



resideo

RTF0B4T1AL59UB

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Feature

- Support RF6 protocol (base on 802.15.4)
- Support BLE 5.0
- 1km open field range @20dBm
- 128/256-bit AES Encryption
- RF signal strength health check
- Low-power consumption
- Built-in Cortex M4 processor
- Host interface: UART
- Other interfaces: 2 ADC, 4 wires USART, Debug UART, 1x I2C, Programming, 3 wires Co-exist, 2x INT, 1 x SPI for flash
- Maximum transmit power: 20dBm @ 2.4GHz
- Receive sensitivity: -101dBm @ 1Mbps 2.4GHz
- Compact form factor: RTF0B4T1AL59UB is 12x15x2.5 mm (L x W x H)
- RoHS compliant

Certification(planning)

- Regulatory certificates: FCC, CE
- Bluetooth SIG certification

Operational

- Operating voltage range: 2V~3.6V
- Storage temperature range: -40 °C to +85 °C
- Working frequency from 2400 to 2480 MHz ISM

Description

RTF0B41AL59UB is wireless module complies with IEEE802.15.4 and Bluetooth 5.0, support security protocol RF6, BLE5.0 full features, high speed, long range and ADE, low power consumption design and integrates rich

peripherals, 3 wires Co-exist, 1x IIC, 2x ADC, 4wires USART, 2wires UART, high radio performance, output power up to 20dBm and receive sensitivity up to -105dBm. Working frequency from 2400 to 2480 MHz ISM and SRD Systems with Down to 4 kHz of Receive Bandwidth

Typical Applications

- Smart Grid and Automatic Meter Reading
 - Water, Gas, and Electricity Meters
 - Heat Cost Allocators
 - Gateways
- Wireless Sensor Networks
 - Long-Range Sensor Applications
- Industrial
 - Asset Tracking and Management
 - Factory Automation
 - Remote Display
- Wireless Healthcare Applications
- Energy Harvesting Applications
- Electronic Shelf Label (ESL)
- Home and Building Automation
 - Wireless Alarms and Security Systems
 - Locks
 - Lightning Control
 - Motion Detectors
 - Connected Appliances
 - HVAC
 - Garage Door Opener

Glossary of Terms

Terms	Description
BLE	Bluetooth Low Energy
UART	Universal Asynchronous Receiver Transmitter
SPI	Serial Peripheral Interface
ADC	Analog-to-Digital Converter
RF	Radio Frequency
AIO	Analog Input / Output
GPIO	General Purpose Input / Output
I2C	Inter-Integrated Circuit

1 Device Overview

RTF0B4T1AL59UB is wireless module complies with IEEE802.15.4 and Bluetooth 5.0, support security protocol RF6, BLE5.0 full features, high speed, long range and ADE, low power consumption design and integrates rich peripherals, 3 wires Co-exist, 1x IIC, 2x ADC, 4wires USART, 2wires UART, high radio performance, output power up to 20dBm and receive sensitivity up to -105dBm. Figure 1-1 lists all the key components of the module. The pinout of the module is shown in Figure 1-2. The physical map of module is shown in Figure 1-3 and the description is presented in Table 1-2.

Figure 1-1: Pin Diagram

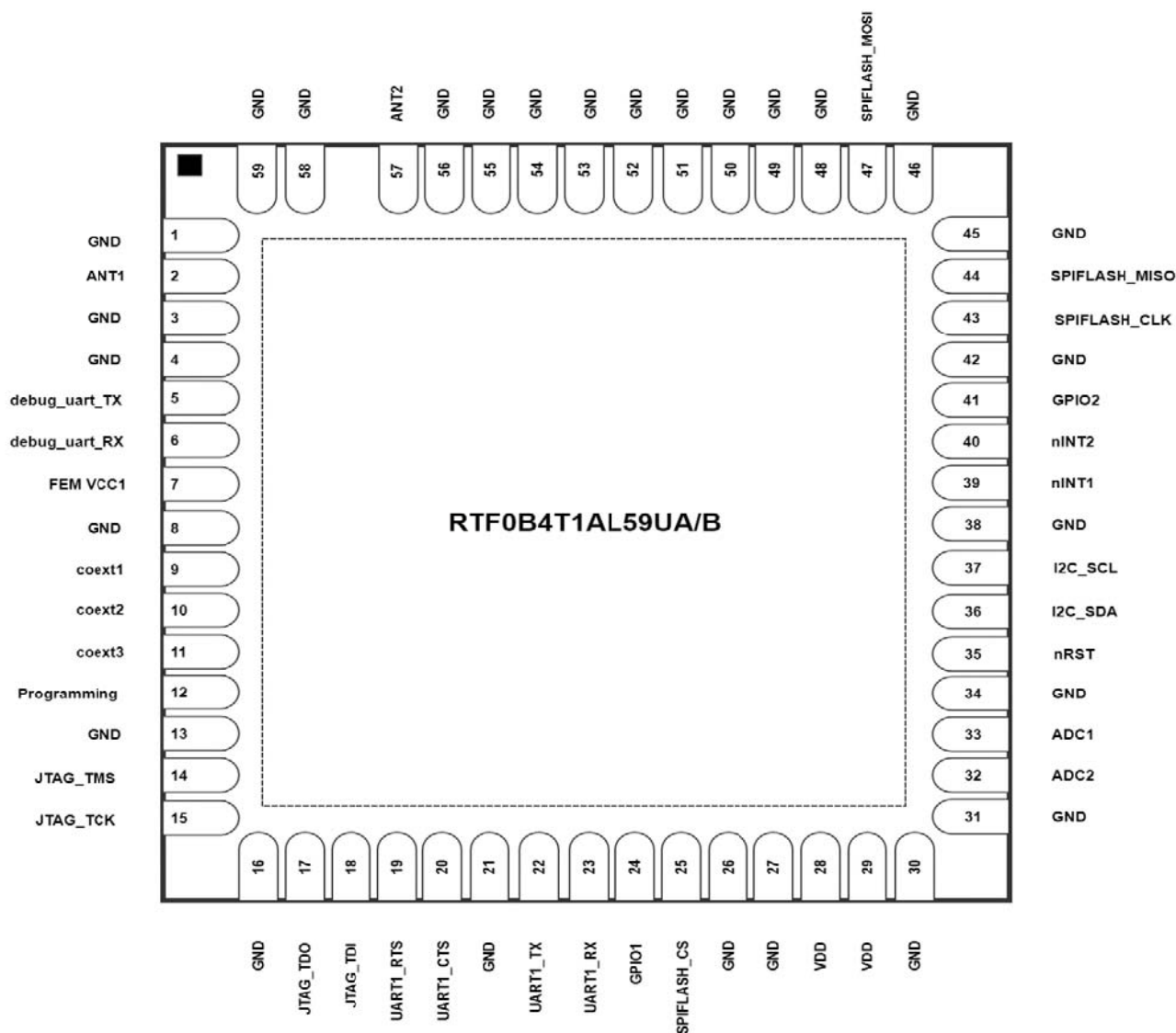


Figure 1-2: The physical map of module

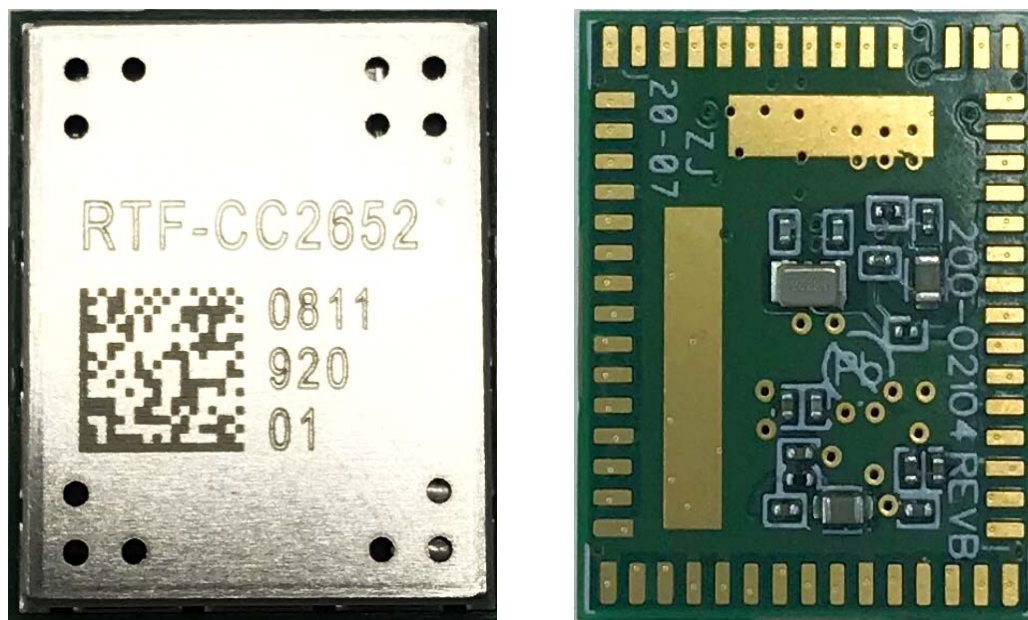


Table 1-1: Pin Description

RTF0B4T1AL59UB Pin Number	RTF0B4T1AL59UB Pin Name	Description
1	GND	Ground
2	ANT1	RF signal antenna 1
3	GND	Ground
4	GND	Ground
5	debug_uart_TX	debug port
6	debug_uart_RX	debug port
7	FEM VCC1	Keep float
8	GND	Ground
9	coext1	co-exist pin with WiFi&BLE
10	coext2	co-exist pin with WiFi&BLE
11	coext3	co-exist pin with WiFi&BLE
12	Programming	when low power up, enter into UART program mode
13	GND	Ground
14	JTAG_TMS	JTAG TMS
15	JTAG_TCK	JTAG TCK
16	GND	Ground
17	JTAG_TDO	GPIO, JTAG_TDO, high-drive capability

18	JTAG_TDI	GPIO, JTAG_TDO, high-drive capability
19	UART1_RTS	UART1 request to send output
20	UART1_CTS	UART1 clear to send input
21	GND	Ground
22	UART1_TX	UART1 Transmit Data output
23	UART1_RX	UART1 Receive Data input
24	GPIO1	GPIO
25	SPIFLASH_CS	SPI-bus master select output/slave input
26	GND	Ground
27	GND	Ground
28	VDD	Power input
29	VDD	Power input
30	GND	Ground
31	GND	Ground
32	ADC2	ADC input
33	ADC1	ADC input
34	GND	Ground
35	nRST	reset input
36	I2C_SDA	Serial Data
37	I2C_SCL	Serial Clock
38	GND	Ground
39	nINT1	Interrupt for SPI communicate
40	nINT2	Interrupt for SPI communicate
41	GPIO2	GPIO
42	GND	Ground
43	SPIFLASH_CLK	SPI-bus master clock output
44	SPIFLASH_MISO	SPI-bus slave Master In Slave Out output
45	GND	Ground
46	GND	Ground
47	SPIFLASH_MOSI	SPI-bus slave Master Out Slave In input
48	GND	Ground
49	GND	Ground
50	GND	Ground
51	GND	Ground
52	GND	Ground
53	GND	Ground
54	GND	Ground
55	GND	Ground
56	GND	Ground
57	ANT2	RF signal antenna 2

58	GND	Ground
59	GND	Ground

2 Electrical Performance

Table 2-1:Absolute Maximum Ratings

Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Parameter	Min.	Typ.	Max.	Units
Input Voltage (Vbat)	0	—	3.6	V
Operating Temperature	-40	—	85	°C

Table 2-2:DC Characteristic

Parameter	Min.	Typ.	Max.	Units
I/O current sink/source capability	—	8	—	mA
supply voltage	2	—	3.6	V

Table 2-3:ADC

Parameter	Description	Min.	Typ.	Max.	Units
Resolution	200kHz Clock	—	—	12	Bits

Table 2-4:Current Consumption

Power Consumption - Power Modes

All electrical parameters in all tables are specified under the following conditions, unless stated otherwise:Typical values are based on T_c = 25°C,V_{DD} = 3.63V.

Total TX/RX Current					
Parameter	Description	Min.	Typ.	Max.	Units
15.4 TX Active @20dBm 1Mbps	radio transmitting	—	125	—	mA
15.4 TX Active @14dBm 1Mbps	radio transmitting	—	66	—	mA
15.4 TX Active @10dBm 1Mbps	radio transmitting	—	46	—	mA
15.4 RX Active	radio in receive mode	—	12.2	—	mA
BLE TX Active @20dBm 1Mbps	radio transmitting	—	125	—	mA
BLE TX Active @14dBm 1Mbps	radio transmitting	—	66	—	mA
BLE TX Active @10dBm 1Mbps	radio transmitting	—	46	—	mA
BLE RX Active	radio in receive mode	—	12.2	—	mA
Icore Active	MCU active, radio off and FEM sleep	—	2.62	—	mA
Sleep mode	RTC running, MCU sleep	—	0.252	—	μA

Table 2-5:Radio performance conducted

Index	Parameter	Condition	Value	Unit	Explanation to the Criteria Setting
TX_10	Output Power	VCC=3.0,CW, 25°C,2405MHz, 2440MHz, 2480MHz at antenna port	20 +/-1.5db	dBm	For obtaining a output power level of 20dBm and minimizing the supply current, the output power of JN5169 should be set to -1.3dBm. Thenomianl output power level of FEM should be around 20dBm
TX_11	Output power variation over temperature	VCC=3.0, CW, 2405MHz, 2440MHz, 2480MHz Temperature=-20°C, -10°C, 25°C, 55°C, 70°C	<+/- 1	db	According to Comments
TX_12	Output power variation over Voltage	VCC= 2.4, 3.3, 3.6, OQPSK, CW, 25°C,2440MHz	<+/- 1	db	No related parameters in datasheet. Will review if the measurement results are reasonable or not.

TX_13	Center Freq. Tolerance	VCC=3.0,CW, 25°C, 2405MHz, 2440MHz, 2480MHz	<40	ppm	According to the standard of IEEE 802.15.4-2011, Chapter 10.3.9
TX_14	Error Vector Magnitude (EVM)	VCC=3.0, OQPSK, 25°C, 2405MHz, 2440MHz, 2480MHz Output Power = 20dBm	< 4.5	%	According to the standard of IEEE 802.15.4-2011, Chapter 10.3.8
TX_15	Band edge and Harmonic	under 38% Duty Cycle	<51(average), <71(peak)	dBμV/m	Follow the Redulation. Method and Criteria need be clarified.
RX_10	Receiver sensitivity	VCC=3.0, PER <1%, 25°C 2405MHz, 2440MHz, 2480MHz	103	dBm	CC2652 RX Sensitivity = -100dBm at this condition. FEM SKY44603 add 4db increase
RX_11	Receive saturation	VCC=3.0, PER <1%, 25°C 2405MHz, 2440MHz, 2480MHz	>-6	dBm	Refer to RTF Test Plan_2019011, BEL_RX_14
RX_12	RSSI Accuracy	VCC=3.0,OQPSK, 25°C, 2440MHz Input power setting is OQPSK. And input power level is -30, -60, and -90dBm Read RSSI of RTF module.	<+/-2	db	
RX_13	Receive sensitivity variation Over Temperature	VCC=3.0, PER <1%, 25°C, 2440MHz -20°C, -10°C, 25°C, 55°C, 70°C	<+/-1 from -10°C to +55°C <+/-2 from -20°C to +70°C	dB	According to Comments

Antennas

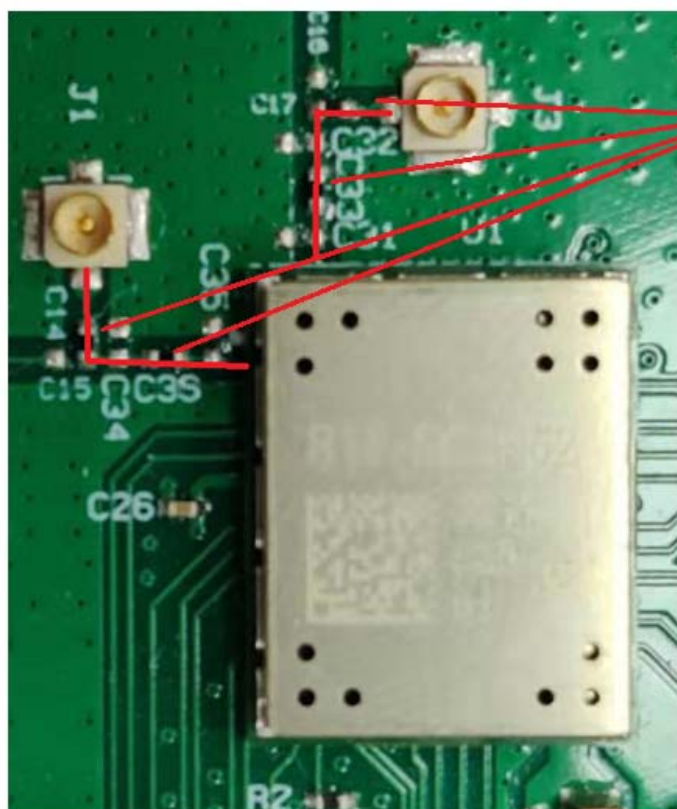
Current design use external antenna, SATIMO company antenna PN is SD2450, dipole type antenna, the nominal dipole impedance is 50ohm with return loss value better than -15dB at the labeled center frequency and better than -10dB return loss in a bandwidth of 10%. For the more information, please see antenna test report.

See following for microstrip layouts, use 50ohm microstrip connect to RF connectors, Connectors part number:

Molex: 73412-0110,

I-PEX CO LTD: 20279-001E-03

AMPHENOL CORP : A-1JB



4 pcs 0ohm
resistors

Layer Stackup 63th

L1(SIGNAL_1)	1.8mil	COPPER
L2(PLANE_1)	3.8mil	PP
L3(PLANE_2)	1.2mil	COPPER
L4(PLANE_2)	47mil	CORE
L5(PLANE_2)	1.2mil	COPPER
L6(PLANE_2)	3.8mil	PP
L7(SIGNAL_2)	1.8mil	COPPER

IMPEDANCE REQUIREMENT 63th

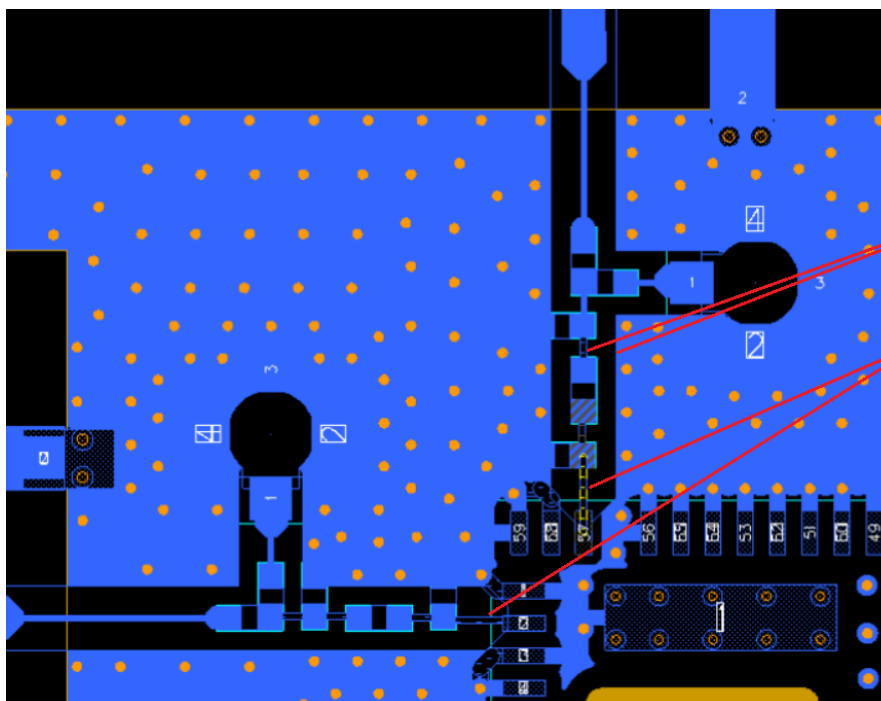
1. Single ended trace impedance(CPW)

Layer	W (mil)	Single ended trace impedance and tolerance(ohm)
L1/L3	6	50 +/-10%

W, width of line

S, space of line

D, space of line to GND

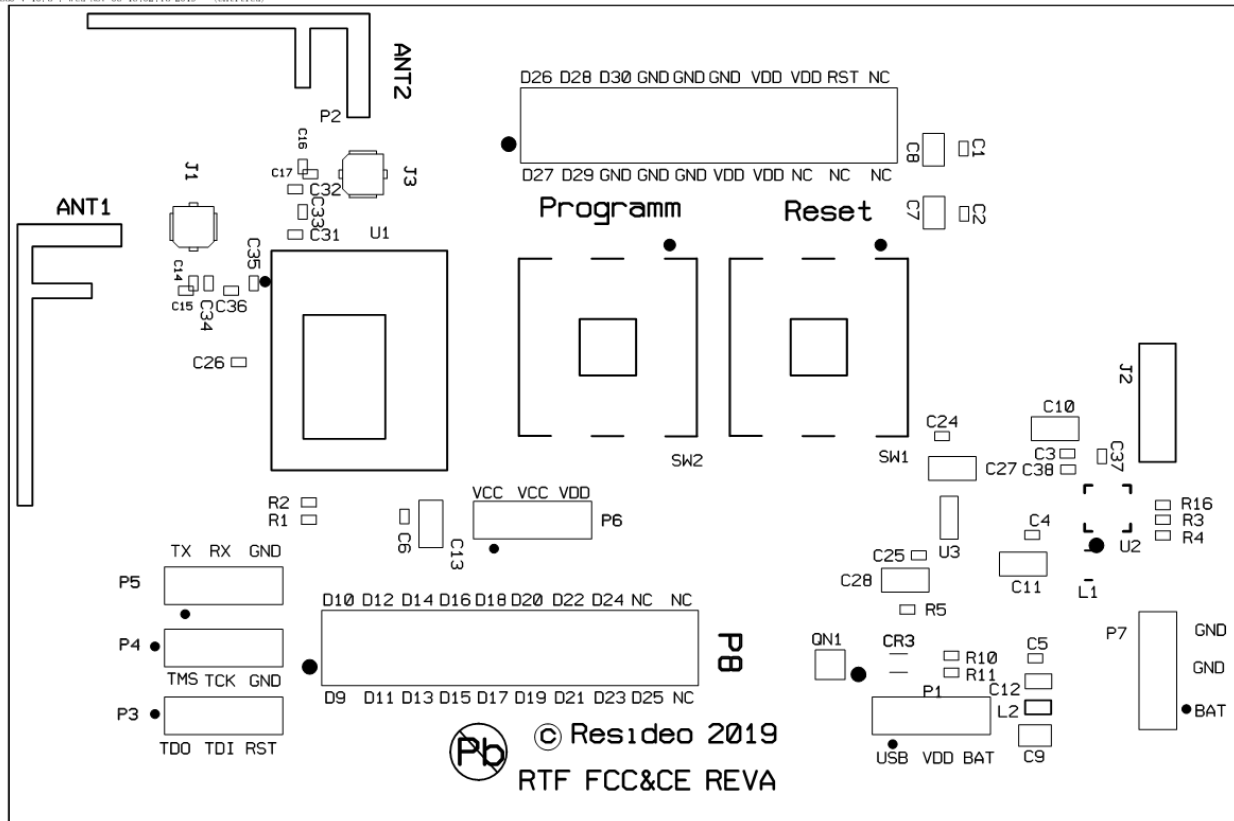


clearance: 26mil

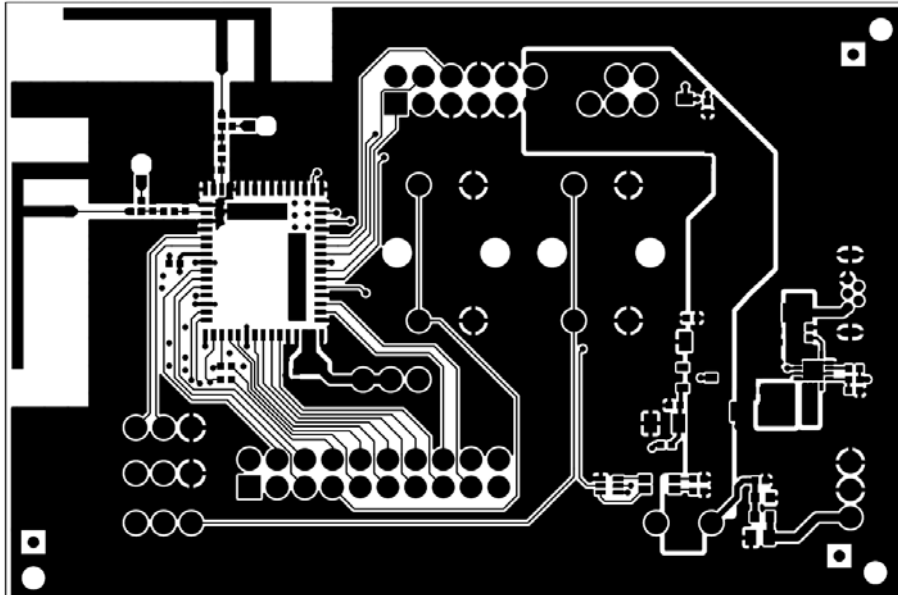
trace width: 6mil

For the exactly dimension, please see attachment for Gerber files.

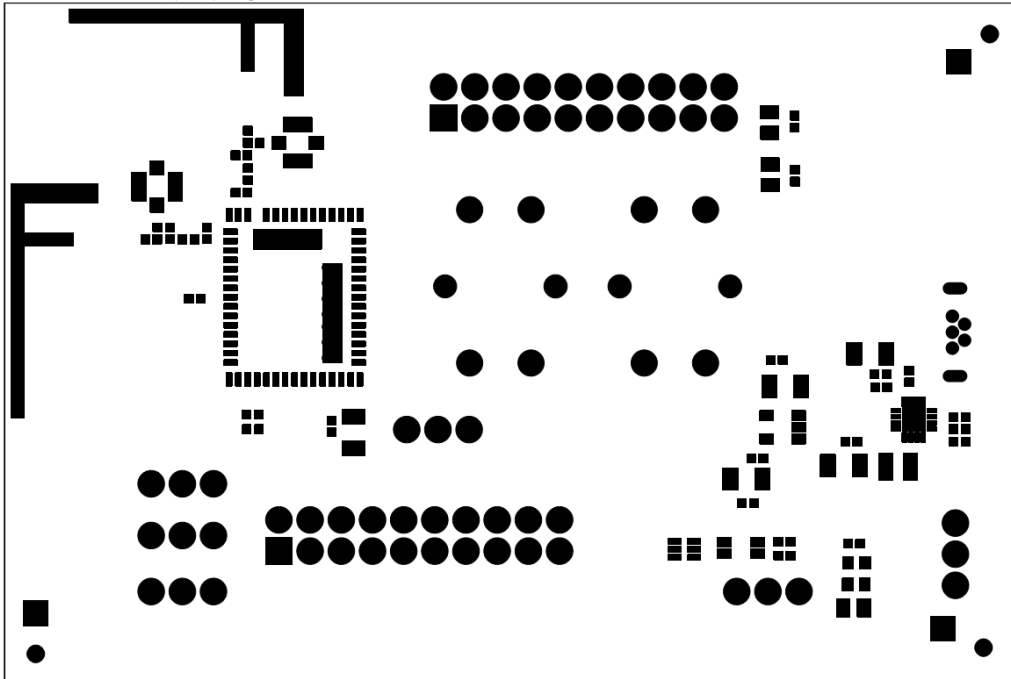
CAM350 V 10.5 : Wed Nov 06 16:02:45 2019 - (Untitled)



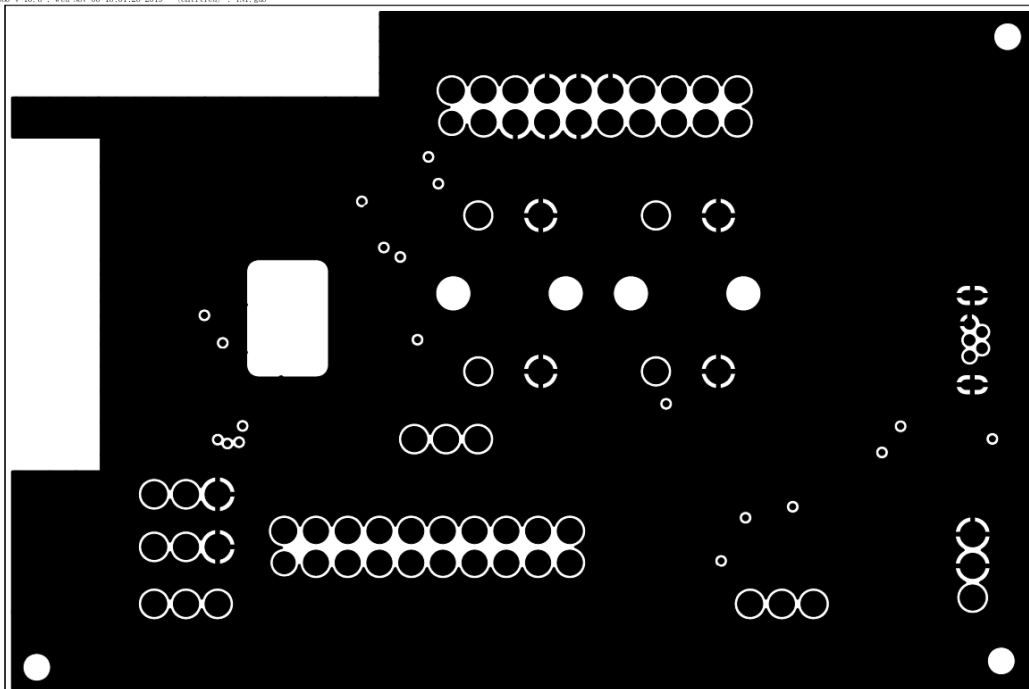
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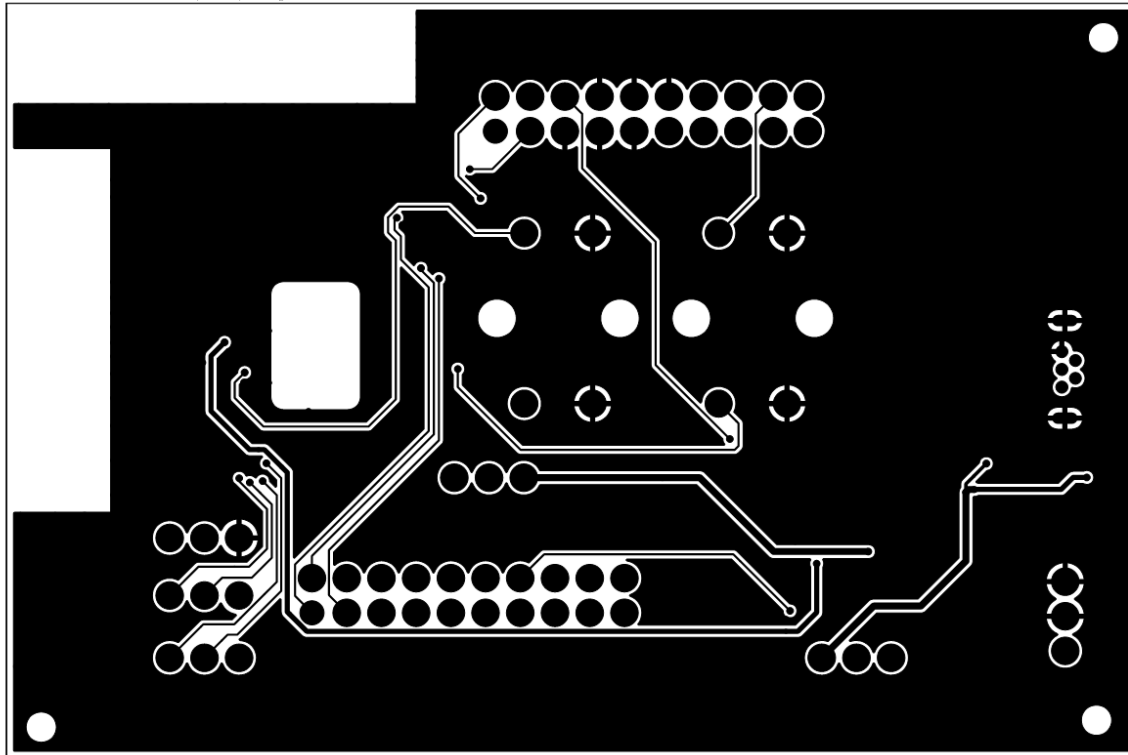
CAM350 V 10.5 : Wed Nov 06 16:01:26 2019 - (Untitled) : CSM.gbr



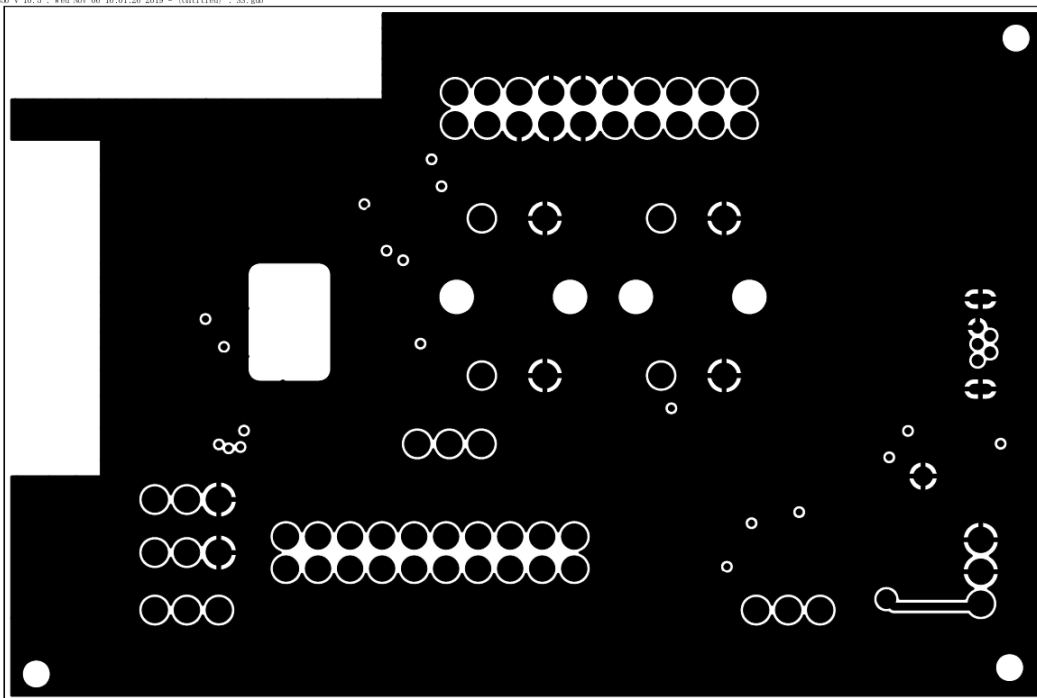
CAM350 V 10.5 : Wed Nov 06 16:01:26 2019 - (Untitled) : IN1.gbr



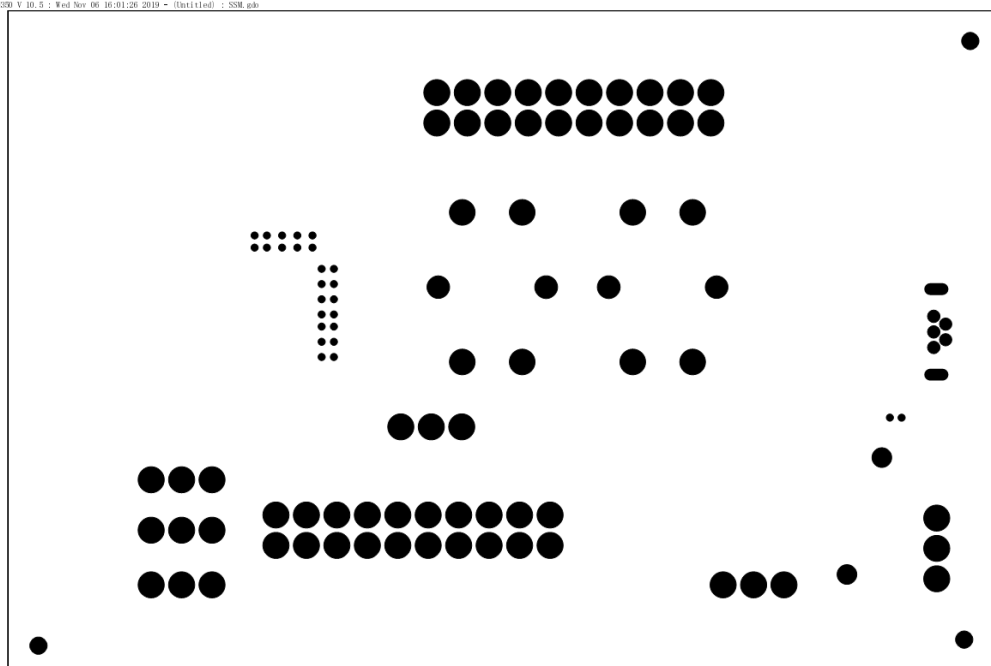
CAM350 V 10.5 : Wed Nov 06 16:01:26 2019 - (Untitled) : IN2.gbr



CAM350 V 10.5 : Wed Nov 06 16:01:26 2019 - (Untitled) : SS.gbr



CAM350 V.10.5 : Wed Nov 06 16:01:26 2019 - (Unlited) : SSL.gds



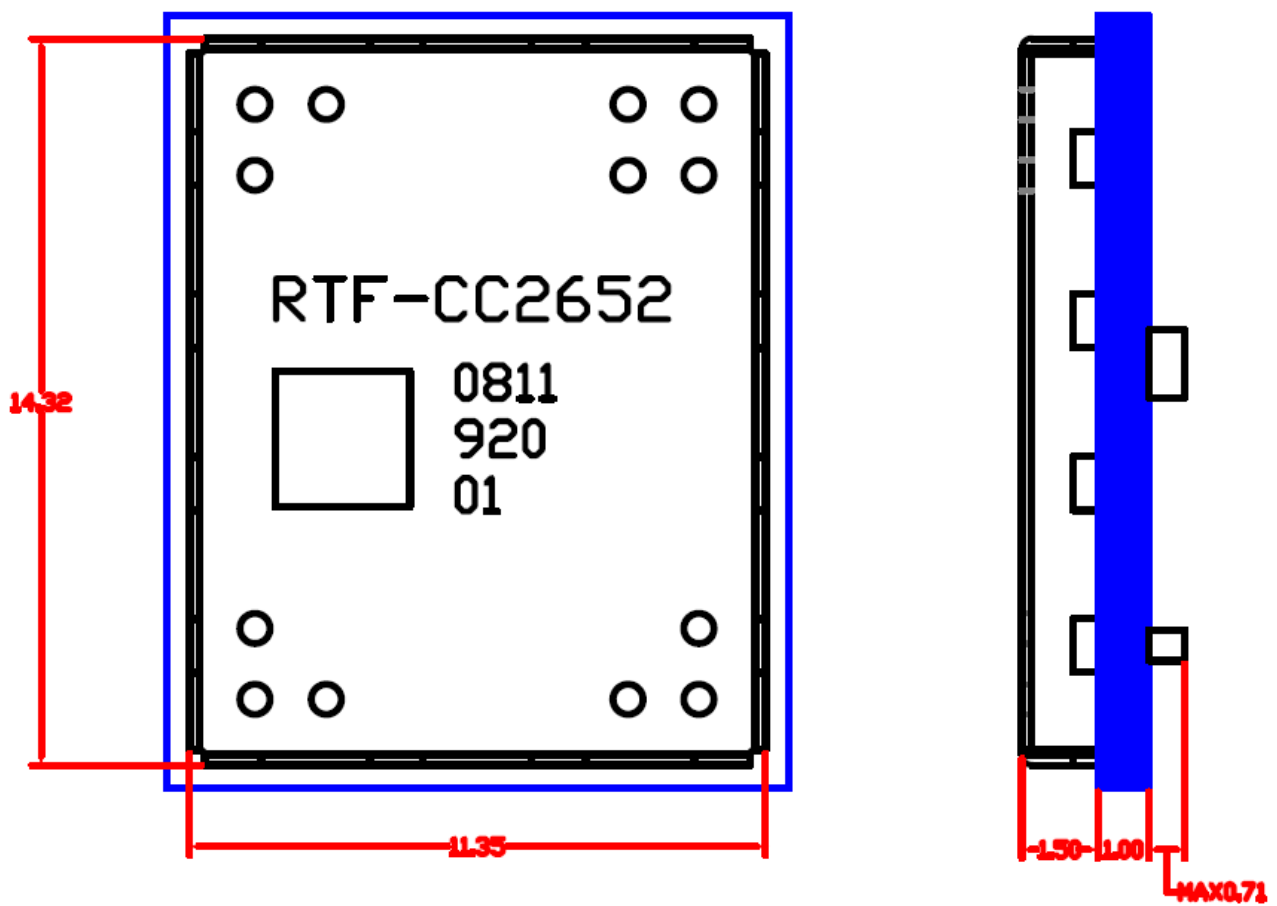
3 Mechanical characteristic

Table 3-1 shows the weight and dimensions. Figure 3-2 shows the physical dimensions for the RTF0B4T1AL59UB module.

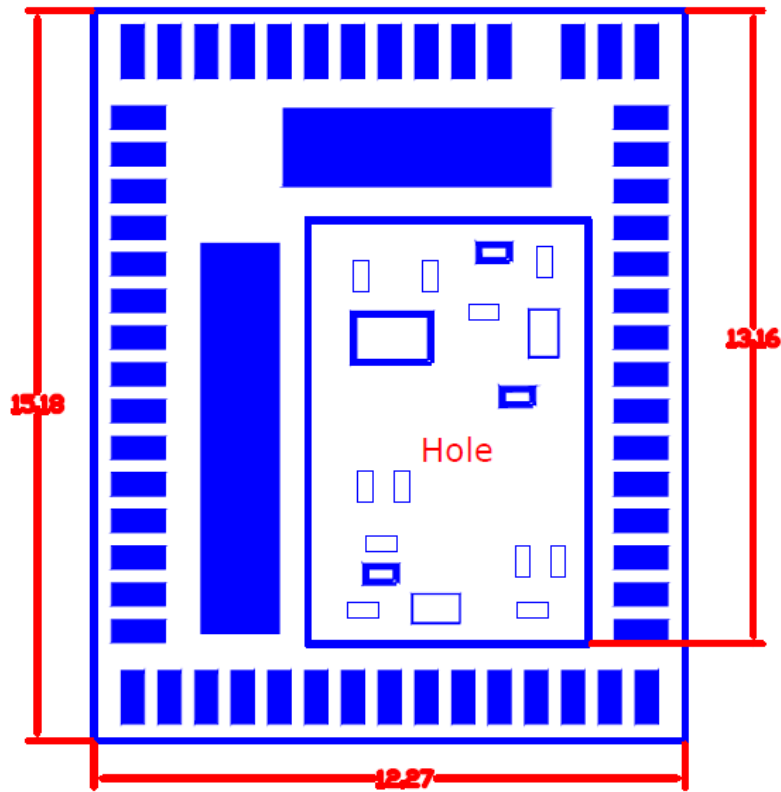
Table3-2: Mechanical characteristic

Specification	Description
Dimensions	12x15x2.5 mm

Figure 3-1: RTF0B4T1AL59UB Module Dimensions



UNIT: mm
Tolerance: 0.05mm



Back View

4 Revision History

Revision A (September 2019)

This is the initial release of this document

FCC Certification Requirements.

According to the definition of mobile and fixed device is described in Part 2.1091(b), this device is a mobile device.

And the following conditions must be met:

1. This Modular Approval is limited to OEM installation for mobile and fixed applications only. The antenna installation and operating configurations of this transmitter, including any applicable source-based time- averaging duty factor, antenna gain and cable loss must satisfy MPE categorical Exclusion Requirements of 2.1091.
2. The EUT is a mobile device; maintain at least a 20 cm separation between the EUT and the user's body and must not transmit simultaneously with any other antenna or transmitter.
3. A label with the following statements must be attached to the host end product: This device contains FCC ID: CFSRTF0B4T1.
4. To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, maximum antenna gain (including cable loss) must not exceed:
 - ☐ BLE (Tx: 2402MHz~2480MHz): <2.15 dBi
 - ☐ Zigbee(Tx: 2405MHz~2480MHz): <2.15 dBi
5. This module must not transmit simultaneously with any other antenna or transmitter

6. The host end product must include a user manual that clearly defines operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

For portable devices, in addition to the conditions 3 through 6 described above, a separate approval is required to satisfy the SAR requirements of FCC Part 2.1093

If the device is used for other equipment that separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.

For this device, OEM integrators must be provided with labeling instructions of finished products. Please refer to KDB784748 D01 v07, section 8. Page 6/7 last two paragraphs:

A certified modular has the option to use a permanently affixed label, or an electronic label. For a permanently affixed label, the module must be labeled with an FCC ID - Section 2.926 (see 2.2 Certification (labeling requirements) above). The OEM manual must provide clear instructions explaining to the OEM the labeling requirements, options and OEM user manual instructions that are required (see next paragraph).

For a host using a certified modular with a standard fixed label, if (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module FCC ID: CFSRTF0B4T1" or "Contains FCC ID: CFSRTF0B4T1" must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID.