

UHF Narrow band radio data module  
**CDP-TX-05M-R 426 MHz**  
**CDP-RX-05M-R 426 MHz**



**Operation Guide**

Version 1.0 (Aug. 2012)

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## GENERAL DESCRIPTION & FEATURES

### Features

- Low power narrow band FSK – 12.5 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
- ARIB STD-T67 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	
	426MHz	
Applicable standard	STD-T67	
Communication form	One way	
Oscillation system	Crystal based PLL oscillation	
Number of channels	4	
Frequencies [MHz]	CH 3*	426.0250 *
	CH 2	426.0625
	CH 1	426.1125
	CH 0	426.1375
* 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 kHz (-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	416 us - 20 ms	
Data rate (FSK)	100 – 2,400 bps	
Operating temp. range	-20 °C to + 65 °C	

### CDP-TX-05M-R Transmitter

Item	Specification	
	426MHz	
RF output power (e.r.p., 50 ohms)	1 mW	
Transmitter start up time	< 20 ms	
Modulation	Fm narrow	
Modulation polarity	Positive	
Deviation	+/- 2 kHz	
Spurious emission	< 2.5 uW (-26 dBm)	
Adjacent channel power(ACP)	< -40 dB (2400 bps PN511 code CH=12.5 kHz BW=8.5 kHz)	
Occupied bandwidth(OBW)	< 8.5 kHz (2400 bps PN511 code )	
Supply voltage	2.2 to 5.5 V	
Supply current (Typ. at 3.0V)	14 mA	
I/O terminals	RFout, Gnd, Vcc, Datain	
Dimension	22 x 12 x 6 mm 1.6cc	
Weight	3 g	

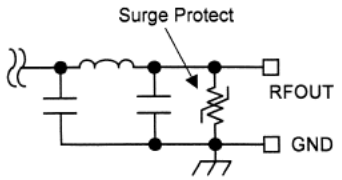
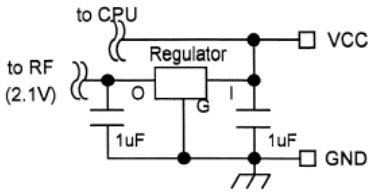
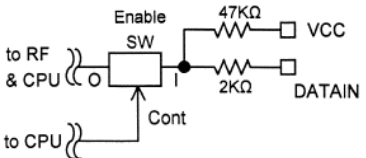
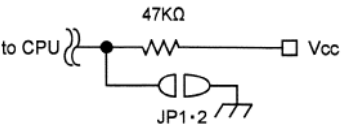
Note: The modules are designed to conform to Japanese ARIB STD-T67. The specification of the data rate is limited up to 2400 bps to meet ACP and OBW requirements for the equipment with channel step of 12.5 kHz.

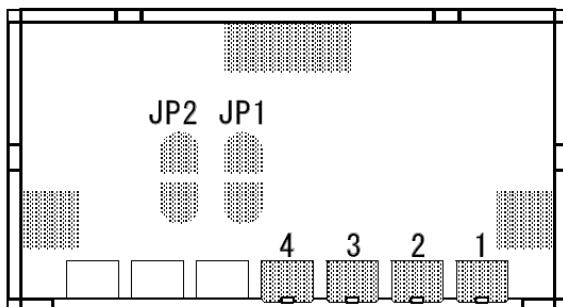
**CDP-RX-05M-R Receiver**

Item	Specification
Demodulation	FM Narrow
Sensitivity (12dB/SINAD at CCITT filter)	-117 dBm (BER <0.1%)
Selectivity	+/-5 kHz at -6 dB point
Adjacent CH selectivity	T.B.D
Spurious radiations	T.B.D
Distortion (AF output)	< 5 % at 1 kHz
S/N ratio (AF output)	45 dBm
AF Output level (Fm=1KHz)	-14 dBm (Fmod=+/- 2 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**

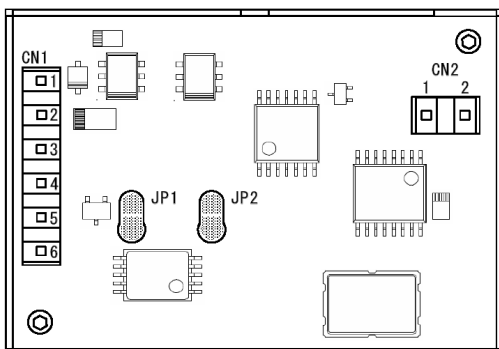
Pin-No.	Pin-Name	I/O	Description	Equivalent internal circuit
1	RFOUT	O	Z=50 ohm The RF output power is 1 mW 1/4 lambda whip antenna is recommended. The antenna length is 17.6 cm for 426 MHz.	
2	GND	-	The ground Please connect to the widest GND on the PCB.	
3	VCC	-	The power supply terminal Operates on 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 -14 dBm typ. (437 mVp-p) (Fm=1 kHz /Fmod=+/-2 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 (Lo active) A voltage of Vcc - 1.8 V or lower voltage makes the circuit active.	
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

The CDP-TX-05M-R and CDP-RX-05M-R are designed for embedding in customer's equipment. The radio characteristics of the modules conform to Japanese ARIB STD-T67 which is a standard for telemetry, telecontrol and data transmission equipment. Customers are required to obtain a Technical Regulations Conformity Certification after they install the modules into their equipment and verify that the final product meets regulatory requirements.

Receivers are not required to obtain the Technical Regulations Conformity Certification.

The knowledge of electronics, know-how of RF technique and high-frequency measurement equipment are essential to develop products using RF modules.

Communication protocols are not embedded in the CDP-05 modules.

Read the following operating instructions carefully before you start development.

### Important notice when obtaining Technical Regulations Conformity Certification

- The absolute gain of the antenna should be 2.14 dB or less.
- The antenna structure should be such that it can NOT be removed from the product.
- In the certification test, the equipment is required to have a function to continuously transmit PN-511 modulated signal. Since the radio characteristics of the equipment are tested with the antenna connected, equipment must have a test terminal or a soldered short coaxial cable for measurement.
- The radio equipment should be housed in a single cabinet and should NOT be able to be opened easily.
- There are transmission time restrictions. For telecontrol equipment, transmission time should be within 5 seconds and transmission quiescence time should be more than 2 seconds. For telemetry equipment, transmission time and quiescence time are within 40 seconds and more than 2 seconds, respectively.

For more details, please refer to STD-T67.

### 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 (48 bits) at 2400 bps. The



minimum pulse width is 416 us. Maximum data rate is 2400 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 (2400 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 17.6 cm (426MHz) 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.

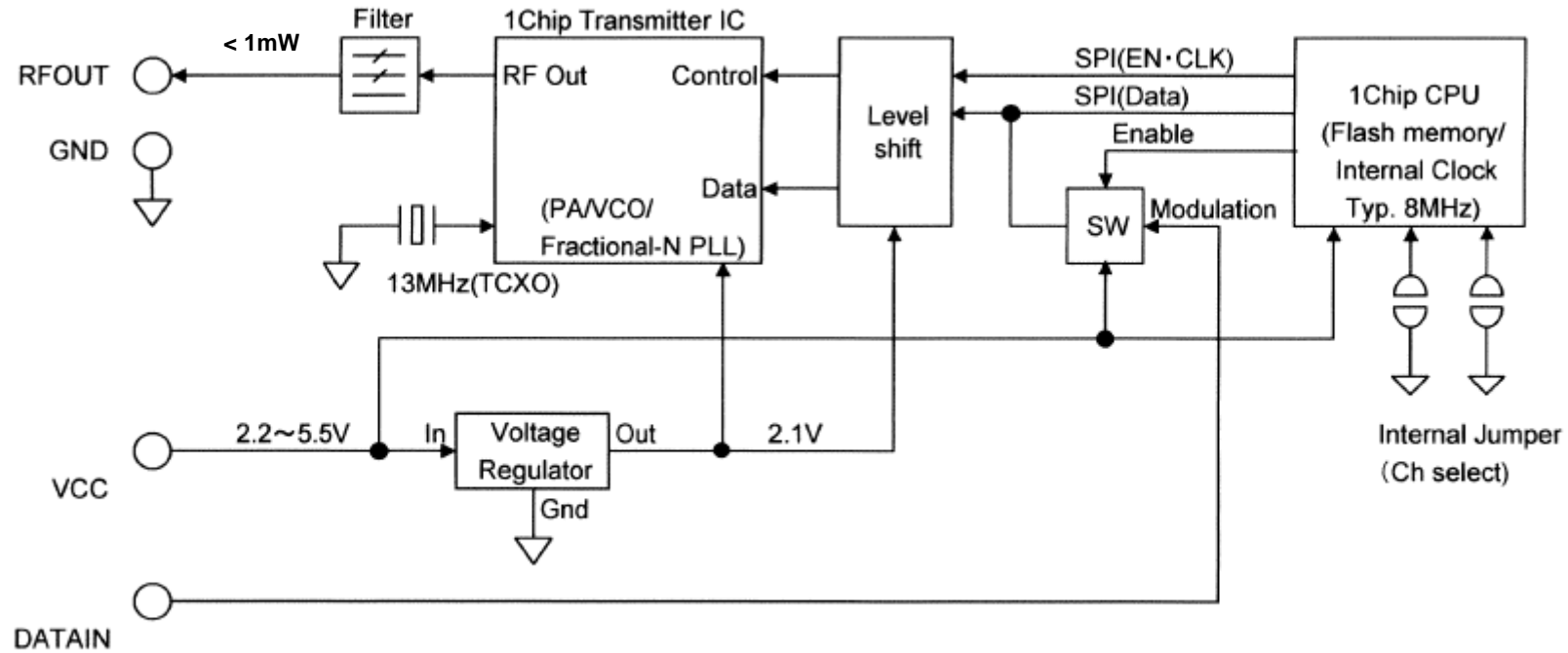
- Connect an antenna with 50 Ohm impedance.
- The easiest construction is a wire of approximately 17.6 cm for 426 MHz.
- Place the antenna vertically, straight up or down from the transmitter and receiver module.
- Do not cover the antenna with metal parts.
- The connection of the metal surface of the 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.

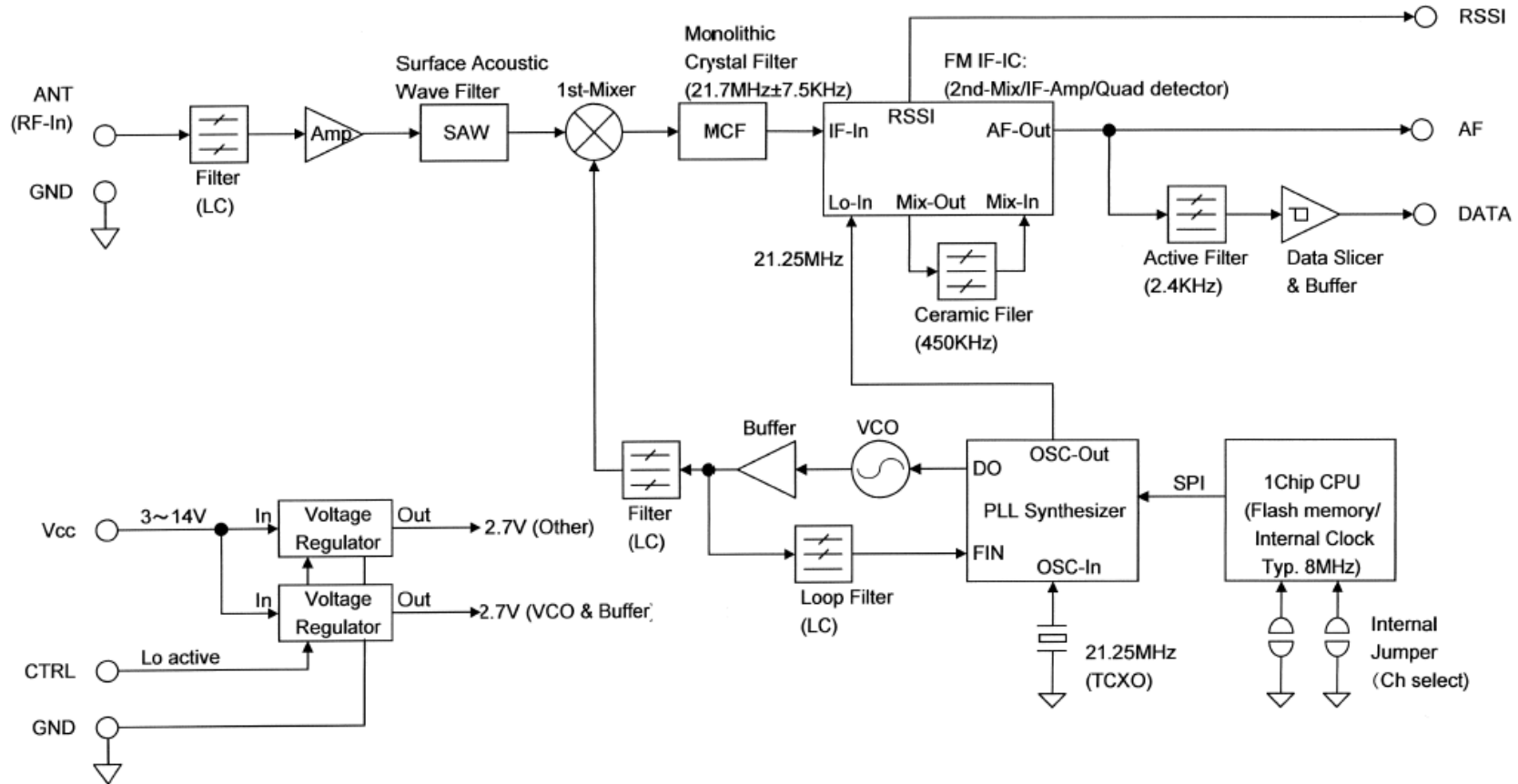
**BLOCK DIAGRAM**

<CDP-TX-05M-R>



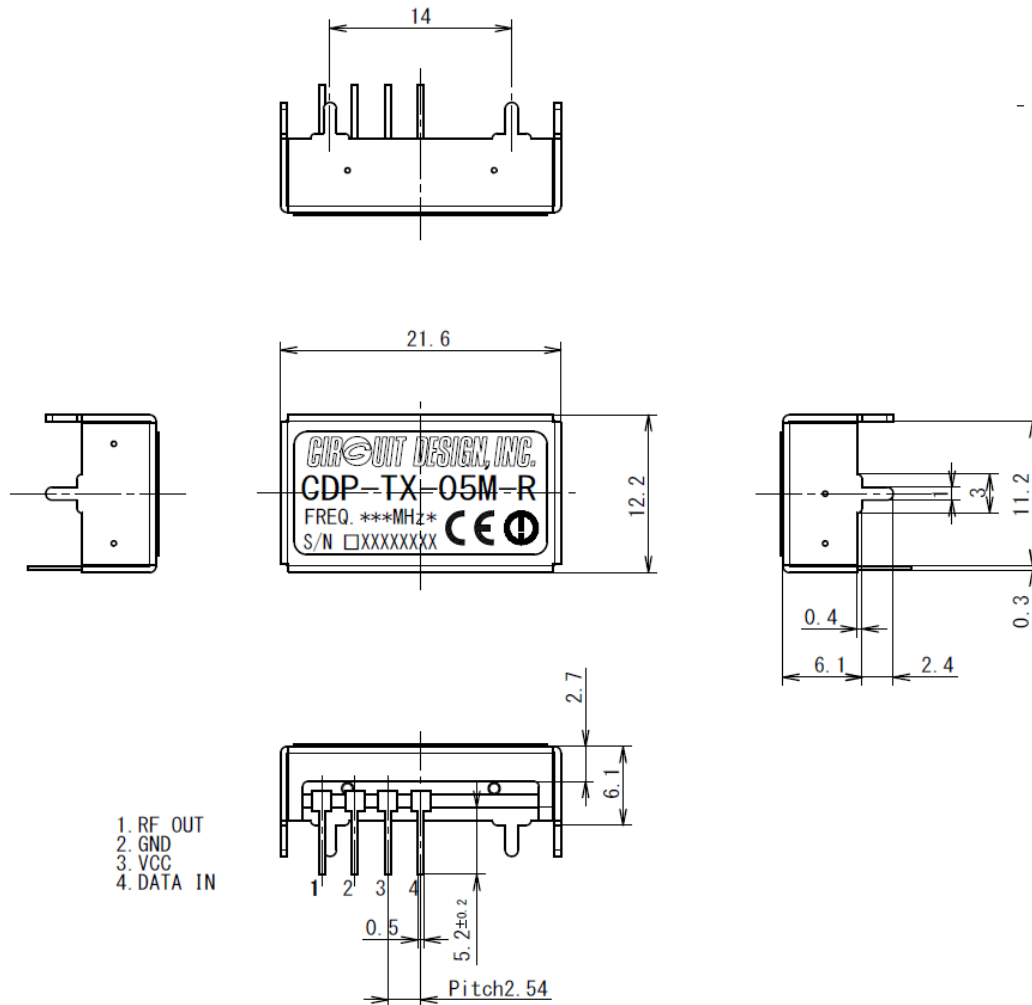
**BLOCK DIAGRAM**

<CDP-RX-05M-R>



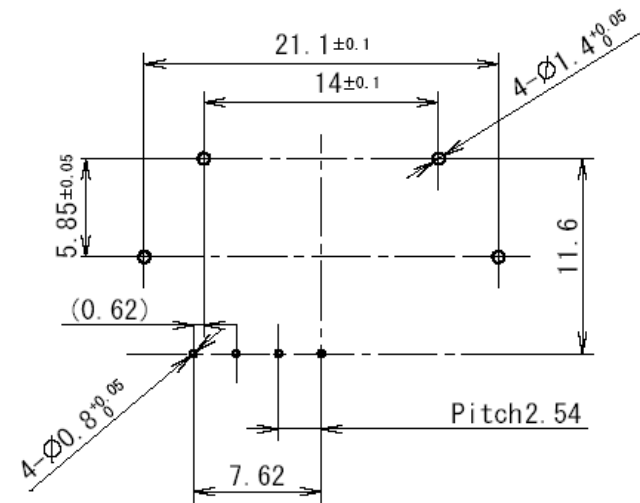
**DIMENSIONS**

<CDP-TX-05M-R>



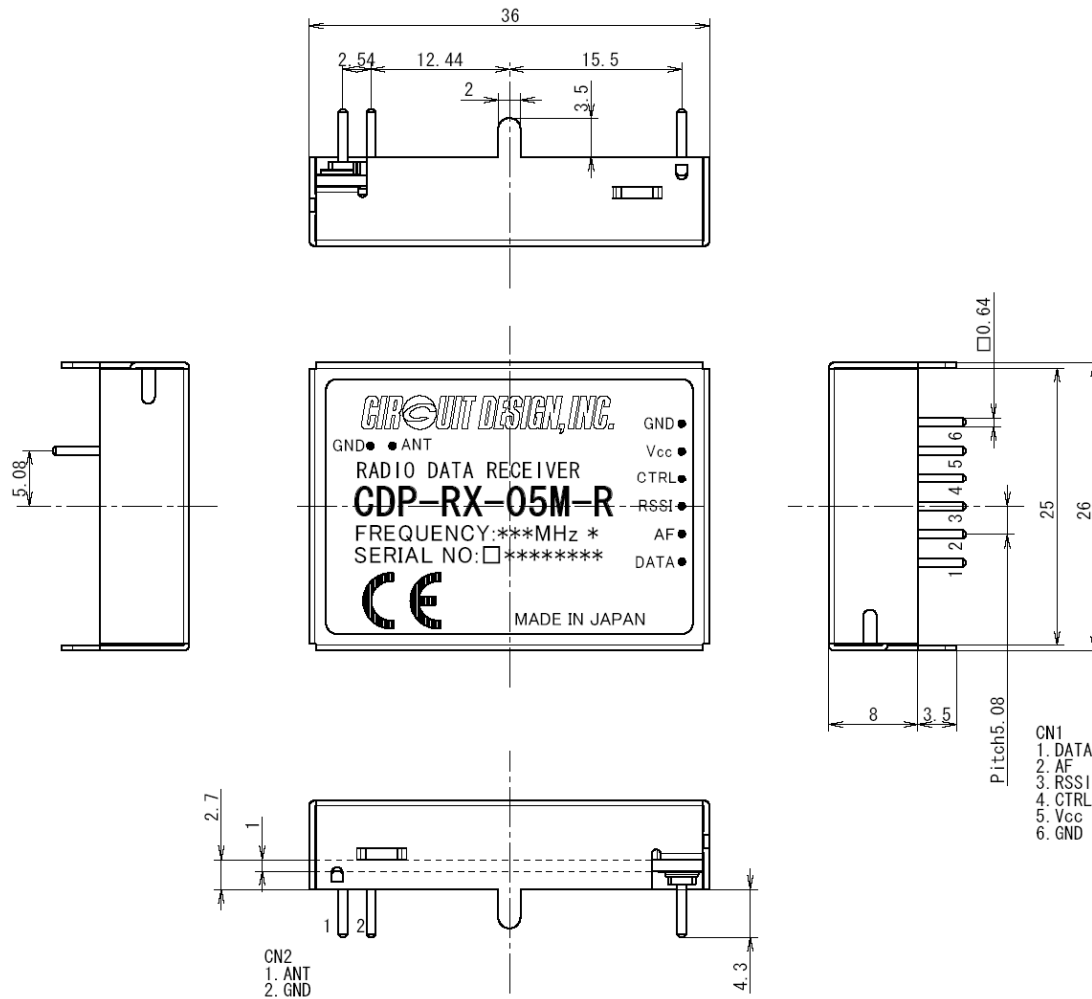
- 1. RF OUT
- 2. GND
- 3. VCC
- 4. DATA IN

Reference hole position for PCB mounting  
(Top view)

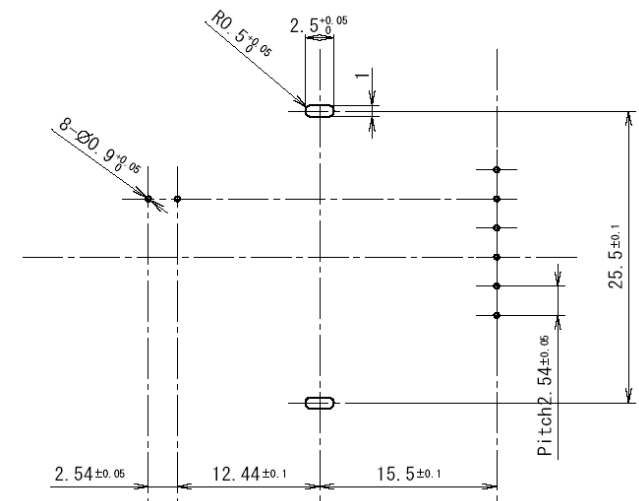


**DIMENSIONS**

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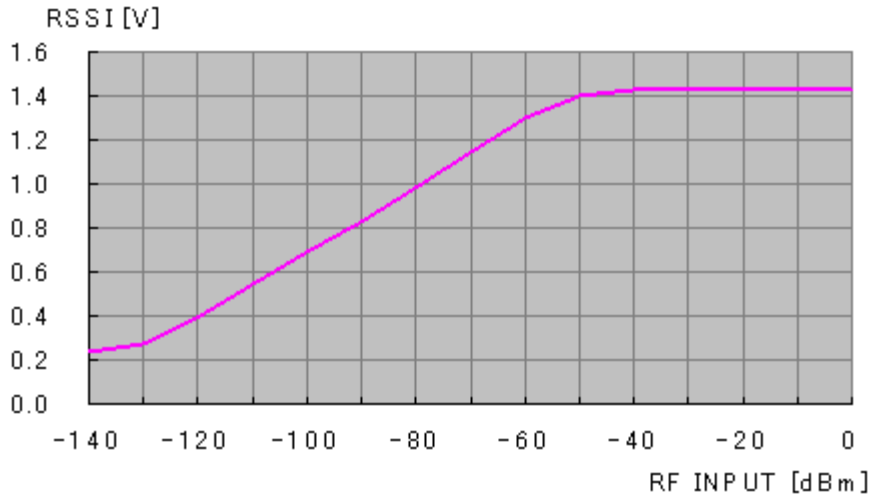


Reference hole position for PCB mounting (Top view)

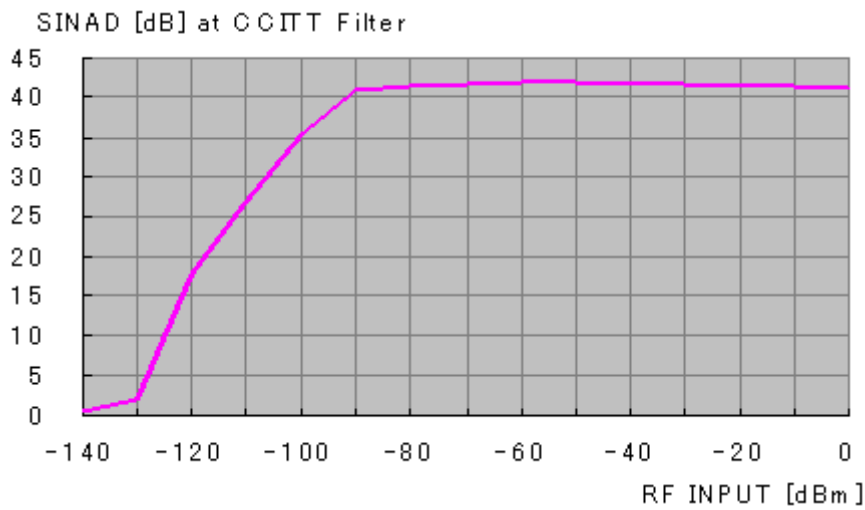


**TEST DATA**

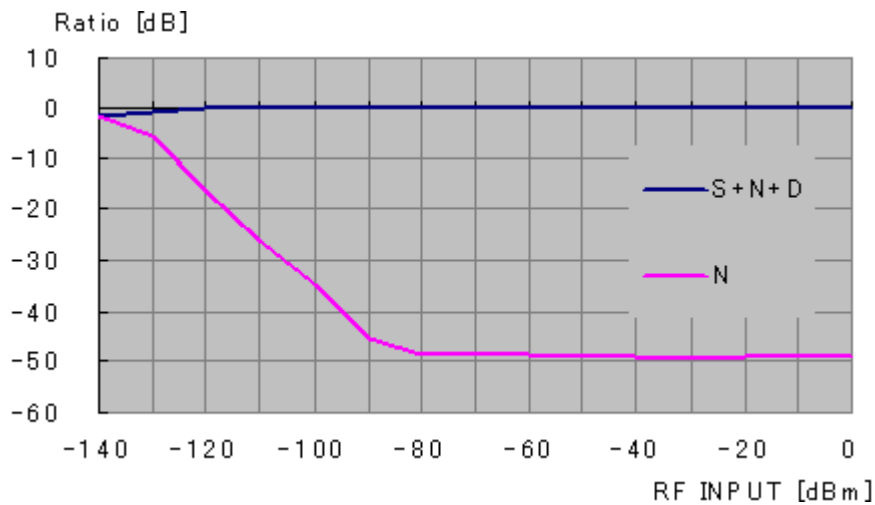
**RSSI rising**



**SINAD rising**



**S/N ratio**



## 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
1.0	Aug. 2012		