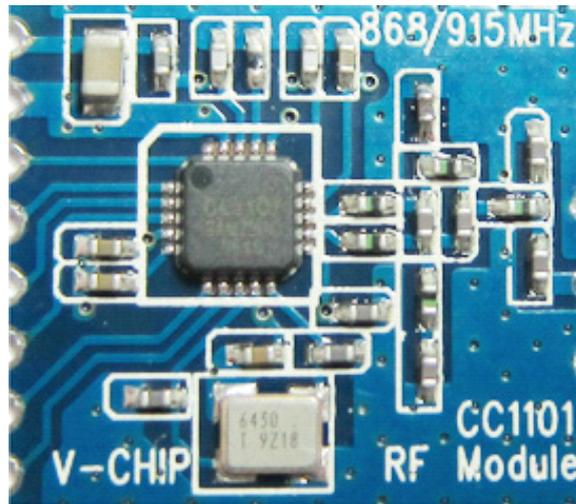


VT-CC1101-868M Wireless Module

User Guide



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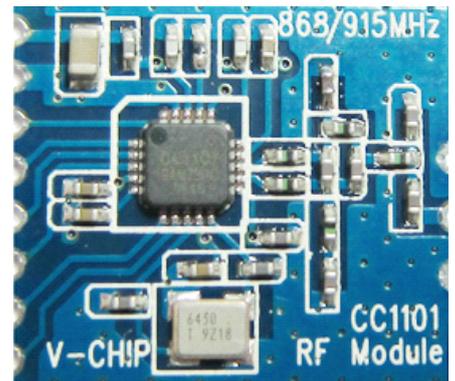
Web Site: www.digiRF.com

General Description

VT-CC1101-868M is based on RF Transceiver CC1101 of TI Chipcon, it's a small size and ultra low power UHF wireless module. CC1101 is a low cost true single chip UHF transmitter designed for very low power wireless applications. The circuit is mainly intended for the ISM (Industrial, Scientific and Medical) and SRD (Short Range Device) frequency bands at 315, 433, 868 and 915 MHz, The MAX RF output power can be set as high as +10dBm, with data rate as high as 500Kbps. The module integrated many RF functions thus you can use it conveniently and reducing your development time.

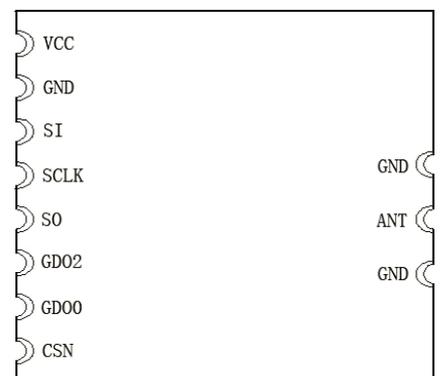
Features

- Central frequency is 868MHz, Frequency bands :779~928MHz
- Programmable output power up to +10dBm for all supported frequencies, the communication distance is above 200m in sight .
- High receiver sensitivity down to -110dBm(at 2.4Kbps data rate)
- Programmable baseband modulator with GFSK/2-FSK/ASK/OOK/MSK
- Programmable data rate 1.2~500Kbps
- 64-byte TX data FIFO
- Optional Forward Error Correction with Interleaving
- Support carrier sense and digital RSSI output.
- Low current consumption with receive mode <20mA, transmit mode at +10dBm output power <30mA
- Low current consumption at power down state <2uA
- Wake-on-radio functionality for automatic low-power RX polling
- Integrated analog temperature sensor
- Efficient SPI interface, All registers can be programmed with one “burst” transfer
- Small dimension: 17.0mm×19.0mm×2.4 mm
- Operating supply voltage: 1.8~3.6V DC



Applications

- Logistics Tracking System, Warehouse patrol, Electronic label.
- Replace RS232 and RS485 in data transmission
- Industrial monitoring and control in data acquisition
- AMR – Automatic Meter Reading
- Home and building automation
- Consumer Electronics products of wireless control
- Wireless alarm and security systems



- Wireless sensor networks

General Characteristics

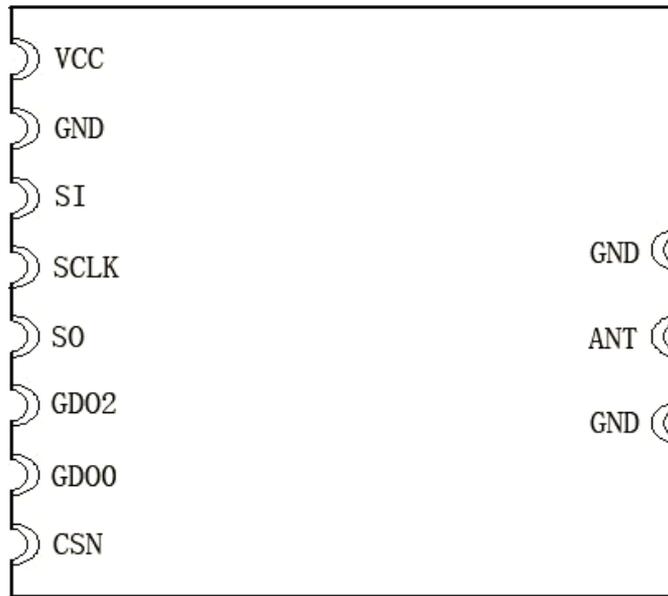
Test operating conditions: Ta=25°C, VCC=3.3V if nothing else satated.

| Parameter | Type | Condition/Note |
|----------------------------------|----------------------------|--|
| Operating supply voltage | DC 1.8~3.6V | |
| Central frequency | 868MHz | Can be programmable to other frequency in bands 779~928MHz |
| Frequency accuracy | ±10KHz | |
| Modulation format | GFSK/2-FSK/ASK/OOK/M SK | Programmable |
| Transmit power | -30~+10dBm | Programmable |
| TX current consumption | <30mA | Po=10dBm |
| Receiver sensitivity | -110dBm | 2.4Kbps |
| RX current consumption | <30mA | 2.4Kbps |
| Sleep State current consumption | <2uA | Refer to IC operation states |
| Data rate | 1.2~500Kbps | Programmable |
| Spurious emissions and harmonics | < -30dBm | TX power +10dBm. |
| Communication distance | >200m | Use VT-CC1101-433M as a receiver, 2-FSK modulation, 1.2kbaud data rate, +10dBm output power. |
| Antenna impedance | 50ohm | |
| Operating temperature | -20~+75 °C | |
| Storage temperature range | -50~+125°C | |
| Dimension | 17.0 mm×19.0 mm×2.4mm | See more in PCB description |

Note:

1. The module transmission data rate will affect Transmission distance ,the higher the data rate , the closer the distance, and the lower the receiving sensitivity.
2. The supply voltage to the module will affect TX power, in the operating supply voltage range, the lower the voltage, the lower the TX power.
3. The module central frequency will change as the operating temperature change, use it under suggest temperature, the module can work well.
4. The antenna will strongly affect the communication distance, please select matched antenna and connect it correctly.
5. The module mount will affect the communication distance.

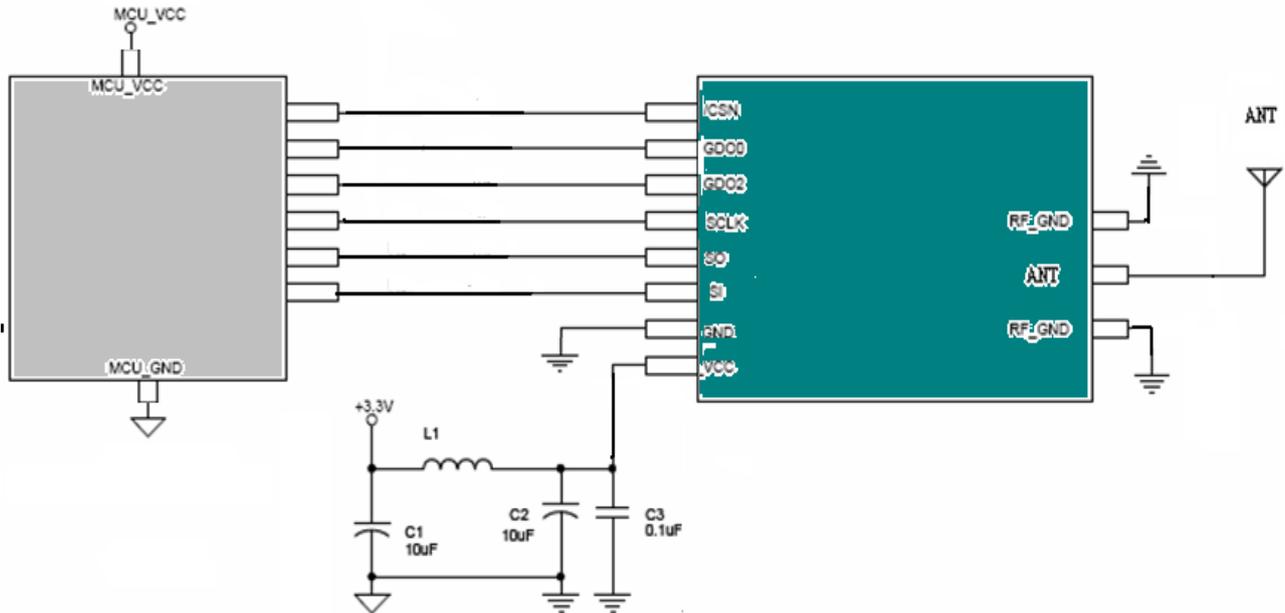
PCB Description



Pin Configuration

| Pin name | Pin type | Description |
|----------|----------------|---|
| VCC | Power(Analog) | 1.8 V - 3.6 V analog power supply connection. |
| GND | Ground | Connect to the system ground. |
| SI | Digital Input | Serial configuration interface, data input. |
| SCLK | Digital Input | Serial configuration interface, clock input. |
| SO | Digital Output | Serial configuration interface, data output. Optional general output pin when CSN is high. |
| GDO2 | Digital I/O | Programmable Clock output, down-divided from XOSC |
| GDO0 | Digital I/O | Programmable Clock output, down-divided from XOSC. |
| CSN | Digital Input | Serial configuration interface, chip select, active low. |
| ANT | RF I/O | RF output signal from PA, connect to the Antenna. |

Circuit Interface

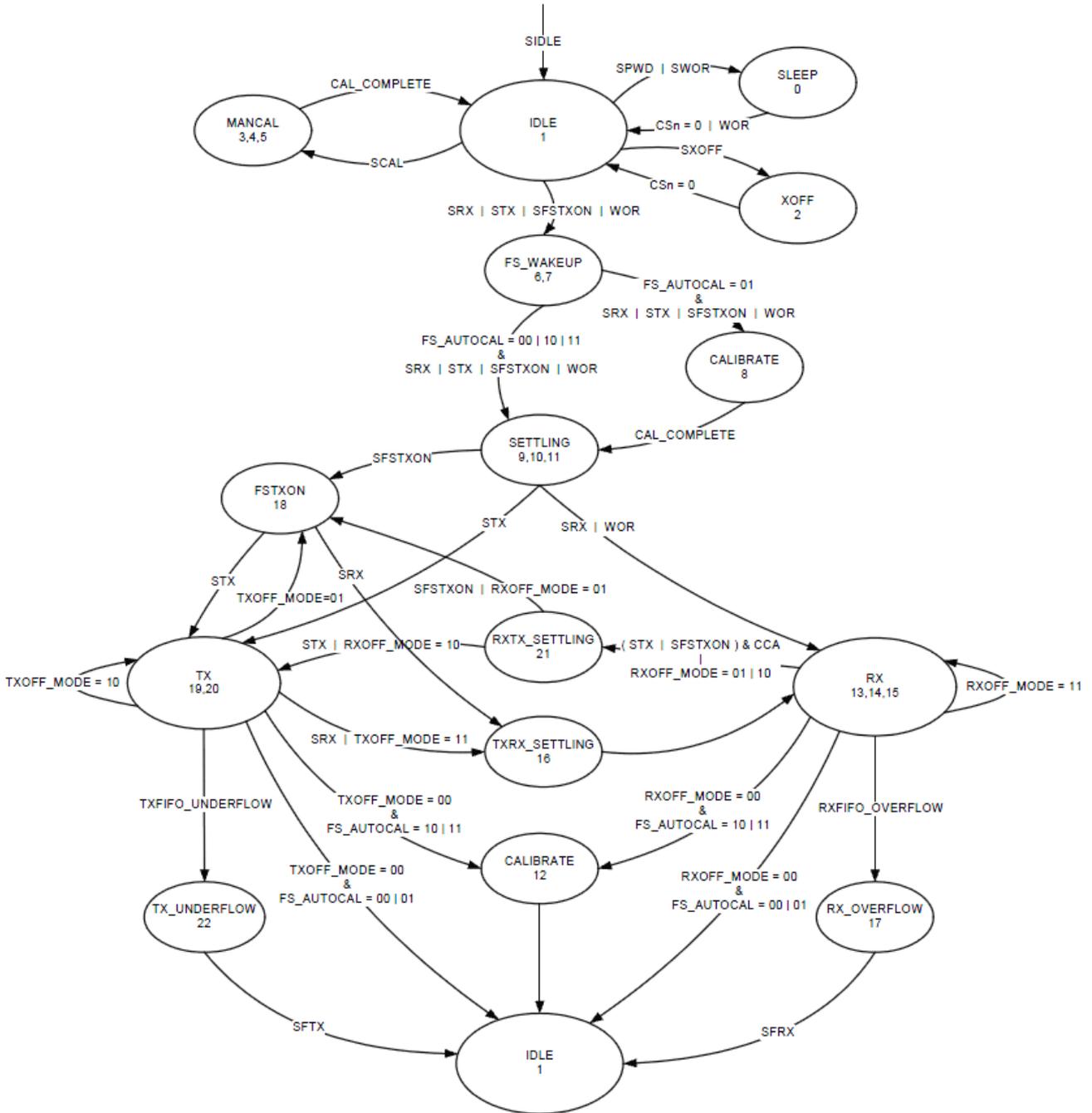


Note:

1. The module power supply voltage range is DC 1.8 ~ 3.6V, above DC 3.6V, the module will damage. It is recommended work at DC 3.3 V.
2. The module interface use half circle pad to soldering on the system PCB board, the GND must soldering to the system digital GND reliably.
3. The antenna must the get to the module's ANT pin as close as possible.
4. The MCU which don't have integrated SPI interface can also control the module, use the normal I/O port to work like SPI timing to read and write. The SPI data rate is below 10MHz.
5. The interface can connect directly to the MCU which use 3.3V power supply, there is no need serial resistor. If the I/O is open-drain, the pull-up resistor will be added. When connect to the MCU which use 5V power supply, the MCU's I/O output current beyond 10 mA, a 2~5k ohm resistor will be series to divide the voltage, or it will damage the module.
6. The module's pin GDO0 is a general digital I/O port, it can be programmable to produce trigger signal or clock output.
7. In the multiple channel application, the channel spacing is recommended to set as 1MHz, or there will be a same frequency interference.

Operation States

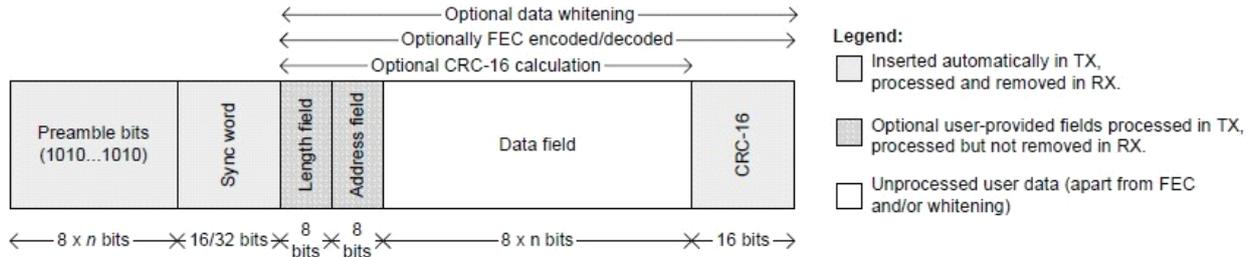
CC1101's operation states contain: Sleep State, Idle State, Active State, Sleep State is the lowest power mode. After wake up from Sleep State, the module get into Idle State. Except the Sleep State, each state can be switch by SPI interface, also programmed to auto-switch. CC1101's radio control state diagram is shown as below, for detail information in the CC1101 datasheet.



Data Transmission

The CC1101 contains a 64 byte FIFO for data to be transmitted, built-in hardware support for packet oriented radio protocols, e.g. Preamble bytes, Synchronization Word, Whitening the data, CRC checksum, Interleave and Forward Error Code, Address checksum. The SPI interface is used for sending command control and writing to the TX FIFO.

The format of the data packet can be configured and consists of the following figure:

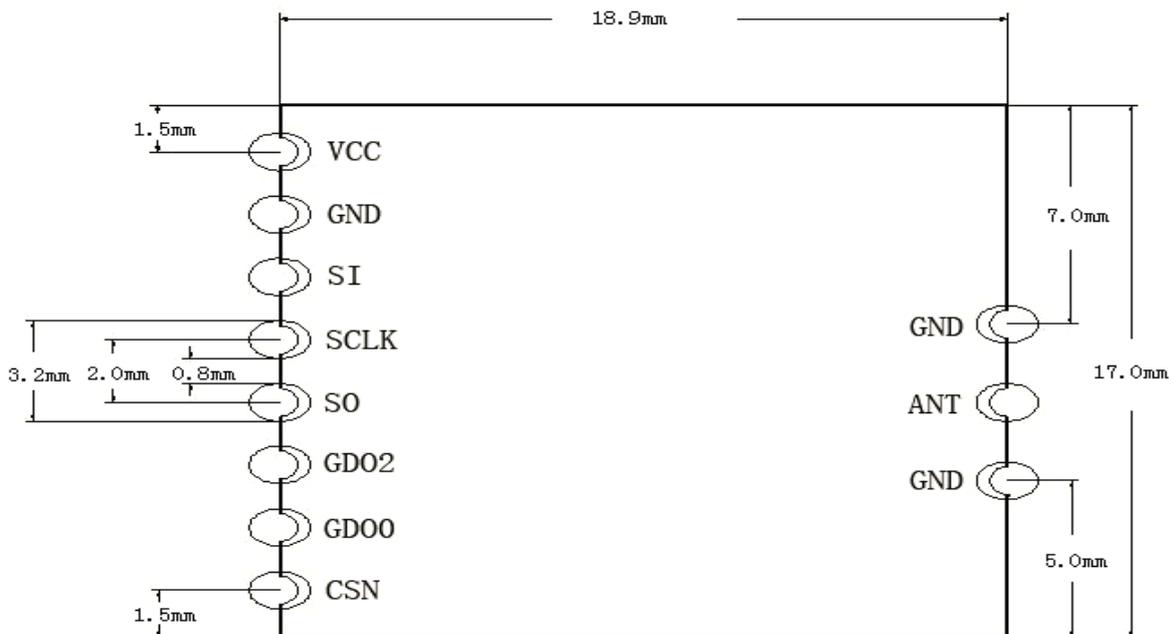


In addition, CC1101 supports fixed packet length protocols, variable packet length protocols and infinite packet length. Details refer to the CC1101 datasheet.

Configuration Registers

The configuration of CC1101 can be done with software SmartRF Studio7. Complete descriptions of the registers are given in the CC1101 datasheet. We can provide evaluation board and demo code to the customer to develop and evaluate the module's capability.

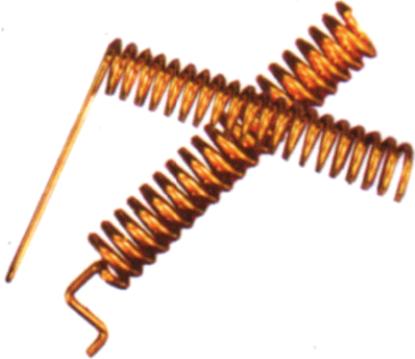
Dimension



Antenna

We can provide antenna match to the module. And if there is some special requirements to satisfy, we can coordinate with you to select antenna, match antenna to the module in order to make the product work well.

Some recommend antennas as the table below.

| | |
|---|--|
| <p>Spring antenna (Standard) Characteristic: small size, low cost, embedded conveniently.</p> |  |
| <p>SMA rubber antenna (Optional) Characteristic: medium-scale, low cost, high gain</p> |  |
| <p>Magnetic Mount Antenna (Optional) Characteristic: high gain, Magnetic Mount , suitable for mount on iron box.</p> |  |

Note: Standard is for free, optional need another payment and the cost refer to the antenna price.

Questions and Answers

| Description | Reason and Solution |
|-------------------------------------|--|
| Can't communication | <ol style="list-style-type: none"> 1. The power supply connect not well, check the module VCC whether it is out of maximum rating. 2. The signal line connect not well, check the module SPI interface. 3. The settings of the transmitter module and receiver module are not the same. Check these modules' register configuration. 4. Signal block. If the transmitter work with a high TX power, and the receiver was put at a short distance(<0.5m), maybe there is a signal block to make no communication. |
| Communication distance is too short | <ol style="list-style-type: none"> 1. The application environment is too bad or the antenna is shield. Put the antenna to a better place outside or higher throw a coaxial line , replace it with a higher gain antenna. 2. The work space contains a same frequency interference source, or a strong magnetic field interference, power source disturbance. Try to change the carrier frequency or get far away from the source of the disturbance. 3. The power supply is not strong. Check the voltage and the current whether it is enough. |
| High data error | <ol style="list-style-type: none"> 1. The power supply ripple is too big, Change the power supply. 2. Check the module register configuration, it is recommended to set as the CC1101-datasheet. 3. There is a carrier frequency interference, change the channel. 4. The antenna unmatched to the module RF interface, change another matched antenna. |

Development Package:

1. CC1101 datasheet (CC1101.pdf)
2. CC1101 register configuration tool (SmartRF Studio 7 v1.4.9.zip)
3. CC1101 demo code (CC1101 Demo Code.rar)
4. Hard ware tools (TI Chipcon Evaluation Board)

Note:

1. **You can get the development package above from the salesman when you order the module.**
2. **As version update, please refer to our latest development materials.**

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