VT-CC2520-Z1 Wireless Module

User Guide
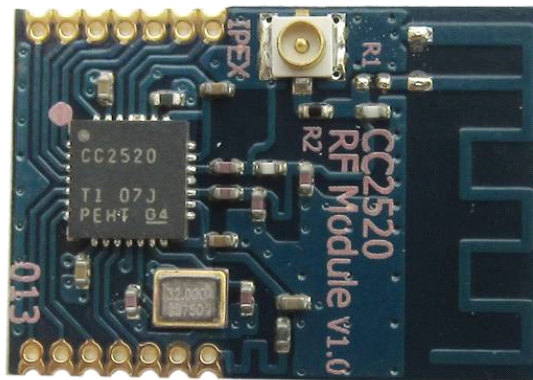
V-CHIP MICROSYSTEMS Co. Ltd

General Description

The VT-CC2520-Z1 Wireless Module use TI's second generation ZigBee® / IEEE 802.15.4 RF transceiver for the 2.4 GHz unlicensed ISM band. In a typical system, This module can be used together with a microcontroller.

Features

- ZigBee/IEEE 802.15.4 RF transceiver for the 2.4 GHZ unlicensed ISM band

- Programmable output power up to +5 dBm，Excellent receiver sensitivity (-98 dBm)

- Provides extensive hardware support for frame handling, data buffering, burst transmissions, data encryption, data authentication, clear channel assessment, link quality indication and frame timing information. These features reduce the load on the host controller

- 6 configurable IO pins

- 128 bit AES

- CC2420 compatibility mode

- Wide supply range: 1.8 V – 3.8 V

- Suitable for systems targeting compliance with worldwide radio frequency regulations: ETSI EN 300 328 and EN 300 440 class 2 (Europe), FCC CFR47 Part 15 (US) and ARIB STD-T66 (Japan)

- Small Size 23.0*16.0*2.0mm

# Application

- 2.4GHz IEEE 802.15.4/ZigBee systems

- Home and building automation

- Set-top boxes and remote controls

- Industrial monitoring and control

- Automatic Meter Reading

- Consumer electronics

- Low-power wireless sensor networks

Parameter

PARAMETER		TYP	REMARK
Frequency range		2394-2507MHz	
Frequency error		+/-10ppm	
Modulation		O-QPSK	
Data rate		250Kbps	
Output power		-20 ~ +5dBm	Programmable
Transmit current		≤38mA	
Receiver sensitivity		-98dBm	
Receive current		≤25mA	
Sleep current	LPM1	≤250uA	**XOSC** off, digital regulator on. State retention.
	LPM2	≤120nA	**XOSC** off, digital regulator off. No state retention.
Supply voltage		1.8-3.8V	
Operating temperature		-20°C ~75°C	
Dimension		23.0*16.0*2.0mm	

Pin
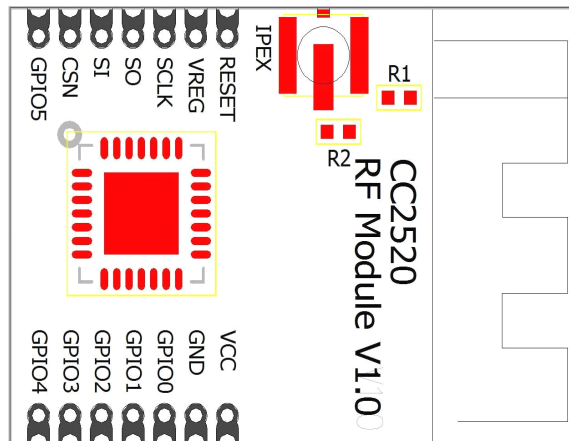
PIN	Type	Description
VCC	Power	1.8 V to 3.8 V analog power supply connections
GND	Ground	
GPIO0	IO	General purpose digital I/O
GPIO1	IO	General purpose digital I/O
GPIO2	IO	General purpose digital I/O
GPIO3	IO	General purpose digital I/O
GPIO4	IO	General purpose digital I/O
GPIO5	IO	General purpose digital I/O

CSN	I	SPI interface: Chip Select, active low
SI	I	SPI interface: Serial In
SO	O	SPI interface: Serial Out
SCLK	I	SPI interface: Serial Clock. Maximum 8 MHz
VREG	I	When high, digital voltage regulator is active
RESET	I	External reset pin, active low
IPEX	Antenna	When use optional antenna outside, place 0 Ohm at R2 and no longer use R1. The antenna impedance is 50 Ohm.

Interface

Interconnection of MSP430F2618 and VT-CC2520-Z1：

VT-CC2520-Z1	MSP430F2618
GPIO0	P01.3/TA2
GPIO1	P01.5/TA0
GPIO2	P01.6/TA1
GPIO3	P01.1/TA0/BSLTX
GPIO4	P01.2/TA1
GPIO5	P01.7/TA2
CSN	P05.0/UCB1STE/UCA1CLK
SI	P05.1/UCB1SIMO/UCB1SDA
SO	P05.2/UCB1SOMI/UCB1SCL
SCLK	P05.3/UCB1CLK/UCA1STE
VREG	P01.0/TACLK/CAOUT
RESET	P05.7/TBOUTH/SVSOUT

NOTE：

1、 The module power supply voltage range is DC 1.8～3.8V, above DC 3.8V, 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 GND reliably.

3、 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 8MHz.

4、 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 over 10 mA, a 2~5k ohm resistor will be series to divide the voltage, or it will damage the module.

5、 Please note overvoltage or overcurrent will damage the module, and the ESD protection must be done.

6、 The module's pin GDO0~GDO5 are general digital I/O port, it can be programmable to produce trigger signal or clock output.

7、 The module could pass soldering machine, at temperature 260°C it can bear 10 seconds. It is recommend to use SMT re-flow oven, especially there must be done ESD protection during the production.

Radio Control State Machine

The FSM module is responsible for maintaining the TX FIFO and RX FIFO pointers, control of analog "dynamic" signals such as power up / power down, control of the data flow within the RF core, generation of automatic acknowledgement frames and control of all analog RF calibration.
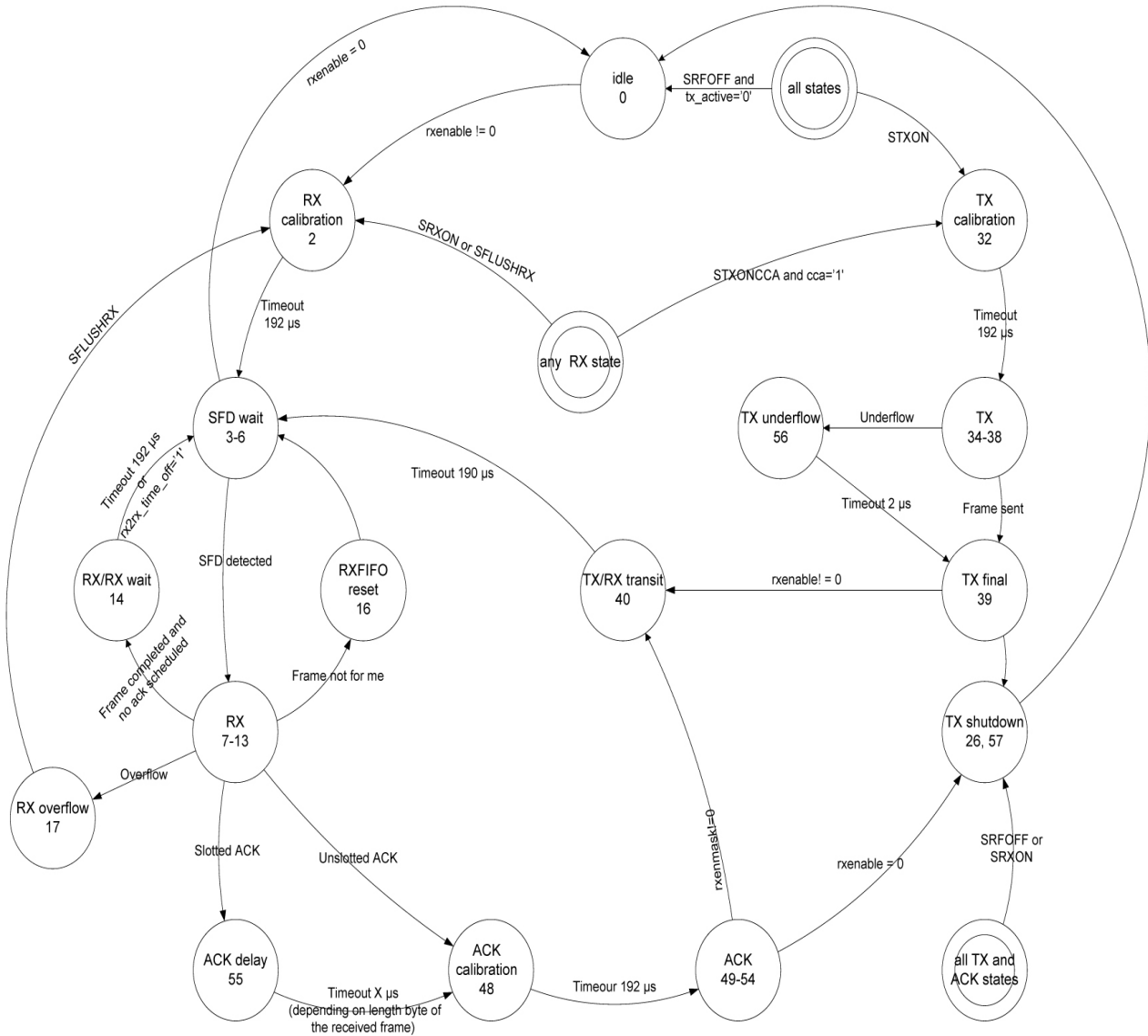
The figure shows the mapping from FSM state to the number which can be read from the FSMSTAT0 register. Note that although it is possible to read the state of the FSM, this information should not be used to control the program flow in the application software. The states may change very quickly (every 32 MHz clock cycle) and an 8 MHz SPI is not able to capture all the activities.

FSM State Mapping

State name	State number（decimal）	Number （hex）	TX_active	RX_active
IDLE	0	0x00	0	0
RX calibration	2	0x02	0	1

SFD wait	3 - 6	0x03 – 0x06	0	1
RX	7-13	0x07 – 0x0D	0	1
RX/RX wait	14	0x0E	0	1
RXFIFO reset	16	0x10	0	1
RX overflow	17	0x11	0	0
TX calibration	32	0x20	1	0
TX	34 - 38	0x22 – 0x26	1	0
TX final	39	0x27	1	0
TX/RX transit	40	0x28	1	0
ACK calibration	48	0x30	1	0
ACK	49 - 54	0x31 – 0x36	1	0
ACK delay	55	0x37	1	0
TX underflow	56	0x38	1	0
TX shutdown	26, 57	0x1A, 0x39	1	0

Configuration Registers

The configuration of CC2520 can be done with software SmartRF Studio7. Complete descriptions of the registers are given in the CC2520 datasheet. We can provide evaluation board and demo code to the customer to develop and evaluate the module's capability.
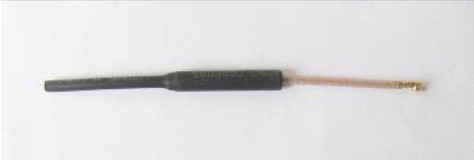
Dimension
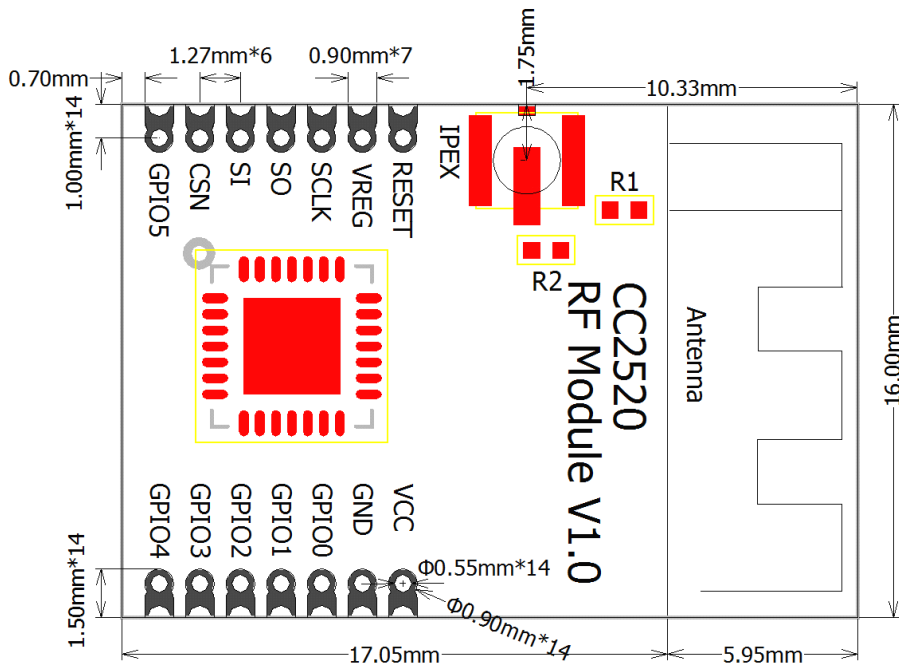
Antenna

VT-CC2520-Z1 support PCB antenna and outer antenna with IPEX connector. R1 and R2 are 0 Ohm when used as jumper to connect two type antenna. For use PCB antenna, there is only need to solder R1. For use outer antenna, there is only need to solder R2. PCB antenna is standard when the module leaving factory, if there is some more requirement about use outer antenna, please contact with the sales. Additionally 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.

2.4G antenna（Optional） **Characteristic**：small size, good direction, low cost, embed convenient.	
Rubber Duck and Tenon Antenna and IPEX connector（Optional） **Characteristic**：High gain, IPX connector extending with ultra coaxial cable, easy to fix.	
SMA rubber antenna（Optional） **Characteristic**：used with IPX-SMA coaxial cable, medium-scale, low cost, high gain。Suit for equipment with iron crust.	

Note: optional need another payment and the cost refer to the antenna price. It is not recommend to DIY soft cable antenna. Because the impedance is difficult to control, and the soft cable's shape is not fixed to make it lack of consistency.

Questions and Answers

Description	Reason and Solution
Can't communication	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, maybe there is a signal block to make no communication.
Communication distance is too short	1．Please check R1 and R2 on the module. When use PCB antenna, soldering R1. When use outer antenna throw IPEX connector, soldering R2. 2．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. 3．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. 4．The power supply is not strong. Check the voltage and the current whether it is enough.
High data error	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 CC2520-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. CC2520 datasheet（CC2520.pdf）

2. CC2520 register configuration tool（SmartRF Studio 7 v v1.8.0.zip）

3. CC2520 demo code (CC2520 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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