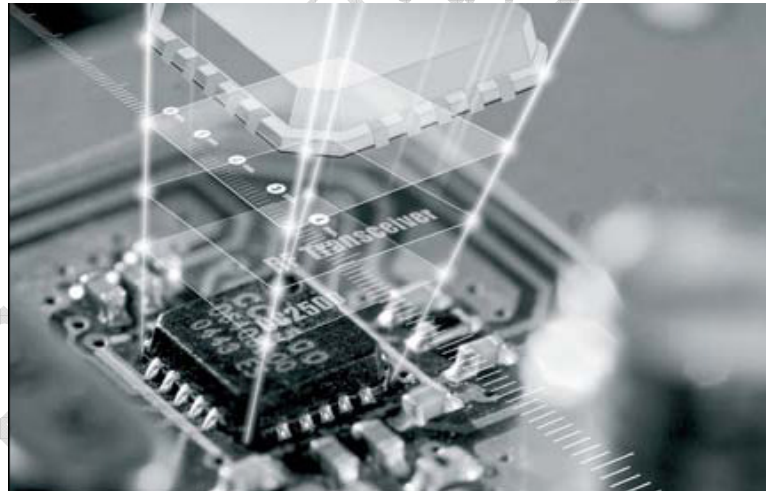# SPECIFICATION

Single Chip Low Cost / Low Power
RF Transceiver

Model   : **2.4GHz RF Module**

Part No : TC2500-xPTI

Version : V2.0

Date   : 2012.10.12

■ Applications

- *2400-2483.5 MHz ISM/SRD band systems*
- *Consumer Electronics*
- *Wireless game controllers*
- *Wireless audio*
- *Wireless keyboard and mouse*

■ Absolute Maximum Ratings

Under no circumstances must the absolute maximum ratings given in Table 1 be violated. Stress exceeding one or more of the limiting values may cause permanent damage to the device.

Caution! ESD sensitive device. Precaution should be used when handling the device in order to prevent permanent damage.

Parameter	Min	Max	Units	Condition
Supply voltage	−0.3	3.6	V	All supply pins must have the same voltage
Voltage on any digital pin	−0.3	VDD+0.3, max 3.6	V	
Voltage on the pins	−0.3	2.0	V	
Voltage ramp-up rate		120	kV/µs	
Input RF level		+10	dBm	
Storage temperature range	−50	150	℃	
Solder reflow temperature		260	℃	According to IPC/JEDEC J-STD-020C
ESD		<500	V	According to JEDEC STD 22, method A114, Human Body Model

■ Operating Conditions

Parameter	Min	Max	Units	Condition
Operating temperature	−40	85	℃	
Operating supply voltage	1.8	3.6	**V**	All supply pins must have the same voltage

■ General Characteristics

Parameter	Min	Typ	Max	Units	Condition/Note
Frequency range	2400		2483.5	MHz	
Data rate	1.2		500	kbps	FSK
	1.2		250	kbps	GFSK and OOK
	26		500	kbps	(Shaped) MSK (also known as differential offset QPSK) Optional Manchester encoding (halves the data rate).

■ Electrical Specifications

● Current Consumption

Tc = 25℃, VDD = 3.0 V if nothing else stated. All measurement results obtained using the CC2500EM reference design

Parameter	Min	Typ	Max	Units	Condition/Note
Current consumption in power down modes		400		nA	Voltage regulator to digital part off, register values retained (SLEEP state)
		900		nA	Voltage regulator to digital part off, register values retained, low- power RC oscillator running (SLEEP state with WOR enabled)
		92		µA	Voltage regulator to digital part off, register values retained, XOSC running (SLEEP state with MCSM0.OSC_FORCE_ON set)
		160		µA	Voltage regulator to digital part on, all other modules in power down (XOFF state)
Current consumption		8.1		µA	Automatic RX polling once each second, using low-power RC oscillator, with 460 kHz filter bandwidth and 250 kbps data rate, PLL calibration every 4_{th} wakeup. Average current with signal in channel *below* carrier sense level.
		35		µA	Same as above, but with signal in channel *above* carrier sense level, 1.9 ms RX timeout, and no preamble/sync word found.
		1.4		µA	Automatic RX polling every 15_{th} second, using low-power RC oscillator, with 460 kHz filter bandwidth and 250 kbps data rate, PLL calibration every 4_{th} wakeup. Average current with signal in channel below carrier sense level
		42		µA	Same as above, but with signal in channel *above* carrier sense level, 37 ms RX timeout, and no preamble/sync word found.
		1.5		mA	Only voltage regulator to digital part and crystal oscillator running (IDLE state)
		7.4		mA	Only the frequency synthesizer running (after going from IDLE until reaching RX or TX states, and frequency calibration states)
Current consumption, RX states		15.3		mA	Receive mode, 2.4 kbps, input at sensitivity limit, MDMCFG2.DEM_DCFILT_OFF = 1
		12.8		mA	Receive mode, 2.4 kbps, input 30 dB above sensitivity limit, MDMCFG2.DEM_DCFILT_OFF = 1
		15.4		mA	Receive mode, 10 kbps, input at sensitivity limit, MDMCFG2.DEM_DCFILT_OFF = 1
		12.9		mA	Receive mode, 10 kbps, input 30 dB above sensitivity limit, MDMCFG2.DEM_DCFILT_OFF = 1
		18.8		mA	Receive mode, 250 kbps, input at sensitivity limit, MDMCFG2.DEM_DCFILT_OFF = 0
		15.7		mA	Receive mode, 250 kbps, input 30 dB above sensitivity limit, MDMCFG2.DEM_DCFILT_OFF = 0
		16.6		mA	Receive mode, 250 kbps current optimized, input at sensitivity limit, MDMCFG2.DEM_DCFILT_OFF = 1
		13.3		mA	Receive mode, 250 kbps current optimized, input 30 dB above sensitivity limit, MDMCFG2.DEM_DCFILT_OFF = 1
		19.6		mA	Receive mode, 500 kbps, input at sensitivity limit, MDMCFG2.DEM_DCFILT_OFF = 0
		17.0		mA	Receive mode, 500 kbps, input 30 dB above sensitivity limit, MDMCFG2.DEM_DCFILT_OFF = 0
Current consumption, TX states		11.1		mA	Transmit mode, –12 dBm output power
		15.1		mA	Transmit mode, -6 dBm output power
		21.2		mA	Transmit mode, 0 dBm output power

● RF Receive Section

Tc = 25℃, VDD = 3.0 V if nothing else stated. All measurement results obtained using the CC2500EM reference design.

Parameter	Min	Typ	Max	Units	Condition/Note
250 kbps data rate, current optimized, MDMCFG2.DEM_DCFILT_OFF = 1 (MSK, 1% packet error rate, 20 bytes packet length, 540 kHz digital channel filter bandwidth)					
Receiver sensitivity		-87		dBm	
Saturation		-13		dBm	
Adjacent channel rejection		21		dB	Desired channel 3 dB above the sensitivity limit. 750 kHz channel spacing
Alternate channel rejection		30		dB	Desired channel 3 dB above the sensitivity limit. 750 kHz channel spacing
500 kbps data rate, MDMCFG2.DEM_DCFILT_OFF = 0 (MSK, 1% packet error rate, 20 bytes packet length, 812 kHz digital channel filter bandwidth)					
Receiver sensitivity		-82		dBm	
Saturation		-18		dBm	
Adjacent channel rejection		14		dB	Desired channel 3 dB above the sensitivity limit. 1 MHz channel spacing
Alternate channel rejection		25		dB	Desired channel 3 dB above the sensitivity limit. 1 MHz channel spacing
General					
Blocking at ±10 MHz offset		47		dB	Desired channel at –80 dBm. Compliant with ETSI EN 300 440 class 2 receiver requirements.
Blocking at ±20 MHz offset		52		dB	Desired channel at –80 dBm. Compliant with ETSI EN 300 440 class 2 receiver requirements.
Blocking at ±50 MHz offset		54		dB	Desired channel at –80 dBm. Compliant with ETSI EN 300 440 class 2 receiver requirements.
Spurious emissions 25 MHz – 1 GHz Above 1 GHz			-57 -47	dBm dBm	

● RF Transmit Section

Tc = 25℃, VDD = 3.0 V, 0 dBm if nothing else stated. All measurement results obtained using the CC2500EM reference design.

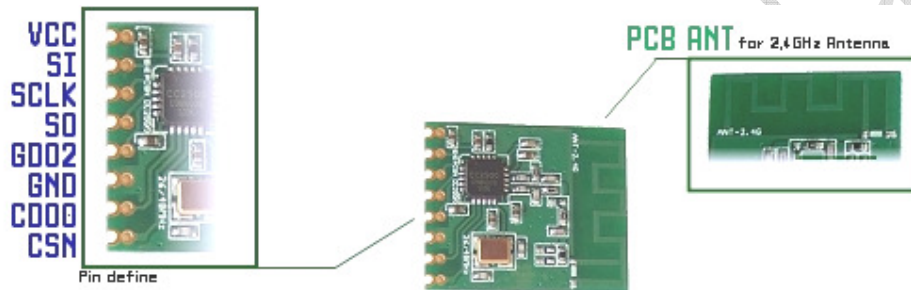| Parameter	Min	Typ	Max	Units	Condition/Note
Differential load impedance		80 + j74		dBm	Differential impedance as seen from the RF-port (RF_P and RF_N) towards the antenna. Follow the CC2500EM reference design available from the TI and Chipcon websites.
Output power, highest setting		0		dBm	Output power is programmable and is available across the entire frequency band. Delivered to a 50 Ω single-ended load via CC2500EM reference design RF matching network.
Output power, lowest setting		-30		dB	Output power is programmable and is available across the entire frequency band. Delivered to a 50 Ω single-ended load via CC2500EM reference design RF matching network
Spurious emissions 25 MHz – 1 GHz 47-74, 87.5-118, 174-230, 470-862 MHz 1800-1900 MHz At 2·RF and 3·RF Otherwise above 1 GHz			−36 −54 −47 −41 −30	dB	Restricted band in Europe Restricted bands in USA

■ **Selection Guide**

Denomination：2.4GHz Wireless high-quality digital audio Module

Part No.　：TC2500- xPTI

x: PCB Antenna　　16.30*19.60(mm)
S: PCB Antenna　　11.68*16.40(mm)
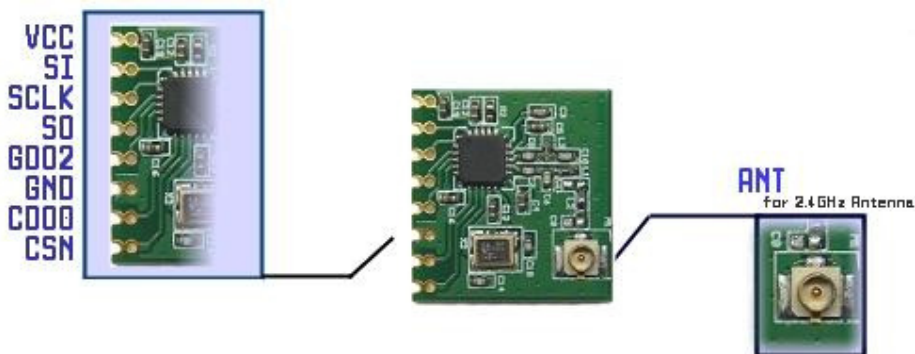N: External Antenna　16.30*15.69(mm)

Chip CC2500

■ **TC2500-PTI　RF Module Pin Configuration**
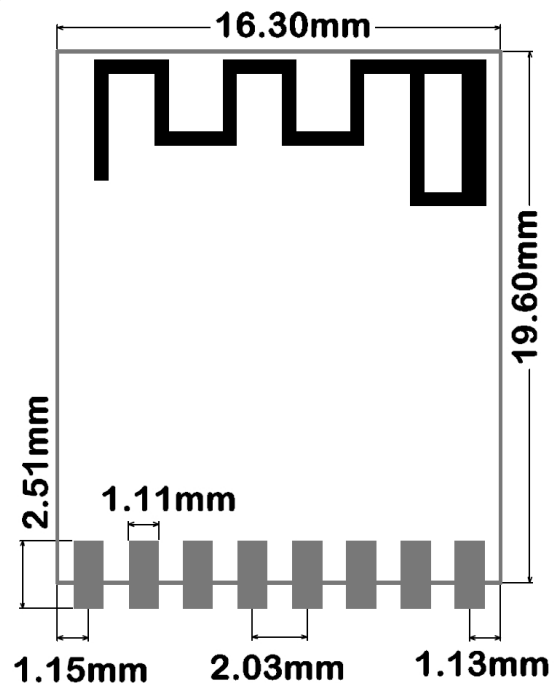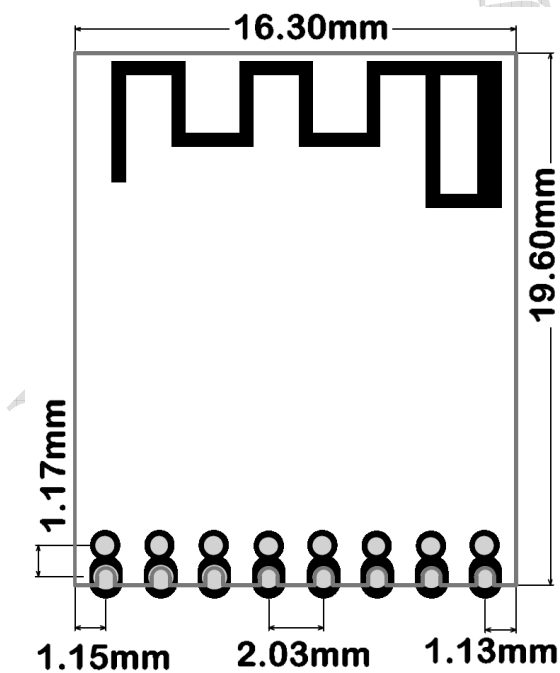

■ **TC2500-SPTI　RF Module Pin Configuration**

■ **TC2500-NPTI　RF Module Pin Configuration**

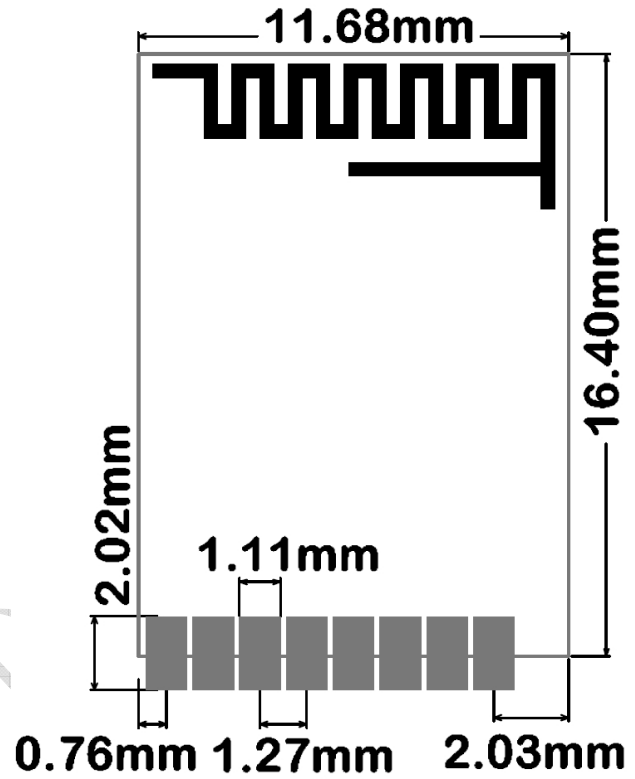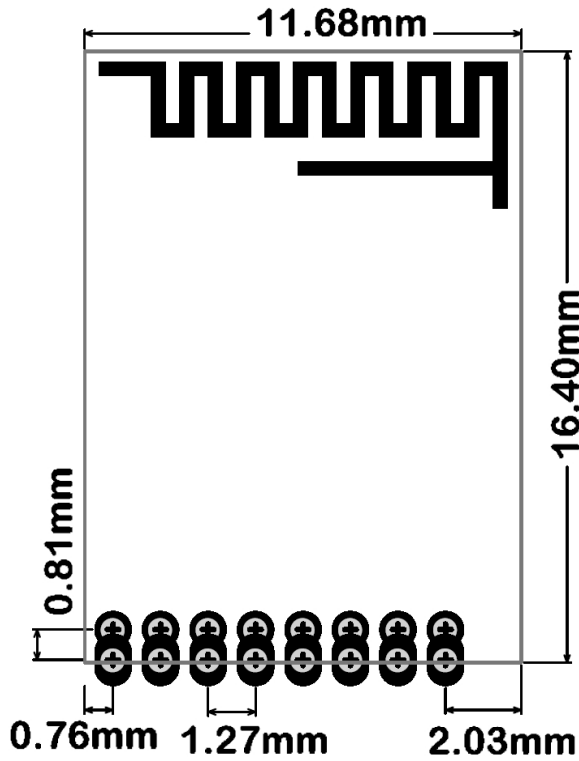| Pin #	Pin name	Pin type	Description
1	VCC	Power (Digital)	Power supply 3.3V
2	SI	Digital Input	Serial configuration interface, data input
3	SCLK	Digital Input	Serial configuration interface, clock input
4	SO	Digital Output	Serial configuration interface, data output. Optional general output pin when CSn is high
5	GDO2	Digital Output	Digital output pin for general use: • Test signals • FIFO status signals • Clear Channel Indicator • Clock output, down-divided from XOSC • Serial output RX data
-	GND	Ground	Ground
-	GDO0	Digital I/O	Digital output pin for general use: • Test signals • FIFO status signals • Clear Channel Indicator • Clock output, down-divided from XOSC • Serial output RX data • Serial input TX data Also used as analog test I/O for prototype/production testing
-	CSN	Digital Input	Serial configuration interface, chip select

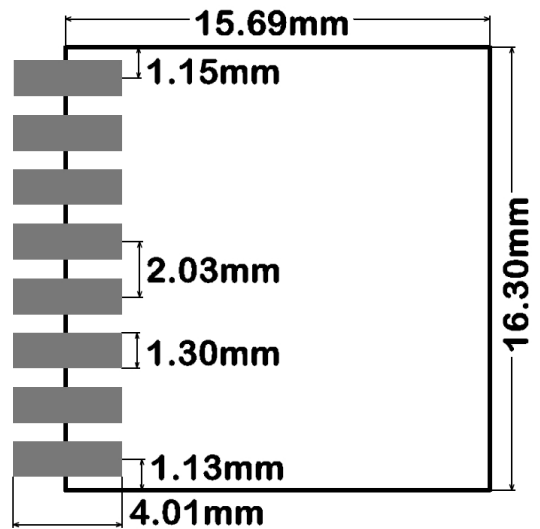■ **TC2500-PTI   Module Description**   ■ **Recommended PCB layout for Module**

■ **TC2500-SPTI   Module Description**

■ **Recommended PCB layout for Module**

11.68mm

16.40mm

0.81mm

0.76mm   1.27mm   2.03mm

11.68mm

16.40mm

2.02mm

1.11mm

0.76mm 1.27mm   2.03mm

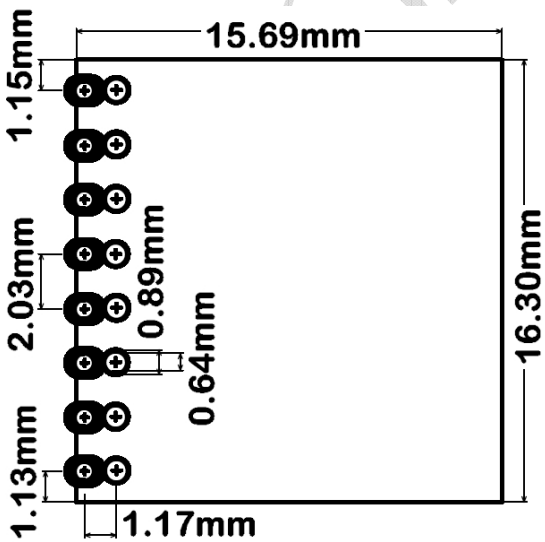■ **TC2500-NPTI   Module Description**

■ **Recommended PCB layout for Module**

1.15mm

15.69mm

16.30mm

2.03mm

0.89mm

0.64mm

1.13mm

1.17mm

15.69mm

1.15mm

16.30mm

2.03mm

1.30mm

1.13mm

4.01mm

■ Document History

Revision	Date	Description/Changes
1.0	2012.10.15	

■ Address Information

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