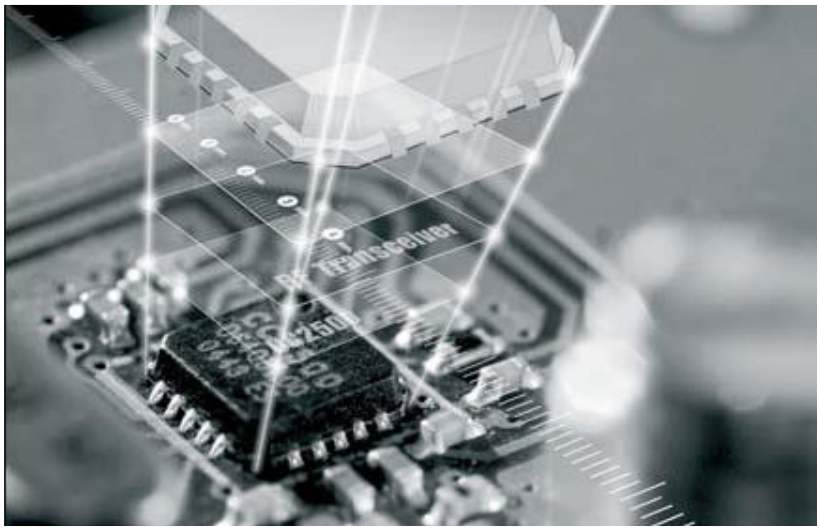
SPECIFICATION

2.4-GHz Wireless System-on-Module



Model : **2.4GHz RF Module**
Part No : TC2640R2L-XX
Version : V1.1
Date : 2020.12.16

■ Applications

- Home and Building Automation
  - Connected Appliances
  - Lighting
  - Locks
  - Gateways
  - Security Systems
- Industrial
  - Logistics
  - Production and Manufacturing
  - Automation
  - Asset Tracking and Management
  - Remote Display
  - Cable Replacement
  - HMI
  - Access Control
- Retail
  - Beacons
  - Advertising
  - ESL / Price Tags
  - Point of Sales / Payment Systems
- Health and Medical
  - Thermometers
  - SpO2
  - Blood Glucose and Pressure Meters
  - Weight-scales
  - Vitals Monitoring
  - Hearing Aids
- Sports and Fitness
  - Activity Monitors and Fitness Trackers
  - Heart Rate Monitors
  - Running Sensors
  - Biking Sensors
  - Sports Watches
  - Gym Equipment
  - Team Sports Equipment
- HID
  - Remote Controls
  - Keyboards and Mice
  - Gaming
- Accessories
  - Toys
  - Trackers
  - Luggage-tags
  - Wearables

■ Selection Guide

Denomination ：2.4GHz Bluetooth RF Module

Part No. ：

TC2640R2L-XX

S: Shielding case

O: without Shielding case

A: internal antenna

E: external antenna

■ 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	MIN	TYP	MAX	UNIT
I_{core}	Core current consumption	Reset. RESET_N pin asserted		100		nA
		Shutdown. No clocks running, no retention		150		
		Standby. With RTC, CPU, RAM and (partial) register retention. RCOSC_LF		1		µA
		Standby. With RTC, CPU, RAM and (partial) register retention. XOSC_LF		1.2		
		Standby. With Cache, RTC, CPU, RAM and (partial) register retention. RCOSC_LF		2.5		
		Standby. With Cache, RTC, CPU, RAM and (partial) register retention. XOSC_LF		2.7		
		Idle. Supply Systems and RAM powered.		550		
		Active. Core running CoreMark		1.45 mA + 31 µA/MHz		
		Radio RX (1)		5.9		mA
		Radio RX(2)		6.1		
		Radio TX, 0 dBm output power(1)		6.1		
		Radio TX, 5 dBm output power(2)		9.1		
I_{peri}	Peripheral Current Consumption (Adds to core current I_{core} for each peripheral unit activated)(3)					
	Peripheral power domain	Delta current with domain enabled		20		µA
	Serial power domain	Delta current with domain enabled		13		µA
	RF Core	Delta current with power domain enabled, clock enabled, RF Core Idle		237		µA
	µDMA	Delta current with clock enabled, module idle		130		µA
	Timers	Delta current with clock enabled, module idle		113		µA
	I^2C	Delta current with clock enabled, module idle		12		µA
	I2S	Delta current with clock enabled, module idle		36		µA
	SSI	Delta current with clock enabled, module idle		93		µA
	UART	Delta current with clock enabled, module idle		164		µA

■ General Characteristics

TA = 25°C 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

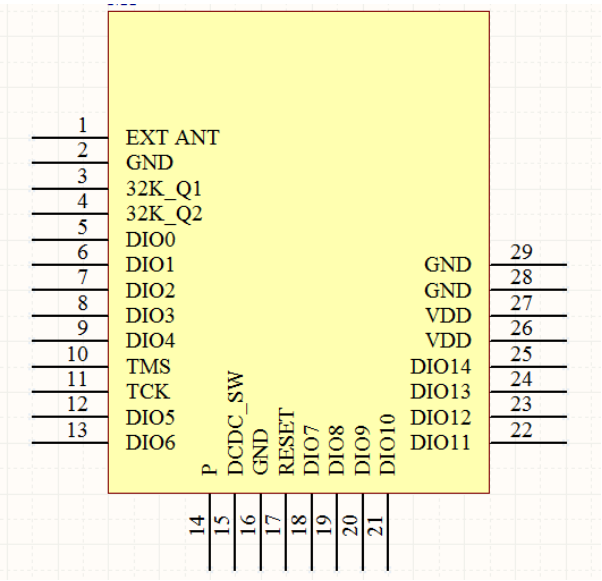
1Mbps, GFSK, 250-KHz deviation, Bluetooth low energy mode and 1%BER

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Receiver sensitivity	Differential mode. Measured at the SMA		–97		dBm

TX output Power

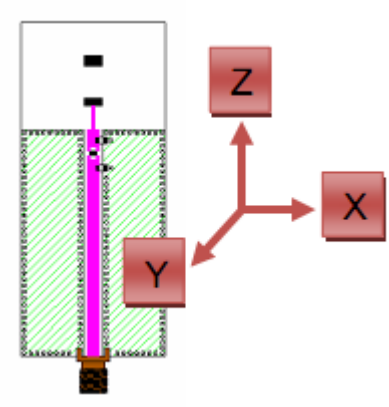
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output power, highest setting	Differential mode, delivered to a single-ended 50-Ω load through a balun		+5		dBm

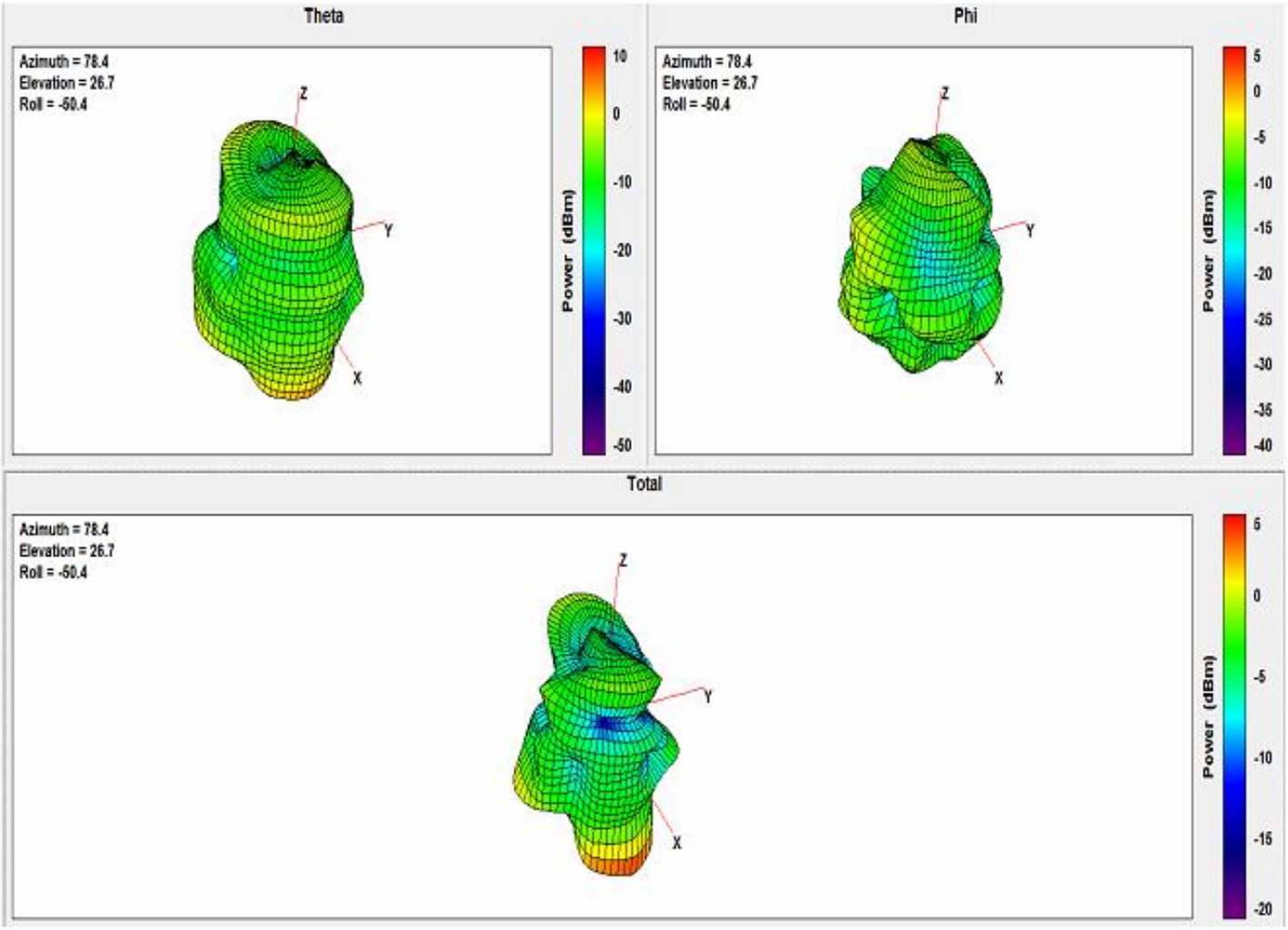
■ TC2640R2L-XX RF Module Pin Configuration



Pin#	Pin Define	Pin Type	Description
1	EXT ANT	Analog	External antenna / NC for internal antenna
2	GND	POWER	
3	32K_Q1	Analog	32.768Khz Crystal connecting
4	32K_Q2	Analog	32.768Khz Crystal connecting
5	DIO_0	Digital I/O	
6	DIO_1	Digital I/O	
7	DIO_2	Digital I/O	
8	DIO_3	Digital I/O	
9	DIO_4	Digital I/O	
10	TMS	Digital I/O	JTAG TMSC
11	TCK	Digital I/O	JTAG TCKC
12	DIO_5	Digital I/O	
13	DIO_6	Digital I/O	
14	P	POWER	Internal power switching
15	DCDC_SW	POWER	Internal power switching
16	GND	GND	
17	RESET	RESET	
18	DIO_7	Digital/Analog I/O	
19	DIO_8	Digital/Analog I/O	
20	DIO_9	Digital/Analog I/O	
21	DIO_10	Digital/Analog I/O	
22	DIO_11	Digital/Analog I/O	
23	DIO_12	Digital/Analog I/O	
24	DIO_13	Digital/Analog I/O	
25	DIO_14	Digital/Analog I/O	
26	VDD	POWER	POWER input(4.7uF and 0.1uF bypass capacitor needed and closed to this pin)
27	VDD	POWER	POWER input(4.7uF and 0.1uF bypass capacitor needed and closed to this pin)
28	GND	GND	
29	GND	GND	

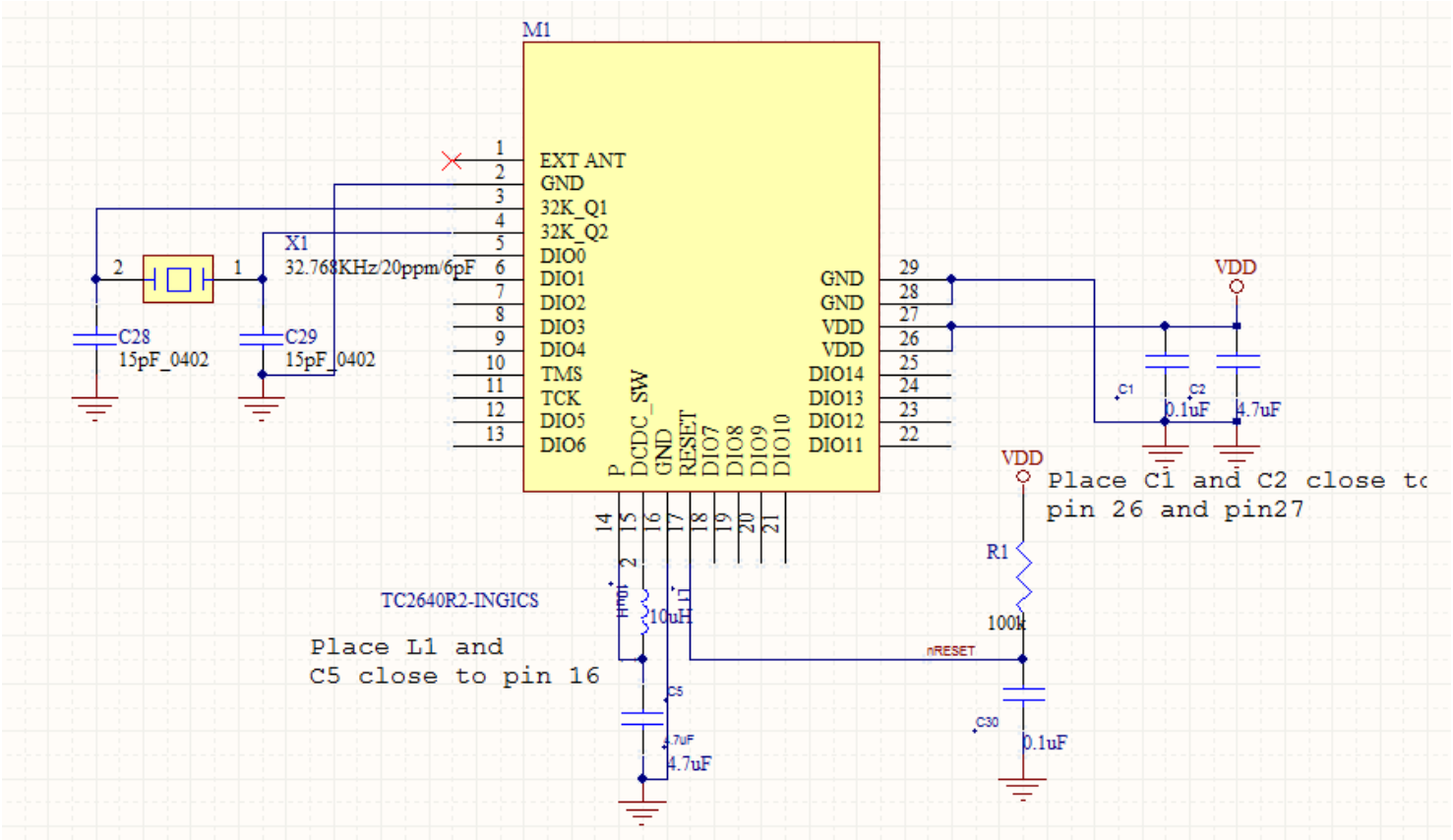
■ Antenna Radiation Pattern



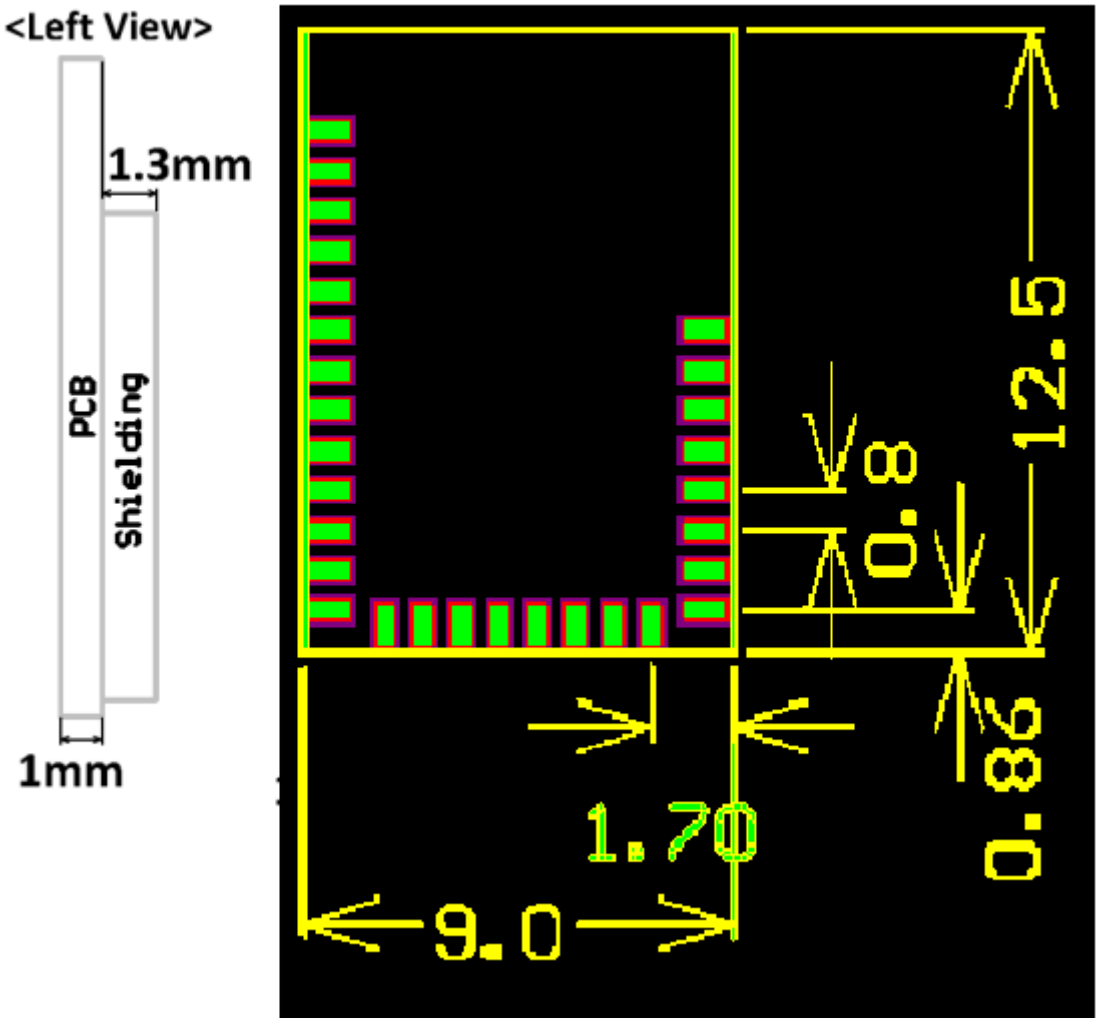


■ TC2640R2L-XX RF Module Example Design schematic

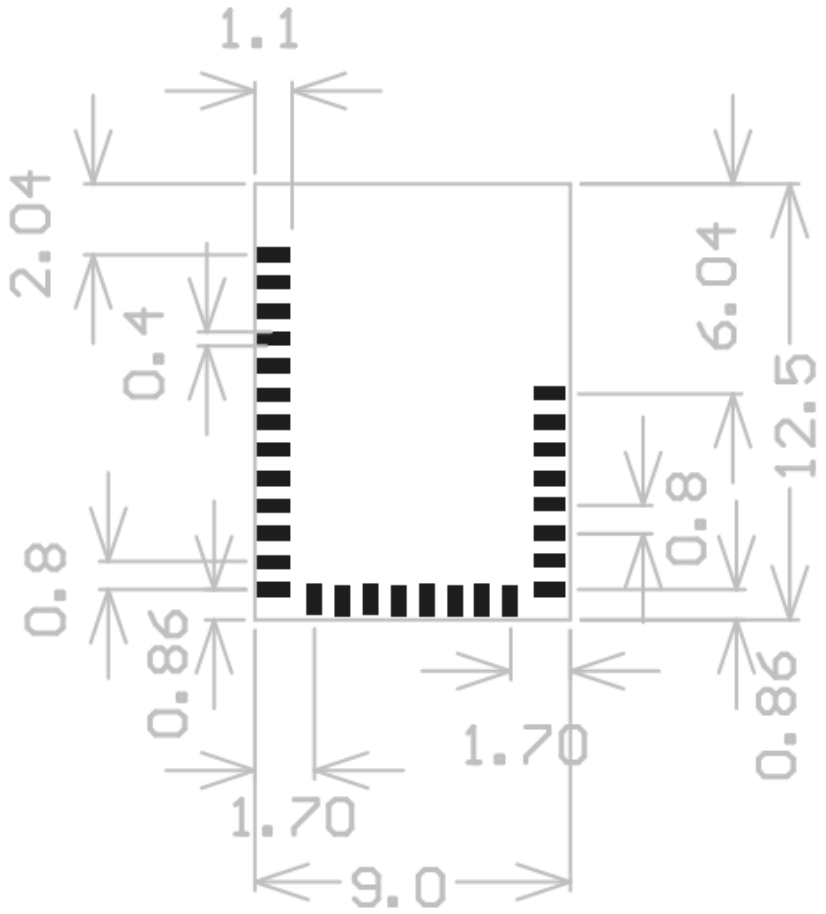
Example schematic:

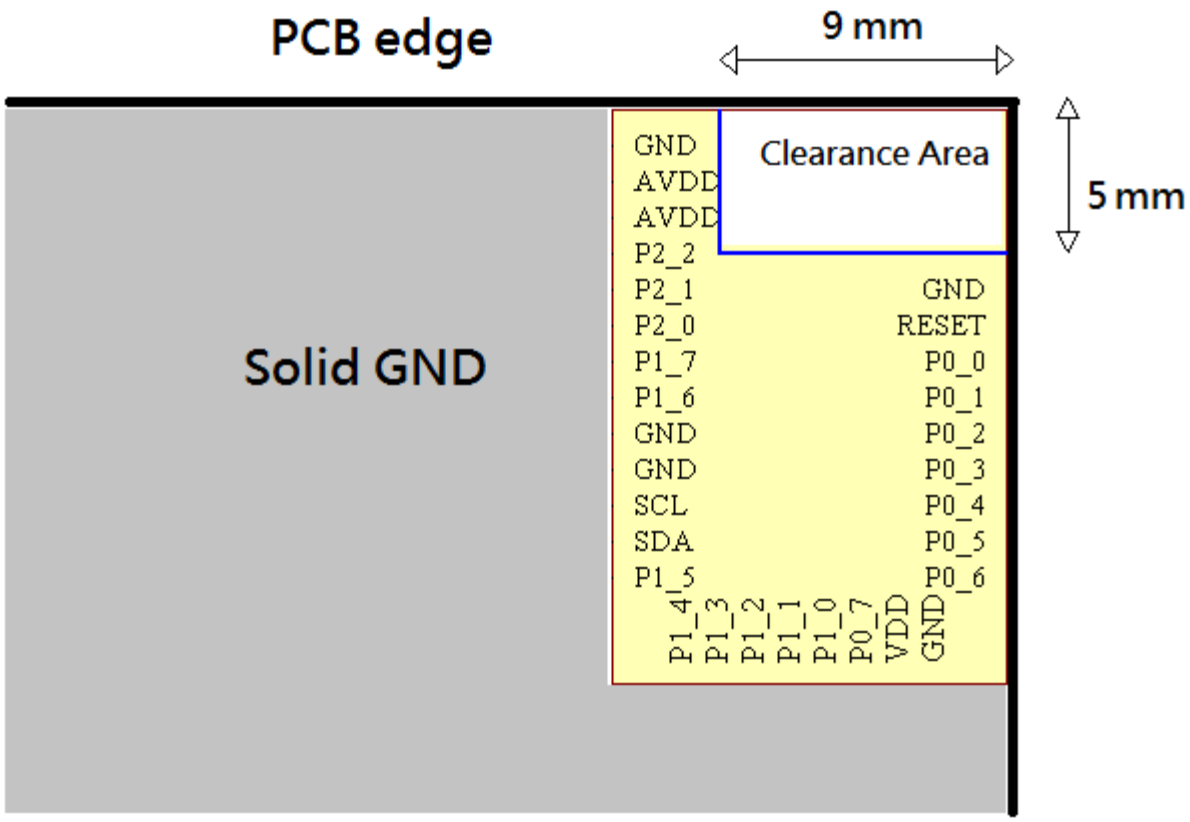


■ TC2640R2L-XX RF Module Dimension



■ Recommended PCB layout for Module





■ Document History

Revision	Date	Description/Changes
1.1	2020.12.16	First release

■ ddress Information

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