SPECIFICATION
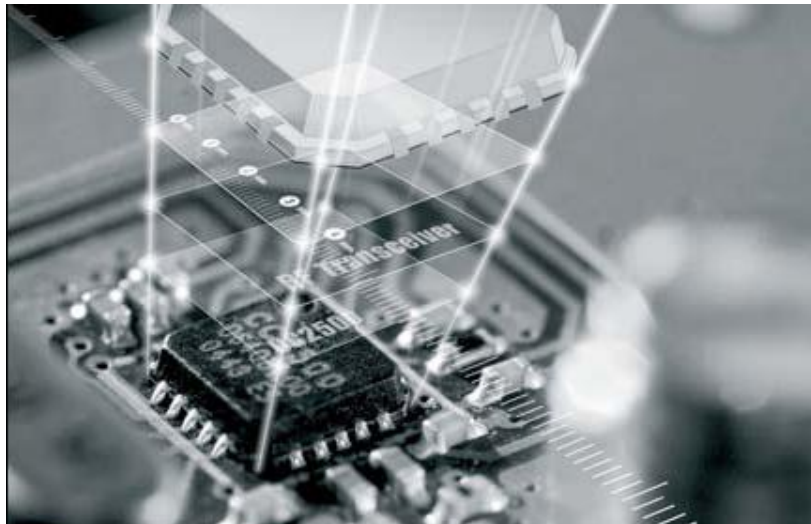
SUB 1GHz Wireless System-on-Module

Model   : **Sub 1GHz RF Module**
Part No : TC1310-SFxxx-x
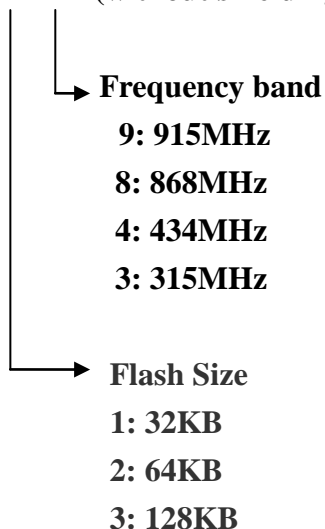Version : V1.0
Date   : 2016.06.21

■ **Applications**

- 315-, 433-, 470-, 500-, 779-, 868-, 915-, and 920-MHz ISM and SRD Systems
- Low-Power Wireless Systems With 50-kHz to 5-MHz Channel Spacing
- SmartGrid and Automatic Meter Reading
- Home and Building Automation
- Wireless Alarm and Security Systems
- Industrial Monitoring and Control

- Wireless Healthcare Applications
- Wireless Sensor Networks
- Active RFID
- IEEE 802.15.4g, IP-Enabled Smart Objects (6LoWPAN), Wireless M-Bus, KNX Systems, Wi-SUN, ZigBee and Proprietary Systems
- Energy Harvesting Applications
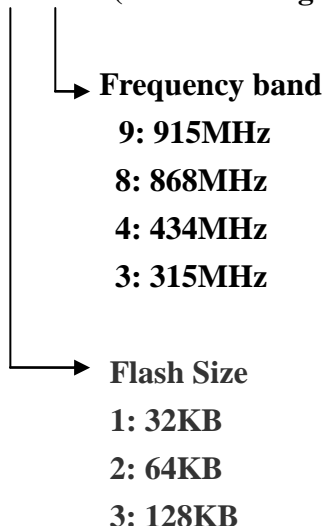- ESL (Electronic Shelf Label)

■ **Selection Guide**

Denomination ：sub-1GHz Bluetooth RF Module

Part No. ：

TC1310-Fxxx-x   **(without shielding case)**

Frequency band
 9: 915MHz
 8: 868MHz
 4: 434MHz
 3: 315MHz

Flash Size
1: 32KB
2: 64KB
3: 128KB

TC1310-SFxxx-x   **(with shielding case)**

Frequency band
 9: 915MHz
 8: 868MHz
 4: 434MHz
 3: 315MHz

Flash Size
1: 32KB
2: 64KB
3: 128KB

■ Absolute Maximum Ratings

		MIN	MAX	UNIT
Supply voltage, VDDS[3]	VDDR supplied by internal DC/DC regulator or internal GLDO	−0.3	4.1	V
Supply voltage, VDDS[3] and VDDR	External regulator mode (VDDS and VDDR pins connected on PCB)	−0.3	2.25	V
Voltage on any digital pin[4]		−0.3	VDDS+0.3, max 4.1	V
Voltage on crystal oscillator pins, X32K_Q1, X32K_Q2, X24M_N and X24M_P		−0.3	VDDR+0.3, max 2.25	V
Voltage on ADC input (V_{in})	Internal fixed or relative reference, voltage scaling enabled	−0.3	VDDS	V
	Internal fixed reference, voltage scaling disabled	−0.3	1.49	
	Internal relative reference, voltage scaling disabled	−0.3	VDDS / 2.9	
	External reference, voltage scaling enabled	−0.3	min (V_{ref} × 2.9, VDDS)	
	External reference, voltage scaling disabled	−0.3	V_{ref}	
Voltage on external ADC reference (V_{ref})		−0.3	1.6	V
Input RF level			+5	dBm
T_{stg}	Storage temperature	−40	150	°C

(1) All voltage values are with respect to VDDS, unless otherwise noted.
(2) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(3) VDDS2 and VDDS3 needs to be at the same potential as VDDS.
(4) Including analog capable DIO.

■ Recommended Operation Condition

		MIN	MAX	UNIT
Ambient temperature range		−40	85	°C
Operating supply voltage (VDDS and VDDR), external regulator mode	For operation in 1.8 V systems (VDDS and VDDR pins connected on PCB, internal DC/DC cannot be used)	1.7	1.95	V
Operating supply voltage (VDDS)	For operation in battery-powered and 3.3 V systems (internal DC/DC can be used to minimize power consumption)	1.8	3.8	V

■ Electrical Specifications
● Current Consumption

TA = 25°C and VDD = 3 V

PARAMETER		TEST CONDITIONS	TYP	UNIT
I_{core}	Core current consumption	Reset. RESET_N pin asserted or VDDS below power-on-reset threshold	100	nA
		Shutdown. No clocks running, no retention	185	
		Standby. With RTC, CPU, RAM and (partial) register retention. RCOSC_LF	0.6	µA
		Standby. With RTC, CPU, RAM and (partial) register retention. XOSC_LF	0.7	
		Standby. With Cache, RTC, CPU, RAM and (partial) register retention. RCOSC_LF	1.6	
		Standby. With Cache, RTC, CPU, RAM and (partial) register retention. XOSC_LF	1.7	
		Idle. Supply Systems and RAM powered.	570	
		Active. MCU running CoreMark at 48 MHz	1.2 mA + 25.5 µA/MHz	
		Active. MCU running CoreMark at 48 MHz	2.5	mA
		Active. MCU running CoreMark at 24 MHz	1.9	
		Radio RX	5.5	mA
		Radio TX, 10-dBm output power	12.9	
		Radio TX, boost mode (VDDR = 1.95 V), 14-dBm output power	22.6	
PERIPHERAL CURRENT CONSUMPTION[1][2][3]				
I_{peri}	Peripheral power domain	Delta current with domain enabled	20	µA
	Serial power domain	Delta current with domain enabled	13	
	RF Core	Delta current with power domain enabled, clock enabled, RF core idle	237	
	µDMA	Delta current with clock enabled, module idle	130	
	Timers	Delta current with clock enabled, module idle	113	
	I²C	Delta current with clock enabled, module idle	12	
	I²S	Delta current with clock enabled, module idle	36	
	SSI	Delta current with clock enabled, module idle	93	
	UART	Delta current with clock enabled, module idle	164	

■ General Characteristics

TA = 25℃ and VDD = 3 V, unless otherwise noted.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Wake-up and Timing					
Idle -> Active			14		µs
Standby -> Active			151		µs
Shutdown -> Active			1015		µs
Flash Memory					
Supported flash erase cycles before failure		100			k Cycles
Flash page/sector erase current	Average delta current		12.6		mA
Flash page/sector erase time [(1)]			8		ms
Flash page/sector size			4		KB
Flash write current	Average delta current, 4 bytes at a time		8.15		mA
Flash write time [(1)]	4 bytes at a time		8		µs

■ RF Characteristics

RX Sensitivity

868Mbps, GFSK, 25KHz deviation, IEEE802.15.4g PHY

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Data rate			50		kbps
Data rate offset tolerance, IEEE 802.15.4g PHY	50 kbps, GFSK, 25-kHz deviation, 100-kHz RX BW (same modulation format as IEEE 802.15.4g mandatory mode), BER = 10^{-3}		1400		ppm
Data rate step size			1.5		bps
Digital channel filter programmable bandwidth	Using VCO divide by 5 setting	40		4000	kHz
Receiver sensitivity, 50 kbps	50 kbps, GFSK, 25-kHz deviation, 100-kHz RX BW (same modulation format as IEEE 802.15.4g mandatory mode), BER = 10^{-2} 868 MHz and 915 MHZ		−110		dBm

TX output Power

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Max output power, boost mode	VDDR = 1.95 V Min VDDS for boost mode is 2.1 V 868 MHz and 915 MHz		+14		dBm
Max output power	868 MHz and 915 MHz		+12		dBm

■ TC1310-SF128-x RF Module Pin Configuration
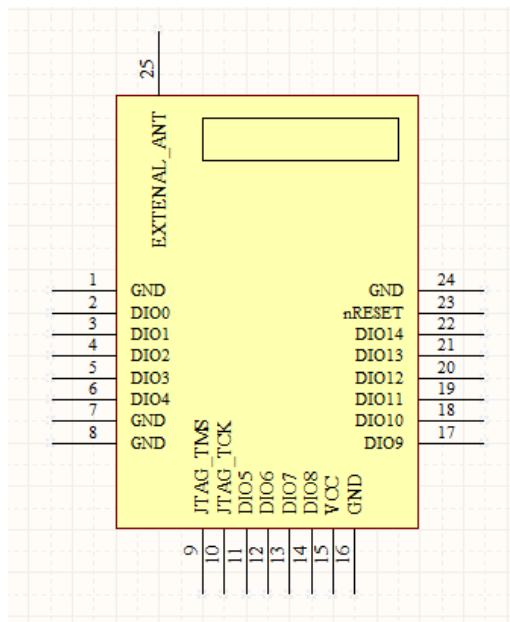
Pin#	Pin Define	Pin Type	Description
1	GND	GND	Ground
2	DIO_0	Digital I/O	
3	DIO_1	Digital I/O	
4	DIO_2	Digital I/O	
5	DIO_3	Digital I/O	
6	DIO_4	Digital I/O	
7	GND	Digital I/O	
8	GND	Digital I/O	
9	TMS	Digital I/O	JTAG TMSC
10	TCK	Digital I/O	JTAG TCKC
11	DIO_5	Digital I/O	
12	DIO_6	Digital I/O	
13	DIO_7	Digital/Analog I/O	
14	DIO_8	Digital/Analog I/O	
15	VDD	POWER	2~3.6V power supply
16	GND	GND	Ground
17	DIO_9	Digital/Analog I/O	
18	DIO_10	Digital/Analog I/O	
19	DIO_11	Digital/Analog I/O	
20	DIO_12	Digital/Analog I/O	
21	DIO_13	Digital/Analog I/O	
22	DIO_14	Digital/Analog I/O	
23	NRESET	RESET	RESET
24	GND	GND	Ground
25	ANT	ANT	External antenna connecting

■ **RIFO antenna for Sub 1G**

CHIP ANTENNA

ISM Band 915/868MHz Chip Antenna

1. Explanation of Product Number

R A 0 2 L P F C 0 1 R A 0 0 2
(1) (2) (3) (4) (5) (6)
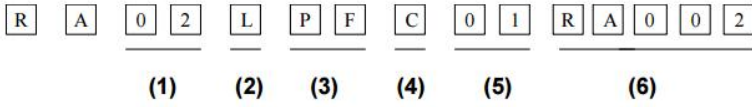
※ The direction of white dot forwards to feed p

ISM Band 434/315MHz Chip Antenna

1. Explanation of Product Number

R A 0 1 L P F B 0 1 R A 0 0 1
(1) (2) (3) (4) (5) (6)
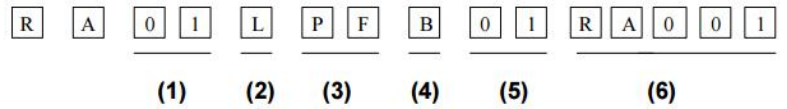
※ The direction of white dot forwards to feed point
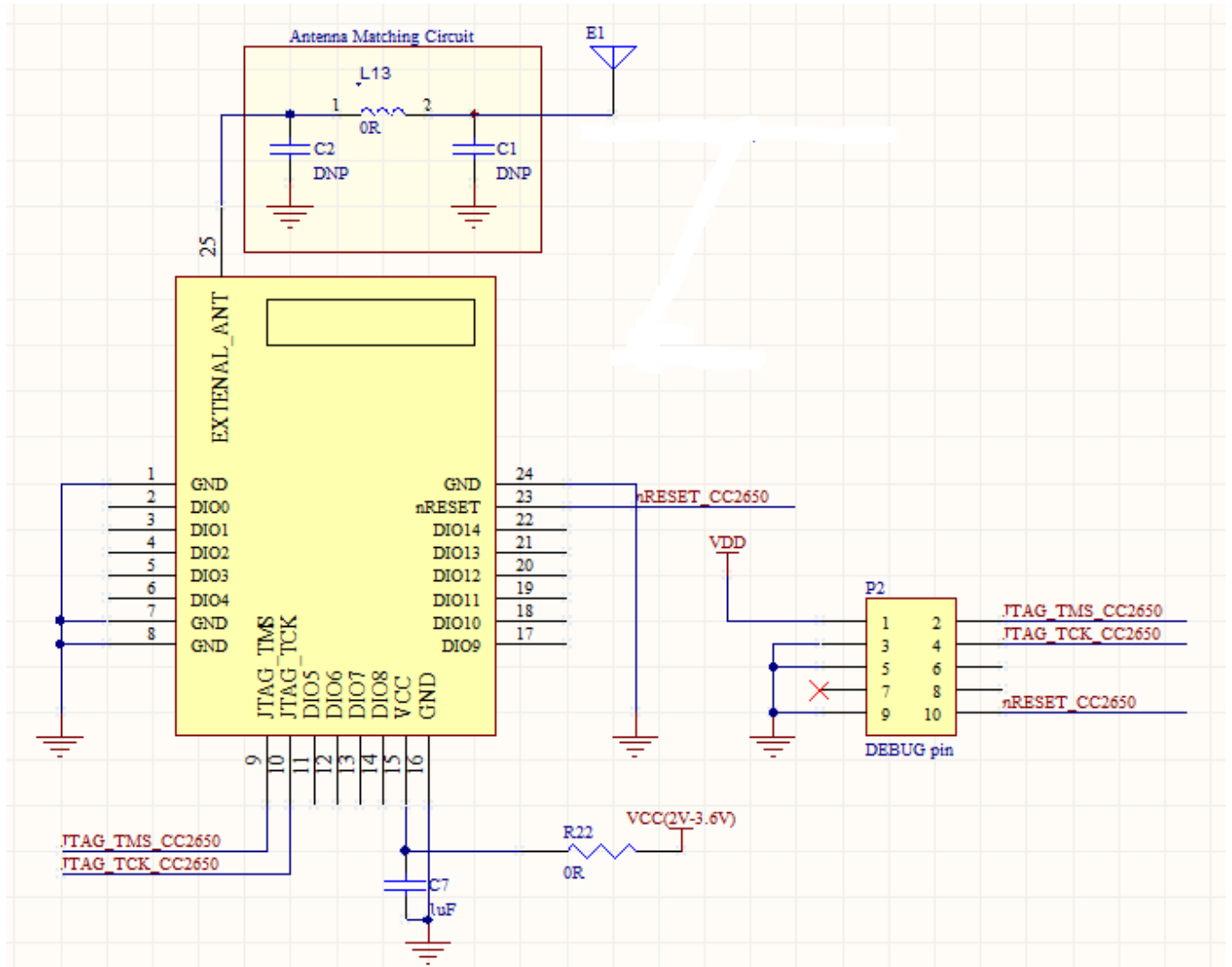
SPRING ANTENNA

■ **TC1310-SFxxx-x   RF Module Example Design schematic**
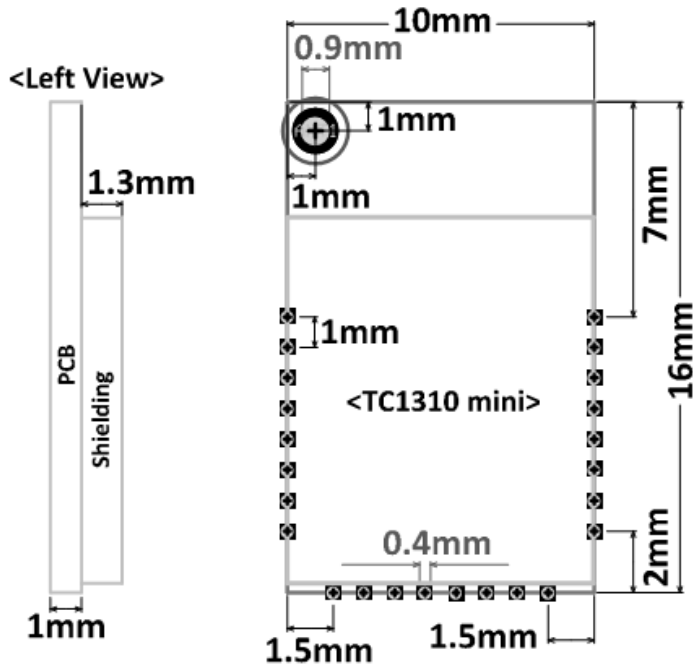

Example schematic (with SPRING antenna)
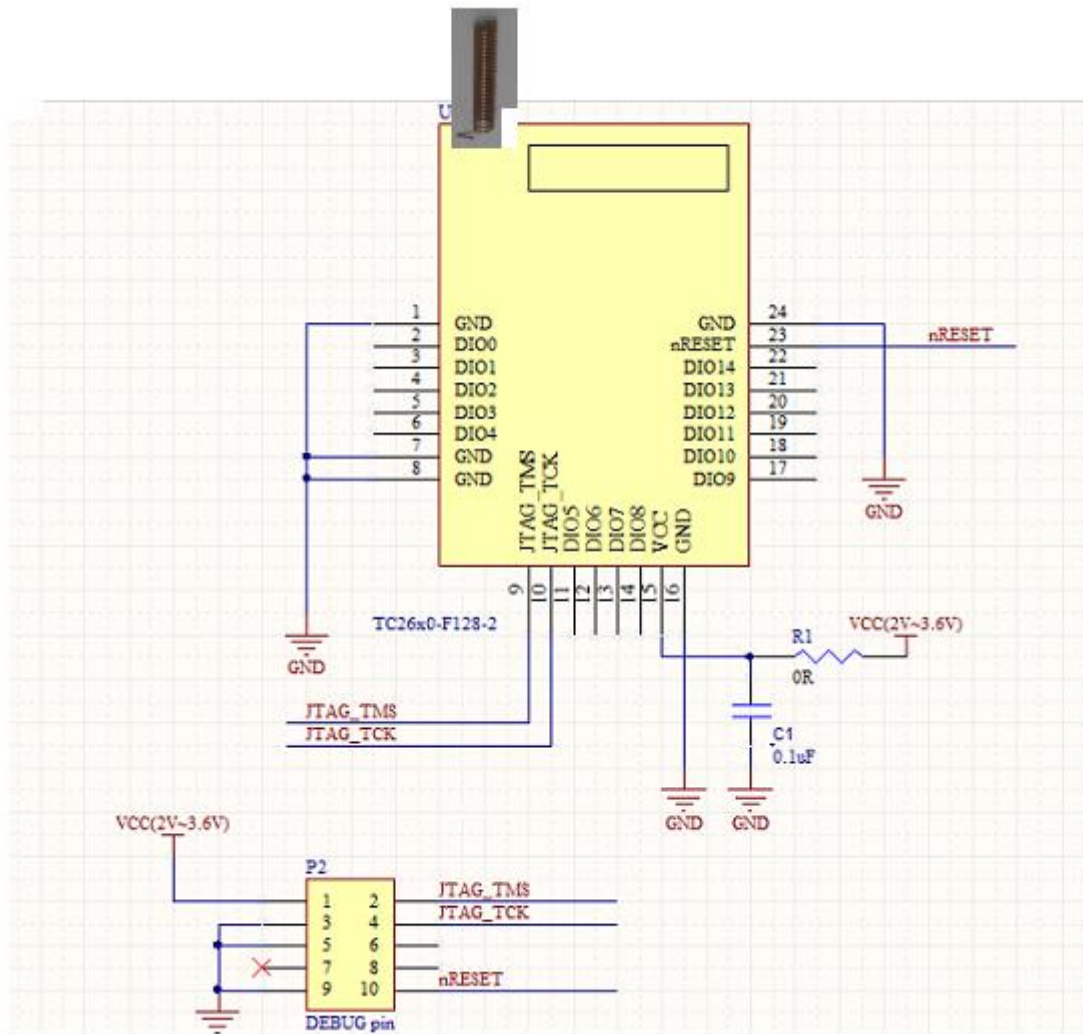
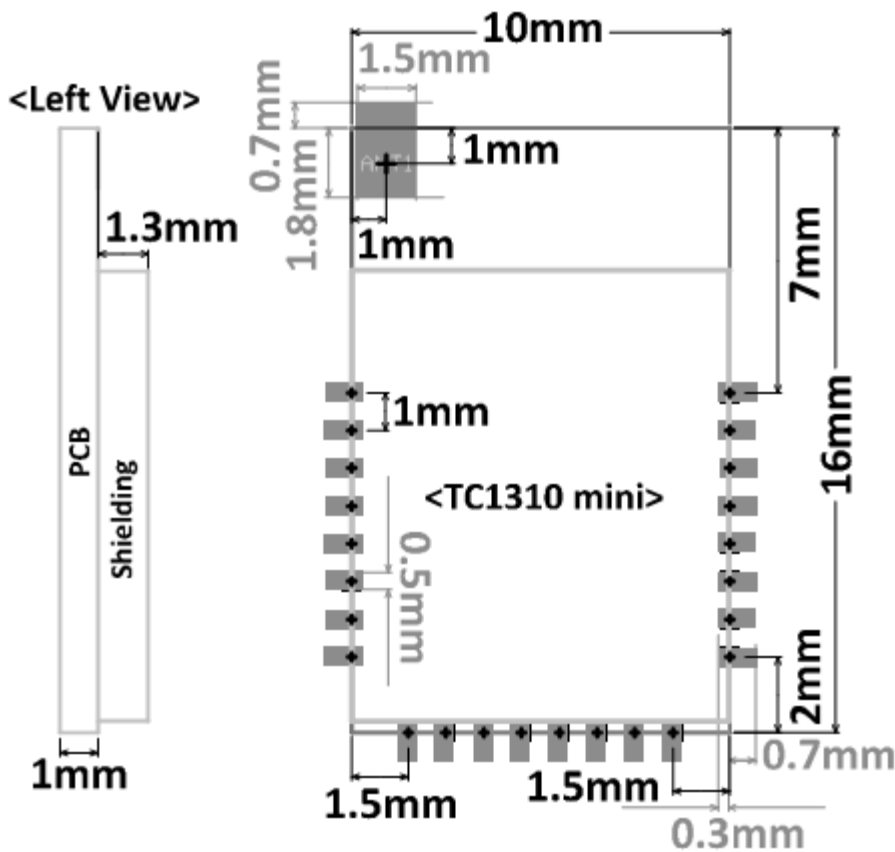## ■ TC1310-SFxxx-x   RF Module Example Design schematic

Example schematic (with external antenna)

■ TC1310-SFxxx-x   RF Module Dimension

■ Recommended PCB layout for Module

■ Document History

Revision	Date	Description/Changes
1.0	2015.07.08	First release

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