300 220-2).

2. Antenna

The CDP-TX-05M-R is supplied without a dedicated antenna.

The conformity assessment of the CDP-TX-05M-R was performed using Circuit Design's standard antenna ANT-LEA-01 for 434MHz or ANT-LEA-02 for 869MHz, so we recommend using the ANT-LEA-01/02 or an antenna with equivalent characteristics (2.14 dBi or less). For details about our standard antenna, refer to www.circuitdesign.jp or contact us. If you use an antenna other than the recommended antenna, further radio conformity assessment may be required.

3. Supply voltage

The CDP-TX-05M-R should be used within the specified voltage range (2.2 V to 5.5 V).

4. Enclosure

To fulfill the requirements of EMC and safety requirements, the CDP-TX-05M-R and CDP-RX-05M-R should be mounted on the circuit board of the final product and must be enclosed in the case of the final product. No surface of the module should be exposed.

Conformity assessment of the final product

The manufacturer of the final system needs to conduct full EMC testing in the final configuration and also ensure the final product fulfills the health and safety requirements and is also responsible for the conformity assessment procedures of the final product in accordance with the RE Directive.

Important notice

- Customers are advised to consult with Circuit Design sales representatives before ordering. Circuit Design believes the provided information is accurate and reliable. However, Circuit Design reserves the right to make changes to this product without notice.
- Circuit Design products are neither designed nor intended for use in life support applications where malfunction can reasonably be expected to result in significant personal injury to the user. Any use of Circuit Design products in such safety-critical applications is understood to be fully at the risk of the customer and the customer must fully indemnify Circuit Design, Inc for any damages resulting from any improper use.
- As the radio module communicates using electronic radio waves, there are cases where transmission will be temporarily cut off due to the surrounding environment and method of usage. The manufacturer is exempt from all responsibility relating to resulting harm to personnel or equipment and other secondary damage.
- The manufacturer is exempt from all responsibility relating to secondary damage resulting from the operation, performance and reliability of equipment connected to the radio module.

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Cautions

- Do not use the equipment within the vicinity of devices that may malfunction as a result of electronic radio waves from the radio module.
- Communication performance will be affected by the surrounding environment, so communication tests should be carried out before actual use.
- Ensure that the power supply for the radio module is within the specified rating. Short circuits and reverse connections may result in overheating and damage and must be avoided at all costs.
- Ensure that the power supply has been switched off before attempting any wiring work.
- The case is connected to the GND terminal of the internal circuit, so do not make contact between the '+' side of the power supply terminal and the case.
- When batteries are used as the power source, avoid short circuits, recharging, dismantling, and pressure. Failure to observe this caution may result in the outbreak of fire, overheating and damage to the equipment. Remove the batteries when the equipment is not to be used for a long period of time. Failure to observe this caution may result in battery leaks and damage to the equipment.
- Do not use this equipment in vehicles with the windows closed, in locations where it is subject to direct sunlight, or in locations with extremely high humidity.
- The radio module is neither waterproof nor splash proof. Ensure that it is not splashed with soot or water. Do not use the equipment if water or other foreign matter has entered the case.
- Do not drop the radio module or otherwise subject it to strong shocks.
- Do not subject the equipment to condensation (including moving it from cold locations to locations with a significant increase in temperature.)
- Do not use the equipment in locations where it is likely to be affected by acid, alkalis, organic agents or corrosive gas.
- Do not bend or break the antenna. Metallic objects placed in the vicinity of the antenna will have a great effect on communication performance. As far as possible, ensure that the equipment is placed well away from metallic objects.
- The GND for the radio module will also affect communication performance. If possible, ensure that the case GND and the circuit GND are connected to a large GND pattern.

Warnings

- Do not take a part or modify the equipment.
- Do not remove the product label (the label attached to the upper surface of the module.) Using a module from which the label has been removed is prohibited.

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REVISION HISTORY

| Version | Date | Description | Remark |
|---------|-----------|---|--------|
| 0.9 | June 2009 | CDP-TX/RX-05M-R 434/869MHz Preliminary | |
| 1.0 | Aug. 2009 | DOC added | |
| 1.1 | Apr. 2011 | Specification: Adjacent channel selectivity added | |
| 1.2 | Aug. 2013 | DOC updated | |
| 1.3 | Feb. 2014 | DOC update | |
| 1.4 | Sep. 2015 | DOC update | |
| 2.0 | Sep. 2016 | CDP-RX-05 design change, Related equivalent circuit diagrams, block diagram and DOC updated | |
| 3.0 | June 2017 | Update according to RED requirements | |
| 4.0 | Mar. 2018 | Description on CTRL terminal added. Correction of erroneous descriptions. | |
| 4.1 | Nov. 2018 | Correction of erroneous descriptions. | |