WKV553-A

User Manual

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Document Revision History

Version	Revision Description	Revised By	Date
V1.0	Initial Release	luo	2023/10/18
V1.1	Optimized RF specifications and reference circuit	luo	2023/12/08

Table of Contents

1. Product Overview

WKV553-A module is a dual-mode Wi-Fi 6 + Bluetooth 5.2 (BLE) wireless module developed by Guangdong WEILA Intelligent Technology Co., Ltd.

The module is based on the GigaDevice GD32VW553 chipset, which integrates a low-power 32-bit RISC-V processor with a clock frequency of up to 160 MHz. It provides a rich set of peripherals, including ADC, SPI, QSPI, I²C, USART, UART, and more.

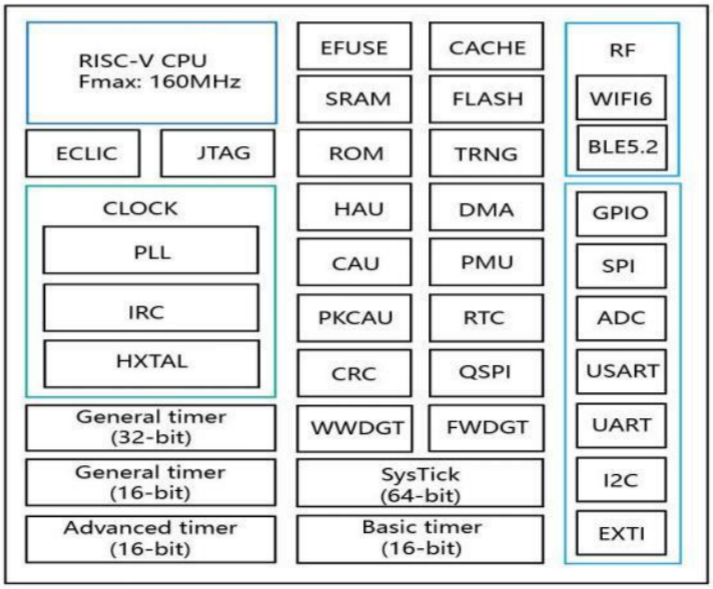
In addition to its powerful MCU capabilities, the GD32VW553 integrates 2.4 GHz Wi-Fi 6 and Bluetooth 5.2 Low Energy (LE) connectivity. Compared with traditional Wi-Fi 4, Wi-Fi 6 offers significant advantages such as higher bandwidth, greater network capacity, lower latency, and reduced power consumption, helping to optimize and enhance the performance of IoT devices.

Combined with BLE 5.2, the module can easily support Bluetooth provisioning (Bluetooth-assisted network configuration). Bluetooth can also operate independently for applications such as data transmission, device communication, and other wireless functions.

The WKV553-A module is suitable for a wide range of applications, particularly in:

- Smart Home Appliances
- Smart Home Systems
- Industrial IoT
- Consumer Electronics
- Portable and Handheld Devices
- Electric Bicycles (E-bikes)
- IoT Devices
- Communication Gateways
- Various Wireless Connectivity Applications

The block diagram of the chipset is shown below.



1.1 Features

- MCU
  - Low-power 32-bit RISC-V processor
  - Operating frequency up to 160 MHz
  - Up to 4096 KB on-chip Flash memory
  - Up to 320 KB SRAM memory

- WIFI
  - Support WIFI 2.4GHz IEEE802.11b/g/n/ax
  - Support 802.11e QoS Enhancement (WMM)
  - Support 802.11i (WPA, WPA2, WPA3). Open, shared key, and pair-wise key authentication services
  - Support WiFi WPS
  - Support WiFi Direct
  - Integrated TCP/IP protocol stack support
  - Support Target Wake up Time (TWT) operation
  - Support Multiple BSSID operation
  - Support OFDMA-based random access
  - Support Transmission and reception of aggregated MPDUs (A-MPDU) for high throughput
  - Support Support for immediate ACK and Block-ACK policies

- BLE
  - Support BLE 5.2
  - Support High speed 2M PHY
  - Support Long range coded PHY
  - Support Data rate: 250, 500, 1000 and 2000kbps

- On-Chip Resources
  - 1 × 12-bit ADC
  - 1 × SPI
  - 1 × QSPI
  - 2 × I²C
  - 1 × USART
  - 2 × UART
  - Wi-Fi / BLE wireless interface
  - 2 × General-purpose 32-bit timers
  - 2 × General-purpose 16-bit timers
  - 1 × Basic timer
  - 1 × Advanced PWM timer
  - Cryptographic Acceleration Unit (CAU)
  - Hash Acceleration Unit (HAU)
  - Public Key Cryptography Acceleration Unit (PKCAU)
  - True Random Number Generator (TRNG)

2. Electrical Characteristics

2.1 General Specifications

2.1.1 Absolute Maximum Ratings

Symbol	Parameter	Min.	Max.	Unit
V_{DD}	External voltage range	-0.3	3.6	V
V_{DDA}	External analog supply voltage	-0.3	3.6	V
AVDD33_ANA	RF Analog voltage	- 0.3	3.6	℃
AVDD33_PA	RF PA voltage	- 0.3	3.6	V
AVDD33_CLK	RF Clock voltage	- 0.3	3.6	V
V_{IN}	Input voltage on 5V tolerant pin	- 0.3	V_{DD}+3.6	V
	Input voltage on other I/O	- 0.3	3.6	V
$\lvert \Delta V_{DDx} \rvert$	Variations between different VDD power pins	—	50	mV
I_{IO}	Maximum current for GPIO pin	—	±25	mA
T_A	Operating temperature range	-40	+105	℃
T_{STG}	Storage temperature range	-65	+150	℃
T_J	Maximum junction temperature	—	125	℃

2.2 BLE RF Specifications

Symbol	Consumption			Unit
Frequency Range	2400~2483.5			MHz
TX power				
Rate mode	Min.	Typ	Max.	Unit
1M	-30	5	15	dBm
2M	-30	5	15	dBm
RX Sensitivity				
Rate mode	Min.	Typ	Max.	Unit
1M	—	-100.5	—	dBm
2M	—	-97.5	—	dBm

2.3 Wi-Fi RF Specifications

2.3.1 Supported Frequencies

Feature	Description
WLAN Standard	IEEE 802.11 b/g/n/ax WiFi compliant
Frequency Range	2.400 GHz~ 2.4835GHz (2.4 GHz ISM Band)
Number of Channels	2.4GHz :Ch1~Ch14

2.3.2 WiFi Power consumption characteristics

Power Mode	Description	Consumption	Unit
Active	Wi-Fi Tx 802.11n, HT 20M MCS0, Pout = +18dBm(1)	316	mA
	Wi-Fi Tx 802.11n, HT 20M MCS7, Pout = +14dBm(1)	275	mA
	Wi-Fi Tx 802.11ax, HE 20M MCS0, Pout = +18dBm(1)	316	mA
	Wi-Fi Tx 802.11ax, HE 20M MCS9, Pout = +12dBm(1)	265	mA
	Wi-Fi Rx 802.11b, CCK 1Mbps, -90dBm(2)	99	mA
	Wi-Fi Rx 802.11b, CCK 11Mbps, -80Bm(2)	100	mA
	Wi-Fi Rx 802. 11g, OFDM 6Mbps, -80dBm(2)	101	mA
	Wi-Fi Rx 802. 11g, OFDM 54Mbps, -70dBm(2)	102	mA
	Wi-Fi Rx 802.11n, HT 20M MCS0, -75dBm(2)	100	mA
	Wi-Fi Rx 802.11n, HT 20M MCS7, -65dBm(2)	103	mA
	Wi-Fi Rx 802.11ax, HE 20M MCS0, -75dBm(2)	101	mA
	Wi-Fi Rx 802.11ax, HE 20M MCS9, -60dBm(2)	107	mA
Wi-Fi Sleep	MCU in Run mode(3)	37.6	mA
Mild Sleep(4)	DTIM= 1	1.4	mA
	DTIM=3	0.55	mA
	DTIM= 10	0.31	mA
Hibernation	MCU in Standby mode(5)	—	μA
Shutdown	—	—	mA

(1)Continuous Tx, Duty cycle = 100%

(2)Rx Packet Length = 1024 Bytes.

(3)VDD = VDDA = 3.3 V, HXTAL = 40 MHz, System clock = 160 MHz, all peripherals enabled, except Wi-Fi.

(4)The DTIM power consumption is equal to the average power consumption of multiple beacon intervals.

(5)VDD = VDDA = 3.3 V, LXTAL off, IRC32K on, RTC on

2.3.3 WiFi RF Performance

Transmitter Characteristics

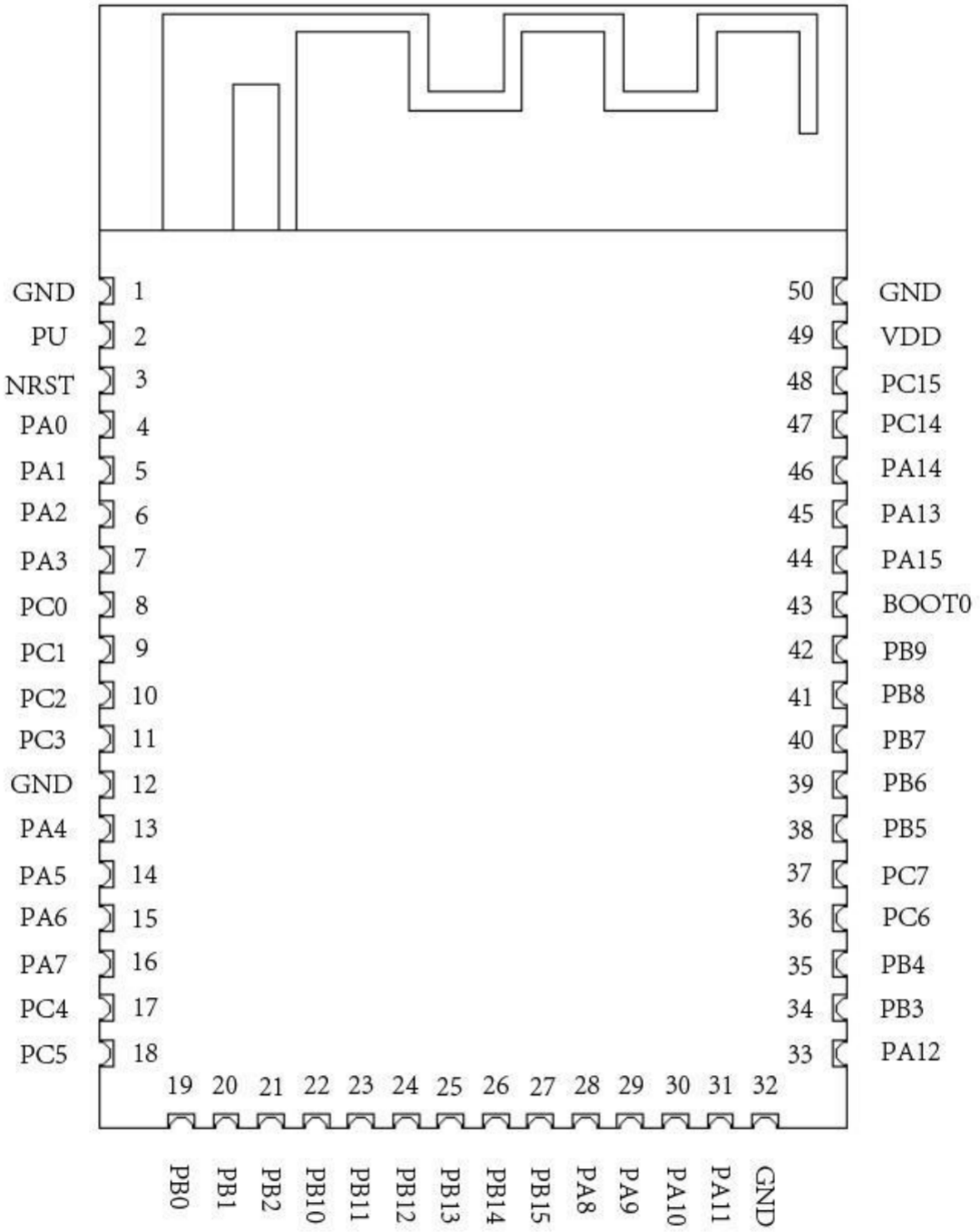
Output Power		
Rate	Typical Value(dBm)	EVM(dB)
802.11b/11M	17	≤-23
802.11g/54M	15	≤-33
802.11n/MCS7	14	≤-34.7
802.11ax/MCS9	12	≤-37.2

Receiver Characteristics

reception sensitivity		
Rate	Channel	Sensitivity(dBm)
802.11b/1M	1	-100.5
	7	-100.5
	13	-100.5
802.11b/11M	1	-91.5
	7	-91.5
	13	-91.5
802.11g/6M	1	-95.5
	7	-95
	13	-95
802.11g/54M	1	-79
	7	-79
	13	-78.5
802.11n/MCS0	1	-95
	7	-95
	13	-94.5
802.11n/MCS7	1	-76.5
	7	-76.5
	13	-76.5
802.11ax/MCS0	1	-95
	7	-94.5
	13	-94.5
802.11ax/MCS9	1	-69
	7	-69
	13	-67.5

3. WKV553 Module

3.1 Pin Description



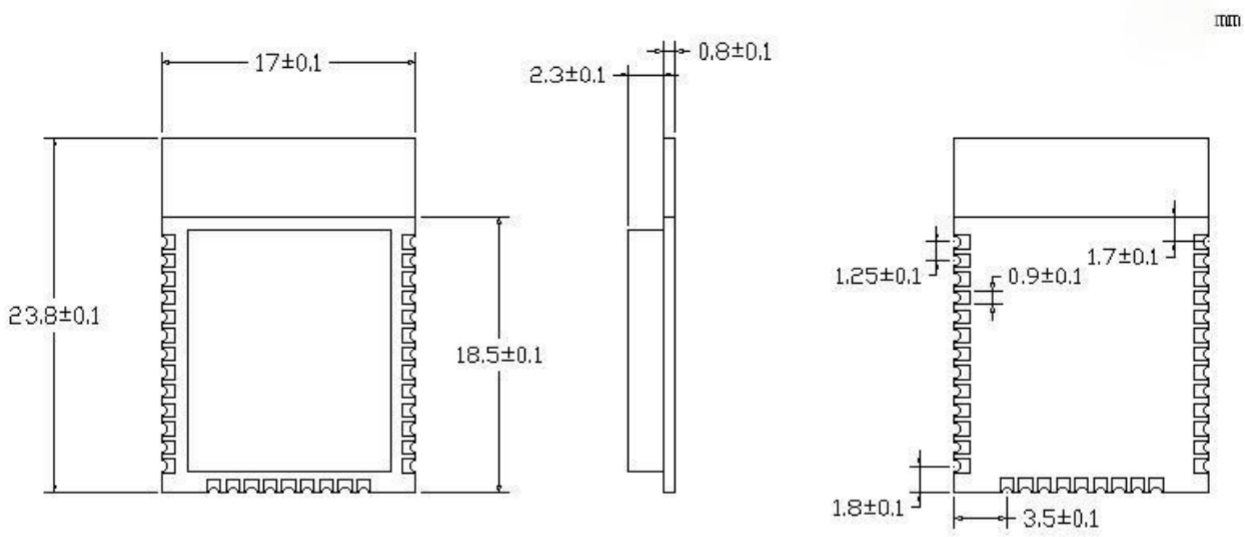
No.	Pin Name	Pin Type	Description
1	GND	POWER	Default: GND Ground connections
2	PA0	I/O	Default: PA0 Alternate: USART0_TX, TSI_G0_IO0, USART1_CTS, EVENTOUT, TIMER1_CH0, TIMER1_ETI, TIMER4_CH0 Additional: ADC_IN0
3	PA1	I/O	Default: PA1 Alternate: USART0_RX, TSI_G0_IO1, USART1_RTS, EVENTOUT, TIMER1_CH1, TIMER4_CH1 Additional: ADC_IN1
4	PA6	I/O	Default: PA6 Alternate: I2S1_CKIN, SPI0_SCK, QSPI_IO0, TIMER2_CH0, DCI_PIXCLK, USART2_TX, TIMER0_CH1, TIMER1_CH1, EVENTOUT, SPI0_MISO, I2S1_MCK, SDIO_CMD, HPDF_A UDIO
5	PA7	I/O	Default: PA7 Alternate: SPI1_NSS, I2S1_WS, SPI0_NSS, QSPI_IO1, TIMER2_CH1, DCI_D7, USART2_RX, TIMER0_CH1_ON, TIMER1_CH2, EVENTOUT, TIMER0_CH0_ON, SPI0_MOSI
6	PA2	I/O	Default: PA2 Alternate: USART0_CK, TSI_G0_IO2, TIMER0_CH0, EVENTOUT, TIMER1_CH2, TIMER4_CH2, I2S1_CKIN, USART1_TX, HPDF_AUDIO Additional: ADC_IN2, WKUP0, RTC_TAMP1
7	PA3	I/O	Default: PA3 Alternate: USART1_CK, TSI_G0_IO3, TIMER0_CH0_ON, HPDF_DATA IN1, EVENTOUT, TIMER1_CH3, TIMER4_CH3, I2S1_MCK, USART1_RX, RTC_OUT Additional: ADC_IN3
8	PA4	I/O	Default: PA4 Alternate: I2S1_ADD_SD, SPI1_MOSI, I2S1_SD, SPI0_MOSI, QSPI_SCK, TIMER4_CH2, DCI_HSYNC, USART1_TX, TIMER0_CH1, EVENTOUT, SPI0_NSS, USART1_CK Additional: ADC_IN8
9	PA5	I/O	Default: PA5

No.	Pin Name	Pin Type	Description
			Alternate: I2S1_MCK, SPI0_MISO, QSPI_CSN, TIMER4_CH3, DCI_VSYNC, USART1_RX, TIMER0_CH1_ON, EVENTOUT, SPI0_SCK
10	PB0	I/O	Default: PB0 Alternate: TSI_G1_IO0, TIMER3_CH0, TIMER2_CH1, DCI_D4, DCI_D6, EVENTOUT, TIMER0_CH1_ON,SDIO_D1
11	PB1	I/O	Default: PB1 Alternate: TSI_G1_IO1, TIMER3_CH1, TIMER2_CH2, DCI_D3, DCI_D5, EVENTOUT, TIMER0_CH2_ON, SDIO_D2
12	PB2	I/O	Default: PB2 Alternate: TSI_G1_IO2, TIMER3_CH2, TIMER2_CH3, DCI_D2, DCI_D4, EVENTOUT, TIMER1_CH3, SDIO_CK Additional: WKUP2
13	PB11	I/O	Default: PB11 Alternate: USBFS_ID, TSI_G2_IO0, TIMER0_CH1_ON, DCI_D0, DCI_D2, EVENTOUT, I2S1_CKIN, USART2_RX, SDIO_D6
14	GND	POWER	Default: GND Ground connections
15	PB12	I/O	Default: PB12 Alternate: I2S1_WS, USBFS_DP, TSI_G2_IO1, DCI_D1, TIMER0_CH3, EVENTOUT, TIMER0_BRKIN, SPI1_NSS, USART2_CK
16	PB13	I/O	Default: PB13 Alternate: USBFS_DM, TSI_G2_IO2, DCI_D0, EVENTOUT, TIMER15_CH0, TIMER0_CH0_ON, SPI1_SCK, I2S1_CK, USART2_CTS
17	PB15	I/O	Default: PB15 Alternate: I2S1_SD, USART1_TX, USART0_TX, I2C0_SCL, I2C1_SCL, IFRP_OUT, EVENTOUT, RTC_REFIN, TIMER0_CH2_ON, SPI1_MOSI
18	PA8	I/O	Default: PA8 Alternate: CK_OUT0, USART1_RX, USART0_RX, I2C0_SDA, I2C1_SDA, EVENTOUT, TIMER15_CH0, TIMER0_CH0, USART0_CK, USBFS_SOF, SDIO_D1, RTC_OUT
19	PA9	I/O	Default: PA9 Alternate: SPI0_MOSI, SDIO_CMD, SQPI_CLK,QSPI_SCK, EVENTOUT, TIMER15_CH0_ON, TIMER0_CH1, SPI1_SCK, I2S1_CK, USART0_TX, SDIO_D2, DCI_D0

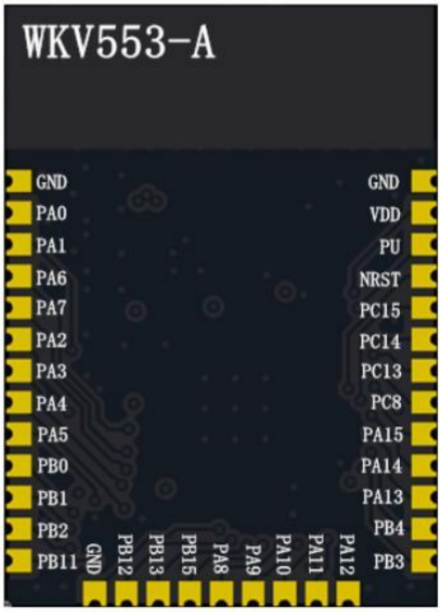
No.	Pin Name	Pin Type	Description
20	PA10	I/O	Default: PA10 Alternate: SPI0_MISO, SDIO_D0, SQPI_CSN, QSPI_CSN, EVENTOUT, TIMER16_CH0, TIMER0_CH2, DCI_D1
21	PA11	I/O	Default: PA11 Alternate: SPI0_SCK, SDIO_CK, SQPI_D0, QSPI_IO0, EVENTOUT, TIMER16_BRKIN, TIMER0_CH3, DCI_D2
22	PA12	I/O	Default: PA12 Alternate: SPI0_NSS, SDIO_D1, SQPI_D1, QSPI_IO1, EVENTOUT, TIMER16_CH0_ON, TIMER0_ETI, USART0_RTS, DCI_D3 Additional: WKUP3
23	PB3	I/O	Default: JTDO, TRACESWO, PB3 Alternate: USART2_CTS, SPI0_IO2, SDIO_D2, SQPI_D2, QSPI_IO2, EVENTOUT, TIMER15_BRKIN, TIMER1_CH1, SPI0_SCK, USART0_RX
24	PB4	I/O	Default: NJTRST, PB4 Alternate: USART2_RTS, SPI0_IO3, SDIO_D3, SQPI_D3, QSPI_IO3, TIMER1_CH0, TIMER1_ETI, EVENTOUT, SPI0_MISO
25	PA13	I/O	Default: JTMS, SWDIO, PA13 Alternate: USART0_CTS, USART1_CTS, I2C0_SMBA, EVENTOUT, TSITG
26	PA14	I/O	Default: JTCK, SWCLK, PA14 Alternate: USART0_RTS, USART1_RTS, I2C1_SMBA, EVENTOUT Additional: BOOT1
27	PA15	I/O	Default: JTDI, PA15 Alternate: I2C0_SCL, USART0_RX, I2C1_SCL, EVENTOUT, SPI0_NSS Additional: WKUP1
28	PC8	I/O	Default: PC8 Alternate: I2C0_SDA, USART0_TX, I2C1_SDA, EVENTOUT, TIMER2_CH2, SDIO_D0, DCI_D2 Additional: BOOT0
29	PC13	I/O	Default: PC13 Alternate: USART0_CK, EVENTOUT Additional: RTC_TAMP_0, RTC_OUT, RTC_TS
30	PC14	I/O	Default: PC14 Alternate: USART0_CK, USART1_CK, EVENTOUT Additional: OSC32IN

No.	Pin Name	Pin Type	Description
31	PC15	I/O	Default: PC15 Alternate: IFRP_OUT, EVENTOUT Additional: RTC_TAMP0, RTC_OUT, RTC_TS, OSC32OUT
32	NRST	I/O	Default: NRST
33	PU	I	Default: PU
34	VDD	POWER	Default: VDD
35	GND	POWER	Default: GND Ground connections

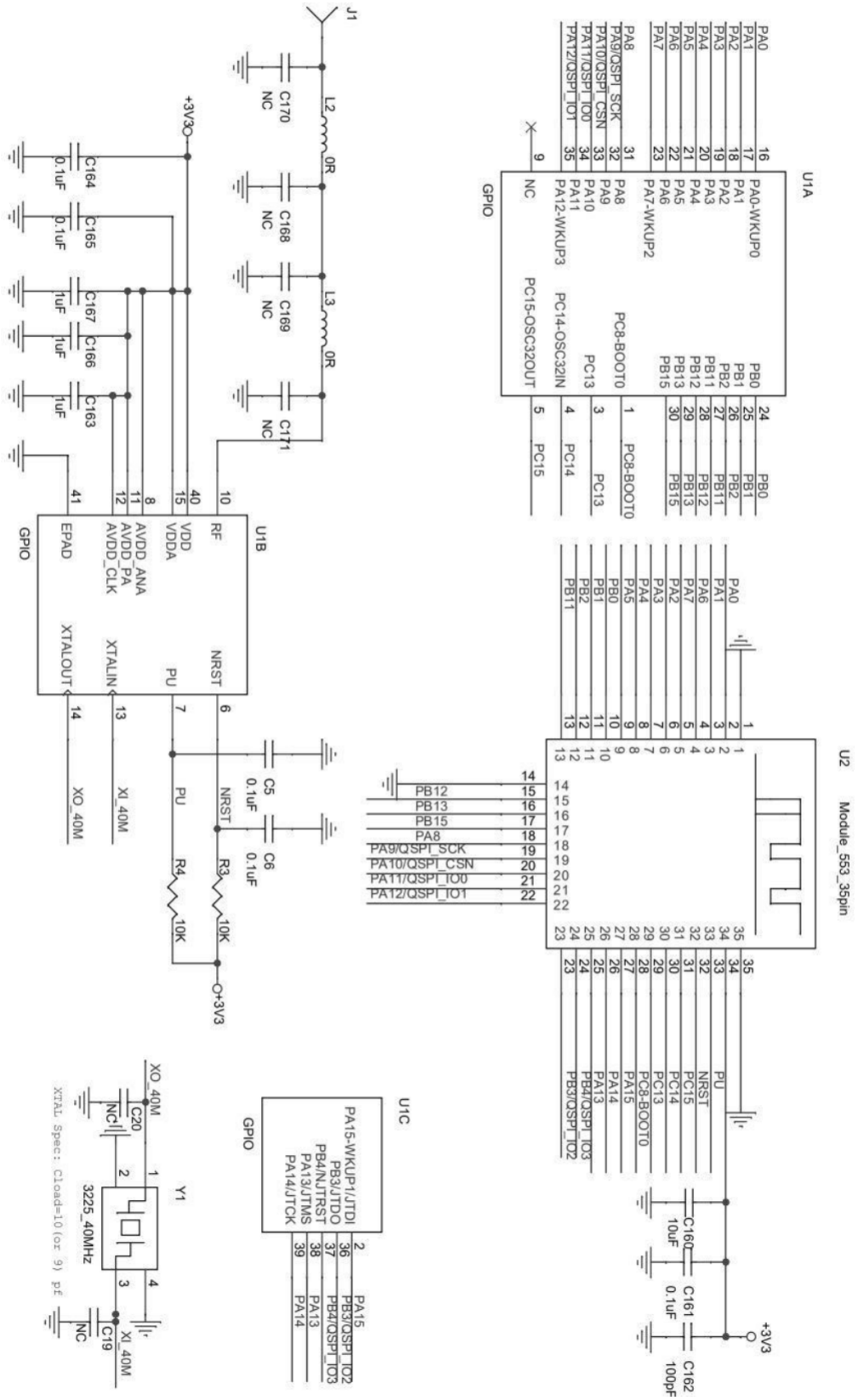
3.2 Mechanical Dimensions



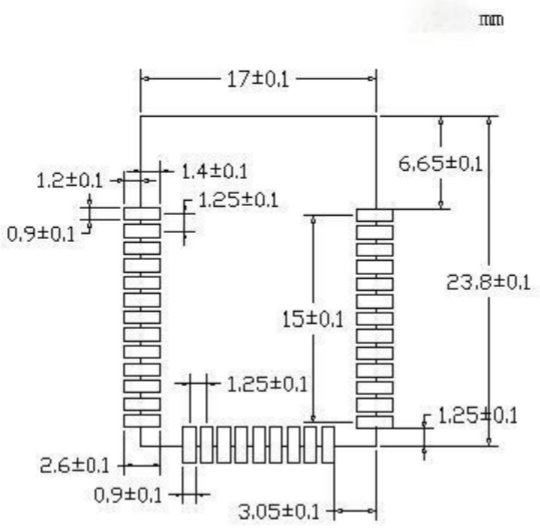
Top View　　Side View　　Bottom View



3.3 Reference Schematic

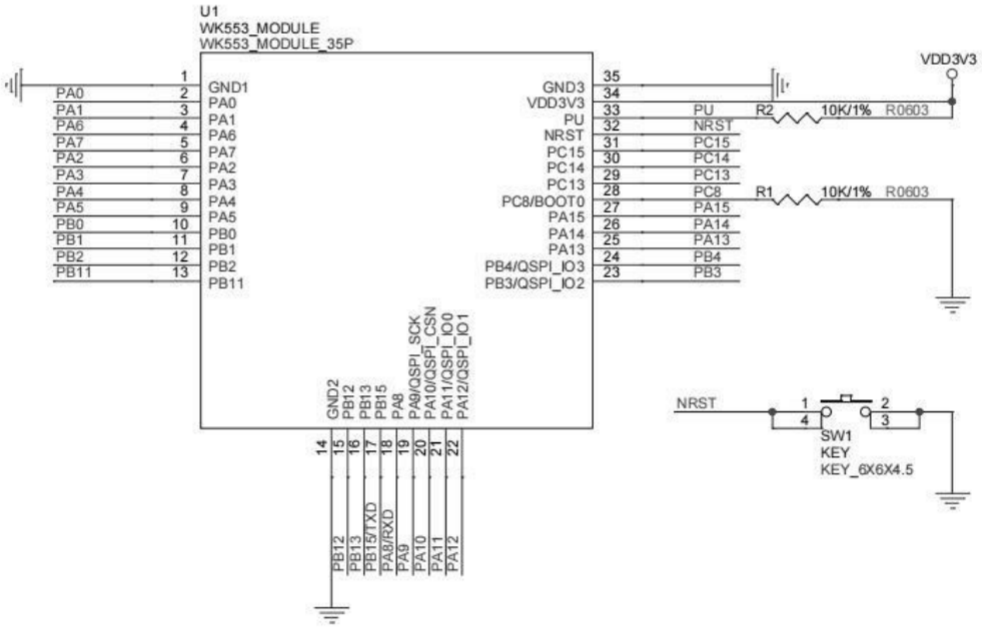


3.4 PCB Footprint



3.5 Design Guidelines

3.5.1 Reference Application Circuit



Note:

Pin 28 (PC8/BOOT0) of the module is the BOOT control pin. When the pin is held at low level, the module operates normally. When the pin is driven to high level, the module enters firmware download mode via UART.

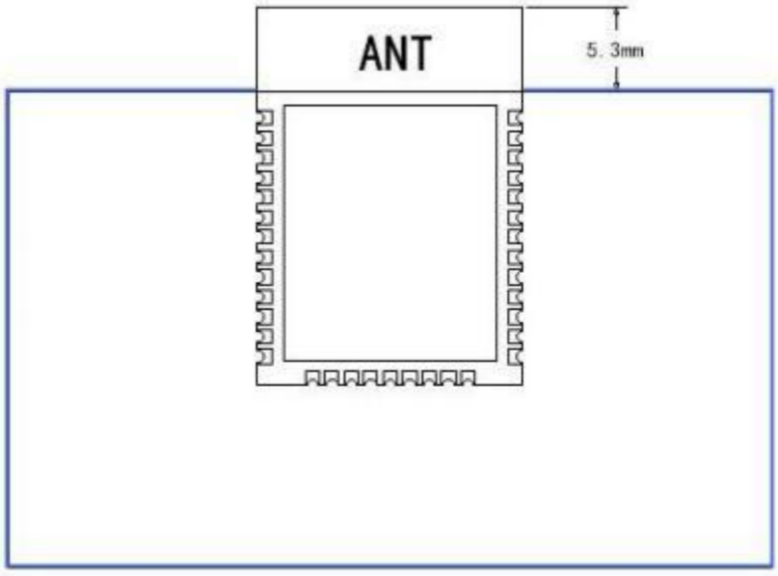
To ensure proper operation of the module, it is recommended to connect a pull-down resistor between the BOOT0 pin and GND.

3.5.2 Onboard Antenna Placement Guidelines

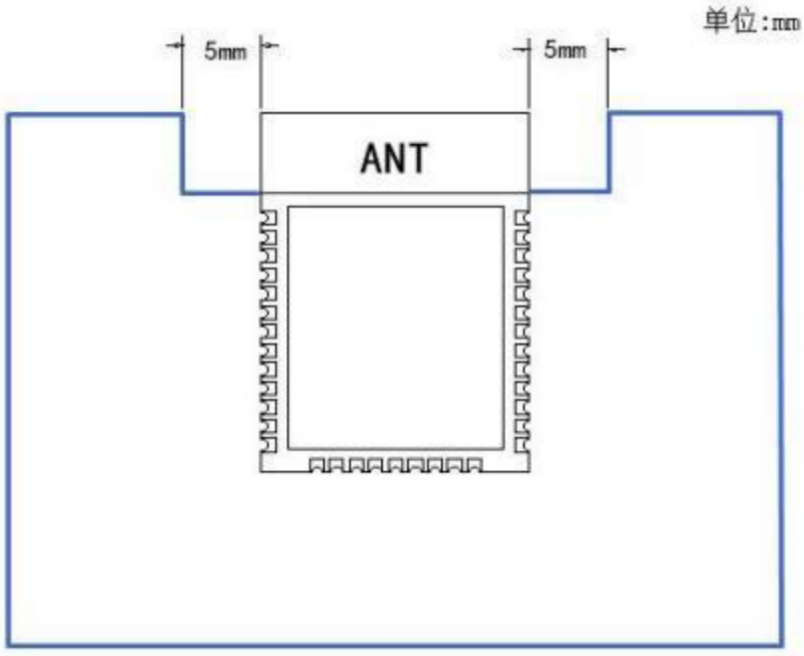
To ensure optimal performance of the on-board antenna, metal components and high-frequency devices should not be placed near the antenna area.

The following two placement examples are recommended for antenna layout and installation:

Example 1

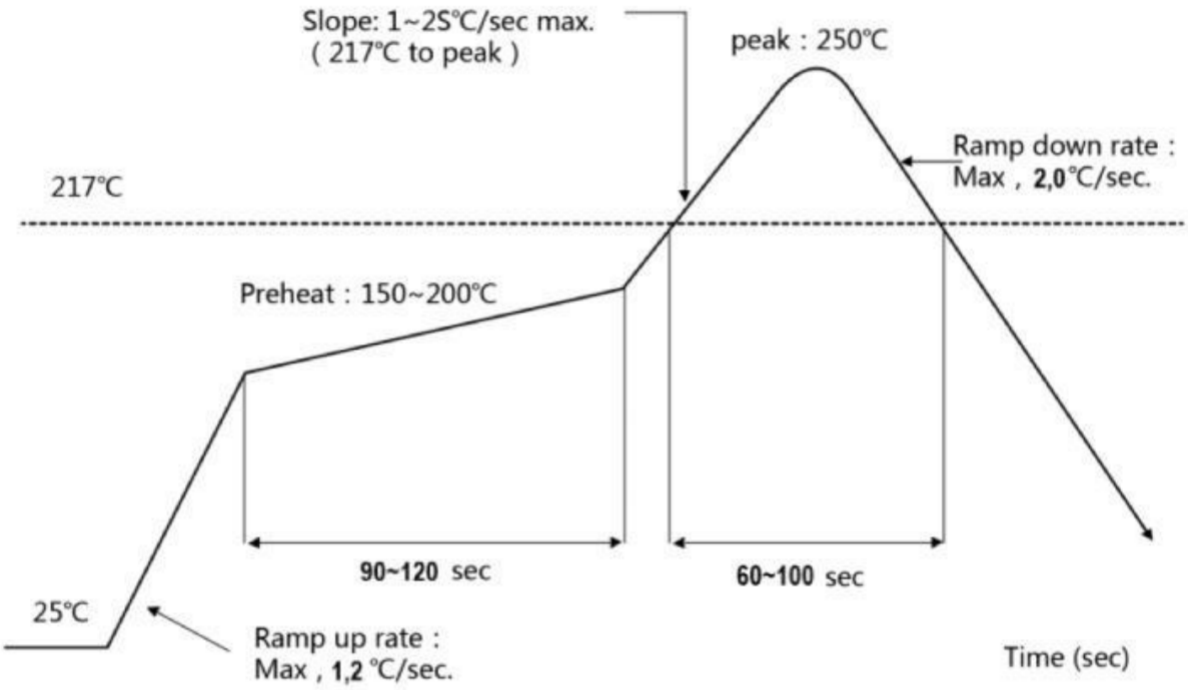


Example 2



4. Reflow Soldering Profile

Compliant with IPC/JEDEC standards.
Peak temperature: < 250°C.
Maximum reflow cycles: < 2 times.



5. Contact Us

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