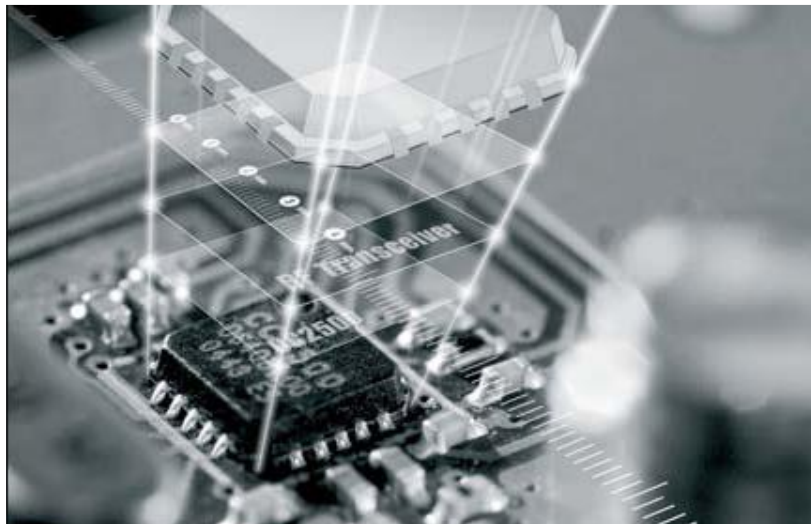




# SPECIFICATION SPECIFICATION

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## 2.4-GHz Wireless System-on-Module



Bluetooth®

Model : **2.4GHz RF Module**  
Part No : TC2640R2-F128-02-XX  
Version : V1.4  
Date : 2020.04.22

■ Applications

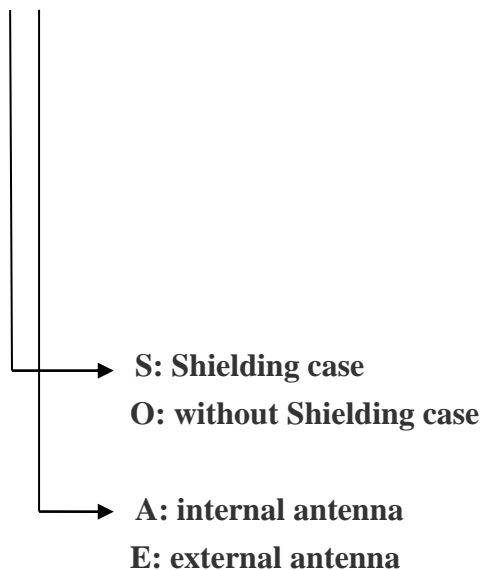
- Home and Building Automation
  - Connected Appliances
  - Lighting
  - Locks
  - Gateways
  - Security Systems
- Industrial
  - Logistics
  - Production and Manufacturing
  - Automation
  - Asset Tracking and Management
  - Remote Display
  - Cable Replacement
  - HMI
  - Access Control
- Retail
  - 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. :

TC2640R2-F128-02-XX



## ■ Absolute Maximum Ratings

		MIN	MAX	UNIT
Supply voltage, VDD <sub>S</sub> <sup>(3)</sup>	VDDR supplied by internal DC/DC regulator or internal GLDO	-0.3	4.1	V
Supply voltage, VDD <sub>S</sub> <sup>(3)</sup> and VDDR	External regulator mode (VDD <sub>S</sub> and VDDR pins connected on PCB)	-0.3	2.25	V
Voltage on any digital pin <sup>(4)</sup>		-0.3	VDD <sub>S</sub> +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 <sub>in</sub> )	Internal fixed or relative reference, voltage scaling enabled	-0.3	VDD <sub>S</sub>	V
	Internal fixed reference, voltage scaling disabled	-0.3	1.49	
	Internal relative reference, voltage scaling disabled	-0.3	VDD <sub>S</sub> / 2.9	
	External reference, voltage scaling enabled	-0.3	min (V <sub>ref</sub> × 2.9, VDD <sub>S</sub> )	
	External reference, voltage scaling disabled	-0.3	V <sub>ref</sub>	
Voltage on external ADC reference (V <sub>ref</sub> )		-0.3	1.6	V
Input RF level			+5	dBm
T <sub>stg</sub>	Storage temperature	-40	150	°C

- (1) All voltage values are with respect to VDD<sub>S</sub>, 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) VDD<sub>S2</sub> and VDD<sub>S3</sub> needs to be at the same potential as VDD<sub>S</sub>.
- (4) Including analog capable DIO.

## ■ Recommended Operation Condition

		MIN	MAX	UNIT
Ambient temperature range		-40	85	°C
Operating supply voltage (VDD <sub>S</sub> and VDDR), external regulator mode	For operation in 1.8 V systems (VDD <sub>S</sub> and VDDR pins connected on PCB, internal DC/DC cannot be used)	1.7	1.95	V
Operating supply voltage (VDD <sub>S</sub> )	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 <sub>core</sub>	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 <sup>(1)</sup>			5.9		mA
		Radio RX <sup>(2)</sup>			6.1		
		Radio TX, 0 dBm output power <sup>(1)</sup>			6.1		
Radio TX, 5 dBm output power <sup>(2)</sup>			9.1				
I <sub>peri</sub>	Peripheral Current Consumption (Adds to core current I <sub>core</sub> for each peripheral unit activated) <sup>(3)</sup>						
	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 <sup>2</sup> C	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
<b>Wake-up and Timing</b>					
Idle -> Active			14		μs
Standby -> Active			151		μs
Shutdown -> Active			1015		μs
<b>Flash Memory</b>					
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 <sup>(1)</sup>			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 <sup>(1)</sup>	4 bytes at a time		8		μs

## ■ RF Characteristics

### RX Sensitivity

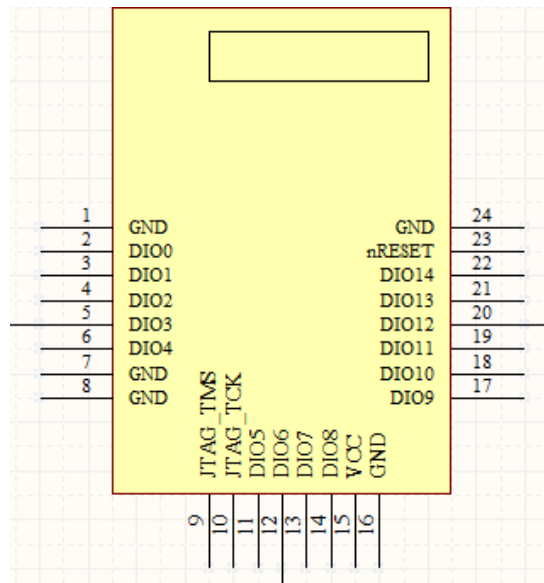
1Mbps, GFSK, 250-KHz deviation, Bluetooth low energy mode and 1%BER

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

### TX output Power

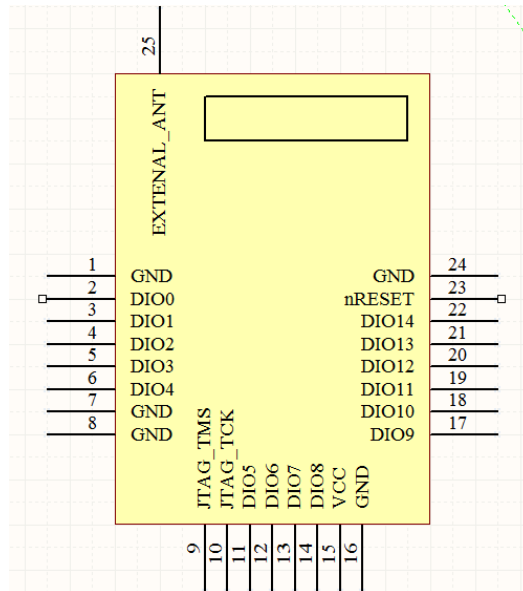
Output power, highest setting	Measured on 50-Ω load, delivered to a single-ended		+2		dBm
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TC2640R2-F128-02-XA RF Module (internal antenna) Pin Configuration



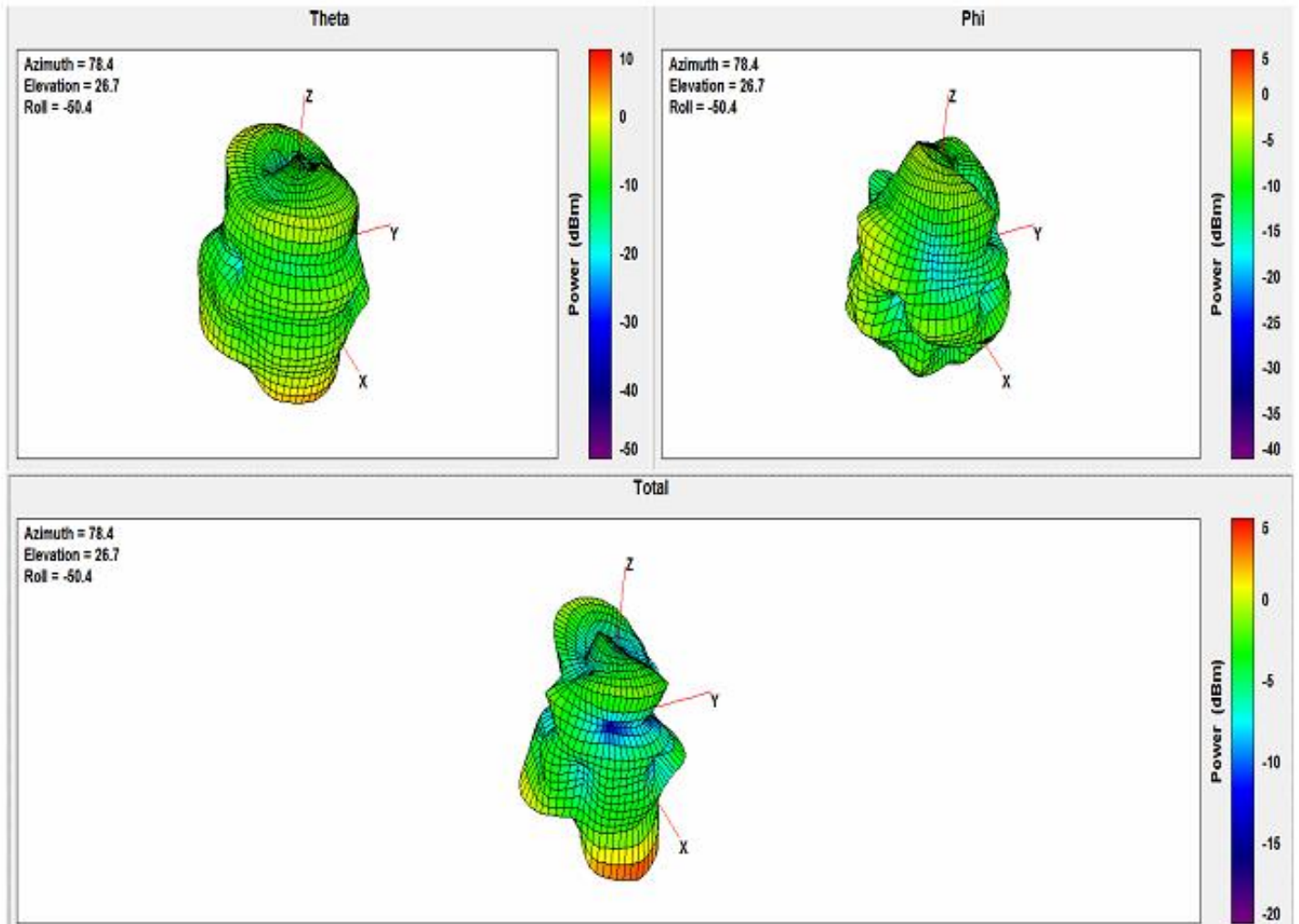
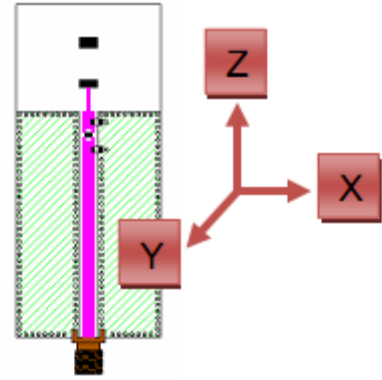
Pin#	Pin Define	Pin Type	Description
1	GND	GND	Ground
2	DIO_0	Digital I/O	
3	DIO_1	Digital I/O	
4	DIO_2	Digital I/O	
5	DIO_3	Digital I/O	
6	DIO_4	Digital I/O	
7	GND	Digital I/O	
8	GND	Digital I/O	
9	TMS	Digital I/O	JTAG TMSC
10	TCK	Digital I/O	JTAG TCKC
11	DIO_5	Digital I/O	
12	DIO_6	Digital I/O	
13	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

TC2640R2-F128-02-XE RF Module (External antenna) 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	Analog	Antenna feed point

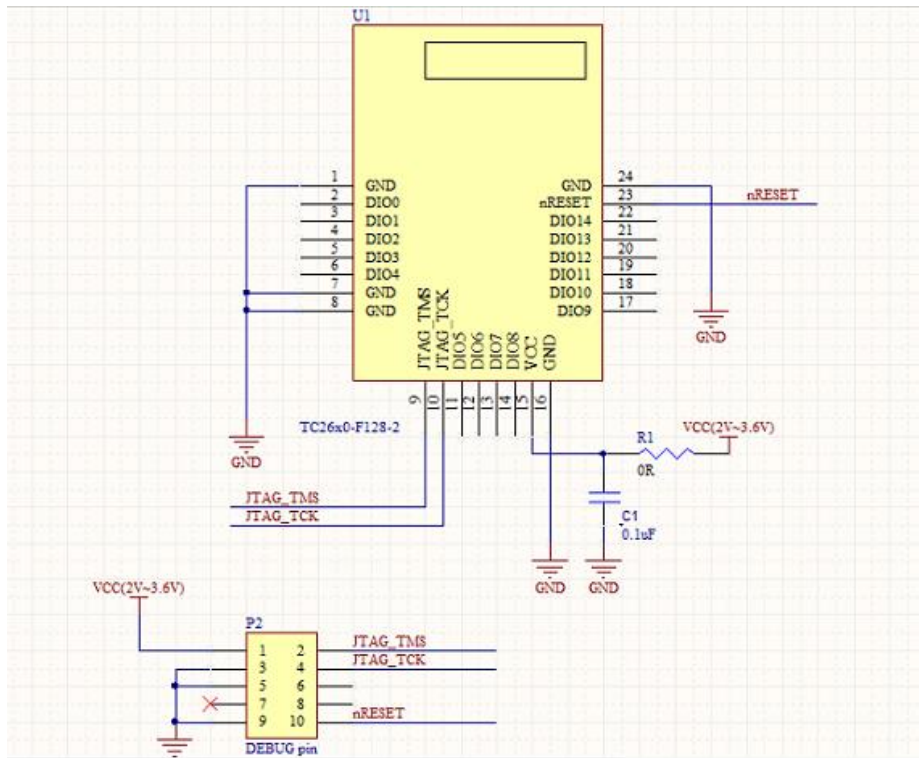
Antenna Radiation Pattern



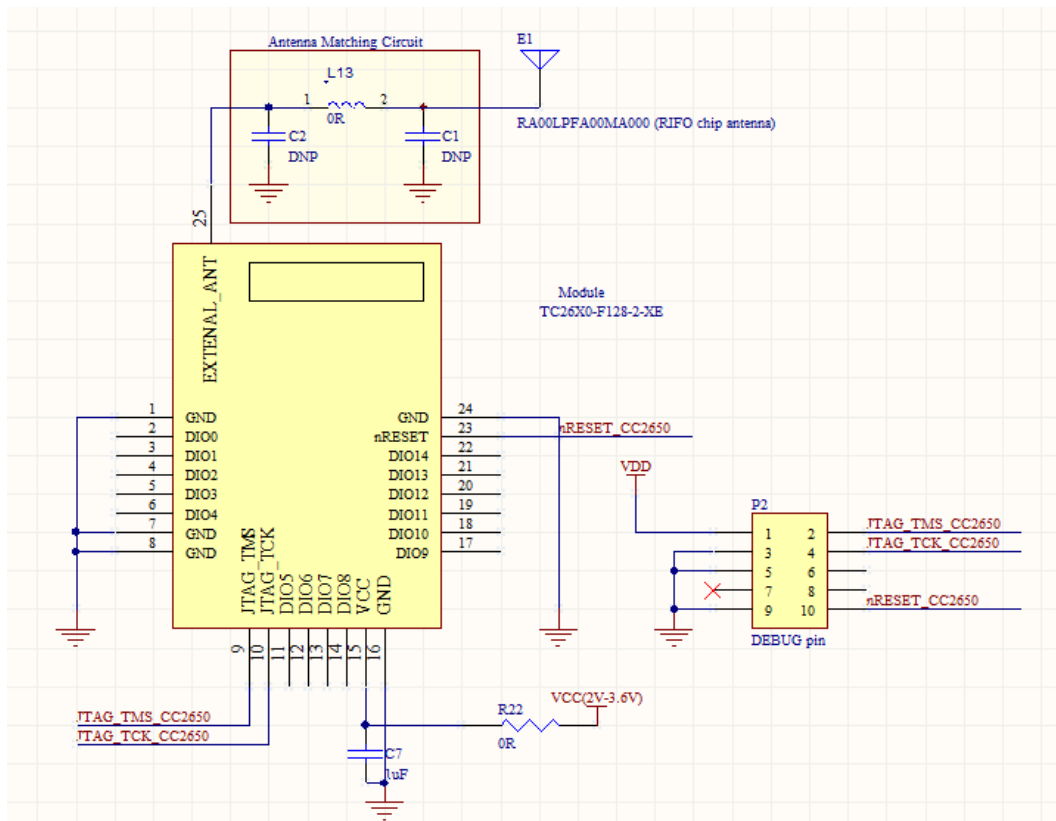


TC2640R2-F128-02-XX RF Module Example Design schematic

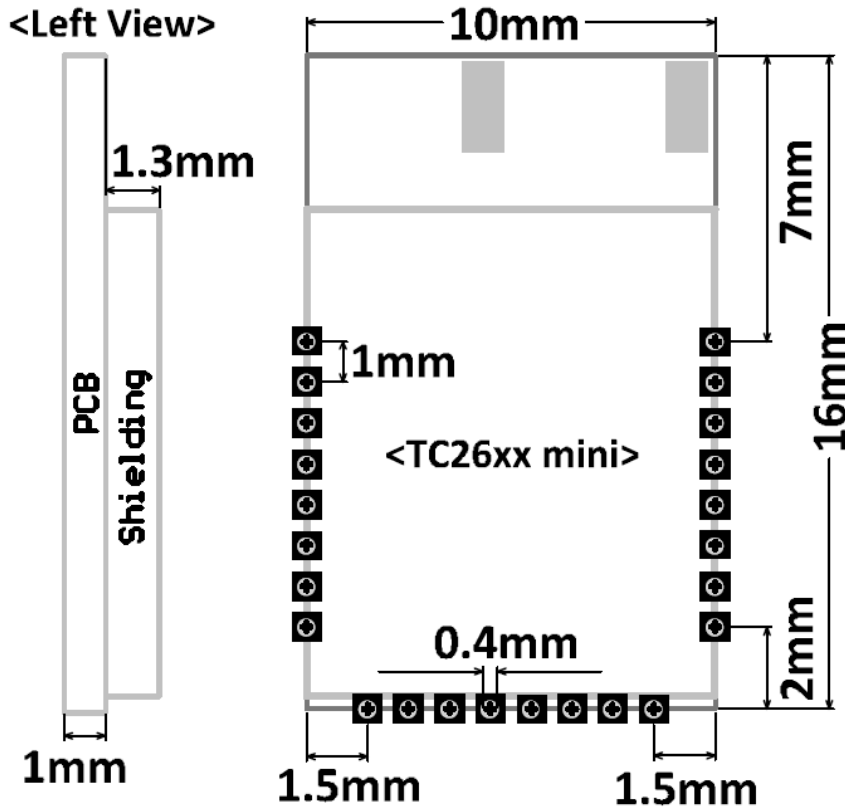
Example schematic:



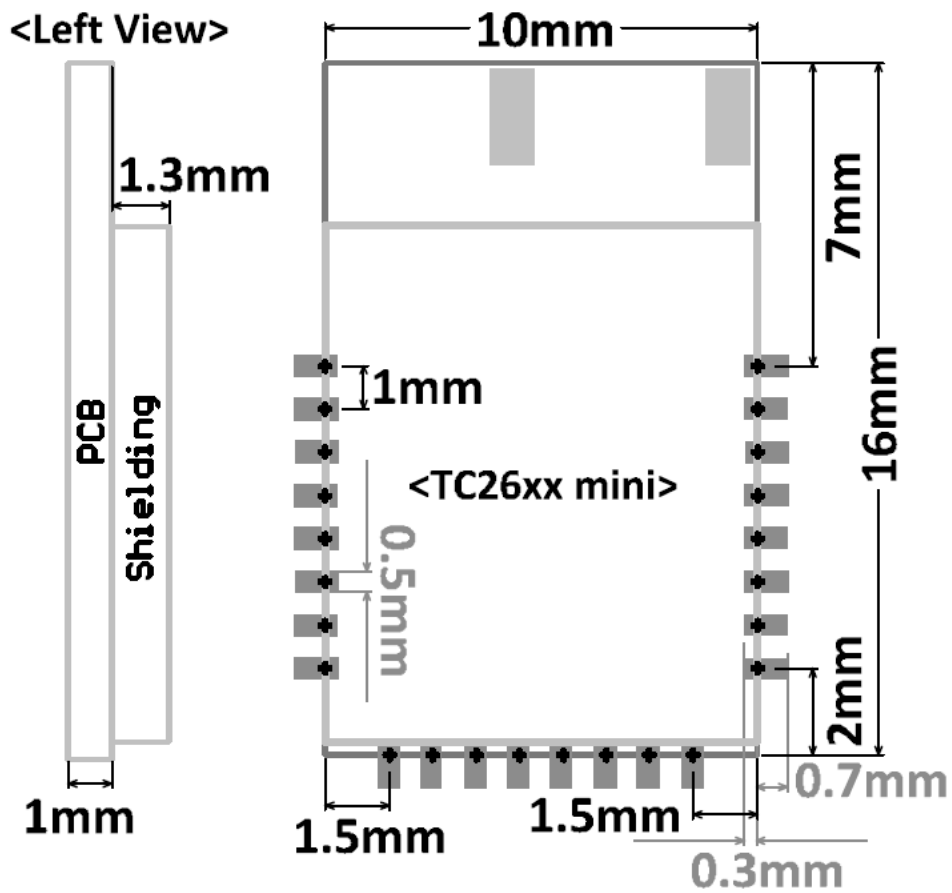
Example schematic (external antenna):



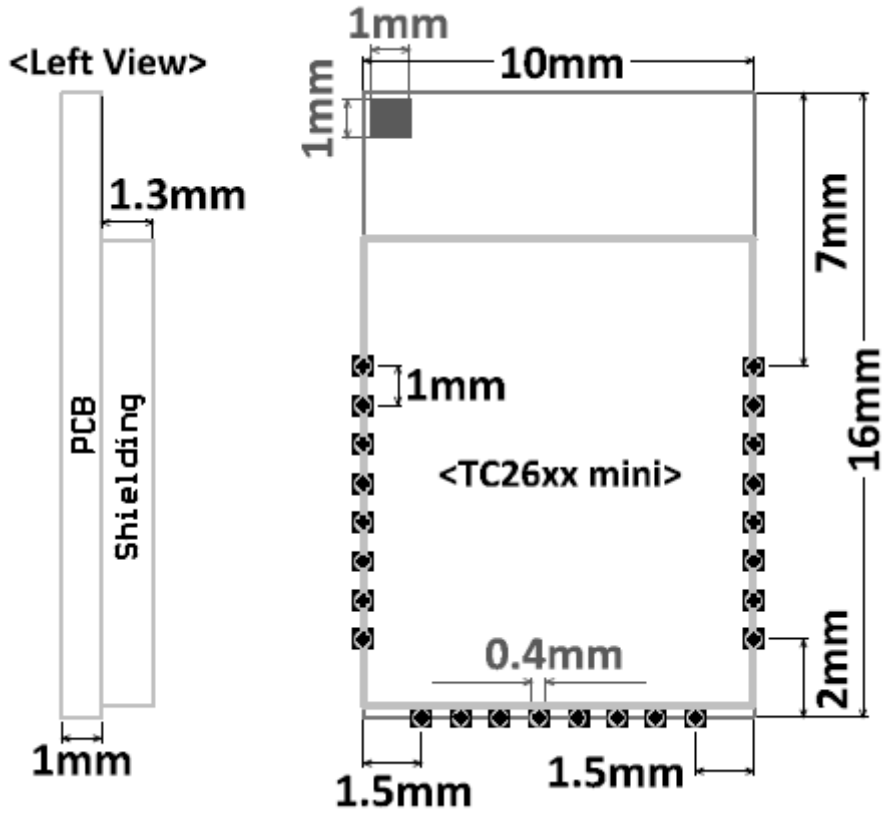
TC2640R2-F128-02-XA RF Module (internal antenna) Dimension



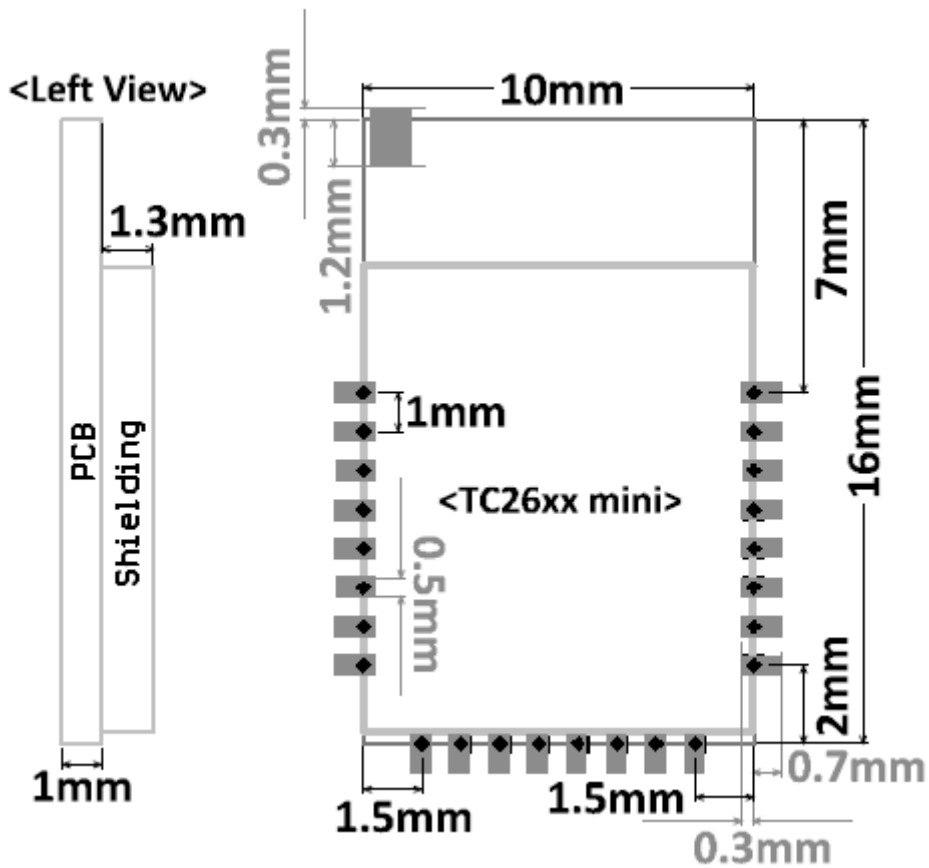
Recommended PCB layout for Module

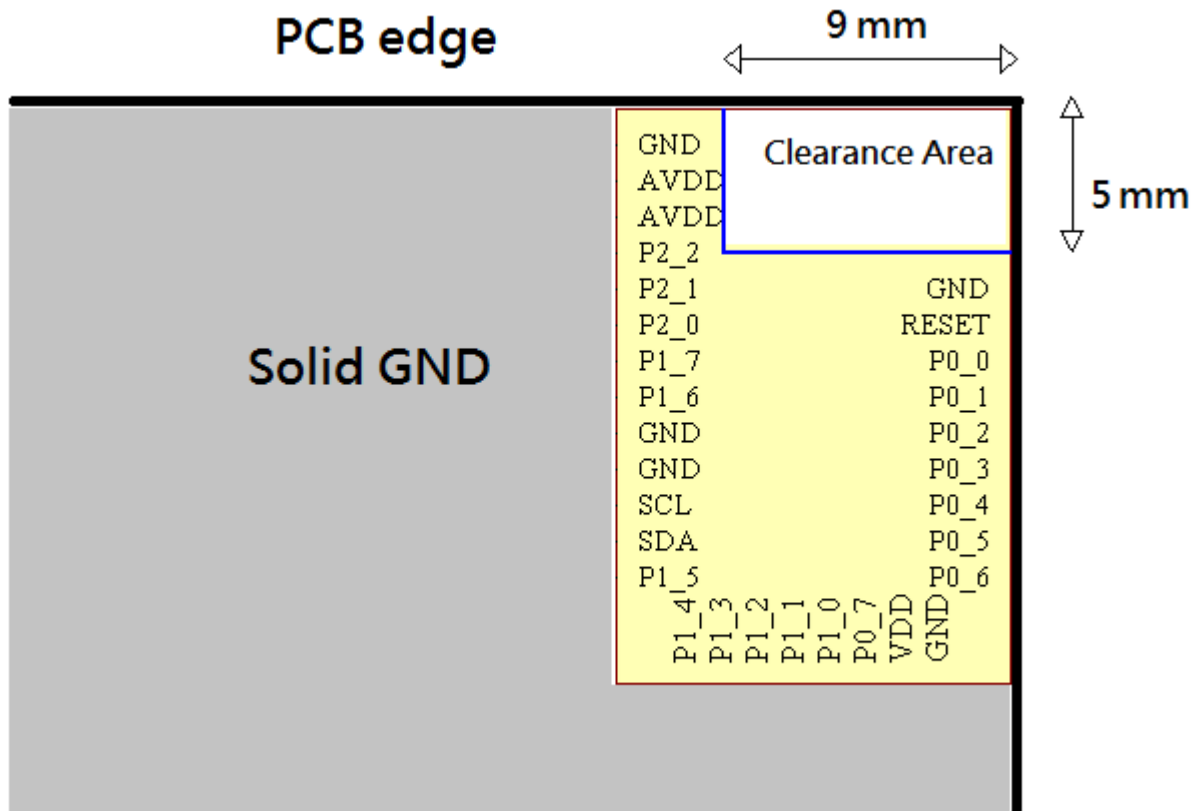


TC2640R2-SF128-02-XE RF Module (external antenna) Dimension



Recommended PCB layout for Module





### ■ Important FCC notice:

In accordance with FCC Part 15C , this module is listed as a Modular Transmitter device.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

The antenna of this transmitter must not be co-located or operating in conjunction with any other antenna or transmitters within a host device, except in accordance with FCC multitransmitter product approval procedures.

### ■ FCC Label Instructions

The outside of final products that contains this module device must display a label referring to the enclosed module. This exterior label can use wording such as the following: **“Contains Transmitter Module FCC ID: 2AEQ403**

” or **“Contains FCC ID: 2AEQ403**

.” Any similar wording that expresses the same meaning may be used.

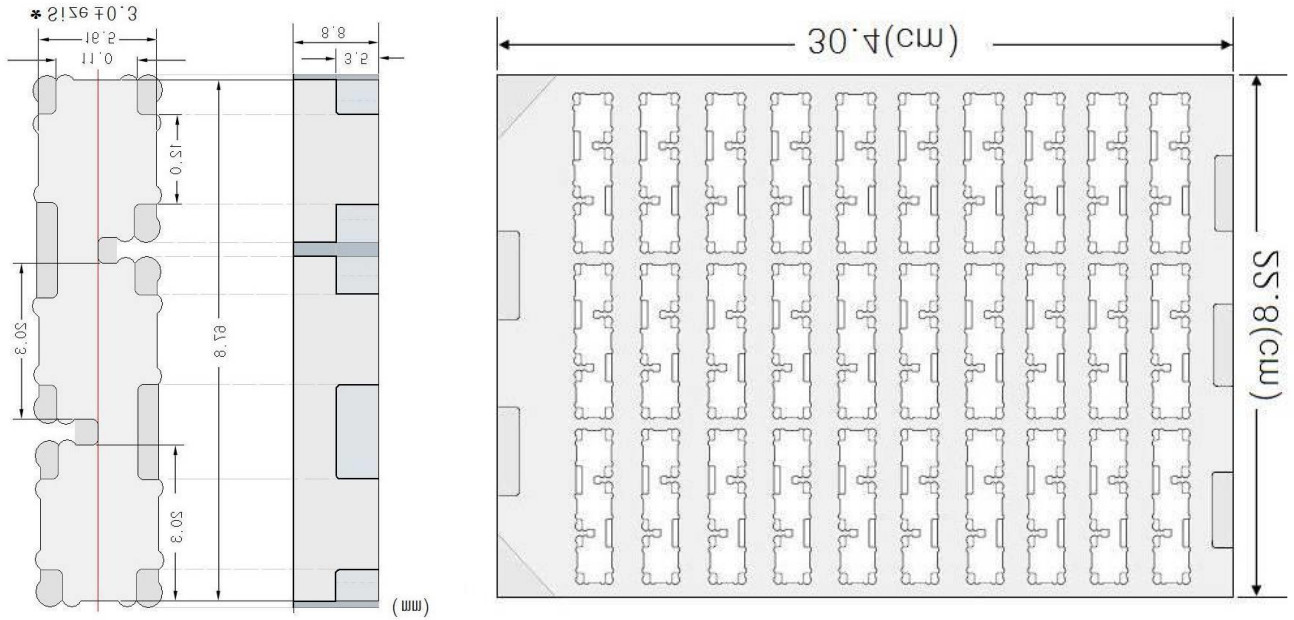
Additionally, there must be the following sentence on the device, unless it is too small to carry it:

“This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

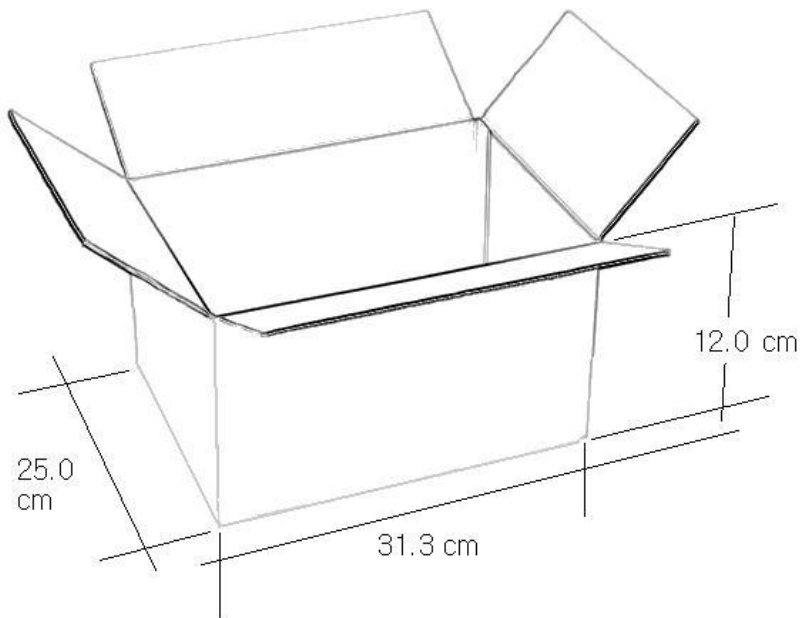
- (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.”

**FCC Certification only covers the shielded version of the module.**

■ Skin packing Information

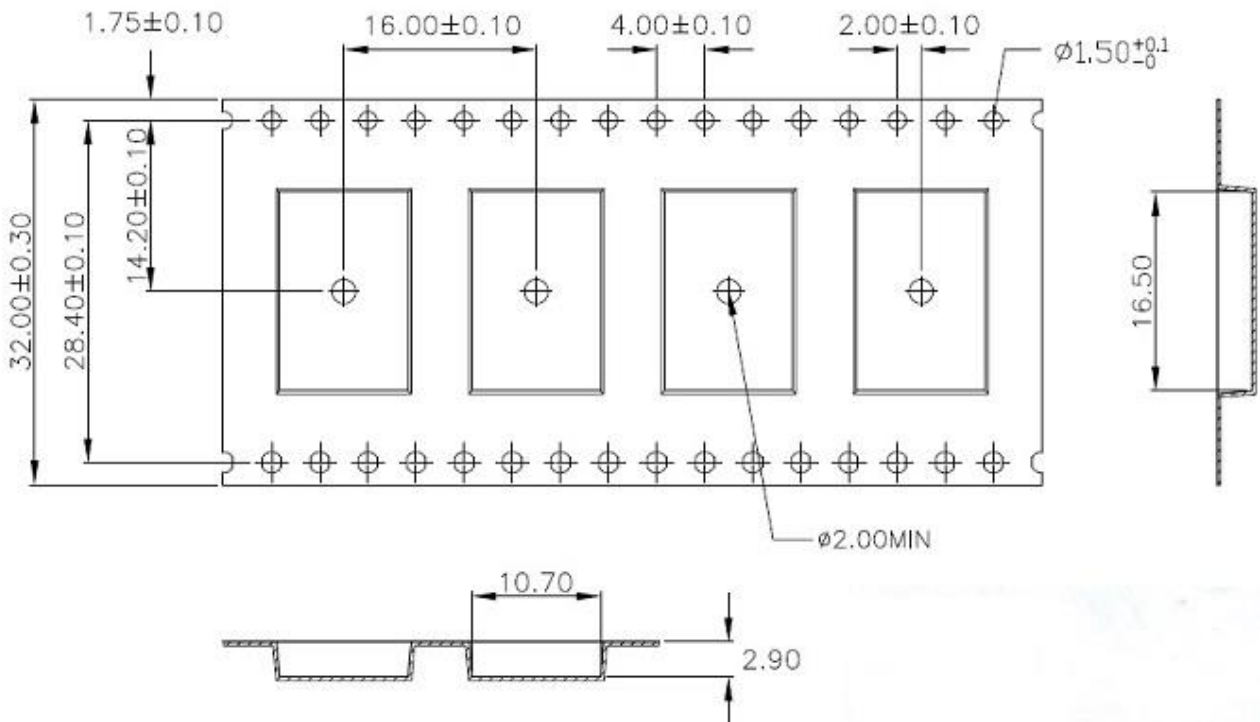


■ Skin packing box Information

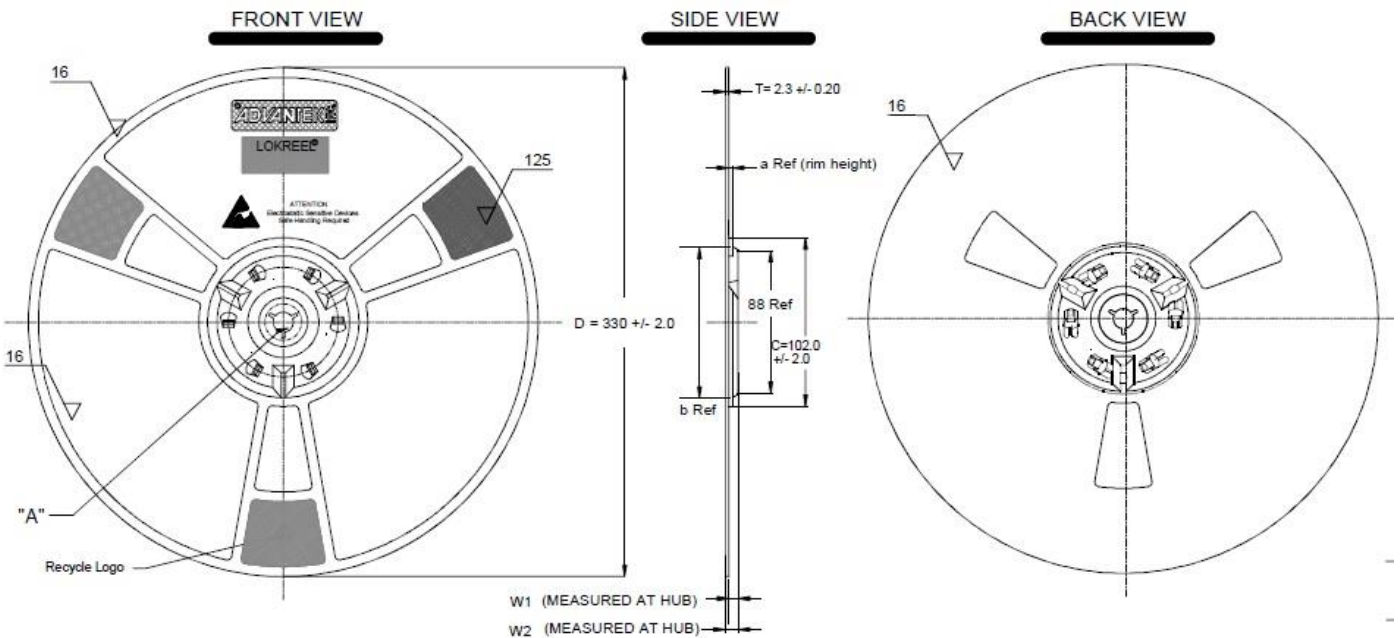


Device	Type	PQ	Length(cm)	Width(cm)	Height(cm)
TC2640R2-F128-02-xx	Module	1080	31.3	25.0	12.0

Reel packing Information (MPQ : 1000)



1. 10 sprocket hole pitch cumulative tolerance ±0.20.
2. Carrier camber is within 1 mm in 250 mm.
3. Material : Black Conductive Polystyrene Alloy.
4. All dimensions meet EIA-481 requirements.
5. Thickness : 0.30±0.05mm.



## Document History

Revision	Date	Description/Changes
1.1	2017.02.21	First release
1.2	2017.06.23	Add packing information
1.3	2019.09.18	Add FCC Important Notice & FCC Label Instruction
1.4	2020.04.22	Add Reel packing information

## Address Information

24250 新北市新莊區中山路一段 107 號 13 樓之 1

電話:02-8522-8250

傳真:02-8522-8121

E-mail:rifo@rifo.com.tw

<http://www.rifo.com.tw>



13F.-1, No.107, Sec. 1, Zhongshan Rd., Xinzhuang  
Dist., New Taipei City 24250, Taiwan (R.O.C.)

Tel :886-2-8522-8250

Fax:886-2-8522-8121