



# **ITM-7231N-BK**

**IEEE 802.11b/g/n WLAN + Bluetooth LE 5.2  
Combo IoT Module Datasheet**

***(Preliminary)***

**V0.3**

# Revision History

Date	Revision Content	Revised By	Version
2021/08/28	- Initial released (Preliminary)	Jim Ieng	0.1
2021/09/24	- Update WIFI and BLE spec.	Issac Chen	0.2
2021/11/05	- Update WIFI spec.	Issac Chen	0.3
	-		

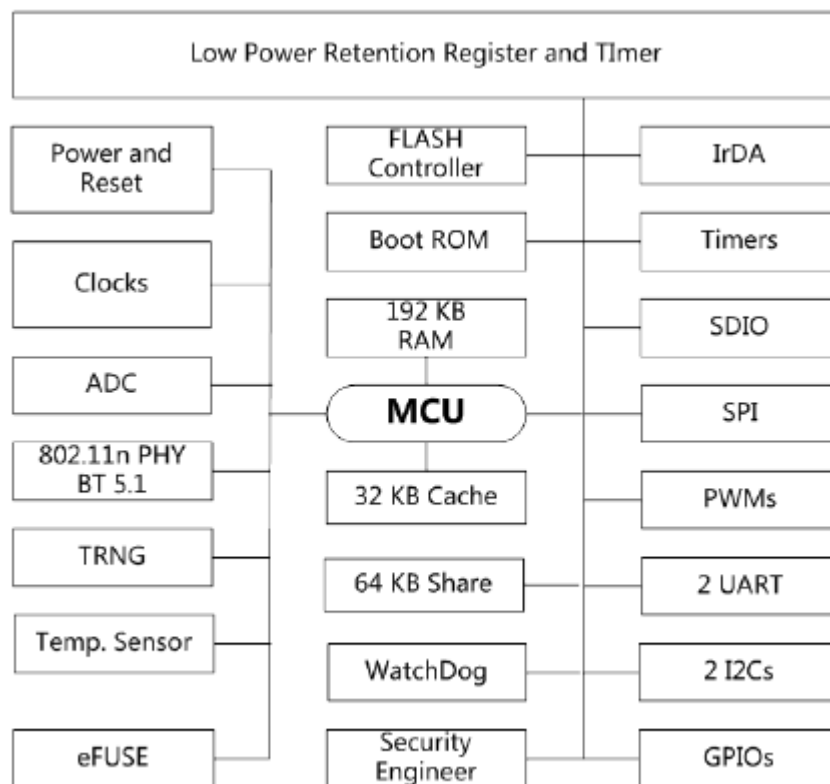
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# 1. General Description

iTM-7231N-BK module features a fully integrated 2.4GHz radio transceiver and baseband processor for Wi-Fi 802.11b/g/n and Bluetooth® v5.2 IoT applications. It can be used as a standalone application-specific communication processor or as a wireless data link in hosted MCU systems where power consumption is critical. It supports flexible memory architecture for storing profiles, stacks and custom application codes, and can be updated using Over-The-Air (OTA) technology.

iTM-7231N-BK module uses Beken BK7231N SoC. It is equipped with a powerful and cost-competitive 32-bit processor with clock rate up to 120Mhz, and 2MB internal flash memory. iTM-7231N-BK can be connected to any external MCU through SPI, I2C or UART interfaces and sensors or other devices through GPIOs. The transceiver interfaces directly to the antenna and is fully compliant with the Wi-Fi 802.11b/g/n and Bluetooth 5.2 BLE standards. With integrated antenna switch, RF balun, power amplifier (PA) and low noise amplifier (LNA), the BK7231N allows both Wi-Fi and Bluetooth to minimize PCB design area and external component requirement. The block diagram for BK7231N is shown as below.



## 2. Features

- Processors
  - 32-bit RISC MCU with clock rate up to 120MHz
  - 32KB Cache memory
  
- Wi-Fi
  - 2.4GHz 1T1R IEEE 802.11b/g/n
  - AP / STA / AP+STA mode support
  - WPA/WPA2 security supported
  - Built-in TCP/IP stack
  - Enhanced and robust sensitivity for wider coverage range
  
- Bluetooth LE
  - Compliant with Bluetooth 5.2 BLE specifications
  - Master / Slave mode support
  - Long Range / High Data Rate support
  - Built-in BLE stack
  - AoA / AoD positioning support
  
- System
  - 256 KB SRAM
  - 2MB flash memory (4MB optional)
  - 32-bit counter x 6, and low-power counter x 1
  - Low-voltage and watchdog reset.
  - Internal temperature sensor
  - True random generator/32B eFuse/256B OTP ROM for security application
  - Multiple power state: Normal/Standby/Low-power standby/Deep sleep/Shutdown
  
- I/O Interfaces (Totals 19-pins GPIOs)
  - SDIO Master/Slave x 1
    - Clock rate up to 50MHz

- SPI Master/Slave x 1
  - Clock rate up to 50MHz
- High Speed UART x 2
  - Baud rate up to 6MHz
- I2C x 2
  - clock rate up to 400kHz
- PWM x 6
  - 32-bit resolution
  - Timer mode / PWM mode / Capture mode
- ADC x 6
  - 10~16-bit output format
  - Sampling mode: Single / Continuous / Read-triggered

## 3. General Specification

### 3.1 Voltages

#### 3.1.1 Absolute Maximum Ratings

Symbol	Description	Min.	Max.	Unit
VBAT	Input supply Voltage	-0.3	3.6	V

Operating temperature	-20°C to 70°C
Storage temperature	-40°C to 85°C

#### 3.1.2 Recommended Operating Ratings

Test conditions: At room temperature				
Symbol	Min.	Typ.	Max.	Unit
VBAT	2.3	3.3	3.6	V

## 3.2 Wi-Fi RF Specification (RX)

Parameters	Conditions	Min.	Typ.	Max.	Unit
Frequency Range		2412		2484	MHz
RX Sensitivity 11b @ 8% PER	- 1Mbps		-97		dBm
	- 2Mbps		-93		dBm
	- 5.5Mbps		-91		dBm
	- 11Mbps		-89		dBm
RX Sensitivity 11g @ 10% PER	- 6Mbps		-92		dBm
	- 9Mbps		-90		dBm
	- 12Mbps		-88		dBm
	- 18Mbps		-86		dBm
	- 24Mbps		-82		dBm
	- 36Mbps		-79		dBm
	- 48Mbps		-77		dBm
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0		-90		dBm
	- MCS=1		-88		dBm
	- MCS=2		-86		dBm
	- MCS=3		-81		dBm
	- MCS=4		-79		dBm
	- MCS=5		-74		dBm
	- MCS=6		-73		dBm
	- MCS=7		-71		dBm
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0		-88		dBm
	- MCS=1		-85		dBm
	- MCS=2		-83		dBm
	- MCS=3		-78		dBm
	- MCS=4		-76		dBm
	- MCS=5		-71		dBm
	- MCS=6		-70		dBm
	- MCS=7		-68		dBm
Maximum Receive Level	802.11b		-10		dBm
	802.11g		-8		dBm
	802.11n		-8		dBm



## 3.3 Wi-Fi RF Specification (TX)

Parameters	Conditions	Min.	Typ.	Max.	Unit
Frequency Range		2412		2484	MHz
Output Power	802.11b (11Mbps)		17.0		dBm
	802.11g (54Mbps)		15.0		dBm
	802.11n (MCS7)		14.0		dBm
@EVM	802.11b (11Mbps)		-15	-10	dB
	802.11g (54Mbps)		-28	-25	dB
	802.11n (MCS7)		-30	-28	dB
VBAT=3.3V, Ambient temperature=25°C					

## 3.4 BLE RF Specification (RX)

Parameters	Conditions	Min.	Typ.	Max.	Unit
Frequency Range		2402		2480	MHz
RX Sensitivity			-85		dBm
Maximum Input Level		-10			dBm

## 3.5 BLE RF Specification (TX)

Parameters	Conditions	Min.	Typ.	Max.	Unit
Frequency Range		2402		2480	MHz
Maximum Output Power		-20	5	18	dBm
20dB Bandwidth			1		MHz

## 3.6 Power Consumption

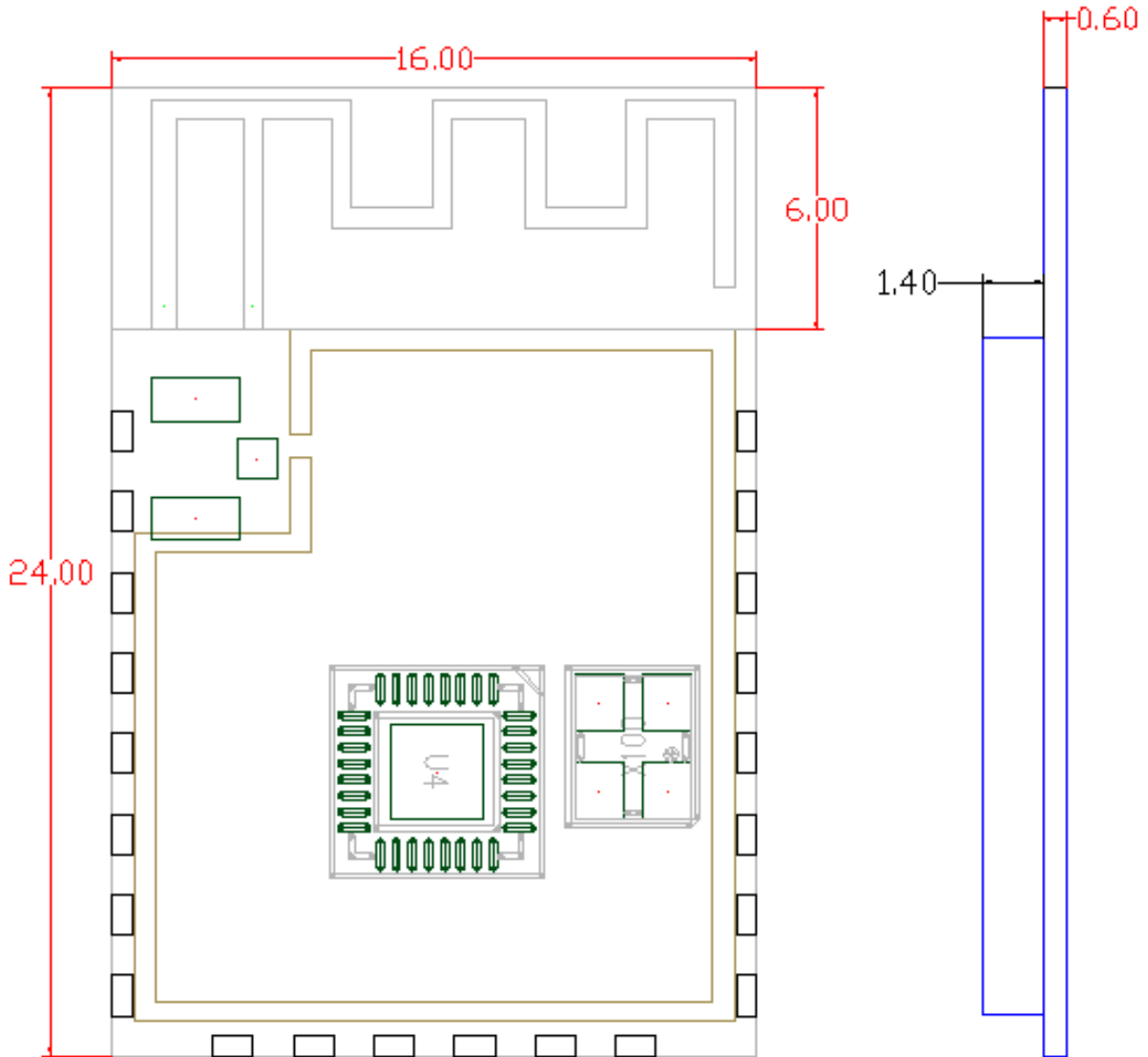
Parameters	Conditions	Min.	Typ.	Max.	Unit
Continuous TX	802.11b/11Mbps/17dB,		280		mA
Continuous TX	802.11g/54Mbps/15dB,		250		mA
Continuous TX	802.11n/HT20-MCS7/14dB,		250		mA
RX mode	802.11b/11Mbps/-10dB input		63		mA
RX mode	802.11g/54Mbps/-10dB input		69		mA
RX mode	802.11n/HT20-MCS7/-10dB input		69		mA
Normal Standby	MCU stop; Modem power-off		30		uA
Low-power Standby	MCU stop in low-power mode		10		uA
Deep Sleep	All main logic circuit power-off		5		uA
Shutdown	CEN pin = LOW		1		uA

# 4. Pin Assignments

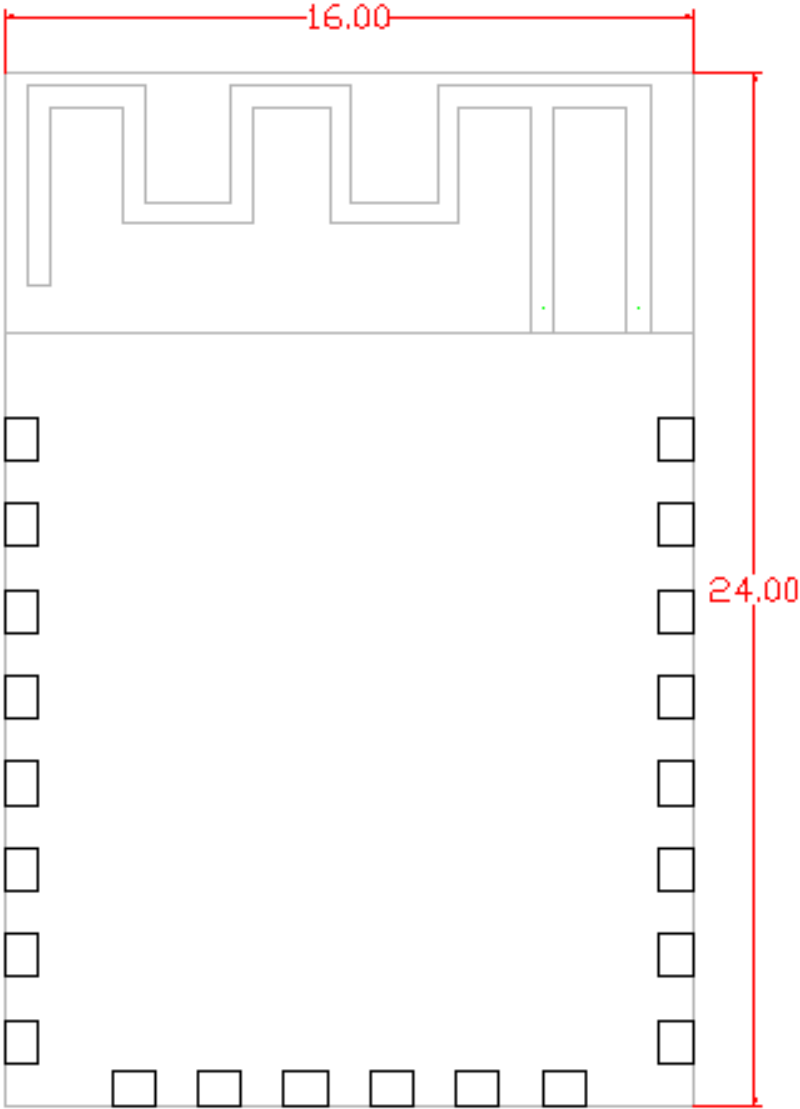
## 4.1 PCB Pin Outline

< TOP VIEW >

< SIDE VIEW >



< BOTTOM VIEW >



## 4.2 Pin Definition

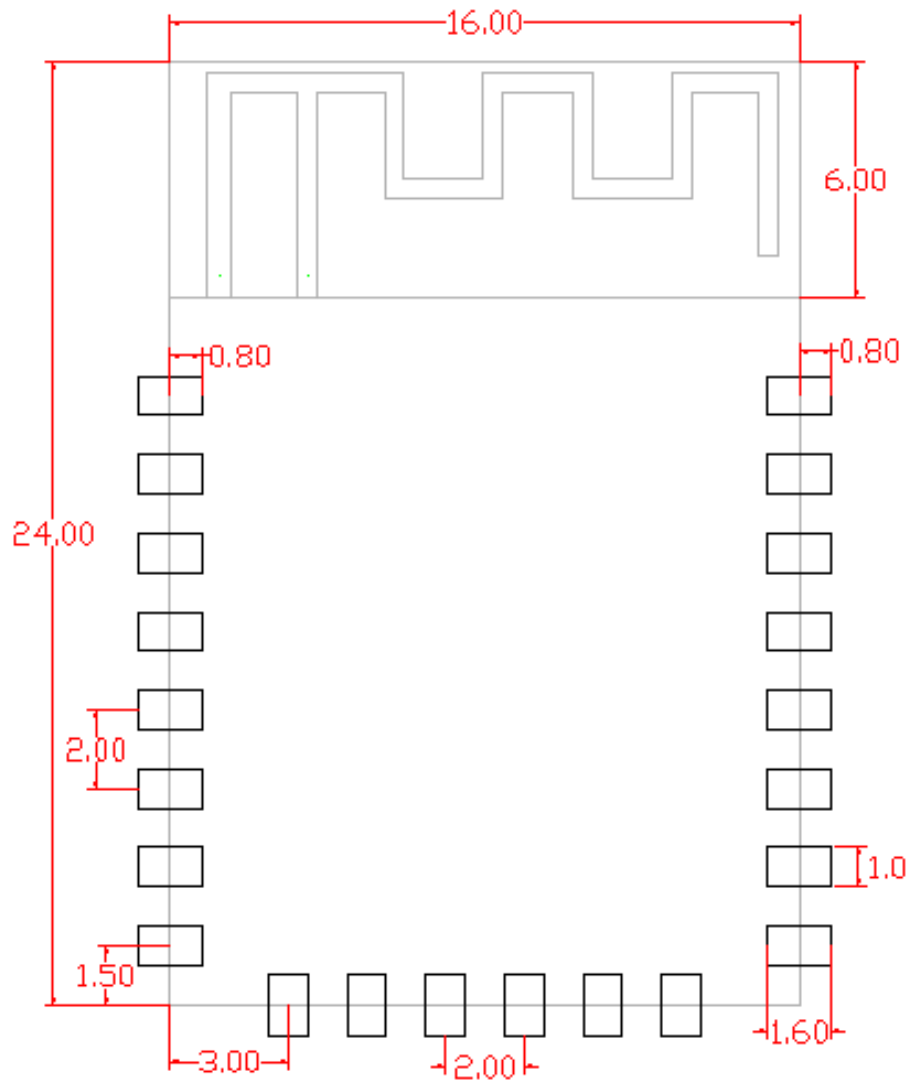
Pin	Pin-Define	Type	Description
1	GPIO14 /SD_CLK /SPI_SCK	I/O	GPIO14 / SDIO clock / SPI clock
2	GPIO28 /ADC4	I/O	GPIO28 / ADC CH4
3	CEN	I	Chip Enable
4	GPIO16 /SD_CMD /SPI_MOSI	I/O	GPIO16 / SDIO CMD / SPI MOSI
5	GPIO15 /SPI_CSN	I/O	GPIO15 / SPI CSN
6	GPIO17 /SD_D0 /SPI_MISO	I/O	GPIO17 / SDIO Data0 / SPI MOSI
7	GPIO26 /ADC1 /IRDA / PWM5	I/O	GPIO17 / ADC CH1 / IrDA / PWM CH5
8	VBAT	P	Main Power Supply Input
9	GPIO24 /ADC2 /LPO_CLK /PWM4	I/O	GPIO24 / ADC CH2 / LPO_CLK / PWM CH4
10	GPIO23 /ADC3 /TDO /F_SO	I/O	GPIO23 / ADC CH3 / JTAG TDO / F_SO for SPI flash download
11	GPIO22 /ADC5 /TDI /CLKO_26M /F_SI	I/O	GPIO22 / ADC CH5 / JTAG TDI / CLKO_26M / F_SI for SPI flash download
12	GPIO21 /ADC6 /I2C1_SDA /TMS /F_SCN	I/O	GPIO21 / ADC CH6 / I2C1_SDA / JTAG TMS / F_SCN for SPI flash download
13	GPIO20 /I2C1_SCL /TCK /F_SCK	I/O	GPIO20 / I2C1_SCL / JTAG TCK / F_SCK for SPI flash download
14	GPIO6 /PWM0 /CLKO_13M	I/O	GPIO6 / PWM CH0 / CLKO_13M
15	GND	P	Ground
16	GPIO7 / PWM1	I/O	GPIO7 / PWM CH1
17	GPIO11 /UART1_TX	I/O	GPIO11 / UART1_TXD
18	GPIO10 /UART1_RX	I/O	GPIO10 / UART1_RXD
19	GPIO8 /PWM2	I/O	GPIO8 / PWM CH2
20	GPIO9 /PWM3	I/O	GPIO9 / PWM CH3
21	GPIO1 /UART2_RX /I2C2_SDA	I/O	GPIO1 / UART2 RXD / I2C2 SDA
22	GPIO0 /UART2_TX /I2C2_SCL	I/O	GPIO0 / UART2 TXD / I2C2 SCL

## 5. Dimensions

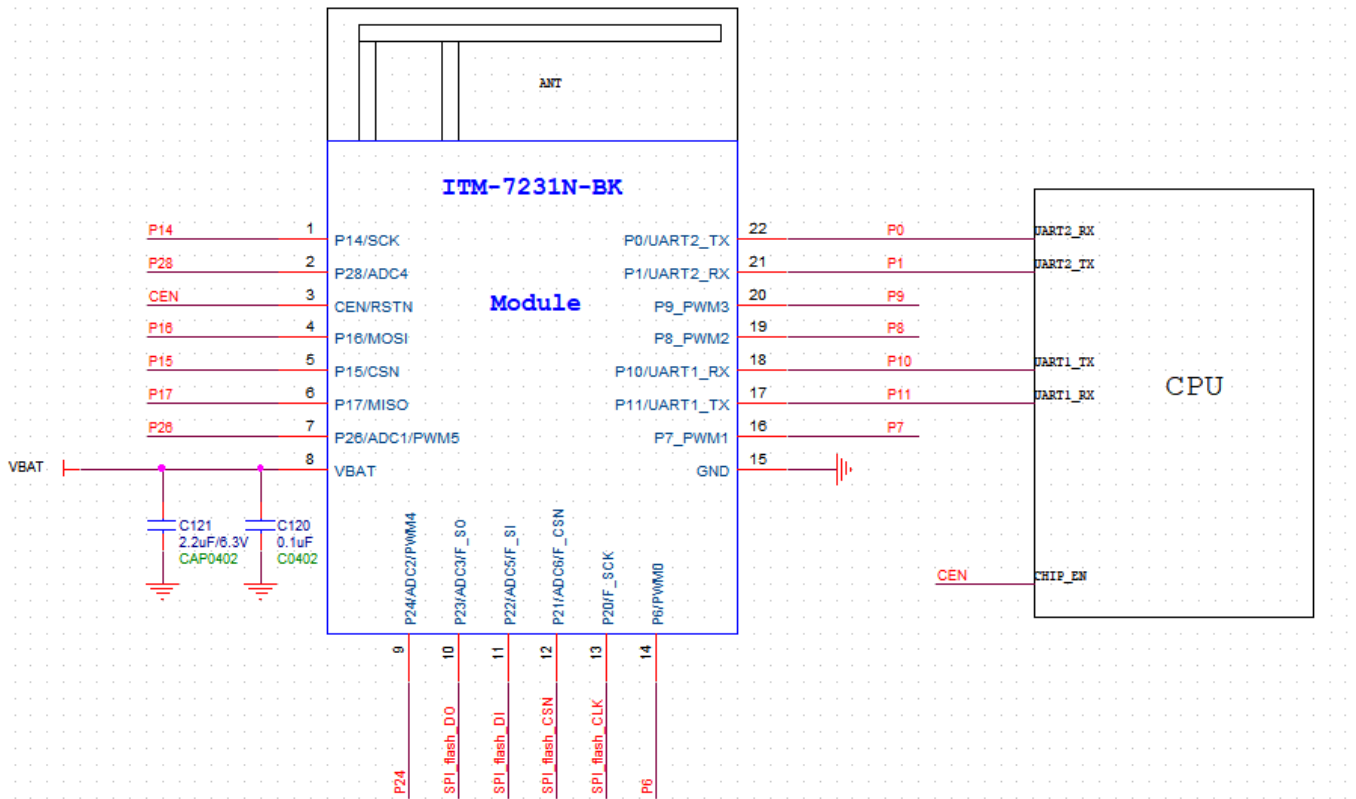
### 5.1 Layout Recommendation

(Unit: mm)

< TOP VIEW >



## 6. Reference Design



# 7. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <250°C

Number of Times : ≤2 times

