Product Specification

Bluetooth LE 5
Module Model Name:
AP-02FC

VERSION: 0.4

20F-B, No.98, Sec. 1, Xintai 5th Rd., Xizhi Dist, New Taipei City 22102, Taiwan
TEL: 886-2-28961888 FAX: 886-2-28961899

TABLE OF CONTENTS

1. INTRODUCTIONS AND SCOPE

AP-02FP is a Bluetooth low energy (BLE) module. It uses ON Semiconductor BLE controller RSL10, which is an ultra−low−power, highly flexible multi−protocol 2.4 GHz radio chipset. AP-02FP is designed for high−performance wearable, medical, and industrial applications. The module integrates PCB antenna, crystal, and controller relative circuit, customer can easily apply it in product.

2. FEATURES

Bluetooth 5 Certified with LE 2M PHY Support

Designed with PCB antenna

Build in 48MHz system clock crystal

Rx Sensitivity (Bluetooth Low Energy Mode, 1 Mbps): −94 dBm

Transmitting Power: −17 to +6 dBm

Build in Arm Cortex−M3 Processor

Build in LPDSP32 for Audio Codec

Support lower voltage to 1.1V

Support Audio Streaming at 7 kHz BW

384 kB of Flash Memory

Supports FOTA

Operating Frequency: 2402 MHz ~ 2480 MHz

Channel Spacing: 2 MHz

Channel number: 40

Data Rate: 1Mbps, 2Mbps

Operation Voltage: 3.3 Vdc

Modulation: GFSK

Maximum Output Power: 0.96 mW (-0.19 dBm)

3. MECHANICAL CHARACTERISTICS

3.1 Weight and Dimension

Weight: 0.8g (L x W x H, without metal cover)
1.0g (L x W x H, with metal cover)

Dimension: 20mm x 14mm x 2mm (L x W x H, without metal cover)
20mm x 14mm x 2.7mm (L x W x H, with metal cover)

3.2 Module Picture

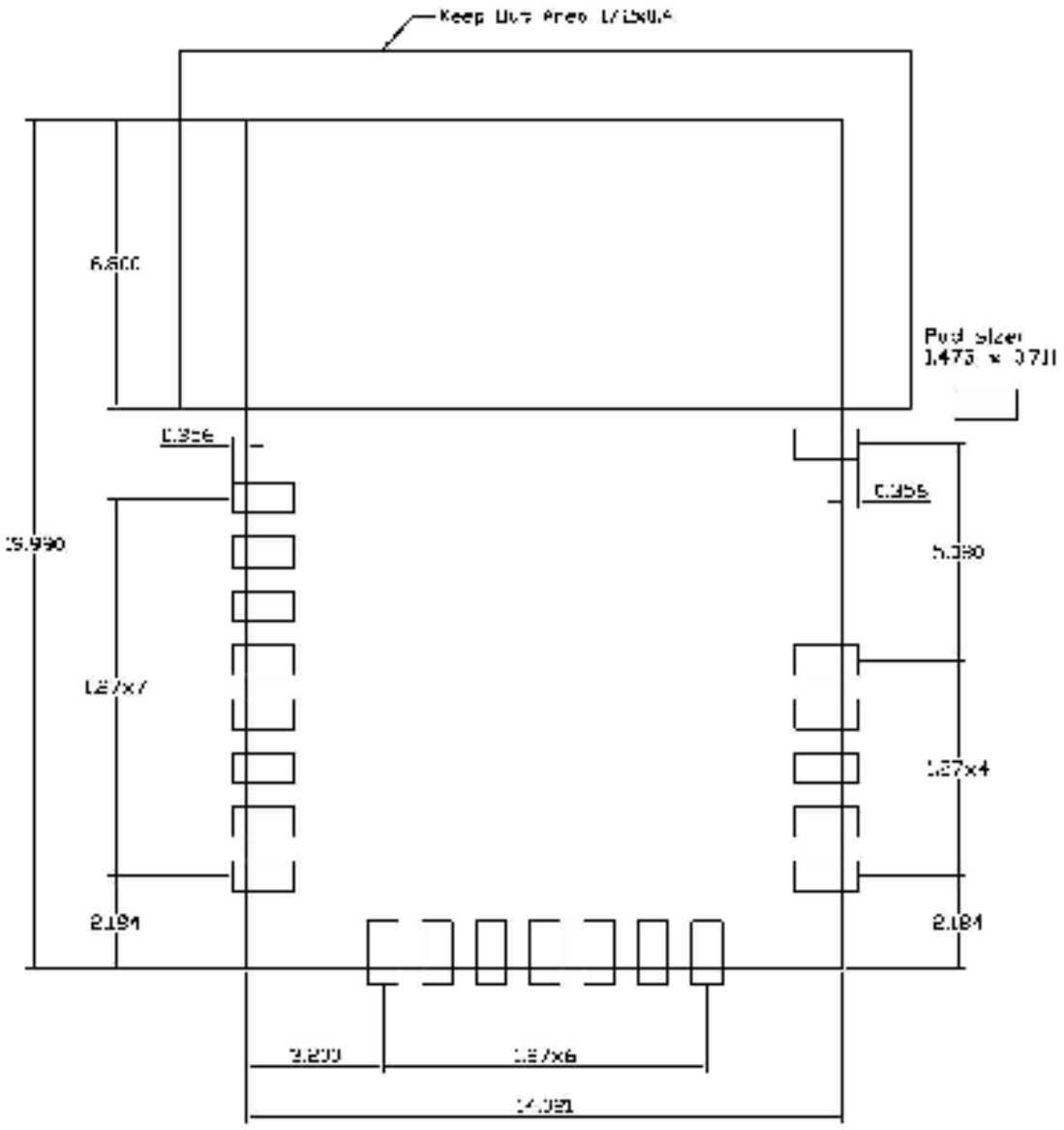
Top Side

Bottom Side

Top Side with Cover

4. EXTERNAL DIMENSION

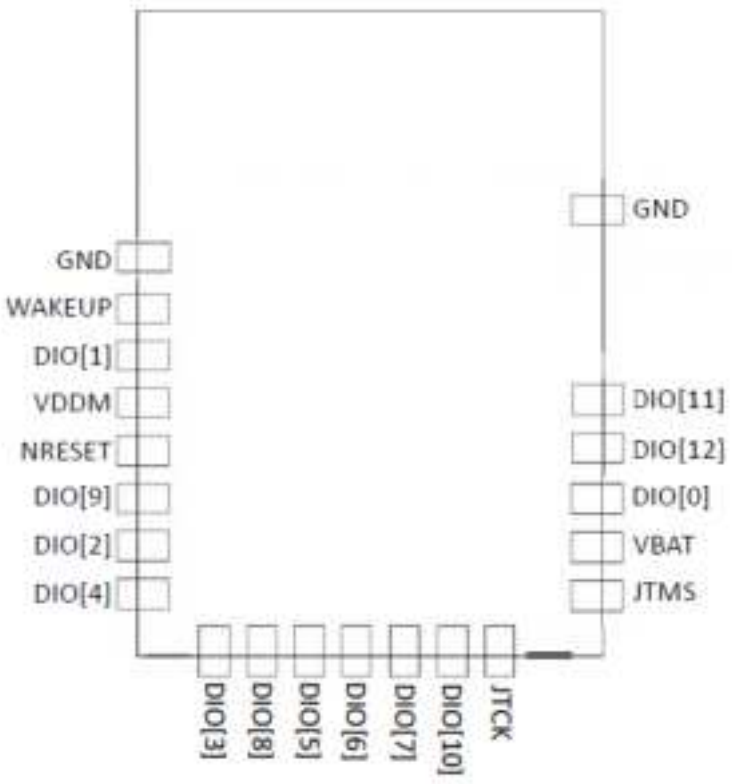
4.1 Outline Dimension of PCBA (Unit: mm)



5. PIN ASSIGNMENT AND DESCRIPTION

5.1 Pin Assignment

Top Side View



5.2 Pin Descriptions

Pin	Symbol	I/O	A/D	Pull	Description
1	GND		P		Ground
2	WAKEUP	I	A		Wake−up pin for power modes
3	DIO[1]	I/O	A/D	U/D	Digital input output / ADC 1
4	VDDM	I/O	P		LDO output for memories voltage supply
5	NREST	I	D	U1	Reset pin
6	DIO[9]	I/O	A/D	U/D	Digital input output
7	DIO[2]	I/O	A/D	U/D	Digital input output / ADC 2
8	DIO[4]	I/O	D	U/D	Digital input output 4
9	DIO[3]	I/O	A/D	U/D	Digital input output / ADC 3
10	DIO[8]	I/O	D	U/D	Digital input output 8
11	DIO[5]	I/O	D	U/D	Digital input output 5
12	DIO[6]	I/O	D	U/D	Digital input output 6
13	DIO[7]	I/O	D	U/D	Digital input output 7
14	DIO[10]	I/O	D	U/D	Digital input output 10
15	JTCK	I/O	D	U	CM3−JTAG Test Clock
16	JTMS	I/O	D	U	CM3−JTAG Test Mode State
17	VBAT	I	P		Battery input voltage
18	DIO[0]	I/O	A/D	U/D	Digital input output / ADC 0
19	DIO[12]	I/O	D	U/D	Digital input output 12
20	DIO[11]	I/O	D	U/D	Digital input output 11

21	GND		P		Ground

Legend:
Type: A = analog; D = digital; I = input; O = output; P = power
Pull: U = pull up; D = pull down
Pull up: selectable between 10 k_ and 250 k_. U1 = pull up, 200 k_.
Pull down: 250 k_
All digital pads have a Schmitt trigger input.
All DIO pads have a programmable I2C low pass filter. All DIOs can be configured to no pull.

6. ELECTRICAL CHARACTERISTICS

6.1 Absolute Maximum Ratings

Symbol	Par	Min	Max	Unit
V_{BAT}	Power supply voltage		3.63	V
V_{DDO}	I/O supply voltage		3.63	V
T functional	Functional temperature range	−40	85	°C
T storage	Storage temperature range	−40	85	°C

6.2 Recommended Operating Conditions

Description	Symbol	Condition	Min	Typ	Max	Units
Supply voltage operating range	V_{BAT}	Input supply voltage on V_{BAT} pin (Note 1)	1.25	1.25	3.3	V

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

6.3 Electrical Performance Specification

Unless otherwise noted, the specifications mentioned in the table below are valid at 25°C at VBAT = VDDO = 1.25 V.

Description	Symbol	Conditions	Min	Typ	Max	Units
OVERALL						
Current consumption RX, V_{BAT} = 1.25 V, low latency	I_{VBAT}	RX Mode, ON Semiconductor propri- etary audio streaming protocol at 7 kHz audio BW, 5.5 ms delay.	−	1.8	−	mA
Current consumption TX, V_{BAT} = 1.25 V, low latency	I_{VBAT}	TX Mode, ON Semiconductor propri- etary audio streaming protocol at 7 kHz audio BW, 5.5 ms delay. Transmit pow- er: 0 dBm	−	1.8	−	mA
Current consumption RX, V_{BAT} = 1.25 V	I_{VBAT}	RX Mode, ON Semiconductor propri- etary audio streaming protocol at 7 kHz audio BW, 37 ms delay.	−	1.15	−	mA
Deep sleep current, example 1, V_{BAT} = 1.25 V	I_{ds1}	Wake up from wake up pin.	−	50	−	nA
Deep sleep current, example 2, V_{BAT} = 1.25 V	I_{ds2}	Embedded 32 kHz oscillator running with interrupts from timer or external pin.	−	90	−	nA

Deep sleep current, example 3, V_{BAT} = 1.25 V	I_{ds3}	As Ids2 but with 8 kB RAM data reten- tion.	–	300	–	nA
Standby Mode current, V_{BAT} = 1.25 V	I_{stb}	Digital blocks and memories are not clocked and are powered at a reduced voltage.	–	30	–	µA
Current consumption RX, V_{BAT} = 3 V	I_{VBAT}	RX Mode, ON Semiconductor propri- etary audio streaming protocol at 7 kHz audio BW, 5.5 ms delay.	–	0.9	–	mA
Current consumption TX, V_{BAT} = 3 V	I_{VBAT}	TX Mode, ON Semiconductor propri- etary audio streaming protocol at 7 kHz audio BW, 5.5 ms delay. Transmit pow- er: 0 dBm	–	0.9	–	mA
Deep sleep current, example 1, V_{BAT} = 3 V	I_{ds1}	Wake up form wake up pin.	–	25	–	nA
Deep sleep current, example 2, V_{BAT} = 3 V	I_{ds2}	Embedded 32 kHz oscillator running with interrupts from timer or external pin.	–	40	–	nA
Deep sleep current, example 3, V_{BAT} = 3 V	I_{ds3}	As Ids2 but with 8 kB RAM data reten- tion.	–	100	–	nA
Standby Mode current, V_{BAT} = 3 V	I_{stb}	Digital blocks and memories are not clocked and are powered at a reduced voltage.	–	17	–	µA

RADIO FRONT−END: General Specifications

Frequency range	F_{RF}	Supported carrier frequencies	2360	−	2500	MHz
Current consumption at 1 Mbps, V_{BAT} = 1.25 V	$IBAT_{RFRX}$	VDDRF = 1.1 V, 100% duty cycle	−	5.6	−	mA
Current consumption at 2 Mbps, V_{BAT} = 1.25 V	$IBAT_{RFRX}$	VDDRF = 1.1 V, 100% duty cycle	−	6.2	−	mA
Current consumption at 1 Mbps, V_{BAT} = 3 V, DC−DC	$IBAT_{RFRX}$	VDDRF = 1.1 V, 100% duty cycle	−	3.0	−	mA
Current consumption at 2 Mbps, V_{BAT} = 3 V, DC−DC	$IBAT_{RFRX}$	VDDRF = 1.1 V, 100% duty cycle	−	3.4	−	mA
RX Sensitivity, 0.25 Mbps		0.1% BER (Notes 7, 8)	−	−97	−	dBm
RX Sensitivity, 0.5 Mbps		0.1% BER (Notes 7, 8)	−	−96	−	dBm
RX Sensitivity, 1 Mbps, BLE		0.1% BER (Notes 7, 8) Single−ended on chip antenna match to 50 Ω	−	−94	−	dBm
RX Sensitivity, 2 Mbps, BLE		0.1% BER (Notes 7, 8)	−	−92	−	dBm

7. RF Warnings

FCC Statement:
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.
NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.
This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.
If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/TV technician for help.
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and a human body.

If theidentification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module, Contains FCC ID: XXXXXXXX, (XXXX should be corrected in accordance with current module ID).
Co-location of this module with other transmitters that operate simultaneously are required to be evaluated using the multi-transmitter procedures.
The host integrator must follow the integration instructions provided in this document and ensure that the composite-system end product complies with the requirements by a technical assessment or evaluation to the rules and to KDB Publication 996369.
The host integrator installing this module into their product must ensure that the final composite product complies with the requirements by a technical assessment or evaluation to the rules, including the transmitter operation and should refer to guidance in KDB 996369.

NCC statement:
取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。
低功率射頻器材之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。
前述合法通信，指依電信管理法規定作業之無線電通信。
低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

此模組於取得認證後將依規定於模組本體標示審驗合格標籤，並要求平台廠商於平台上標示本產品內含發射器模組 CCXXxxLPyyyZzW