GigaDevice Semiconductor Inc.

GD32VW553-UNIFI

Wi-Fi Single Band 1x1 802.11b/g/n/ax + BLE 5.2

loT Combo Module

Datasheet

Revision 1.0

(DEC. 2024)

Website: www.GD32MCU.com

Table of Contents

Table of Contents 2
List of Figures 3
List of Tables 4
1. General Features 5
2. General description 6
3. Block diagram 7
4. Pin definition 8
4.1. Pinouts 8
4.2. Pin definitions 8
5. Wireless radio characteristics 11
5.1. Wi-Fi characteristics 11
5.2. Bluetooth LE characteristics 12
6. Electrical Characteristics 13
6.1. Absolute maximum ratings 13
6.2. Operating conditions 13
6.3. Power consumption 13
7. Size information 15
7.1. Physical dimensions 15
7.2. Layout recommendation 15
7.3. Dimensions of external antenna connector 16
8. Peripheral circuit reference design 17
9. Requirements for antenna placement 18
10. Recommended reflow profile 19
11. Package 20
11.1. Reel 20
12. Moisture sensitivity 21
13. Revision history 22

List of Figures

Figure 3-1. Block diagram 7
Figure 4-1. Pinouts from top view 8
Figure 7-1. Physical dimensions 15
Figure 7-2. Layout recommendation 15
Figure 7-3. Dimensions of IPEX connector 16
Figure 8-1. Reference design 17
Figure 9-1. Recommended Placement 18
Figure 10-1. Recommended reflow profile 19
Figure 11-1. Reel detail 20

List of Tables

Table 2-1. Description of module types 6
Table 4-1. Pin definitions 8
Table 5-1. Wi-Fi characteristics 11
Table 5-2. BLE characteristics 12
Table 6-1. Absolute maximum ratings 13
Table 6-2. Operating conditions 13
Table 6-3. Power consumption (1)(2)(3) 13
Table 8-1. Boot mode selection 17
Table 13-1. Revision history 22

1. General Features

- Built-in QFN40 GD32VW553 chip, RISC-V 32-bit processor up to 160 MHz
- Built-in 4096 KB on-chip Flash memory and 320KB (288 KB + 32KB Shared) SRAM memory
- 802.11b/g/n/ax compatible
- 802.11i (WPA, WPA2, WPA3). Open, shared key, and pair-wise key authentication services
- Single antenna 1x1 stream in 20MHz channels
- Support of 802.11ax MCS up to MCS9 with a Max PHY rate of 114.7Mbps
- Bluetooth LE 5.2
- Support of BLE High-Speed 2M PHY and Long-Range modes (125 kbps, 500 kbps).
- Peripheral interfaces: 18 GPIOs, support of ADC, PWM, UART, I2C, SPI
- Onboard PCB antenna for GD32VW553-UNIFI-IMHx, and external IPEX connector for the GD32VW553-UNIFI-EMHx
- Operating voltage: 3.0V ~ 3.6V
- Operating temperature: -40 ~ 85℃ for grade 6 and -40 ~ 105℃ for grade 7

2. General description

The GD32VW553-UNIFI series modules are highly integrated 2.4GHz Wi-Fi and BLE modules, they are optimized modules designed for a broad array of smart devices for Internet of Things (IoT) applications especially in areas such as industrial control, motor drives, user interface, power monitor and alarm systems, consumer and handheld equipment, gaming and GPS, E-bike, optical module and so on.
The GD32VW553-UNIFI series modules are currently available in four types, based on different antenna type and operating temperature.

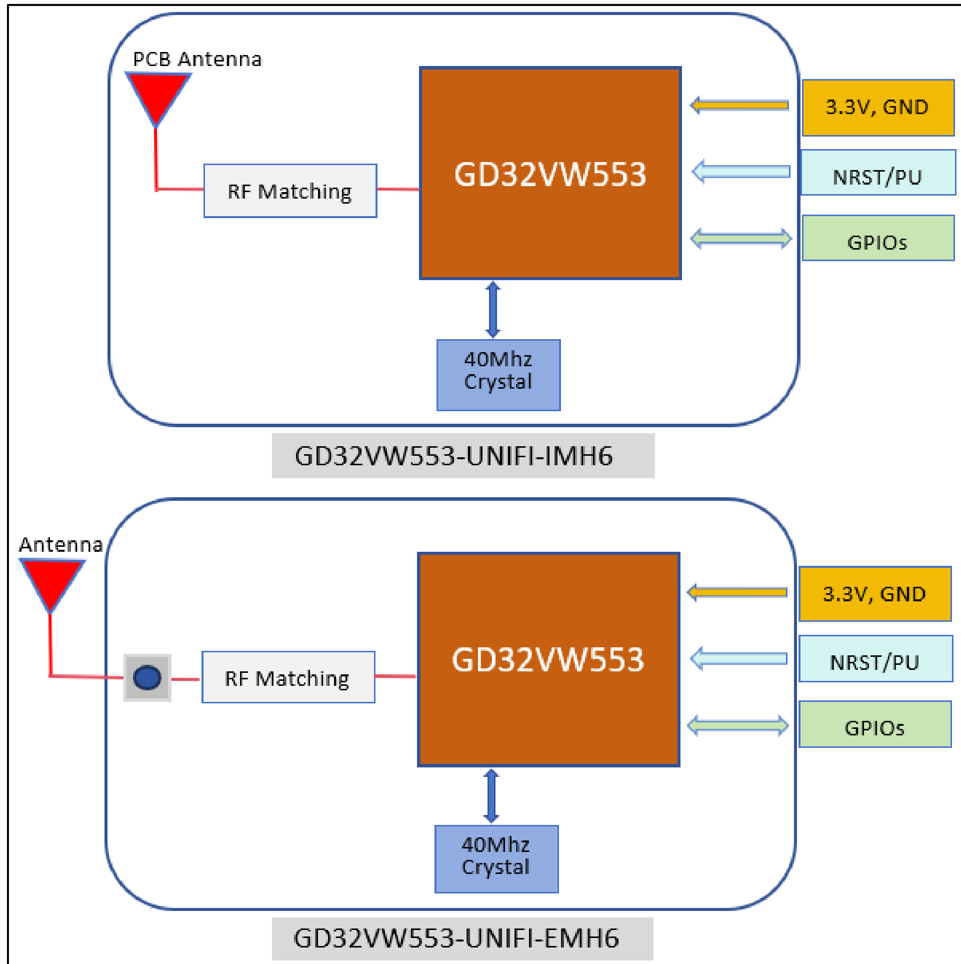
Table 2-1. Description of module types

Module Part Number	Flash	Operating Temperature	Antenna Type	Module Size(mm)
GD32VW553-UNIFI-IMH6	4MB	-40 ~ 85℃	Onboard	24 x 16 x 2.2
GD32VW553-UNIFI-IMH7		-40 ~ 105℃	Onboard	
GD32VW553-UNIFI-EMH6		-40 ~ 85℃	External	
GD32VW553-UNIFI-EMH7		-40 ~ 105℃	External	

3. Block diagram

An onboard PCB antenna is used for GD32VW553-UNIFI-IMHx, while an external antenna with an IPEX connector is used for GD32VW553-UNIFI-EMHx.

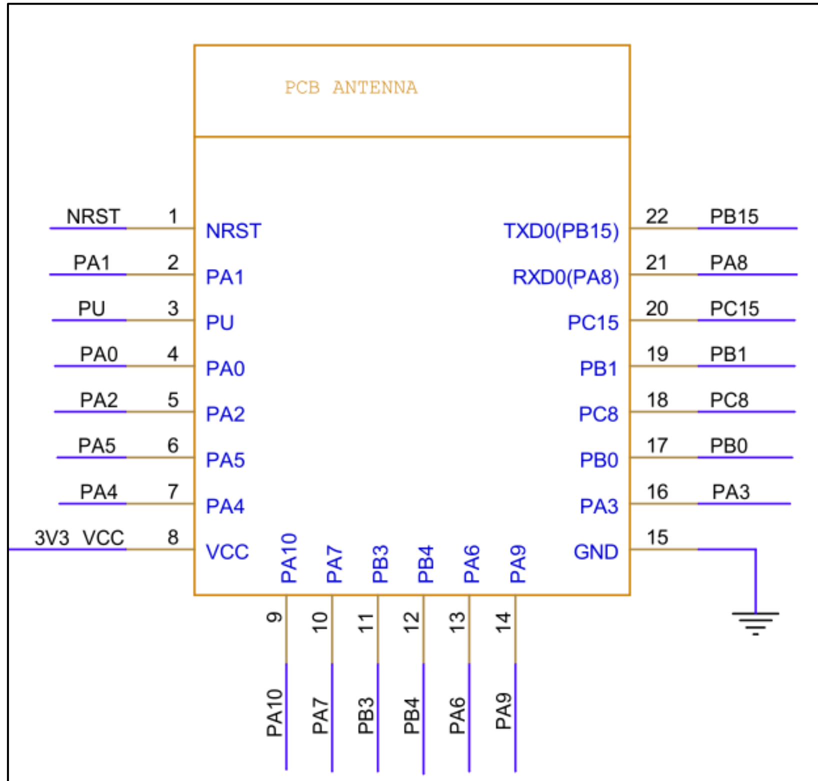
Figure 3-1. Block diagram



4. Pin definition

4.1. Pinouts

Figure 4-1. Pinouts from top view



4.2. Pin definitions

Table 4-1. Pin definitions

NO.	Name	Type	Function Description
1	NRST	I	Default: NRST
2	PA1	I/O	Default: PA1 Alternate: USART0_RX, TIMER1_CH1, SPI_MISO, UART1_RTS, EVENTOUT Additional: ADC_IN1
3	PU	I	Default: PU
4	PA0	I/O	Default: PA0 Alternate: USART0_TX, TIMER1_CH0, TIMER1_ETI, SPI_MOSI, UART1_CTS, TIMER0_ETI, EVENTOUT Additional: ADC_IN0, WAKEUP0, RTC_TAMP1
5	PA2	I/O	Default: PA2

			Alternate: USART0_CTS, TIMER1_CH2, I2C0_SCL, SPI_SCK, TIMER0_CH0, UART1_TX, EVENTOUT Additional: ADC_IN2
6	PA5	I/O	Default: PA5 Alternate: UART1_RX, TIMER2_ETI, QSPI_CSN, SPI_MISO, SPI_SCK, TIMER0_CH1_ON , EVENTOUT Additional: ADC_IN5
7	PA4	I/O	Default: PA4 Alternate: UART1_TX, SPI_MOSI, QSPI_SCK, SPI_NSS, TIMER0_CH1, EVENTOUT Additional: ADC_IN4
8	VCC	P	3.3V(+/-0.3)
9	PA10	I/O	Default: PA10 Alternate: SPI_MISO, TIMER0_CH2, QSPI_CSN, TIMER16_CH0, USART0_RX, EVENTOUT
10	PA7	I/O	Default: PA7 Alternate: I2C1_SDA , TIMER0_CH0_ON, TIMER2_CH1, QSPI_IO1, SPI_NSS, SPI_MOSI, TIMER0_CH1_ON, UART2_RX, TIMER1_CH2, EVENTOUT Additional: ADC_IN7, WAKUP2
11	PB3	I/O	Default: JTDO, PB3 Alternate: TIMER1_CH1, QSPI_IO2, USART0_RX, UART1_RX, TIMER15_BRKIN, EVENTOUT
12	PB4	I/O	Default: NJTRST, PB4 Alternate: TIMER1_CH0, TIMER1_ETI, QSPI_IO3, USART0_TX, UART1_TX, EVENTOUT
13	PA6	I/O	Default: PA6 Alternate: TIMER2_CH0, QSPI_IO0, I2C1_SCL, SPI_MISO, SPI_SCK, TIMER0_CH1, TIMER1_CH1, UART2_TX, EVENTOUT Additional: ADC_IN6
14	PA9	I/O	Default: PA9 Alternate: SPI_MOSI, TIMER0_CH1, QSPI_SCK, USART0_TX, TIMER15_CH0_ON, EVENTOUT
15	GND	P	GND
16	PA3	I/O	Default: PA3 Alternate: USART0_RTS, TIMER1_CH3, I2C0_SDA, SPI_NSS, TIMER0_CH0_ON, UART1_RX, RTC_OUT, EVENTOUT Additional: ADC_IN3
17	PB0	I/O	Default:PB0 Alternate:TIMER0_CH1_ON,TIMER0_CH0, TIMER0_CH2, UART1_TX, I2C0_SCL, TIMER2_ETI, TIMER16_CH0, UART2_CTS, TIMER0_BRKIN, EVENTOUT Additional: ADC_IN8
18	PC8	I/O	Default: PC8

			Alternate: TIMER2_CH2, I2C0_SDA, I2C1_SDA, USART0_TX, UART1_TX, EVENTOUT Additional: BOOT0
19	PB1	I/O	Default: PB1 Alternate: TIMER0_CH2_ON, TIMER0_CH0_ON, TIMER2_CH2, UART1_RX, I2C0_SDA, TIMER16_CH0_ON, UART2_RTS, EVENTOUT Additional: BOOT1
20	PC15	I/O	Default: PC15 Alternate: IFRP_OUT, EVENTOUT Additional: OSC32OUT
21	PA8	I/O	Default: PA8 Alternate: CK_OUT0, TIMER0_CH0, USART0_RX, UART1_RX, I2C0_SDA, I2C1_SDA, USART0_CK, TIMER15_CH0, RTC_OUT, TIMER0_CH2_ON, EVENTOUT
22	PB15	I/O	Default: PB15 Alternate: RTC_REFIN, TIMER0_CH2_ON, TIMER2_CH0, I2C0_SCL, I2C1_SCL, UART1_TX, USART0_TX, IFRP_OUT , EVENTOUT

5. Wireless radio characteristics

5.1. Wi-Fi characteristics

Table 5-1. Wi-Fi characteristics

Features	Description		
WLAN Standard	IEEE 802.11 b/g/n/ax		
Range of frequency	2412 MHz ~ 2484 MHz		
channels	2.4GHz：Channel 1 ~ 14		
Transmitter characteristics	**Rate**	**Typical value**	**Unit**
Output Power (Pass 802.11 Mask & EVM spec.)	802.11b /1Mbps	23.2	dBm
	802.11b /11Mbps	23.2	
	802.11g /6Mbps	21.6	
	802.11g /54Mbps	19.9	
	802.11n, HT20 /MCS0	21.2	
	802.11n, HT20 /MCS7	19.1	
	802.11ax, HE20 /MCS0	21.0	
	802.11ax, HE20 /MCS9	17.3	
Receiver characteristics	**Rate**	**Typical value**	**Unit**
Sensitivity (Pass 802.11 PER spec.)	802.11b /1Mbps	-99.3	dBm
	802.11b /11Mbps	-91.4	
	802.11g /6Mbps	-95	
	802.11g /54Mbps	-78.4	
	802.11n, HT20 /MCS0	-94.6	
	802.11n, HT20 /MCS7	-76	
	802.11ax, HE20 /MCS0	-94.8	
	802.11ax, HE20 /MCS9	-69.4	
Maximum input Level (Pass 802.11 PER spec.)	802.11b /1Mbps	10	dBm
	802.11b /11Mbps	10	
	802.11g /6Mbps	10	
	802.11g /54Mbps	1	
	802.11n, HT20 /MCS0	10	
	802.11n, HT20 /MCS7	-1	
	802.11ax, HE20 /MCS0	10	
	802.11ax, HE20 /MCS9	-5	
Adjacent Channel Rejection (Pass 802.11 spec.)	802.11b /1Mbps	50	dB
	802.11b /11Mbps	50	
	802.11g /6Mbps	29	

	802.11g /54Mbps	10	
	802.11n, HT20 /MCS0	27	
	802.11n, HT20 /MCS7	10	
	802.11ax, HE20 /MCS0	25	
	802.11ax, HE20 /MCS9	0	

5.2. Bluetooth LE characteristics

Table 5-2. BLE characteristics

Features	Description	
Bluetooth LE Specification	Bluetooth LE V5.2	
Host interface	UART	
Range of frequency	2402 MHz ~ 2480 MHz	
channels	40	
Transmitter characteristics		
Transmitter Power Range	-24.0 ~ 15.0 dBm	
Receiver characteristics	**Rate**	**Typical Value (dBm)**
Receiver Sensitivity (@ PER=30.8%.)	LE 1Mbps	-100.5
	LE 2Mbps	-97.3
	LE 125Kbps	-107.7
	LE 500Kbps	-101.7
Receiver Maximum input Level (@ PER=30.8%.)	LE 1Mbps	10
	LE 2Mbps	10
	LE 125Kbps	10
	LE 500Kbps	10

6. Electrical Characteristics

6.1. Absolute maximum ratings

Table 6-1. Absolute maximum ratings

Symbol	MIN	MAX	Unit
Supply Voltage	-0.3	3.6	V
Storage Temperature	-40	125	deg.C

6.2. Operating conditions

Table 6-2. Operating conditions

Symbol	MIN	TYP	MAX	Unit
Supply Voltage	3.0	3.3	3.6	V
Operating Temperature (grade 6 module)	-40	25	85	deg.C
Operating Temperature (grade 7 module)	-40	25	105	deg.C

6.3. Power consumption

Table 6-3. Power consumption (1)(2)(3)

Power Mode	Description	Typical value	Unit
Wi-Fi Active	Tx 802.11b, 1Mbps, Pout = 18dBm	335.9	mA
	Tx 802.11b /11Mbps, Pout = 17dBm	324.0	
	Tx 802.11g /6Mbps, Pout = 18dBm	336.8	
	Tx 802.11g /54Mbps, Pout = 15dBm	302.7	
	Tx 802.11n, HT20 /MCS0, Pout = 18dBm	338.1	
	Tx 802.11n, HT20 /MCS7, Pout = 14dBm	291.5	
	Tx 802.11ax, HE20 /MCS0, Pout = 18dBm	339.1	
	Tx 802.11ax, HE20 /MCS9, Pout = 12dBm	273.2	
	Rx 802.11b, 1Mbps, Pin = -90dBm	99.7	
	Rx 802.11b /11Mbps, Pin = -80dBm	100.5	
	Rx 802.11g /6Mbps, Pin = -80dBm	101.8	
	Rx 802.11g /54Mbps, Pin = -70dBm	102.5	
	Rx 802.11n, HT20 /MCS0, Pin = -75dBm	101.6	
	Rx 802.11n, HT20 /MCS7, Pin = -65dBm	102.6	
	Rx 802.11ax, HE20 /MCS0, Pin = -75dBm	102.1	
	Rx 802.11ax, HE20 /MCS9, Pin = -60dBm	112.3	

BLE Active	Tx LE 1Mbps, Pout = -24dBm	124.0	mA
	Tx LE 1Mbps, Pout = 0dBm	136.3	
	Tx LE 1Mbps, Pout = 15dBm	259.9	
	Rx LE 1Mbps, Pin = -80dBm	95.3	
Wi-Fi Sleep	MCU in Run mode	39	mA
Mild Sleep	DTIM=1	1.8	mA
	DTIM=3	0.68	mA
	DTIM=10	0.34	mA

(1) DC Power = 3.3 V, HXTAL = 40 MHz

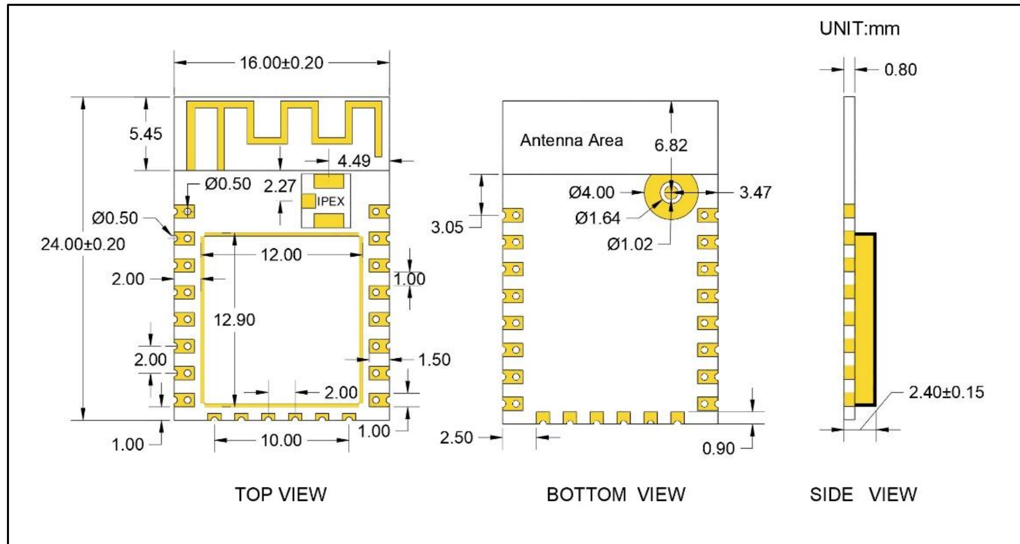
(2) Continuous Tx, Duty cycle = 100%.

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

7. Size information

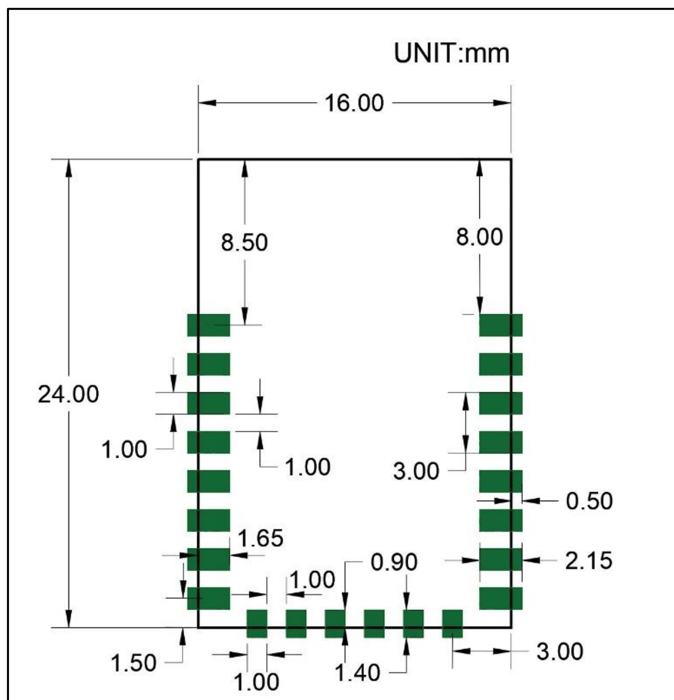
7.1. Physical dimensions

Figure 7-1. Physical dimensions



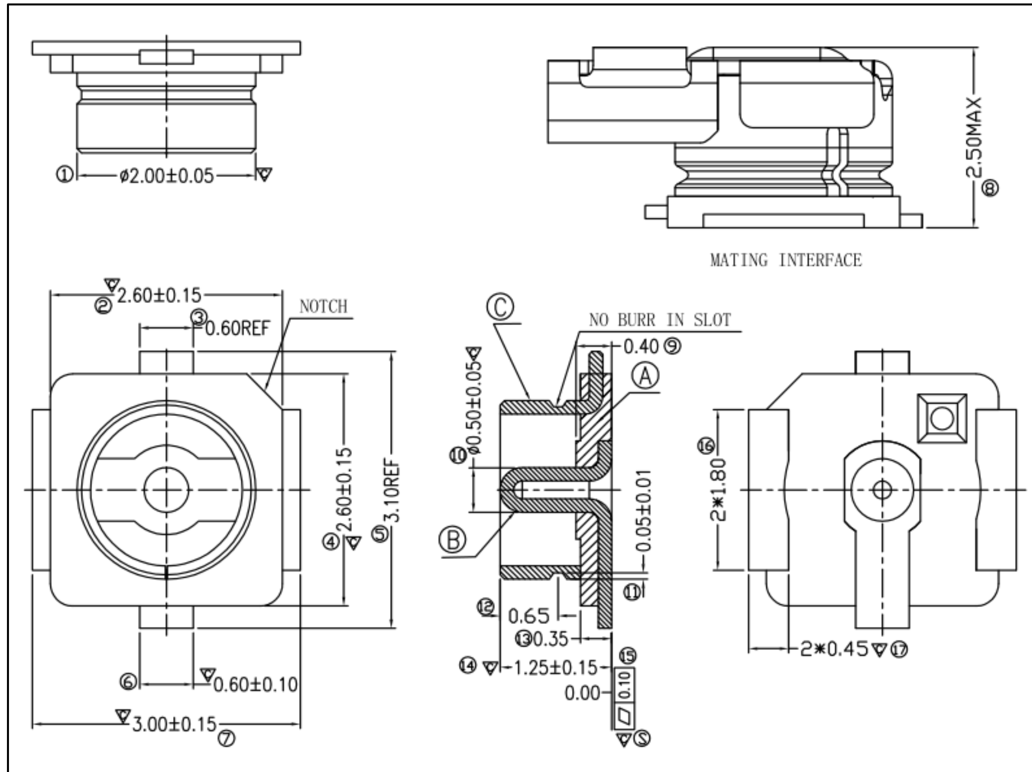
7.2. Layout recommendation

Figure 7-2. Layout recommendation



7.3. Dimensions of external antenna connector

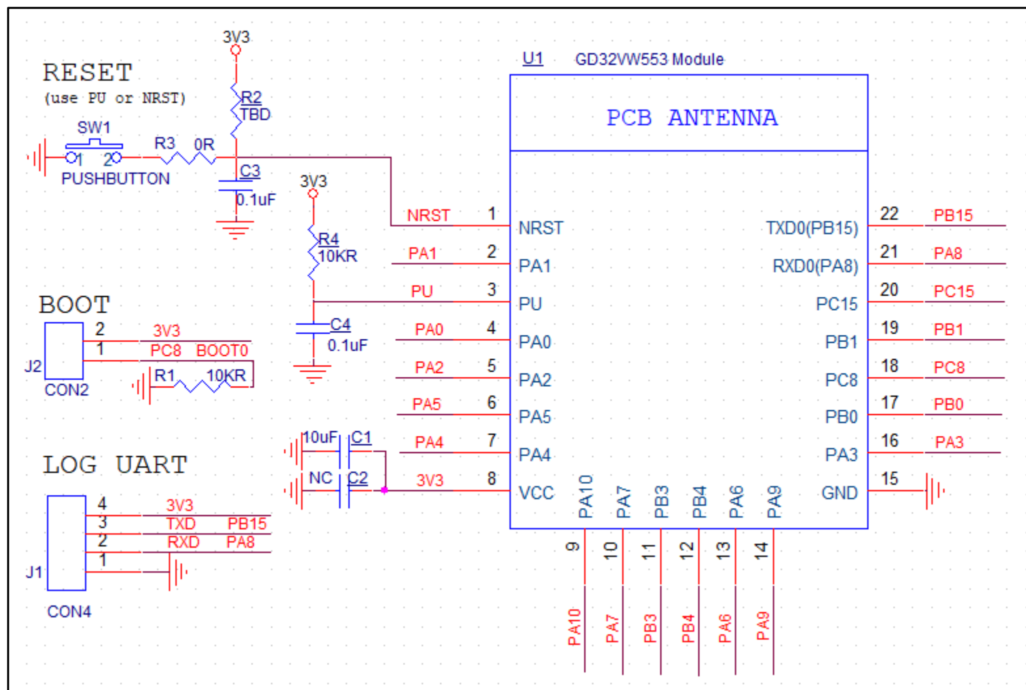
Figure 7-3. Dimensions of IPEX connector



8. Peripheral circuit reference design

Module pins PU and NRST are the power supply enable and reset pins respectively. The chip can operate only when both pins are pulled up. A 0.1uF filter capacitor and a 10K Ohm pull-up resistor have been placed on the module for NRST pin only. If the GD32VW553 is used as a master MCU, it is recommended to use NRST as the enable pin with PU always pulled up on the motherboard. If the GD32VW553 is used as a slave device, it is recommended to use PU as the enable pin, and no more circuit is needed for NRST. Besides, the log Uart pins are recommended to be connected out.

Figure 8-1. Reference design



The power supply of 3.3V must provide a minimum of 500mA.

The selected pins for the boot mode are BOOT0 (PC8) and BOOT1 (PB1). Definitions of several modes are shown in the table below. Typically, flash boot mode is utilized, therefore BOOT0 needs to be pulled down on the motherboard.

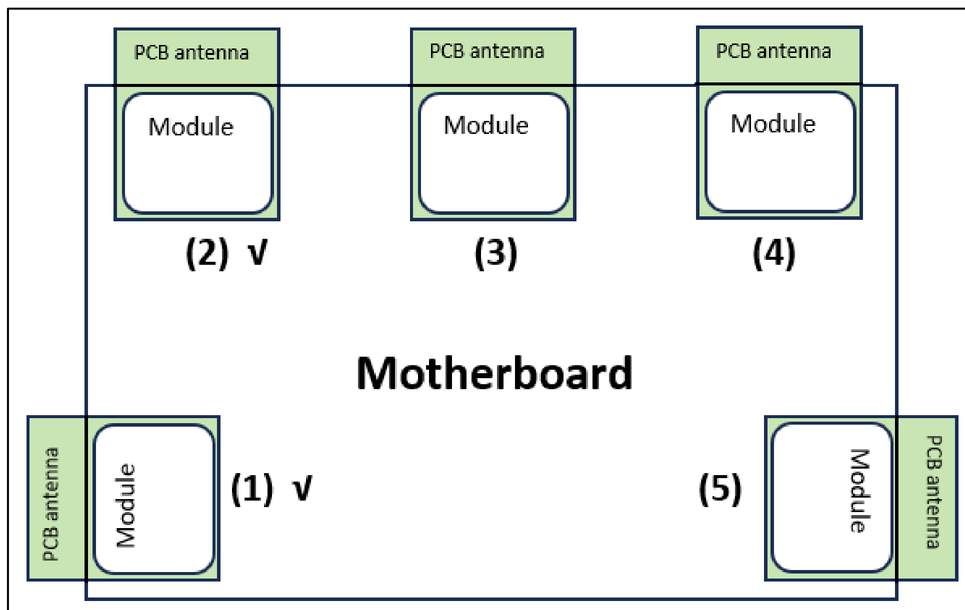
Table 8-1. Boot mode selection

BOOT1	BOOT0	Start-up Mode
X	0	Flash
0	1	Legacy Bootloader
1	1	SRAM

9. Requirements for antenna placement

If using the onboard PCB antenna, the antenna area of the module needs to extend away from the motherboard. The distance between the PCB of the motherboard and other metal devices must have a minimum clearance of 15mm. The area below and above the onboard antenna area is required to be kept away from metal devices, sensors, interference sources, and other materials that may cause signal interference.
The recommended placement of the module is shown below.

Figure 9-1. Recommended Placement



10. Recommended reflow profile

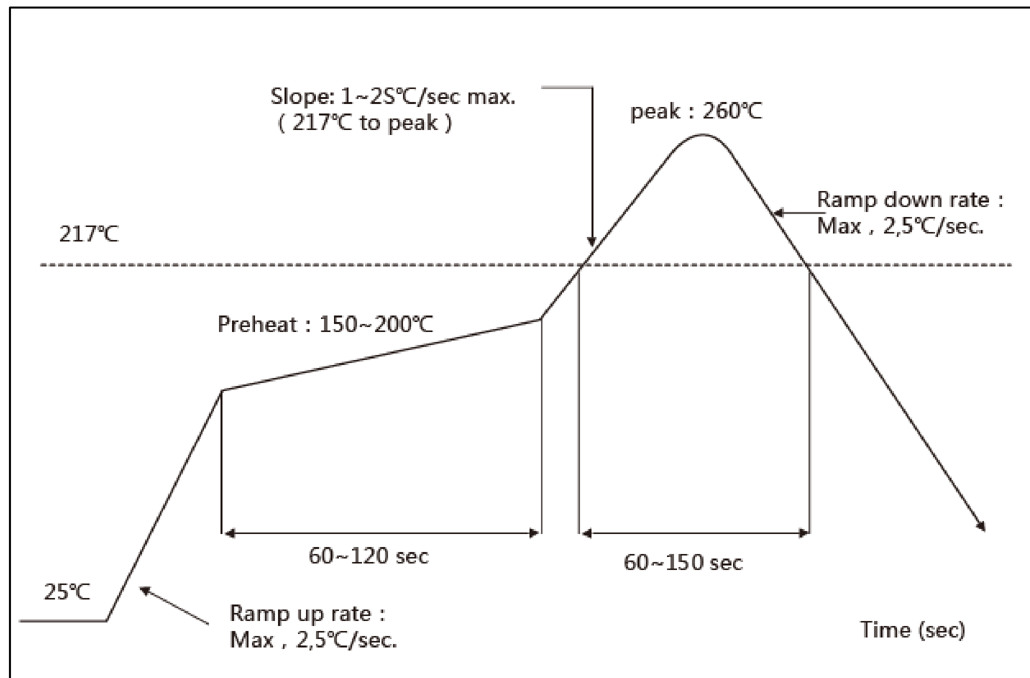
Referred to IPC/JEDEC standard

Peak Temperature: 260±5 °C

5Time within 5°C of peak temperature: ≥10s

Number of Times: 2 times

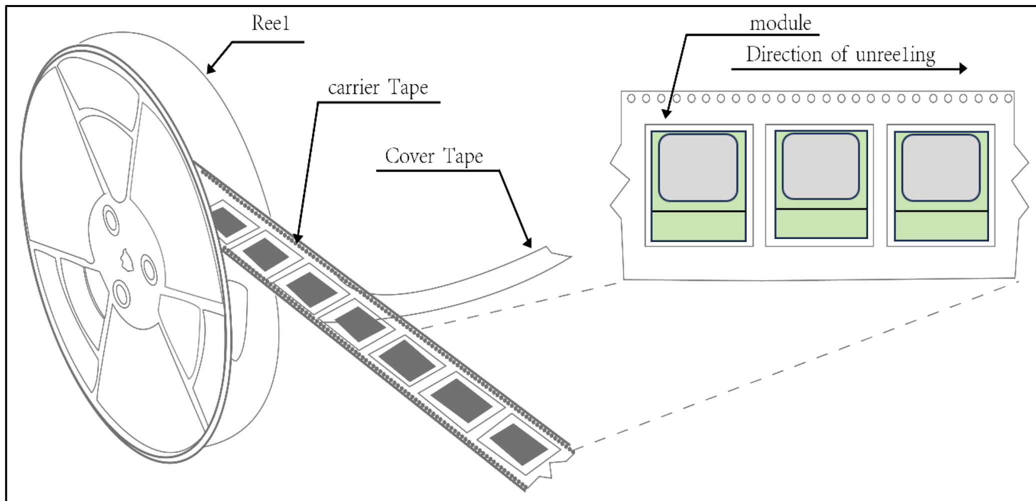
Figure 10-1. Recommended reflow profile



11. Package

11.1. Reel

Figure 11-1. Reel detail



12. Moisture sensitivity

The Module is a level 3 Moisture Sensitive Device, by the standard IPC/JEDEC J-STD-020. Special care must be provided to adhere to all of the requirements for using this class of component. Furthermore, the customer must allow for the following conditions:

a) Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH)

b) Environmental condition during the production: 30°C / 60% RH according to IPC/JEDEC J-STD-033A paragraph 5

c) The maximum time between the opening of the sealed bag and the reflow process allowed is 168 hours if “IPC/JEDEC J-STD-033A paragraph 5.2” is respected

e) Baking is required if either conditions b) or c) are not respected

f) Baking is required if the humidity indicator inside the bag indicates 10% RH or more

13. Revision history

Table 13-1. Revision history

Revision No.	Description	Date
1.0	Initial Release	Dec.3rd, 2024

Important Notice

This document is the property of GigaDevice Semiconductor Inc. and its subsidiaries (the "Company"). This document, including any product of the Company described in this document (the “Product”), is owned by the Company under the intellectual property laws and treaties of the People’s Republic of China and other jurisdictions worldwide. The Company reserves all rights under such laws and treaties and does not grant any license under its patents, copyrights, trademarks, or other intellectual property rights. The names and brands of third party referred thereto (if any) are the property of their respective owner and referred to for identification purposes only.

The Company makes no warranty of any kind, express or implied, with regard to this document or any Product, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The Company does not assume any liability arising out of the application or use of any Product described in this document. Any information provided in this document is provided only for reference purposes. It is the responsibility of the user of this document to properly design, program, and test the functionality and safety of any application made of this information and any resulting product. Except for customized products which has been expressly identified in the applicable agreement, the Products are designed, developed, and/or manufactured for ordinary business, industrial, personal, and/or household applications only. The Products are not designed, intended, or authorized for use as components in systems designed or intended for the operation of weapons, weapons systems, nuclear installations, atomic energy control instruments, combustion control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, life-support devices or systems, other medical devices or systems (including resuscitation equipment and surgical implants), pollution control or hazardous substances management, or other uses where the failure of the device or Product could cause personal injury, death, property or environmental damage ("Unintended Uses"). Customers shall take any and all actions to ensure using and selling the Products in accordance with the applicable laws and regulations. The Company is not liable, in whole or in part, and customers shall and hereby do release the Company as well as it’s suppliers and/or distributors from any claim, damage, or other liability arising from or related to all Unintended Uses of the Products. Customers shall indemnify and hold the Company as well as it’s suppliers and/or distributors harmless from and against all claims, costs, damages, and other liabilities, including claims for personal injury or death, arising from or related to any Unintended Uses of the Products.

Information in this document is provided solely in connection with the Products. The Company reserves the right to make changes, corrections, modifications or improvements to this document and Products and services described herein at any time, without notice.

© 2024 GigaDevice – All rights reserved