VU-BLE-PBE020-V3.3 specification

Name: Bluetooth module Type: VU-BLE-PBE020-V3.3

Date	Content	Version
2025-05	Release	V3.3

XIAMEN WEIYOU INTELLIGENT TECHNOLOGY CO.,LTD.

ADD: Unit 3 No.6 Xianghong Road,Torch Hi-Tech Zone Industrial Park,
Xiang'an District,Xiamen P.R.China

TEL:(86)-592-6252495 FAX:(86)-592-6252548
WEB:www.vuchina.cn www.vudvt.com www.weiuit.com
MAI:sales@weiuit.com

A.Summary

The VU-BLE-PBE020-V3.3 Bluetooth module integrated circuit has a fully integrated radio transceiver and baseband processor for Bluetooth Low Energy. It can be used as an application processor as well as a data pump in fully hosted systems.

The MCU part of this module is the 32-bit microcontroller. It supports a wide range of applications from low-end, price sensitive designs to computing-intensive ones and provides advanced high-end features in economical products.

B.Electrical Specifications

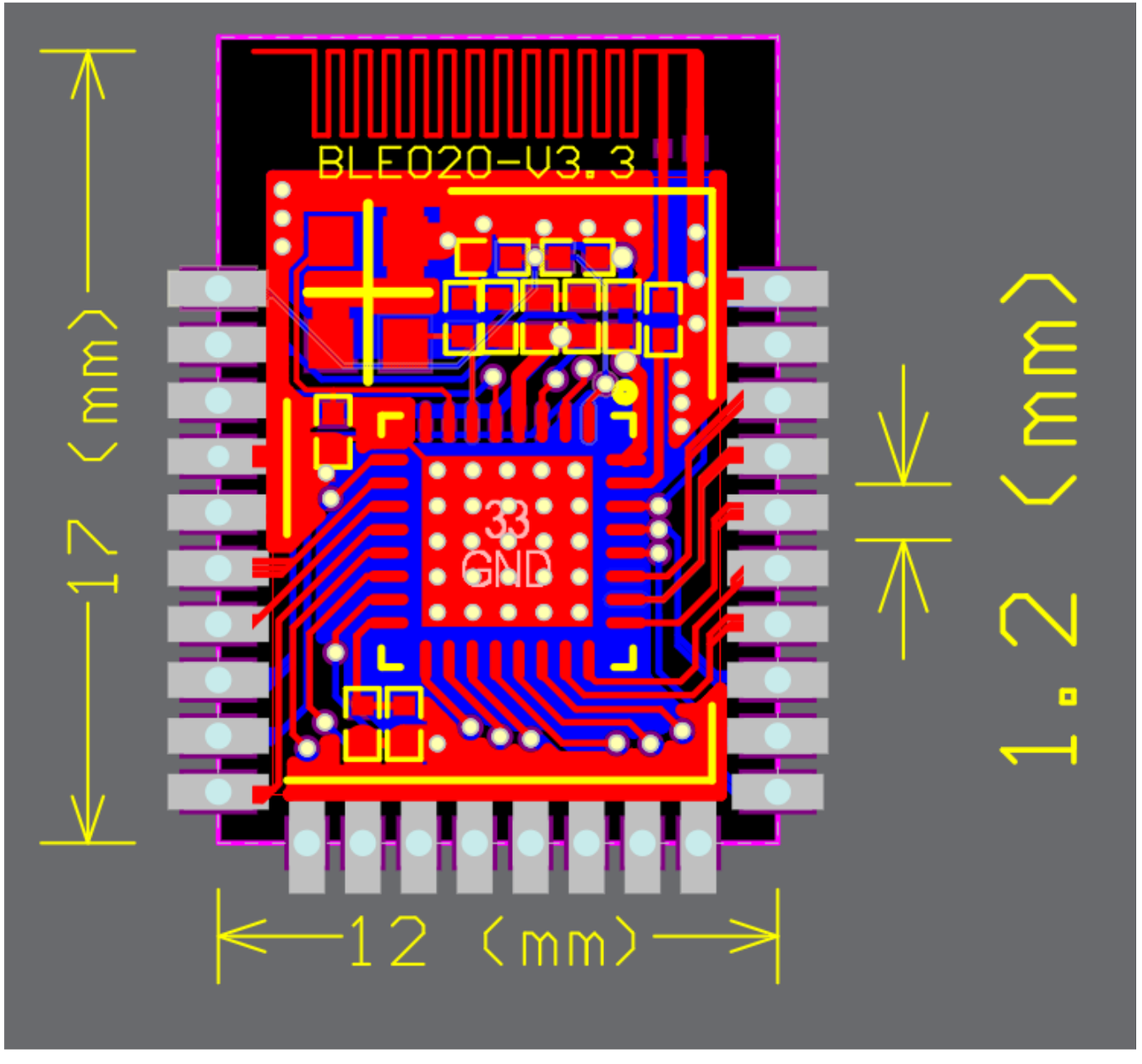
The VU-BLE-PBE020-V3.3 Bluetooth module has many high-performance peripheral functions, such as general purpose I/O port(25 GPIOs), three 32-bit timers, two UARTs, two group SPI interfaces, two I2C interfaces, one 16-bit PWM generators providing eight channels, an 8-channel 12-bit ADC, Watchdog Timer, Window Watch-dog Timer, and a Brown-out Detector. All these peripherals have been incorporated into the module to reduce component count, board space and system cost.

Additionally, the module is equipped with ISP (In-System Programming) and ICP

(In-Circuit Programming) functions, which allow the user to update the program memory without removing the module from the actual end product. It also supports In-Application-Programming (IAP) function, user switches the code executing without the chip reset after the embedded flash updated.

It can run up to 52 MHz and operate at a wide voltage range of 2.2V ~ 3.6V and temperature range of -40℃ ~ +125℃. For this module, the embedded FLASH size up to 256 Kbytes and SRAM up to 16 Kbytes. It also offers size configurable Data Flash (shared with program flash), and configurable flash size for the ISP.

C.PCB Layout Dimensions and Pin Functions



Pin functions

Pin	Pin Name	Pin Function
1	RST	Reset pin
2	P46	Digital IO /UART1 RX/I2C0 CLK/SPI1 CLK/SPI2 CLK/ICE clk input pin
3	P47	Digital IO /UART1 TX/I2C0 data/SPI1 SS/SPI2 SS/Debug and program data pin
4	GND	Ground pin
5	VDD	Power supply
6	P12	Digital IO /UART1 CTS/ UART0 RX /ADC channel2/PWM0 channel0
7	P13	Digital IO /UART1 RTS/ UART0 TX /ADC channel3/PWM0 channel1
8	P52	Digital IO /External interrupt pin/ External wake-up pin
9	P10	Digital IO /SPI1 MOSI/ SPI2 MOSI /ADC channel1/PWM0 channel3
10	P14	Digital IO /UART0 CTS/ UART1 RX /ADC channel4/PWM0 channel4
11	P15	Digital IO /UART0 RTS/ UART1 TX /ADC channel5/PWM0 channel6
12	P30	Digital IO /UART0 CTS/ UART1 RX /ADC channel6/PWM0 channel7
13	P31	Digital IO /UART0 RTS/ UART1 TX /ADC channel7/PWM0 channel5

14	P36	Digital IO /SPI1 SS/ SPI3 SS /Timer external input
15	P04	Digital IO /SPI0 SS/ SPI2 SS /PWM0 channel5
16	P57	Digital IO /SPI1 MISO/ SPI3 MISO /PWM0 channel7/I2C0 data
17	P22	Digital IO /SPI1 CLK/ SPI3 CLK /PWM0 channel0/I2C1 CLK
18	P23	Digital IO /SPI1 SS/ SPI3 SS /PWM0 channel1/I2C1 data
19	P24	Digital IO /UART1 RX/ UART0 CTS /PWM0 channel2
20	P20	Digital IO /SPI1 SS/ SPI3 SS /I2C1 data
21	P03	Digital IO
22	P25	Digital IO /UART1 TX/ UART0 RTS /PWM0 channel3
23	P26	Digital IO /SPI0 SS/ SPI2 SS /PWM0 channel4
24	P07	Digital IO /SPI0 CLK/ SPI2 CLK /PWM0 channel0/I2C1 CLK
25	P06	Digital IO /SPI0 MISO/ SPI2 MISO /PWM0 channel1/UART1 TX/UART0 RTS/32K Crystal pin2
26	P05	Digital IO /SPI0 MOSI/ SPI2 MOSI /PWM0 channel4/UART1 RX/UART0 CTS/32K Crystal pin1
27	P02	Digital IO
28	GND	Ground pin

D.Specifications

1. RF

- 2.4GHz RF transceiver(Compatible with BLE4.2)
- RX sensitivity: -90 dBm@1Mbps
- Maximum received signal: 0 dBm
- Programmable TX output power: 13 dBm(Maximum), 8 dBm(Typical)
- Single wire antenna: no RF matching or RX/TX switching required

2. Core

- MCU core running up to 52 MHz
- One 24-bit system timer
- Supports low power Idle mode
- A single-cycle 32-bit hardware multiplier
- Supports Serial Wire Debug (SWD) interface and two watchpoints/four breakpoints

3. Memory

- 256 KB Flash memory for program memory
- 16 KB SRAM

4. Peripheral

- Three channel 32-bit Timers (one 8-bit pre-scaler counter with 24-bit up-timer for each timer)
- DMA up to 3 channels (one per source and destination pair)
- Two UART devices with DMA
- Two Group SPI master and slave devices with DMA
- Two I2C master and slaver devices with DMA
- Up to 40 general-purpose I/O (GPIO) pins
- 12-Bit ADC with Eight Channels
- One built-in 16-bit PWM generators with eight channels
- One WDT with 18-bit up counter
- One WWDT with 6-bit down counter value (CNTDAT) and 6-bit compare value (CMP-DAT)

5. Specical features

- ISP (In-System Programming), ICP (In-Circuit Programming), and IAP (In Application Programming)
- BOD (Brown-out Detector) threshold levels: 2.87V/2.72V/2.34V/2.06V
- 96-bit unique ID
- LVR (Low Voltage Reset) threshold voltage level: 1.7±0.1V

6. DC/AC Charactaristics

- Operating Temperature: -40℃~125℃
- Operating voltage: 2.2~3.6V
- Reliability: ESD HBM pass ±2KV
- Built-in LDO for wide operating voltage: 2.2V to 3.6V

~2uA @ deep sleep mode, wake up by internal 32K oscillator

E.Application areas

1.Internet of Things(IoT)

- Smart home automation
- Sensor networks
- Building automation
- Industrial
-
- Retail

2.Personal area networks

- Health/fitness sensor and monitor devices
- Medical devices
-
- Key fobs and wrist watches

3.Interactive entertainment devices

- TV and STB remote control
- Wireless gamepads
-

4.Computer peripherals and I/O devices

- Wireless mouse and keyboard

F.Operating conditions

1.Absolute Maximun Ratings

Symbol	Description	Parameter			Unit
		Min	Typ	Max	
VDD	VDD1/VDD2	-0.3	-	3.6	V
VI	Input voltage	-0.3	-	VDD	V
VO	Output voltage	VSS	-	VDD	V
TOP	Operating Temperature	-40	-	125	℃
TSTG	Storage Temperature	-40	-	125	℃

2.DC Electrical Characteristics

Symbol	Description	Min	Typ	Max	Unit	Test Conditions
VDD1/VDD2	Power Supply	2.2	3	3.6	V	TA=25℃
VSS	Ground	-	0	-	V	-
IDP_SLP_PAD	Deep sleep current	1.5	2	2.5	uA	MCU power down, SRAM maintain, HCLK and

						32K RC off, wake up by GPIO or RE-SET
IDP_SLP_RC	Deep sleep current	2	3	5	uA	MCU power down, SRAM maintain, HCLK off, 32K RC on
ITX,0dBm	Operating Current of TX mode	-	17	-	mA	0dBm output power
ITX,8dBm	Operating Current of TX mode	-	31	-	mA	8dBm output power

2.DC Electrical Characteristics

Symbol	Description	Min	Typ	Max	Unit	Test Conditions
VDD1/VDD2	Power Supply	2.2	3	3.6	V	TA=25℃
VSS	Ground	-	0	-	V	-
IDP_SLP_PAD	Deep sleep current	1.5	2	2.5	uA	MCU power down, SRAM maintain, HCLK and 32K RC off, wake up by GPIO or RE-SET
IDP_SLP_RC	Deep sleep current	2	3	5	uA	MCU power down, SRAM maintain, HCLK off, 32K RC on
ITX,0dBm	Operating Current of TX mode	-	17	-	mA	0dBm output power
ITX,8dBm	Operating Current of TX mode	-	31	-	mA	8dBm output power
ITX,10dBm	Operating Current of TX mode	-	41	-	mA	10dBm output power
IRX	Operating Current of RX mode	-	16	-	mA	Maximum LNA Gain
VOH	Output high level voltage	VDD-0.3	-	VDD	V	-
VOL	Output low level voltage	VSS	-	VSS+0.3	V	-
VIH	Input high level voltage	2.0	3	3.6	V	-
VIL	Input low level voltage	VSS	-	VSS+0.3	V	-

G.Attentions in PCB Layout

Please pay attention to avoid the test pads area at the bottom of the Bluetooth module, if vias must be placed in the area, please cover oil screen. The antenna area of Bluetooth module should be as far away as possible from metal,and no traces in this area. Copper polygn, power supply traces should not go through the antenna area. Please place the antenna area at the edge of the PCB.

H. Storage Conditions

1) Products should be stored in sealed packages: when the temperature is less than 30 degrees and the humidity is less than 90%, it can last for 12 months.

2) After the package is opened, the components will be used in the reflow process or other high-temperature processes. The following conditions must be met:

a) Completed within 72 hours and the factory environment is less than 30℃≤ 60% RH.

b) Stored in 10% RH environment.

c) Exhaust at 125℃ for 24 hours to remove internal water vapor before used.

Caution:

- 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.

- The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

- The module in this product is labeled with its own FCC ID. The FCC ID is not visible when the module is installed inside another device. Therefore, the outside of the device into which the module is installed must also display a label referring to the module. The final end device must be labeled in a visible area with the following
  “Contains FCC ID: 2BOPZ-BLE020”

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.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.