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# 2.4G Wireless Transceiver Module

## SPECIFICATION

**Version: V1.1**



**Model No.: DL-24TRGC**



**Model No.: DL-24D8A-C**

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**Before using this module, please pay attention to the following important matters:**

This module is an electrostatic sensitive product. Please operate it on an anti-static workbench during installation and testing.

The module is integrated with all RF related devices and has PCB onboard antenna, so excellent RF performance can be obtained without additional antenna configuration. Please do not use metal case above the antenna, otherwise it will lead to serious attenuation of radio frequency signals, which will affect the effective use of distance.

Metal objects and wires should be kept away from the antenna as much as possible.

When installing the module, nearby objects should be kept at a sufficient safety distance from the module to prevent short circuit damage.

This module should be used in a dry environment. Please do not make any liquid substance come into this module.

Please use an independent voltage regulator circuit to supply power to this module, and avoid sharing with other circuits. The tolerance of the power supply should not be less than 5%.

**Limitations:**

This module is intended to be embedded in the customer's terminal product application, and does not provide a casing itself. It is not recommended that the customer directly resell this module as a final product without permission.

This series of modules are in accordance with commonly used international standards. If there is any special certification needed, we can adjust certain indicators according to your needs.

This module cannot be applied to life rescue, life-support systems, or any occasion where personal injury or life threatening may cause by equipment failure. Any organization or individual carrying out the above-mentioned applications shall bear all risks at their own.

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## 1. Brief Introduction of the Module

Designed base on TI-Chipcon's CC2500 wireless transceiver chip, DL-24TRGC/DL-24D8A-C is a compact, cost-effective, remote wireless transceiver module, which is widely used in smart home, toy aeromodelling and close-range data transmission control fields. Sensitivity up to -98dbm, maximum transfer rate up to 500Kbps, output power through register configuration ranges from -30dbm to +1dbm. The module is integrated with all RF related devices and has PCB onboard antenna, so excellent RF performance can be obtained without additional antenna configuration.

This module uses standard 8PIN output. RSSI and low power mode can be set up effectively in the application to reduce the cost. You can easily develop wireless products with stable performance and high reliability directly, which will extremely shorten the development cycle without in-depth understanding of RF circuit design.

### Importance notice:

**DL-24TRGC:** manual welding is required, due to different thermal expansion coefficient of the black glue and the binding wire inside, as it is binding version base on **CC2500 wafer**.

**DL-24D8A-C:** it can be SMT directly in mass production, since it was **CC2500RGPR** chip-based design.

## 2. Features

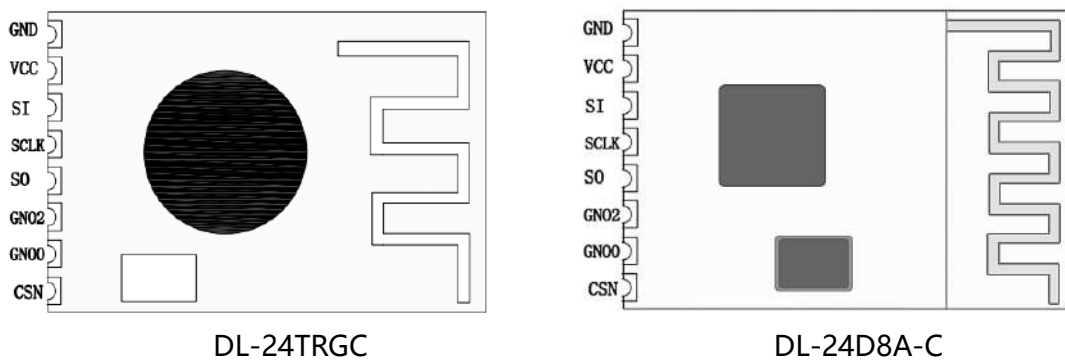
- The center frequency is 2433MHz, can work in the range of 2400~2483.5MHz
  - The maximum output power is +1dBm, and the open transmission distance is more than 100m
  - High reception sensitivity, up to -105dbm (@2.4Kbps)
  - Support GFSK/OOK/2-FSK/ASK/MSK modulation mode, programmable control
  - Communication rate 1.2~500Kbs, programmable configuration;
  - Separate 64byte transmit/receive data buffer
  - Separate 64-byte RX FIFO and TX FIFO
  - Built-in CRC check to ensure reliable data transmission
  - Carrier sense function;
  - Digital RSSI output;
  - Low power consumption, receiving current less than 15Ma, transmission current less than 25mA;
  - With a low power consumption mode, the power consumption is less than 2 uA;
  - Switching time of the standby and receive state under the WOR function can be pre-set, which can greatly save the power consumption;
  - Integrated temperature sensor;
  - Four-line SPI interface, strong versatility;
  - Power supply: 1.8~3.6V DC.
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### 3. Typical application

Logistics tracking, warehouse patrols, RFID (radio frequency identification);  
Replace 232, 485 for wireless data communication;  
Wireless data collection and control for industrial instruments and meters;  
Automatic AMR (Water, Electricity, Gas) meter reading system;  
Building and residential (smart home) control;  
Wireless remote control for electronic consumer products;  
Wireless Alarm, Security & Protection System;  
Wireless sensor network, etc.

### 4. Pins Definition



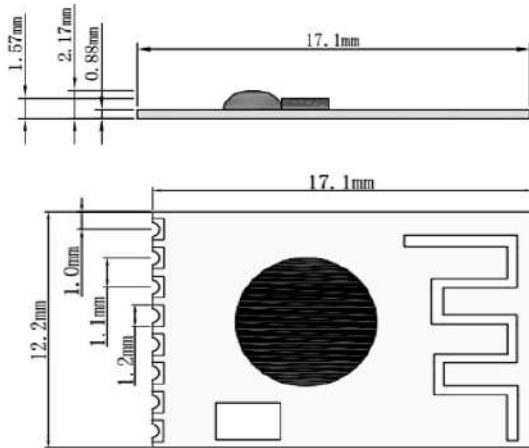
The **DL-24TRGC/DL-24D8A-C** RF modules both have 8 pins, which are Pin to Pin with each other, and were defined as following:

No.	Definition	Function
1	GND	Grounding, common ground with the MCU system
2	VCC	Supply voltage 3V
3	SI	SPI Data input, MOSI
4	SCLK	SPI CLOCK
5	SO	SPI data output, MISO
6	GND2	CLOCK Output
7	GND0	System Data Input and Output
8	CSN	Module Configuration Port, CS (Chip Selection) Port

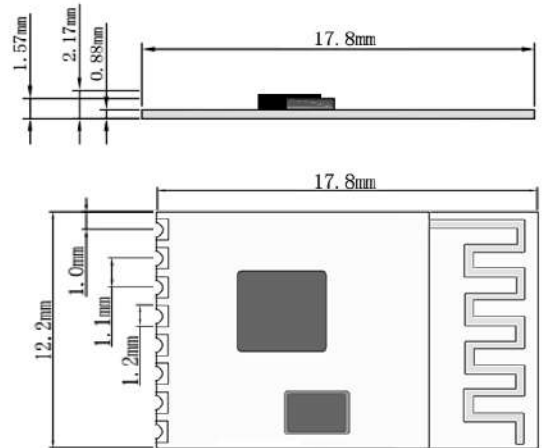
Table 1 Pin Definition of DL-24TRGC/DL-24D8A-C

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## 5. Product Size:



DL-24TRGC



DL-24D8A-C

## 6. Technical Parameters

RF Features (unless otherwise stated, Temperature is 25°C, VCC = 3.3V)

No	Technical index	Parameters	Remark
1	VDD Voltage	DC1.8~3.6V	
2	Center Frequency	2433MHz	Working range: 2400~2483.5MHz
3	Frequency Tolerance	±30KHz	
4	Modulation Mode	GFSK/OOK/2-FSK/ASK/MSK	Programmable configuration
5	Tx Power	-30~+1dBm	Programmable configuration
6	Rx sensitivity	-105dBm	2.4Kbps
7	Receiving current	< 15mA	2.4Kbps
8	Tx Current	< 25mA	Po= +1dBm, Related to the output power
9	Standby current	< 2uA	Refer to IC working mode
10	Transmission rate	1.2~500Kbps	Programmable configuration
11	Harmonic power	< -30dBm	
12	Communication distance	> 100 米	Clear and open field transmission, 2.4kbps visible distance
13	Antenna impedance	50ohm	Onboard PCB antenna
14	Working temperature	-40~85°C	
15	Storage temperature	-50~125°C	
16	Dimension		Please refer to the outline drawing for pins and detailed dimensions

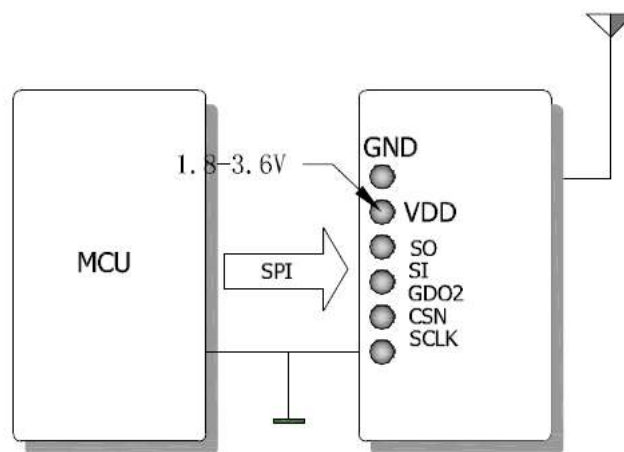
**Table 2: High Frequency Characteristic of the module**

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**Remarks:**

1. The communication rate of the module will affect the communication distance. The higher the rate, the closer the communication distance;
2. The communication rate of the module will affect the receiving sensitivity. The higher the rate, the lower the sensitivity;
3. The power supply voltage of the module will affect the transmitting power. Within the working voltage range, the lower the voltage, the lower the transmitting power;
4. When the operating temperature of the module changes, the center frequency will change. As long as it does not exceed the operating temperature range, the application will not be affected;
5. The antenna has a great impact on the communication distance, the antenna should be far away from the system GND when installation;
6. The installation of modules will affect the communication distance.

## 7. Module Connection Diagram (TTL Level):

**Remarks:**

1. The power supply voltage range is 1.8~3.6v, which cannot be exceed. If it exceeds 3.6V, the module will burn out. The recommended working voltage is 3.3V.
  2. The module interface adopts semicircle pad mode, and all GND pins shall be logically and reliably connected with the system grounding ports.
  3. PCB antenna on board shall be far away from system ground.
  4. The MCU with integrated SPI interface can also control this module. The ordinary I/O port can be used to simulate SPI timing for reading and writing operation. The speed of SPI shall not exceed 10MHz.
  5. The interface can be directly connected with the 3.3V power supply MCU without series resistance; the use of resistance depends on the type of I / O port of the MCU, and the pull-up resistor should be added if it is a leakage type I/O port; when the interface is connected with a 5V power supply MCU, if the output current of I/O port is more than
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10mA, it needs to be connected in series with 2-5k resistor to divide the voltage, otherwise it is easy to burn the module

6. GDO0 and GDO2 of C2500 are universal digital I/O ports, which can be configured according to the application to generate the required touch signal or clock signal.
7. In the application of multi-channel, the channel interval is 1MHz, if the interval is less than 1MHz, it is easy to produce the same frequency interference.
8. During the module test and evaluation, both the transmitter and the receiver should use the same module to avoid the poor communication, due to the configuration problems of crystal oscillator and load capacitance.

## **8. Working mode**

The operation modes of CC2500 include Sleep Mode, Idle Mode, Transmit Mode and Receive Mode, and the power consumption in Sleep Mode is the lowest.

After waking up from Sleep Mode, it enters Idle Mode. The other modes, except the Sleep Mode, can be switched to each other or configured to switch automatically. The main working state diagram of CC2500 is shown in the figure below. For detailed description, please refer to CC2500 chip specification.



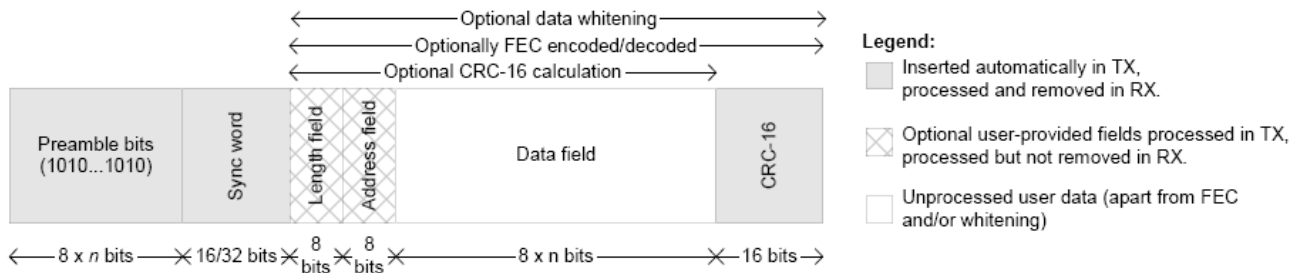
## 9. Data transmission mode:

The CC2500 has an independent 64bytes receive / transmit buffer, and the hardware supports many packets processing features, such as preamble, synchronization word, data whitening, CRC verification, FEC forward error correction, address verification, etc.

Users only need to transmit corresponding commands through SPI interface to control the CC2500, and only need to directly operate the data buffer through SPI when receiving and sending data.



The typical packet format is shown in below figure:



In addition, CC2500 supports the transmission mode of fixed packet length, variable packet length and unlimited packet length. Different packet lengths have different configuration and control modes. For details, please refer to CC2500 chip specification.

## 10. Programming

CC2500 register configuration values can be generated by the SmartRF Studio tool. Refer to the CC2500 chip specification to know more about each register.

At the same time, we can provide a complete set of evaluation kits and related routines, which can help you to develop and evaluate the module' s performance.

Our evaluation suite functions the same as the TI SmartRF04 suite, either directly connecting SmartRF Studio to control CC2500, or demonstrating the communication effect of the CC2500 module by our own routines is no problem.

## 11. Common Troubleshooting:

Phenomena	Reasons and Troubleshooting
Data not available	<ol style="list-style-type: none"> <li>Whether the power supply is in poor contact. Test whether the power supply voltage of the module is within the rated range;</li> <li>Whether the signal wire is in poor contact. Test whether the SPI interface of the module works normally;</li> <li>Whether the configuration of the transceiver module is consistent. Check whether the register configuration of receiving module and transmitting module is consistent;</li> <li>Whether the signal is blocked. If the transmitting power is large and the distance between the transceiver module and the transmitter module is very close (<math>&lt; 0.2\text{m}</math>), the signal may be blocked, resulting in data impassability;</li> </ol>