

UHF Narrow band radio data module

CDT-TX-02M-R 434 MHz

CDT-RX-02M-R 434 MHz



Operation Guide

Version 2.0 (Aug. 2017)

CIRCUIT DESIGN, INC.

7557-1 Hotaka, Azumino
Nagano 399-8303 JAPAN
Tel: + +81-(0)263-82-1024
Fax: + +81-(0)263-82-1016

e-mail: info@circuitdesign.jp
<http://www.circuitdesign.jp>

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Outline

The CDT-TX-02M-R and CDT-RX-02M-R are integrated wireless modules for telecontrol applications. The communication method is one-way and you can easily achieve a telecontrol device that can send and receive six contact switch signals. MSK modulation and highly sensitive reception performance enable a communication range of 1 km or more.

You can choose from four frequency channels. By setting each unit to a different channel, you can use up to four systems within the same area simultaneously.

You can register the IDs of up to 100 transmitters in the receiver. The output port of the receiver uses photo MOSFET output, enabling direct drive of relays. The output control mode can be set to four modes. You can meet the requirements of a variety of applications by setting the mode accordingly.

The CDT-TX-02M-R/CDT-RX-02M-R can also be used in combination with CDT-TX-01/CDT-RX-01.

Features

You can choose from four frequency channels.

Six contacts (input/output) for communication

The receiver uses photo MOSFET output

The receiver has four output control mode settings

You can register the IDs of up to 100 transmitters in the receiver

Low voltage, low consumption current operation

Compact size

RoHS / RED compliant

Application examples

Calling systems

Signaling systems for construction sites and industrial plants

Electric shutter control

Warning systems

Switching device for LED display panel

Main Specifications

Common specifications

Item	Specification	Remarks
Compatible standards	EN 300 220	
Frequency channels	434.075 / 433.920 / 434.600 / 434.700 MHz	Selected with DIP switches
Communication method	One-way communication	
Modulation	Sub-carrier MSK	
Bit rate	1,200 bps	
Operating temperature range	-20 to +60 °C	No condensation (non-waterproof, non-dustproof spec)
Communication range	1 km or more	Average for line of sight at 25 °C

CDT-TX-02M-R

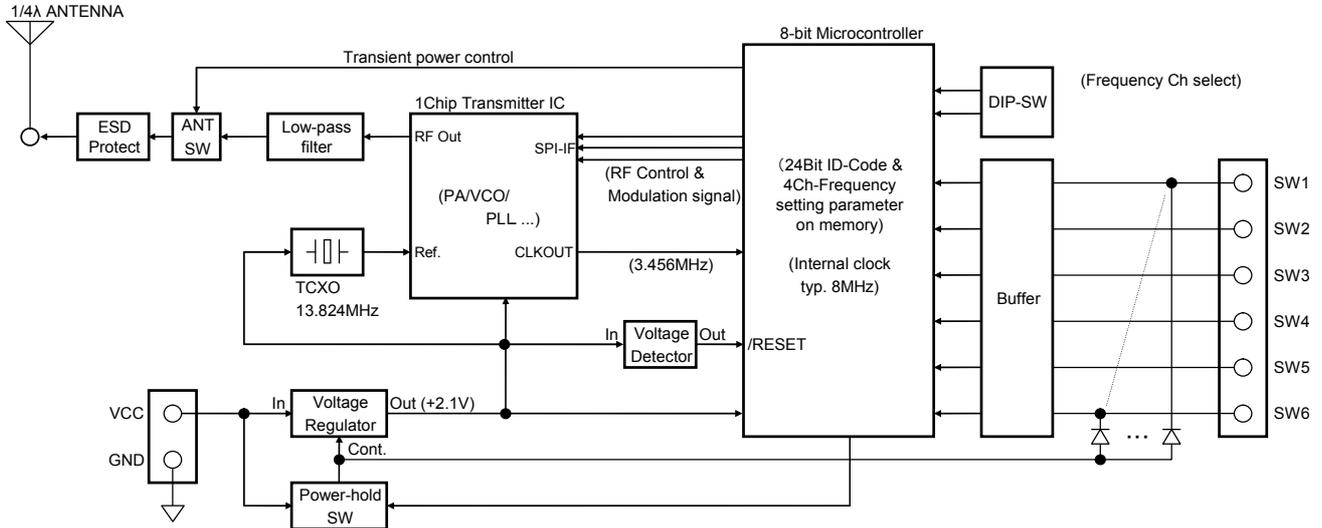
Item	Specification	Remarks
Oscillation system	PLL-controlled VCO	
Transmission output	10 mW or less	
Operating voltage	DC 2.2 to 12 V	Maximum rating: DC 14.5 V
Current consumption	Transmitting: 27 mA Standby: 1 µA	
Input ports	SW1 to SW6 (6 inputs)	Negative logic (active Low)
Connection terminals	VCC, GND (2 terminals) SW1 to SW6 (6 terminals)	
DIP switches (2 circuits)	You can set four different frequency channels	
Antenna	Lead antenna Antenna length: Approx. 175 mm (quarter-wave)	
External dimensions	36 × 26 × 8 mm	Not including projecting parts and the antenna
Weight	Approx. 15 g	

CDT-RX-02M-R

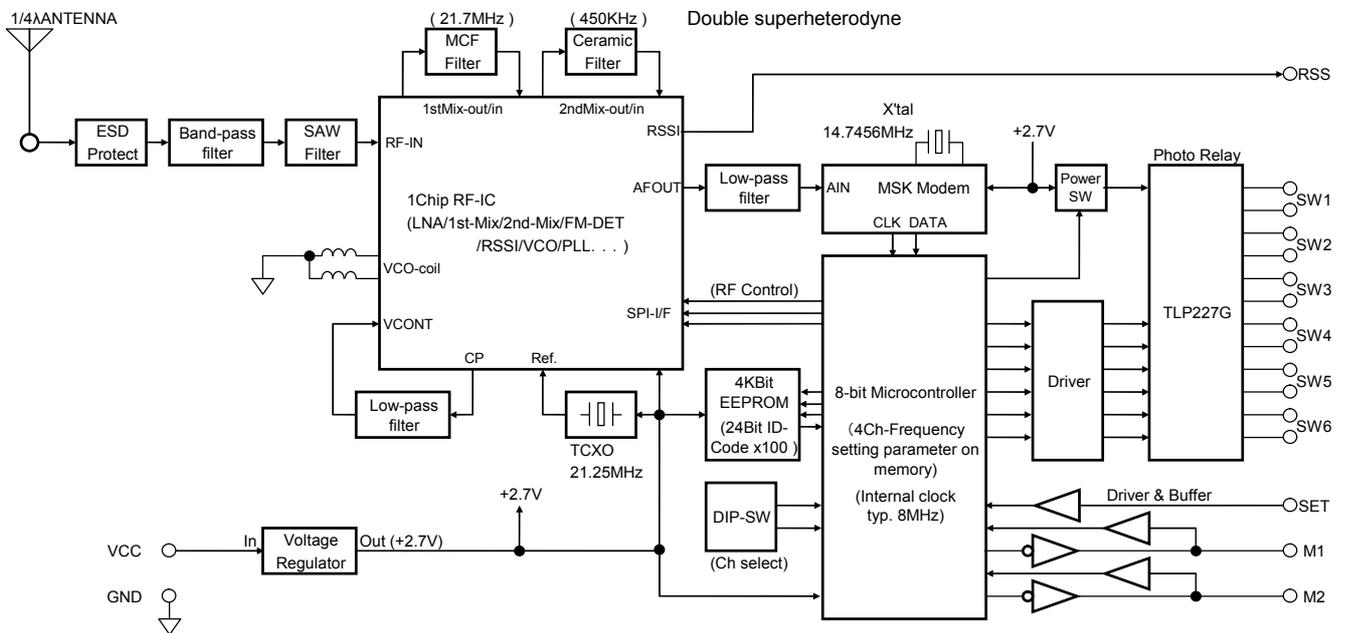
Item	Specification	Remarks
Receive sensitivity	-120 dBm (BER = 1×10^{-2})	
Operating voltage	DC +3 to 12 V	Maximum rating: DC 14.5 V
Current consumption	Standby (6 outputs off): 16 mA During output (6 outputs on): 50 mA	
Output ports	SW1 to SW6 (6 outputs) Photo MOSFET output AC / DC 48 V, 100 mA (max)	
Output control modes	4 modes (one-shot, toggle, switching, continuous)	The mode is set with the SET, M1, and M2 ports
Connection terminals	RF: ANT input M1, M2, SET, SW1 to SW3 (9 terminals) SW4 to SW6, RSS, VCC, GND (9 terminals)	
DIP switches (2 circuits)	You can set four different frequency channels	
Antenna	Lead antenna Antenna length: Approx. 175 mm (quarter-wave)	
External dimensions	53 × 35 × 12 mm	Not including projecting parts, connectors and antenna
Weight	Approx. 35 g	

Block diagram

CDT-TX-02M-R

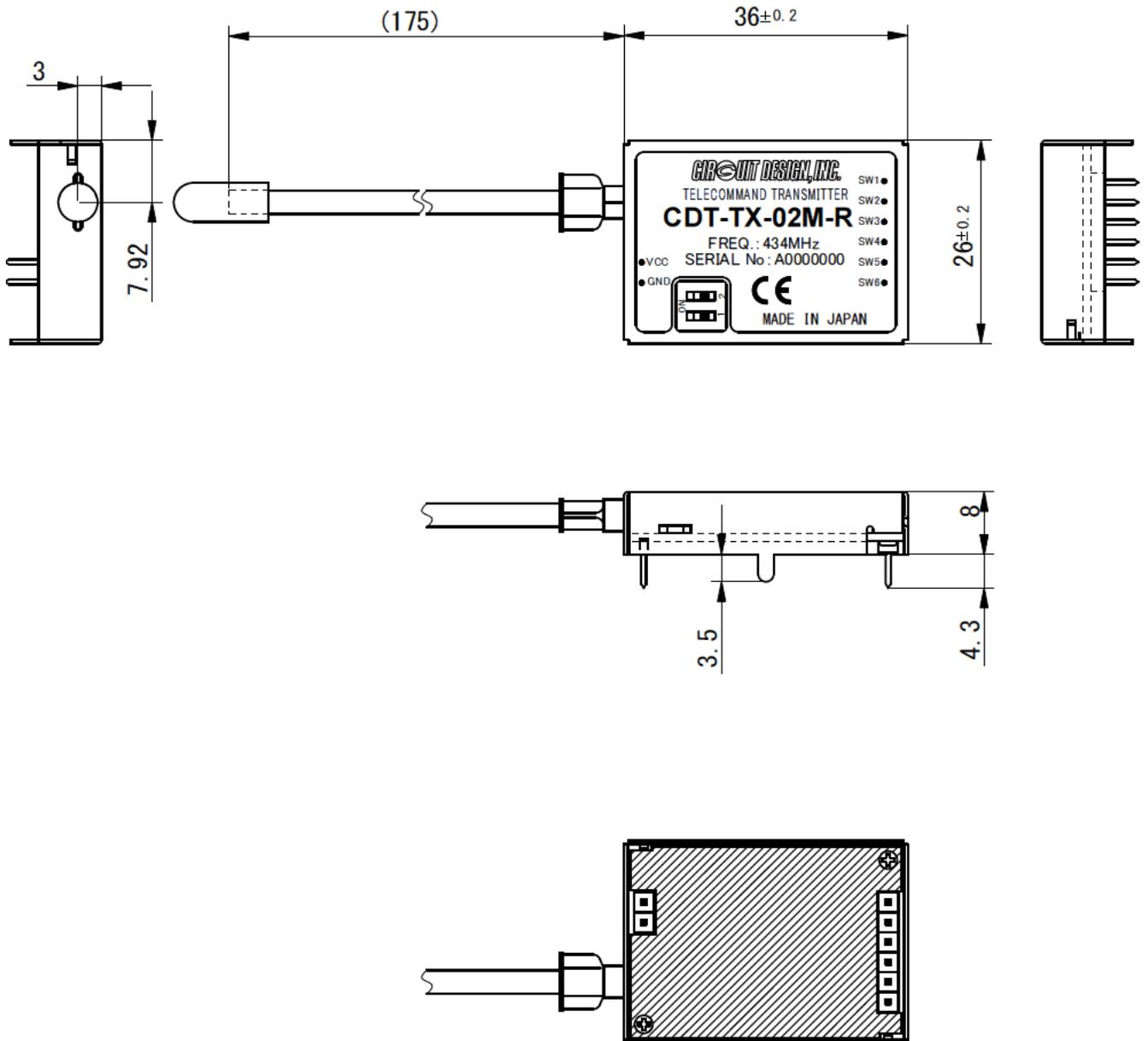


CDT-RX-02M-R

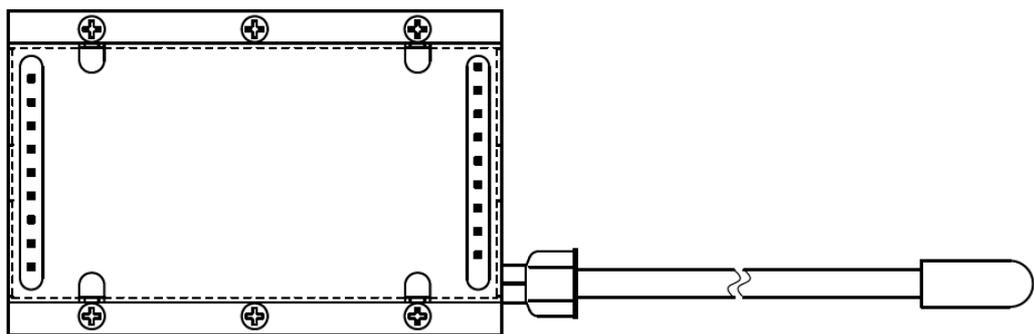
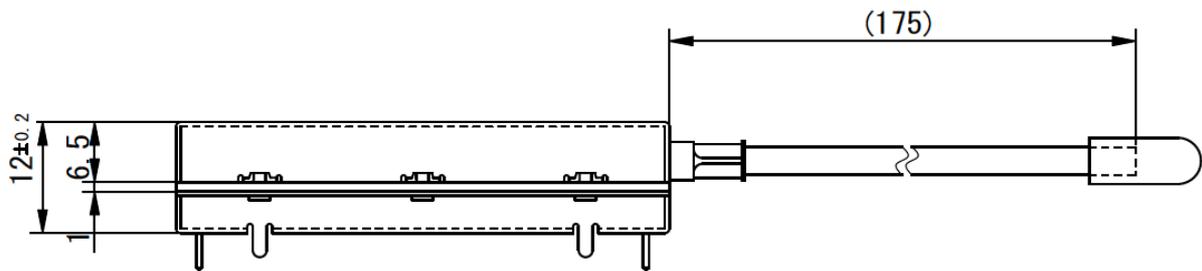
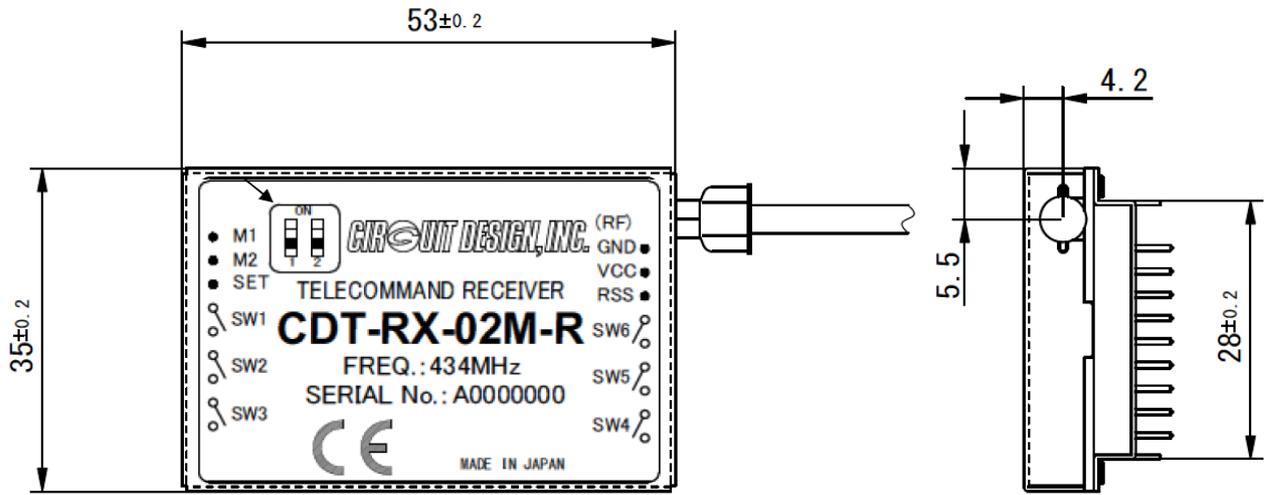


Dimensional drawing

CDT-TX-02M-R



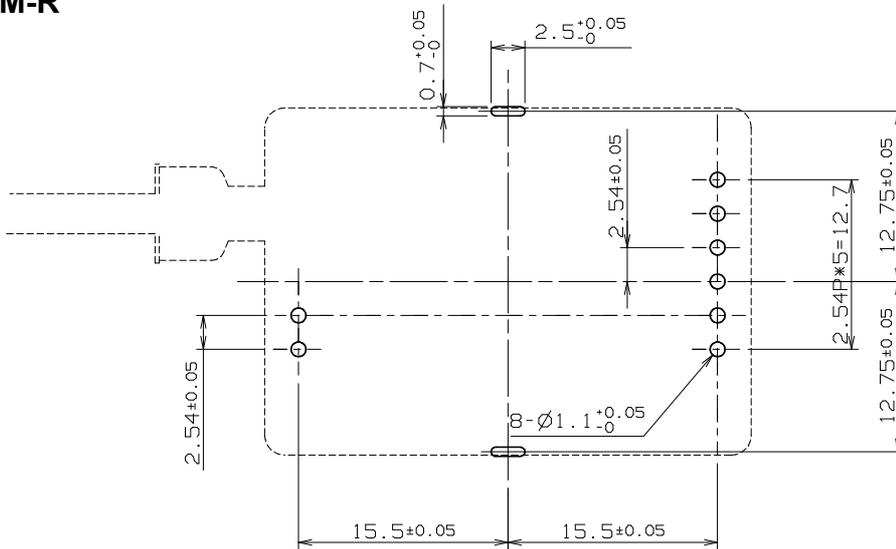
CDT-RX-02M-R



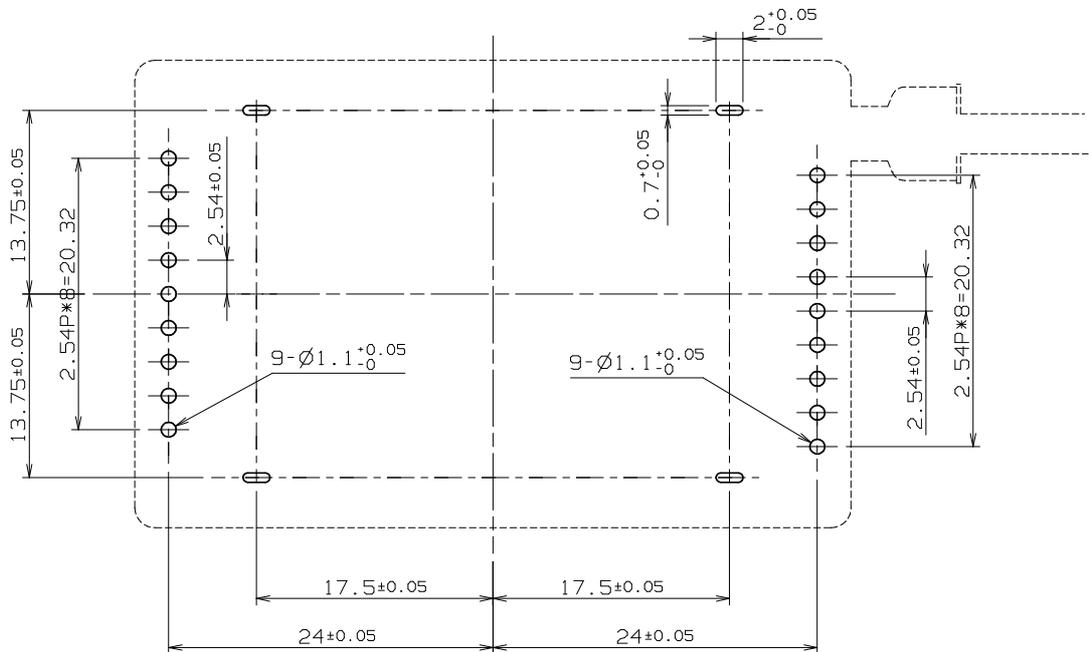
PCB mounting hole dimensional drawing

Recommended dimensions for the PCB mounting holes. Positions of the holes viewed from the mounting surface side of the module.

CDT-TX-02M-R

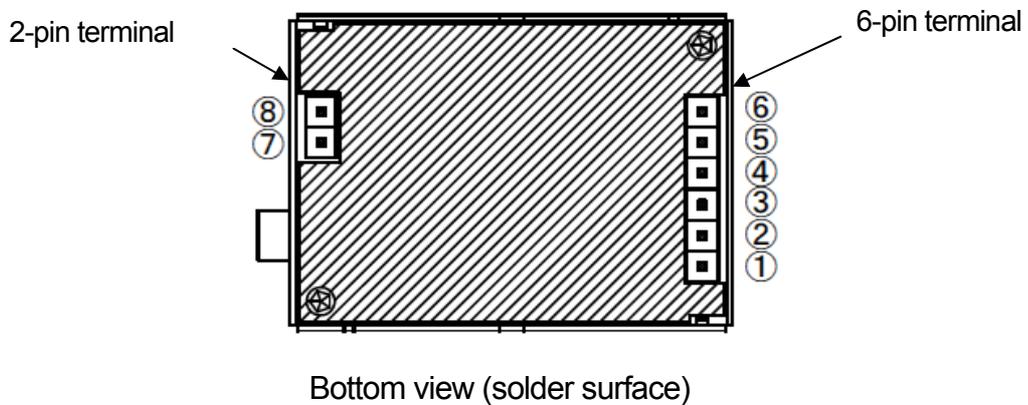
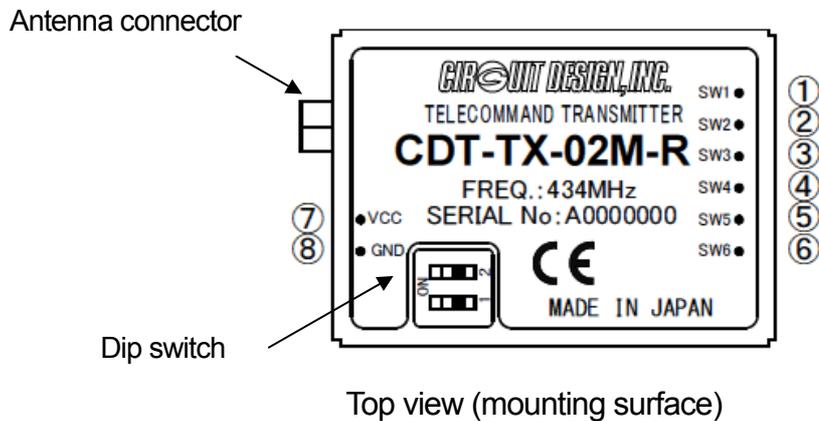


CDT-RX-02M-R



Functions of each part

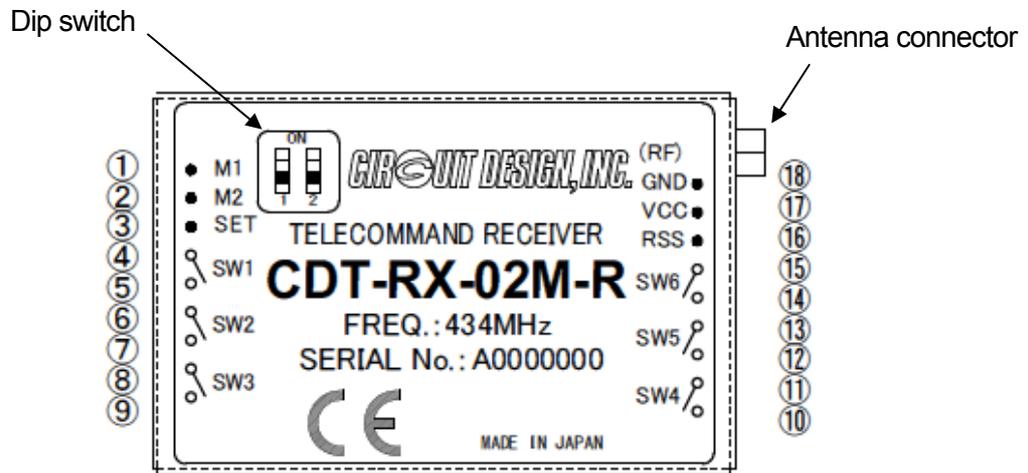
CDT-TX-02M-R



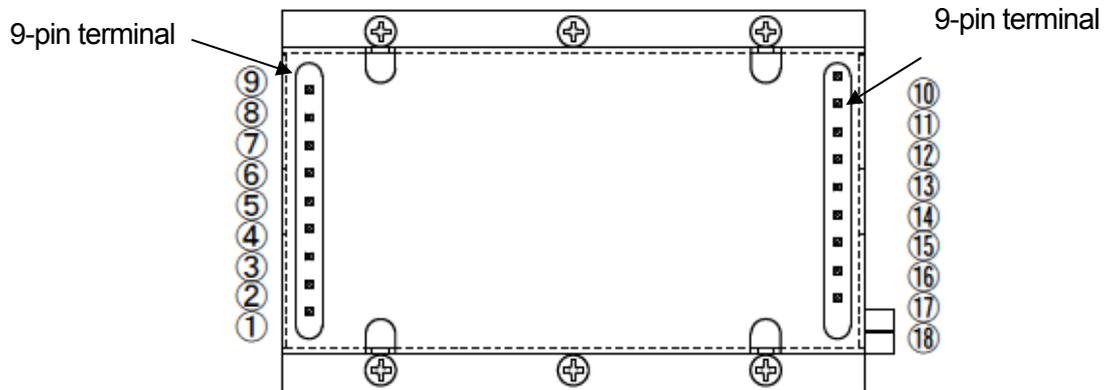
* See page 11 for a detailed explanation of each terminal (1 to 8).

Antenna connector	RF output terminal (50 Ω impedance)
DIP switches	For selecting frequency channels: 2 circuits
6 pin terminals: 1 to 6	Terminals for external connections: SW1 to SW6
2 pin terminals: 7 and 8	Power terminals: VCC, GND

CDT-RX-02M-R



Top view (mounting surface)



Bottom view (solder surface)

* See page 12 for a detailed explanation of each terminal (1 to 18).

Antenna connector	RF input terminal (50 Ω impedance)
DIP switches	For selecting frequency channels: 2 circuits
9 pin terminals: 1 to 9	Terminals for external connections: M1, M2, SET Contact output terminals: SW1 to SW3
9 pin terminals: 10 to 18	Contact output terminals: SW4 to SW6 Terminal for external connections: RSS Power terminals: VCC, GND

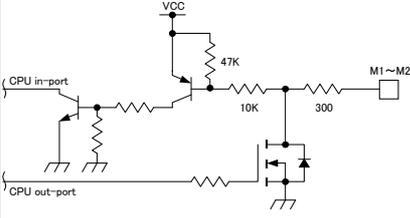
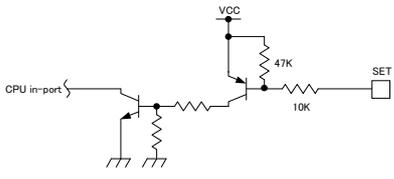
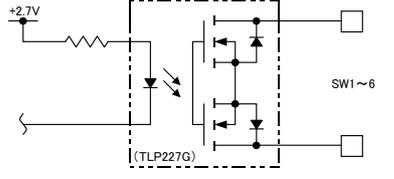
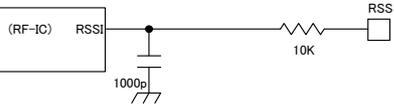
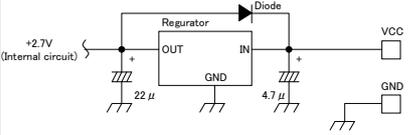
Explanation of the terminals
CDT-TX-02M-R

No.	Terminal name	Input/output	Description	Internal equivalent circuit
1 to 6	SW1 to 6	Input	Switch input. SW1 to SW6 are the same specification. If GND is connected to any of SW1 to SW6, the unit transmits data. When the input of all switches is set to open, the unit enters standby mode.	
7	VCC	Input	The power supply positive terminal. Operates in a range from 2.2 to 12 V. Avoid reverse connection to the power supply and overvoltage. They may damage the circuit. Connect a 10 μF electrolytic capacitor between the VCC terminal and ground of the module.	
8	GND	Input	The power supply negative terminal. Connect with the ground on the printed circuit board. The ground serves both as the input for the power supply and the antenna radial. In order to increase the efficiency of the antenna and achieve stable operation, provide as large a ground pattern as possible.	

The antenna

- The antenna is quarter-wave for maximum radiation.
- We recommend using the antenna supplied (ANT-LEA-01) or an antenna with equivalent characteristics. If you use an antenna other than the recommended antenna, the unit may no longer comply with the regulations.
- The antenna is a lead type, designed for integration in other equipment. If the transmitter is enclosed in a metal case, it will not be able to emit radio waves. Be sure to use plastic or other casing. Design your equipment so that the antenna is located as far as possible from metal objects (such as the shielding case of the transmitter and printed circuit board).

CDT-RX-02M -R

No.	Terminal name	Input/output	Description	Internal equivalent circuit
1	M1	Input/output	Mode input. Set "normal operation" and "ID learning" with the M1, M2 and SET terminals. All terminals are input ports for loading settings to the built-in CPU when the power is turned on, and after setting, they switch to output ports. "Low" for 2 seconds when "ID registration" ends. "Low" when "Clear all IDs" ends, until the power is turned on again.	
2	M2	Input/output	Mode input. "Low" for 2 seconds when "Clear ID" ends.	
3	SET	Input	Mode input. "OPEN" starts normal operation and "GND" starts ID learning.	
4 to 15	SW1 to 6	Output	Photo MOSFET output (TLP227G or equivalent). Because it is a photo MOSFET, it is isolated from the internal circuitry (floating). It is also isolated from each switch output. You can connect a load up to AC/DC 48 V, 100 mA load, making it ideal for driving an external relay or signal control.	
16	RSS	Output	Receive level output. Outputs electric field intensity as a DC voltage. It can be used as a field intensity meter (S meter)	
17	VCC	Input	The power supply positive terminal. Operates in a range from 3 to 12 V. Avoid reverse connection to the power supply and overvoltage. They may damage the circuit. Connect a 10 μF electrolytic capacitor between the VCC terminal and ground of the module.	
18	GND	Input	The power supply negative terminal. Connect with the ground on the printed circuit board. The ground serves both as the input for the power supply and the antenna radial. In order to increase the efficiency of the antenna and achieve stable operation, provide as large a ground pattern as possible.	

The receiving antenna

- The antenna is quarter-wave for maximum radiation.
- For long distance communication, we recommend a high-gain antenna such as a Yagi antenna.
- The antenna supplied is a lead type, designed for integration in other equipment. If the receiver is enclosed in a metal case, receiver performance may be degraded. Be sure to use plastic or other

casing. Design your equipment so that the antenna is located as far as possible from metal objects (such as the shielding case of the receiver and printed circuit board).

Selecting frequency channels

- When you turn on the power of the CDT-02M-R, it checks the status of the DIP switches of each unit to determine the frequency to use.
You can set four different frequency channels shown in the table below using the DIP switches.
- By setting each unit to a different frequency, you can use up to four systems within the same area simultaneously.

DIP switch settings		Frequency channels MHz
SW2	SW1	
OFF	OFF	434.075 MHz *
OFF	ON	433.920 MHz
ON	OFF	434.600 MHz
ON	ON	434.700 MHz

* Default (factory) setting

ID learning of the receiver

The setting conditions of the mode input ports (M1, M2, and SET) when the receiver CDT-RX-02M-R learns transmitter IDs, and the signals output from ports M1 and M2 when ID registration/clearing is complete, are shown in the table below.

ID learning	M1	M2	SET	M1 (output)	M2 (output)
Registers ID	OPEN	OPEN	GND	Low output for 2 seconds	–
Clears ID	GND	OPEN	GND	–	Low output for 2 seconds
Clears all IDs	OPEN	GND	GND	Low output continues	–

- See pages 14 to 16 for the procedures for ID learning (registering IDs, clearing IDs, and clearing all IDs)

Registering transmitter IDs in the receiver

To use the CDT-RX-02M-R, you must register the IDs of transmitters. Before using the equipment for normal operations, you must use the following procedure to register transmitter IDs.

You can register the IDs of up to 100 transmitters in the receiver. IDs are saved in a shift register, so that when 100 IDs are registered, the oldest ID is cleared when you register a new ID.

Once an ID is registered, it is saved even when the receiver is turned off. During normal operation, the receiver outputs data if the pre-registered ID and received ID match.

Procedure		Remarks
1	Turn off the power supply (VCC) of the receiver.	
2	Set the mode input terminals (ports) of the receiver as follows. M1→OPEN M2→OPEN SET→GND	
3	Turn on the power supply (VCC) of the receiver.	The receiver enters ID registration mode.
4	On the transmitter you want to register, connect any of SW1 to 6 to GND to transmit data. If ID registration is successful, the M1 terminal (port) of the receiver outputs Low for two seconds.	The receiver recognizes the transmitter ID, and its ID number is registered automatically. After transmission, if the M1 terminal does not output Low for two seconds, the ID has not been registered. Repeat the registration procedure from step 1.
5	Then if there are more transmitters to register, from the second unit repeat step 4.	You can register the IDs of up to 100 transmitters in the receiver
6	Turn off the power supply (VCC) of the receiver.	After registering the IDs of all the transmitters, turn off the power supply.
7	Set the mode input terminals (ports) of the receiver as follows. M1→OPEN M2→OPEN SET→OPEN	
8	Turn on the power supply (VCC) of the receiver.	The receiver returns to normal operation mode.

Note: You cannot check the registered ID numbers.

Clearing transmitter IDs from the receiver

You can clear specific transmitter IDs from the receiver.
Use the following procedure to clear a transmitter ID.

Procedure		Remarks
1	Turn off the power supply (VCC) of the receiver.	
2	Set the mode input terminals (ports) of the receiver as follows. M1→GND M2→OPEN SET→GND	
3	Turn on the power supply (VCC) of the receiver.	The receiver enters the ID clearing mode.
4	On the transmitter you want to clear, connect any of SW1 to 6 to GND to transmit data. If ID clearing is successful, the M2 terminal (port) of the receiver outputs Low for two seconds.	The receiver recognizes the transmitter ID, and its ID number is cleared automatically. After transmission, if the M2 terminal does not output Low for two seconds, the ID has not been cleared. Repeat the procedure from step 1.
5	Turn off the power supply (VCC) of the receiver.	After clearing the IDs, turn off the power supply.
6	Set the mode input terminals (ports) of the receiver as follows. M1→OPEN M2→OPEN SET→OPEN	
7	Turn on the power supply (VCC) of the receiver.	The receiver returns to normal operation mode.

Clearing all transmitter IDs from the receiver

You can clear all transmitter IDs from the receiver.
Use the following procedure to clear all the transmitter IDs.

Procedure		Remarks
1	Turn off the power supply (VCC) of the receiver.	
2	Set the mode input terminals (ports) of the receiver as follows. M1→OPEN M2→GND SET→GND	
3	Turn on the power supply (VCC) of the receiver.	The receiver enters the all ID clearing mode.
4	Turn on the power supply and wait five seconds. If all ID clearing is successful, the M1 terminal (port) of the receiver outputs Low continuously.	All registered IDs are cleared. If the M1 terminal does not output Low for two seconds, the IDs have not been cleared. Repeat the procedure from step 1.
5	Turn off the power supply (VCC) of the receiver.	After clearing all the IDs, turn off the power supply.
6	Set the mode input terminals (ports) of the receiver as follows. M1→OPEN M2→OPEN SET→OPEN	
7	Turn on the power supply (VCC) of the receiver.	The receiver returns to normal operation mode.

Receiver output control mode setting

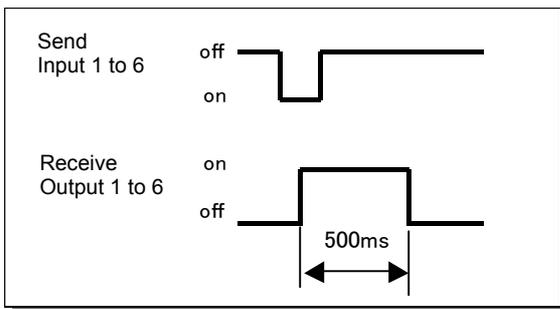
You can select from four output control modes for the CDT-RX-02M-R (one-shot, toggle, switching, continuous). Set the receiver mode input port (M1, M2, SET for each port) with the conditions in the table below, and turn on the power again to complete output control mode setting.

Output control modes	M1	M2	SET
One-shot output	OPEN	OPEN	OPEN
Toggle output	GND	OPEN	OPEN
Switching output	OPEN	GND	OPEN
Continuous output	GND	GND	OPEN

After changing the output control mode, be sure to turn the receiver off, then on again. Only setting the M1, M2, or SET port does not change the output control mode.

Explanation of each output control mode

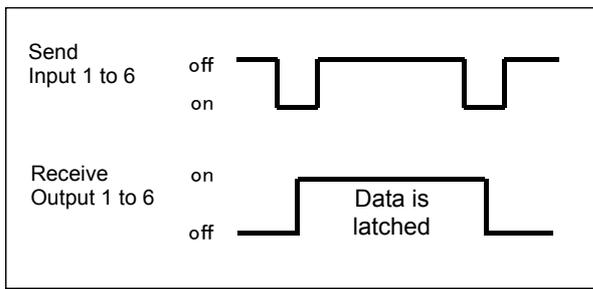
One-shot output



Transmitter SW input	Receiver Contact output
SW1	SW1 output 500 ms ON
SW2	SW2 output 500 ms ON
SW3	SW3 output 500 ms ON
SW4	SW4 output 500 ms ON
SW5	SW5 output 500 ms ON
SW 6	SW6 output 500 ms ON

When the transmitter SW input is turned on, the output of the receiver turns on for 500 ms. When the transmitter SW input is turned on, the output of the receiver is as shown above.

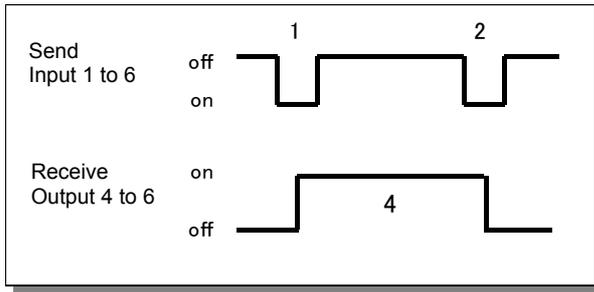
Toggle output



Transmitter SW input	Receiver Contact output
SW1	SW1 output ON/OFF switching
SW2	SW2 output ON/OFF switching
SW3	SW3 output ON/OFF switching
SW4	SW4 output ON/OFF switching
SW5	SW5 output ON/OFF switching
SW 6	SW6 output ON/OFF switching

When the transmitter input is turned on, the output of the receiver turns on and the output is latched. When the same SW input is turned on again, the output turns off. When the transmitter SW input is turned on, the output of the receiver is as shown above.

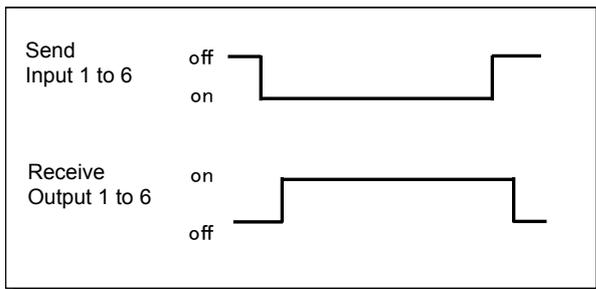
Switching output



Transmitter SW input	Receiver Contact output
SW1	SW4 output ON
SW2	SW4 output OFF
SW3	SW5 output ON
SW4	SW5 output OFF
SW5	SW6 output ON
SW 6	SW6 output OFF

When the transmitter SW1 input is turned on, the SW4 output of the receiver turns on and the output is latched. When the SW2 input is turned on, the SW4 output of the receiver turns off. In the same way, SW3 input and SW4 input of the transmitter control SW5 output of the receiver, while SW5 input and SW6 input control SW6 output.

Continuous output

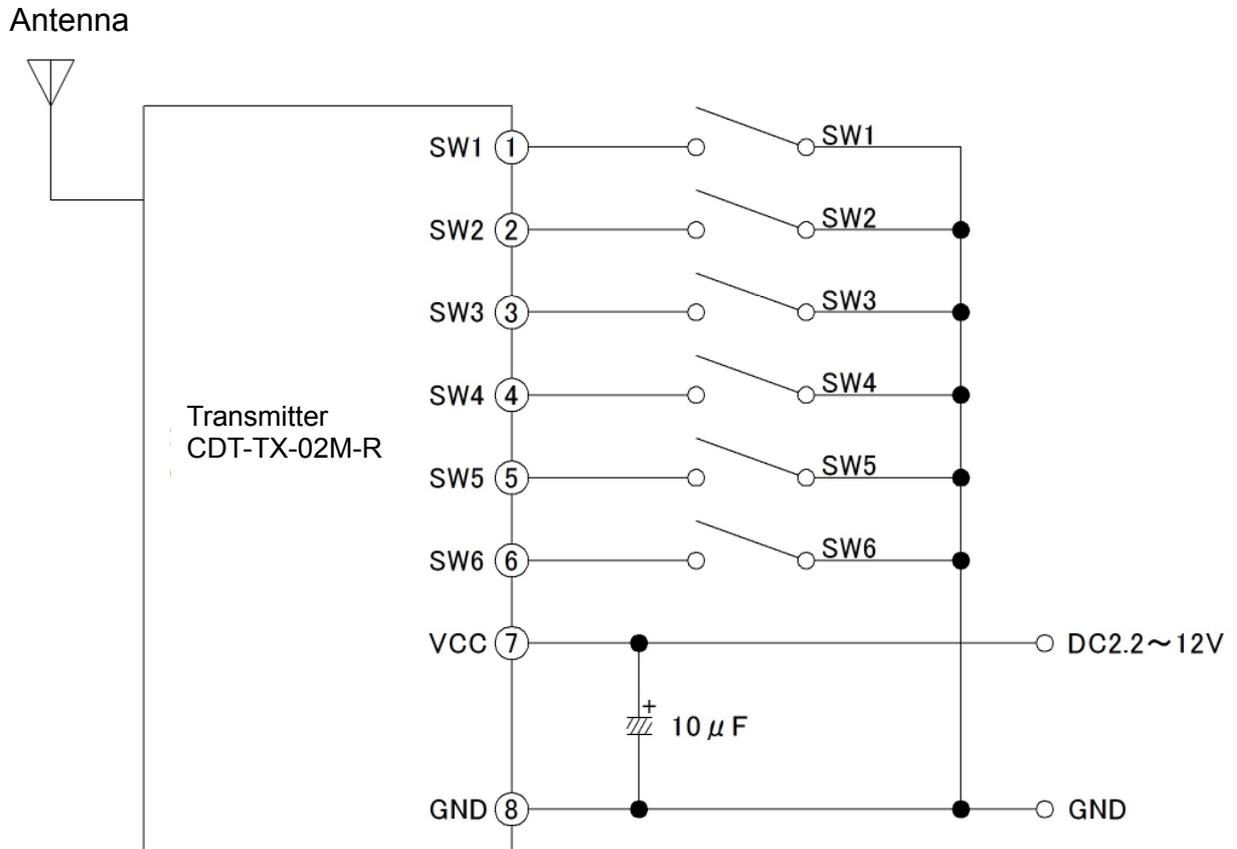


Transmitter SW input	Receiver Contact output
SW1	SW1 output Continuously on
SW2	SW2 output Continuously on
SW3	SW3 output Continuously on
SW4	SW4 output Continuously on
SW5	SW5 output Continuously on
SW 6	SW6 output Continuously on

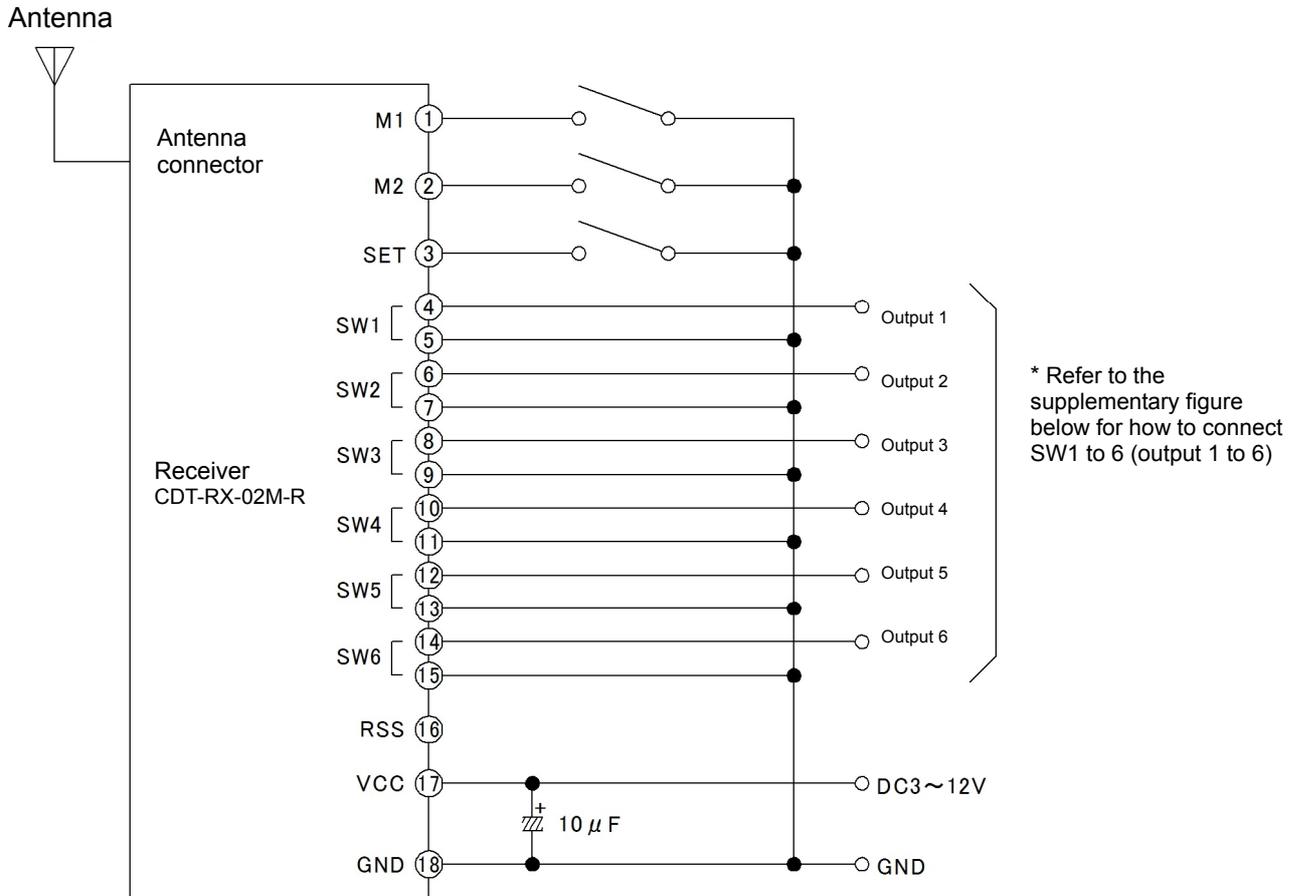
When the transmitter input is turned on, the output of the receiver is continuously on. When the transmitter SW input is turned on, the output of the receiver is as shown above.

Connection method

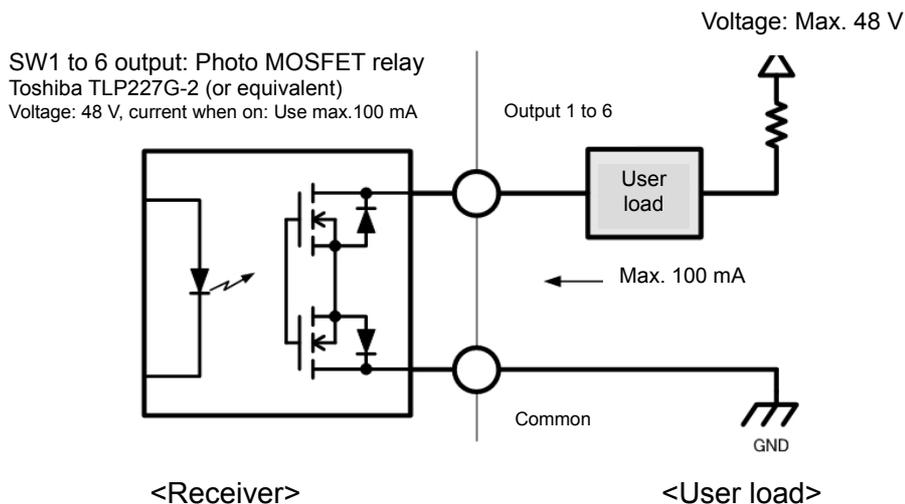
CDT-TX-02M-R transmitter basic connection diagram



CDT-RX-02M receiver basic connection diagram



*** Supplementary figure: SW1 to SW6 (Output 1 - 6) connection**



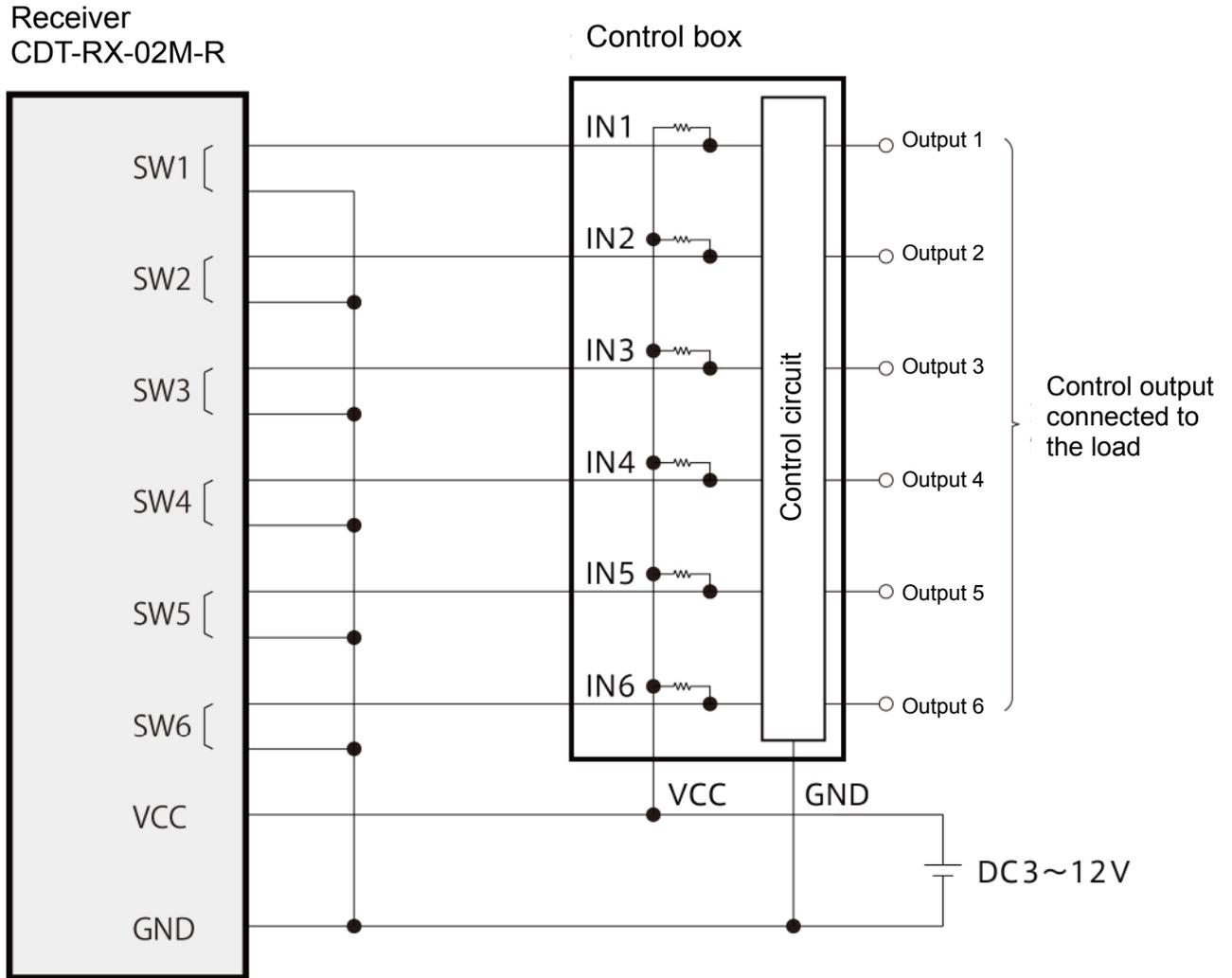
The receiver uses photo MOSFET output. When a load is connected, use a voltage of 48 V or less with a current of 100 mA or less during output. The above connection diagram and supplementary figure show the situation where one side of SW1 to SW6 outputs is used as the ground (common).

Receiver connection examples

Examples of connections using CDT-RX-02M-R receiver outputs (SW1 to SW6).

Connection example 1

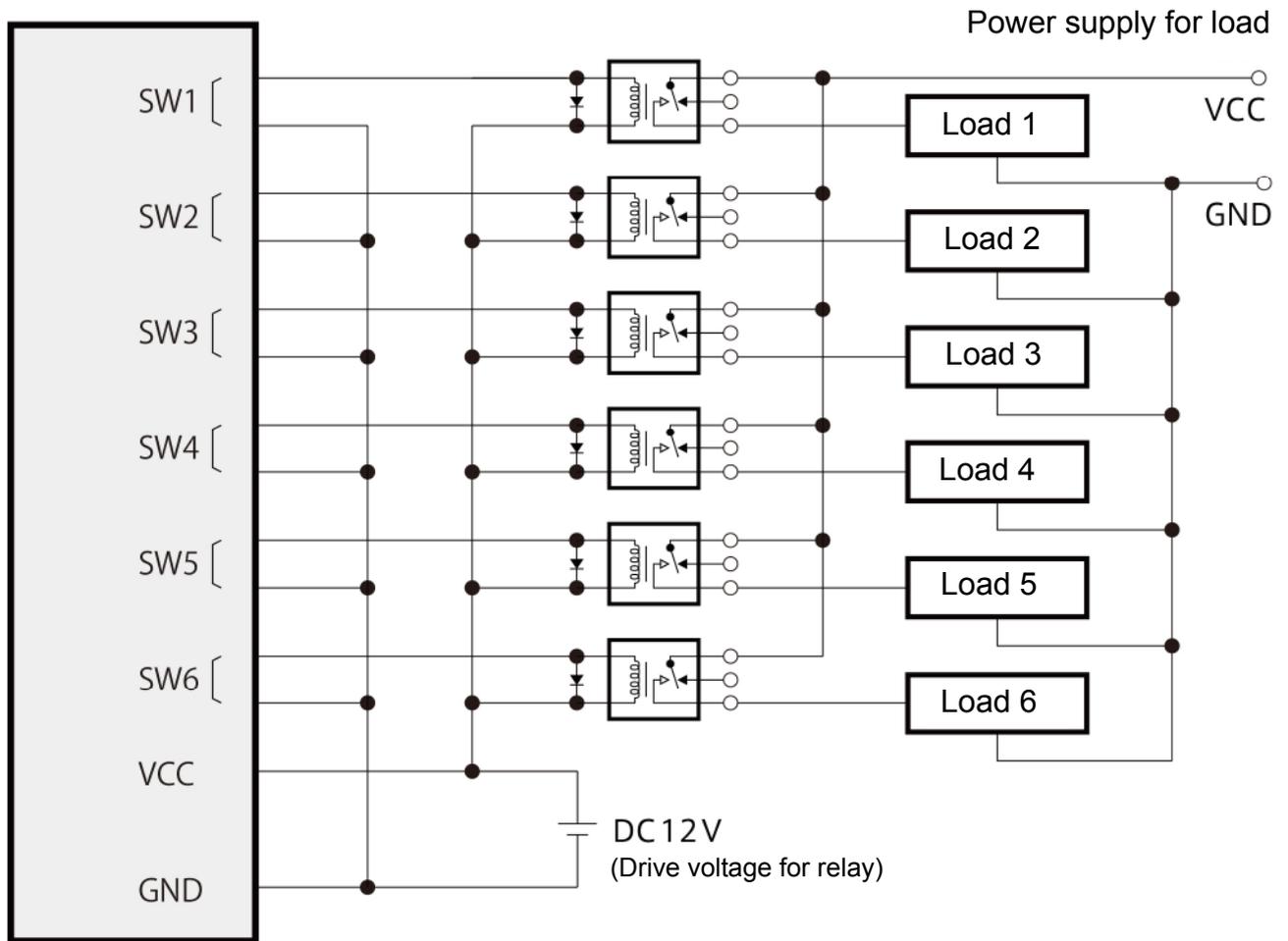
Example where the control input of the control box is used directly for output.



Connection example 2

Example where a relay is connected for controlling a large capacity load (on/off).
 In this case, toggle mode or switching mode is used as the output control mode.

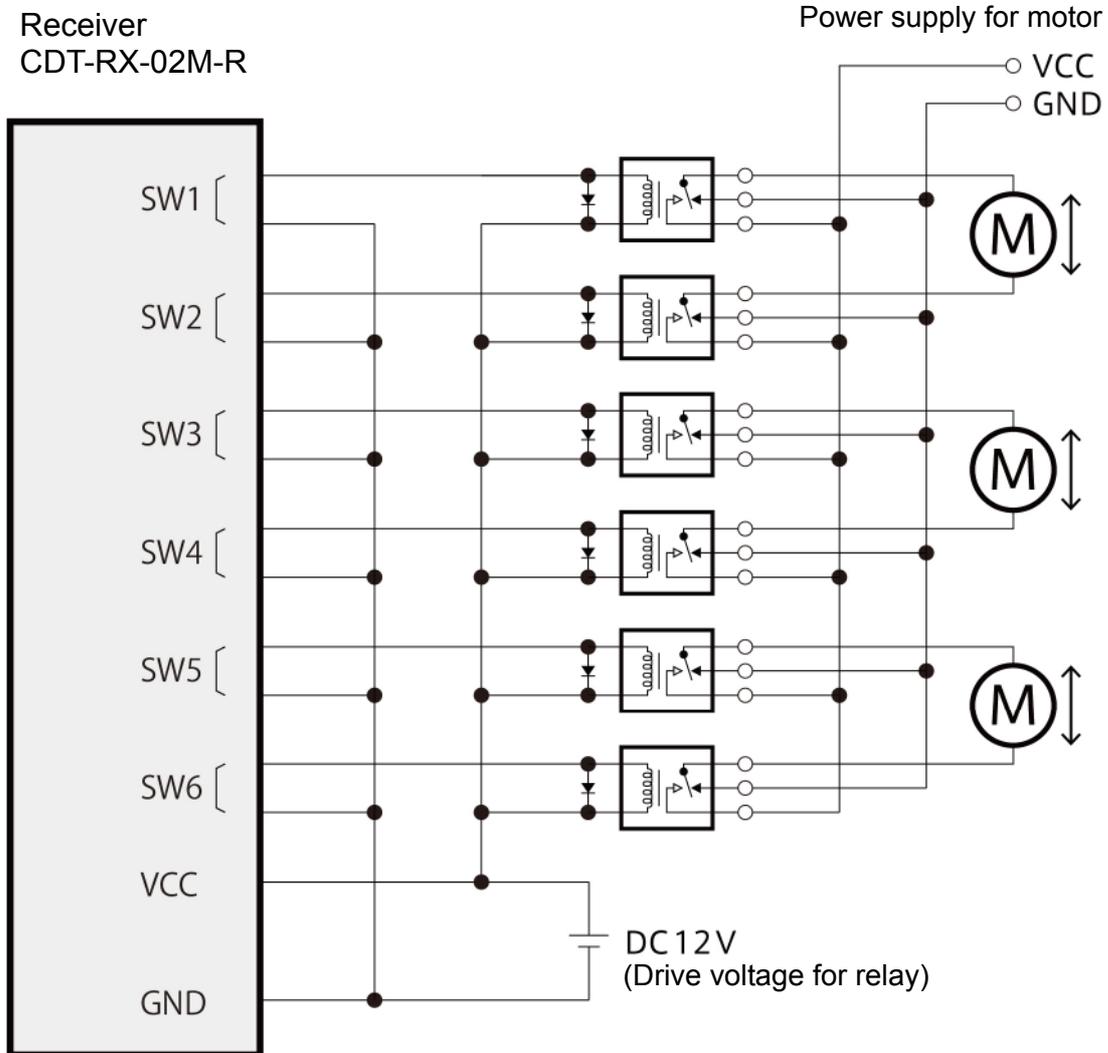
Receiver
 CDT-RX-02M-R



Connection example 3

Example where a relay is connected for controlling a motor.

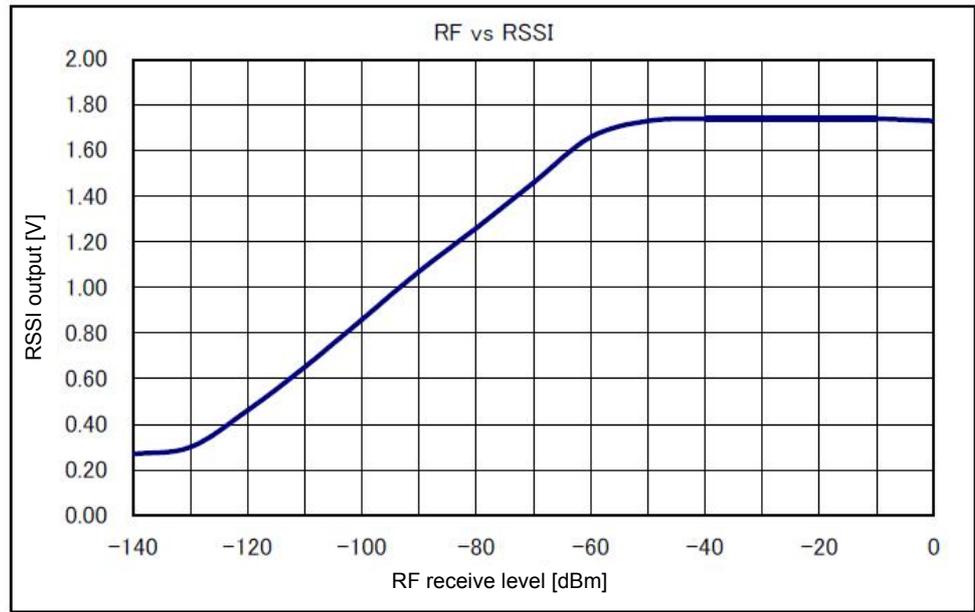
In this case, toggle mode, switching mode or continuous mode is used.



Receiver RSSI output characteristics

The RSSI output characteristics of the CDT-RX-02M-R receiver. The RSSI output voltage characteristics for the RF receive level (voltage value output from the receiver's No.16 terminal). The following output characteristics are for typical data. Note that there may be some individual differences in output characteristics depending on the receiver.

RF receive level [dBm]	RSSI output [V]
-140	0.27
-130	0.30
-120	0.46
-110	0.65
-100	0.86
-90	1.07
-80	1.26
-70	1.46
-60	1.66
-50	1.73
-40	1.74
-30	1.74
-20	1.74
-10	1.74
0	1.73



Timing of transmission and time until output

- **Time between switch input and start of transmission**

It takes about 40 ms from setting the transmitter switch input to on until the start of transmission

After switch input is set to on, it takes about 20 to 25 ms for the RF power to come on. 20 ms later, data transmission starts. Data is sent frame by frame, and it takes 63 ms to send one frame, including the on and off signals.

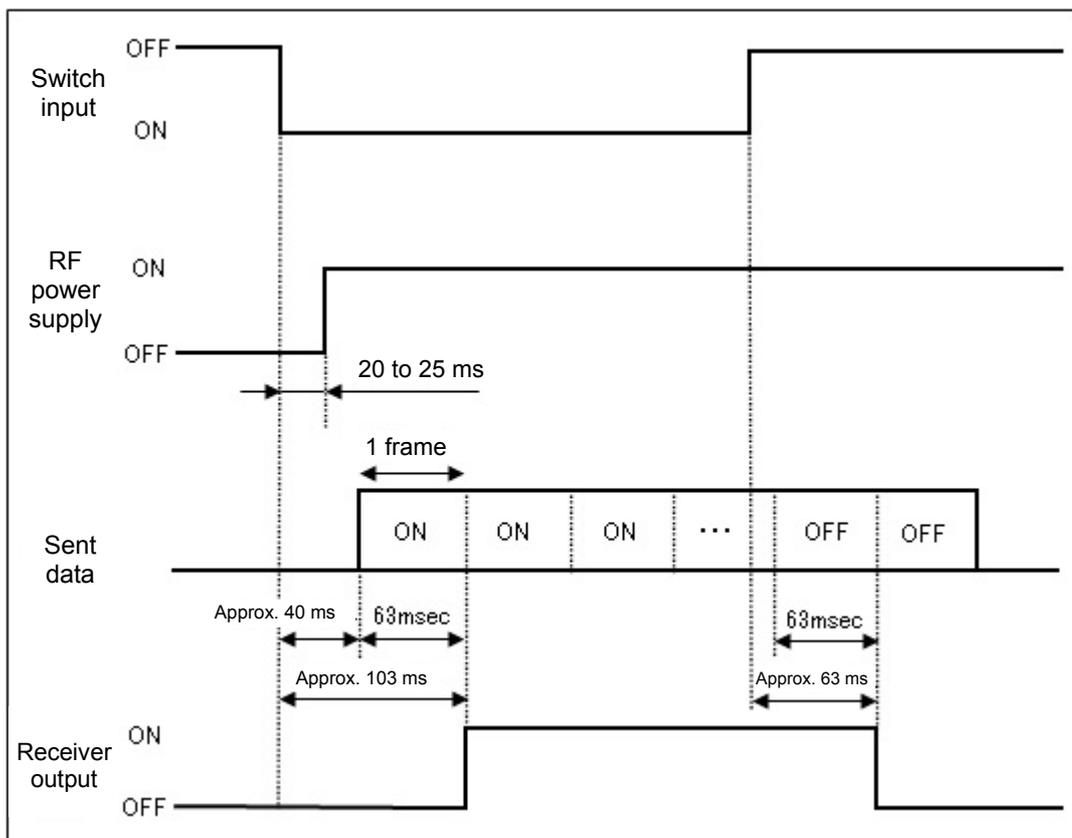
- **When reception is good**

The time it takes from setting the transmitter switch input to on until the start of output from the receiver is about 103 ms at the shortest. The time until the start of output is the same for all output control modes (one-shot, toggle, switching, continuous).

When the transmission data on signal has been received in the first frame, the time it takes from setting the transmitter switch input to on until the start of output from the receiver is about 103 ms at the shortest.

Similarly, when the transmission data off signal has been received in the first frame, the time it takes from setting the switch input to off until the end of output is about 63 ms at the shortest.

When radio conditions are good and the first frame of data has been received

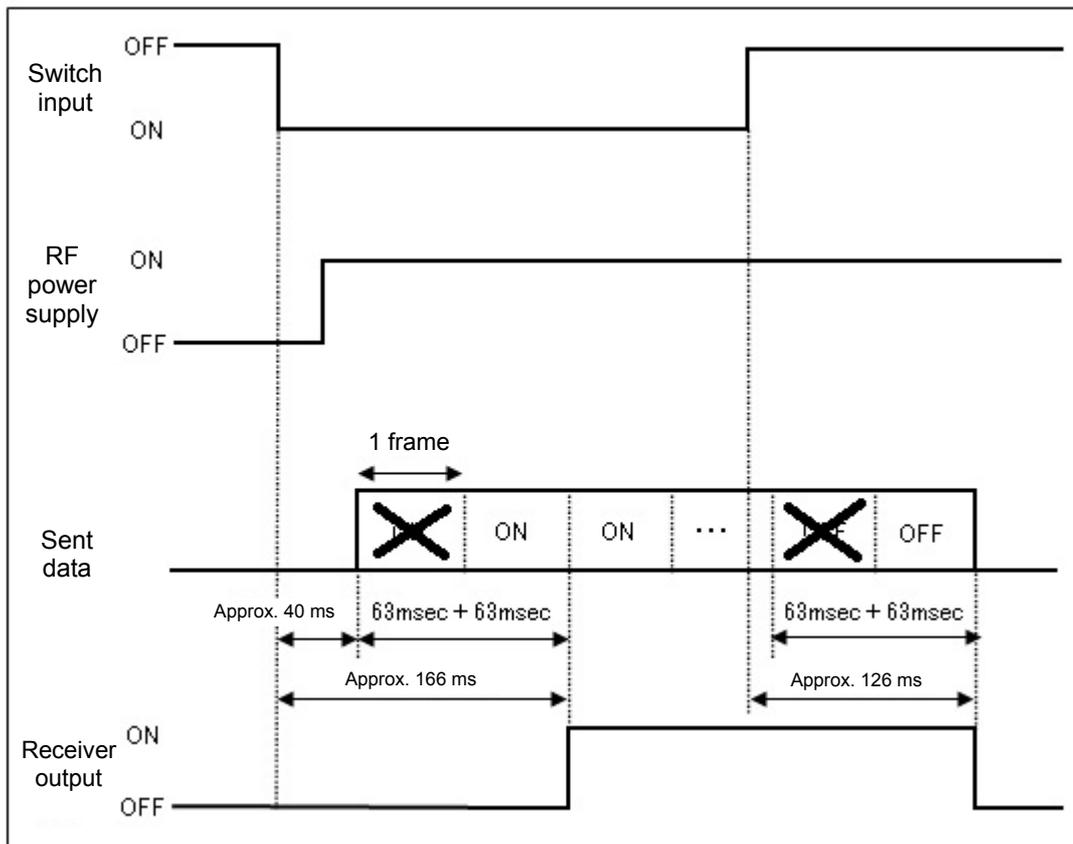


• **When reception is bad**

If reception is bad and the first frame of the transmission data has not been received, the time it takes from setting the switch input to on is delayed by the time required for the frames that were not received (at 63 ms per frame).

When the transmission data on signal has not been received in the first frame but is received in the second frame, the time it takes until the start of output is about 166 ms at the shortest. Similarly, when the transmission data off signal has not been received in the first frame but is received in the second frame, the time it takes from setting the switch input to off until the end of output is about 126 ms at the shortest.

When radio conditions are bad and data has been received in the second frame



Regulatory compliance information

Declaration of Conformity

Hereby, Circuit Design, Inc. declares that the CDT-TX-02M-R and CDT-RX-02M-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 CDT-TX-02M-R and CDT-RX-02M-R

1. Duty cycle

The CDT-TX-02M-R and CDT-RX-02M-R are designed to be used in the EU wide harmonised frequency bands for short range devices. 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 conformity assessment of the CDT-TX-02M-R was performed using Circuit Design's standard antenna ANT-LEA-01 (1/4 lambda lead antenna), so we recommend using the ANT-LEA-01 antenna 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 CDT-TX-02M-R should be used within the specified voltage range (2.2 V to 12.0 V).

4. Enclosure

To fulfill the requirements of EMC and safety requirements, the CDT-TX-02M-R and CDT-RX-02M-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 apart 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	June 2011	First created	
1.1	Sept. 2011	DOC added	
1.2	Feb. 2014	DOC updated	
1.3	Sep.2015	Correction of erroneous description, DOC update	
2.0	Aug.2017	Update according to RED requirements	