

## High Performance 2.4G RF Transceiver Module

# SPECIFICATION

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

**Version: V1.0**



**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 integrates all RF related devices and has PCB on-board antenna, which can achieve good RF performance without any antenna configuration. It also integrates all radio frequency related functions, 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.

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.

## 1. Brief Introduction of the Module

Designed base on TI-Chipcon's CC2500 wireless transceiver chip, DL-24A 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 range from -30dbm to +1dbm.

The module integrates all radio frequency related functions, 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.

SMD and DIP interface modes are adopted, but manual welding is required due to different thermal expansion coefficient of the black glue and the binding wire inside.

The small size of the module is convenient for portable products, and it can well meet the requirements of low-power system by combining with low-power MCU.

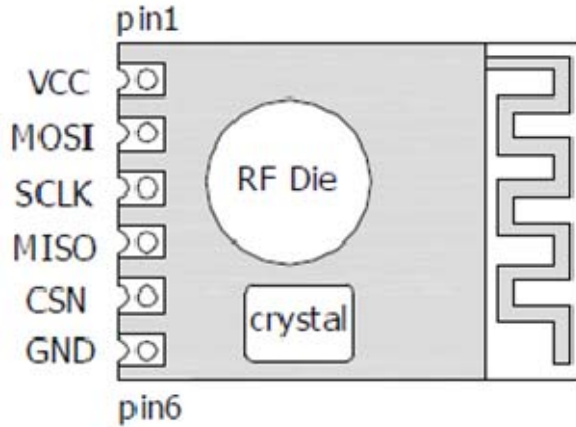
## 2. Features

- Transmission distance: 60m in an open air (250Kbps);
- Operating frequency: 2400-2483mhz
- Operating voltage: 1.8V-3.6V
- Programmable carrier detection, digital RSSI output
- Excellent selectivity and out-of-band isolation
- Gold plate binding process, high cost performance
- Four-line SPI interface, strong versatility;

## 3. Typical application

- Wireless game controller
- Wireless keyboard and mouse
- Consumer electronics and toy model airplanes
- Wireless voice/audio transmission
- Data monitoring transmission
- Smart home control
- Remote control that supports radio frequency (RF) technology

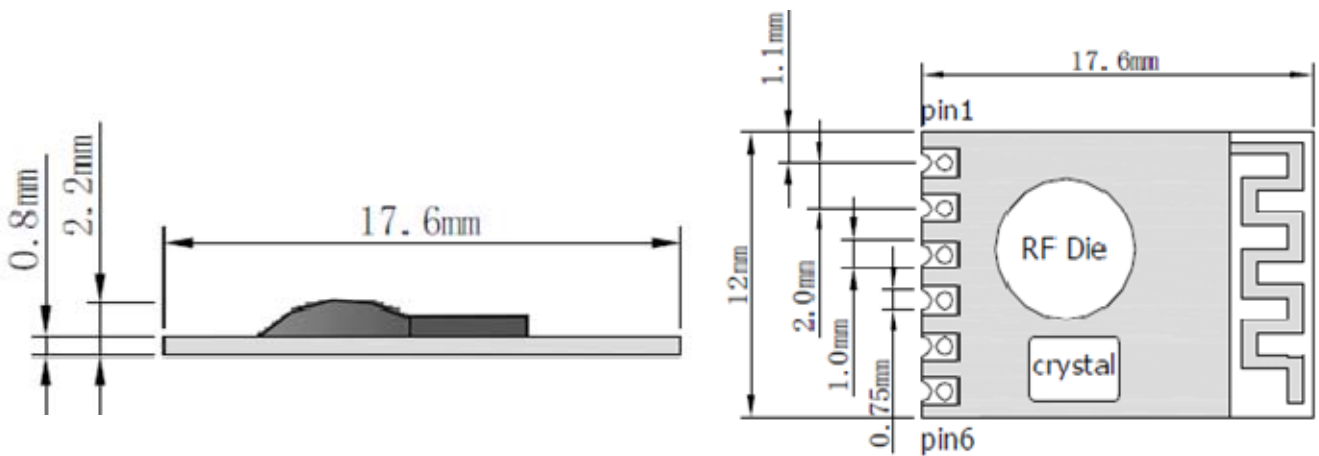
### 4. Pins Definition



No.	Definition	Function
1	VCC	Power Supply, DC1.8-3.6V
2	MOSI	SPI Data input , MOSI
3	SCLK	SPI CLOCK signal
4	MISO	SPI data output, MISO
5	CSN	CSN=0 valid
6	GND	Grounding, common ground with the system
7	ANT	Antenna interface, the standard 50 Ω antenna

Table 1: Pin Definition of DL-24A

### 5. Product Size :



### 6. Technical Parameters

### DC Features

Description	Min.	Max.	Unit
Power supply voltage	1.8	3.6	V
Working current	RX < 17mA	TX=22mA@0dbm	mA
Stand-by current		< 1uA	uA
Voltage of I/O Port	Vss-0.3	Vdd+0.3	V
Working temperature	-20	+75	°C

Table 2: DC Features of the module

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

No	Description	Parameter Range			Unit
		Min.	Type.	Max.	
1	Applied Frequency Range	2400		2483.5	MHz
2	Frequency Interval		100K		Hz
3	Transmit Power	-30		1	dBm
4	Reception sensitivity		-89		dBm
5	Modulation mode	GFSK	2-FSK	OOK	MSK
6	Transmission rate	1.2		500	Kbps
7	Harmonic power	-48	—	-45	dBm
8	Communication distance	80		100	M
9	Sensitivity at a rate of 2.4K		-104		dBm
10	TX Rate in OOK modulation mode			100	Kbps
11	Standby Power Consumption			0.9	mA
12	Crystal Precision *3225/ 2*6		10		PPM

Table 3: High Frequency Characteristic of the module

#### Remarks:

1. The communication rate of the module affects the communication distance. The higher the speed, the closer the communication distance is.
2. The module's communication rate will affect the reception sensitivity. The higher the rate, the lower the sensitivity.
3. The power supply voltage of the module will affect the transmission power. Within the working voltage range, the lower the voltage, the smaller the transmission power.

4. When the working temperature of the module changes, the center frequency will change, so long as it does not exceed the working temperature range, it will not affect the application.
5. The antenna has a great influence on the communication distance. Keep the antenna away from the system grounding during installation.
6. The way of module installation will affect the communication distance.

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

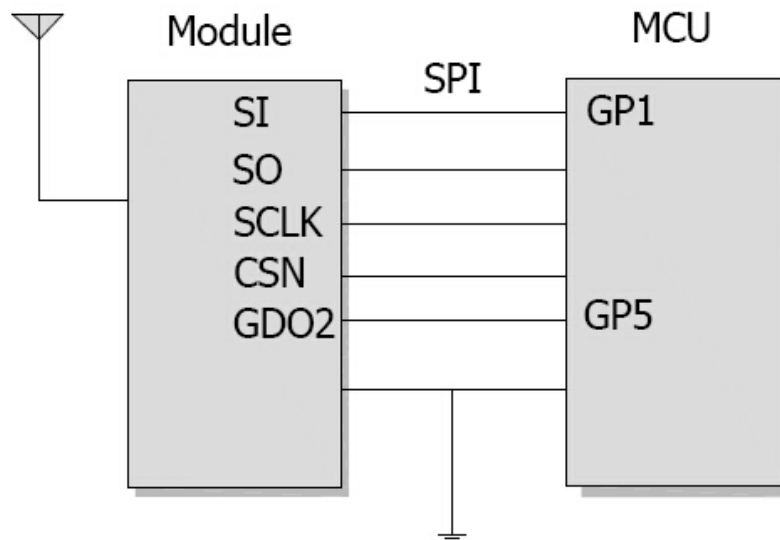


Figure 1: Module Connection Diagram

#### 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 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.

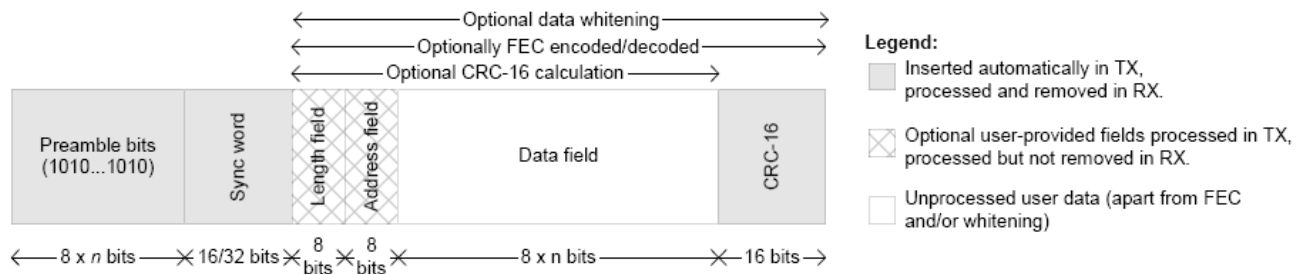


## 9. Data transmission mode:

The CC2500 has an independent 64bytes receive / transmit buffer, and the hardware supports many packet 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>1. Whether the power supply is in poor contact. Test whether the power supply voltage of the module is within the rated range;</li> <li>2. Whether the signal wire is in poor contact. Test whether the SPI interface of the module works normally;</li> <li>3. Whether the configuration of the transceiver module is consistent. Check whether the register configuration of receiving module and transmitting module is consistent;</li> <li>4. 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 (&lt; 0.2m), the signal may be blocked, resulting in data impassability;</li> </ol>
Transmission distance is too close	<ol style="list-style-type: none"> <li>1. Whether the environment is bad and whether the antenna is shielded;</li> <li>2. Whether there is co-frequency or strong magnetism, or power interference, change channel or keep away from interference source;</li> <li>3. Whether the power supply matches. Whether the voltage and current are large enough;</li> </ol>
High bit error rate	<ol style="list-style-type: none"> <li>1. The power supply ripple is large: replace the power supply;</li> <li>2. Check whether the register configuration of the module is correct and configure the register according to the recommended value;</li> <li>3. If there is co frequency interference, replace the channel;</li> <li>4. Whether the antenna is shielded;</li> </ol>

## 12. Contact us

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