

**GigaDevice Semiconductor Inc.**

**GD32VW553-MINI**

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

**IoT Combo Module**

**Datasheet**

Revision 1.1

(FEB 2025)

## Table of Contents

<b>Table of Contents .....</b>	<b>2</b>
<b>List of Figures .....</b>	<b>3</b>
<b>List of Tables .....</b>	<b>4</b>
<b>1. General Features.....</b>	<b>5</b>
<b>2. General description .....</b>	<b>6</b>
<b>3. Block diagram .....</b>	<b>7</b>
<b>4. Pin definition .....</b>	<b>8</b>
4.1. Pinouts .....	8
4.2. Pin definitions.....	8
4.3. Default Pin usage .....	10
<b>5. Wireless radio characteristics .....</b>	<b>12</b>
5.1. Wi-Fi characteristics .....	12
5.2. Bluetooth LE characteristics .....	13
<b>6. Electrical Characteristics .....</b>	<b>14</b>
6.1. Absolute maximum ratings.....	14
6.2. Operating conditions.....	14
6.3. Power consumption .....	14
<b>7. Size information .....</b>	<b>16</b>
7.1. Physical dimensions .....	16
7.2. Layout recommendation .....	17
7.3. Dimensions of external antenna connector.....	18
<b>8. Module Schematic .....</b>	<b>19</b>
<b>9. Peripheral circuit reference design .....</b>	<b>21</b>
<b>10. Requirements for antenna placement.....</b>	<b>22</b>
<b>11. Recommended reflow profile.....</b>	<b>23</b>
<b>12. Package .....</b>	<b>24</b>
<b>13. Moisture sensitivity .....</b>	<b>25</b>
<b>14. Related Documents and Resources.....</b>	<b>26</b>
<b>15. Revision history .....</b>	<b>27</b>

## List of Figures

Figure 3-1. Block diagram .....	7
Figure 4-1. Pinouts from top view .....	8
Figure 7-1. Physical dimensions of MINI-I .....	16
Figure 7-2. Physical dimensions of MINI-E.....	16
Figure 7-3. Layout recommendation of MINI-I.....	17
Figure 7-4. Layout recommendation of MINI-E .....	17
Figure 7-5. Dimensions of IPEX connector .....	18
Figure 8-1. Module Schematic of GD32VW553-MINI-I .....	19
Figure 8-2. Module Schematic of GD32VW553-MINI-E .....	20
Figure 9-1. Reference design .....	21
Figure 10-1. Recommended Placement .....	22
Figure 11-1. Recommended reflow profile .....	23
Figure 12-1. Package detail .....	24

## List of Tables

Table 2-1. Description of module types .....	6
Table 4-1. Pin definitions.....	8
Table 4-2. Pin Definitions of default Usage .....	11
Table 4-3. Boot mode selection .....	11
Table 5-1. Wi-Fi characteristics .....	12
Table 5-2. BLE characteristics .....	13
Table 6-1. Absolute maximum ratings .....	14
Table 6-2. Operating conditions .....	14
Table 6-3. Power consumption <sup>(1)(2)(3)</sup> .....	14
Table 10-1. Reflow process and condition .....	23
Table 12-1. Package Information .....	24
Table 15-1. Revision history .....	27

## 1. General Features

- Built-in QFN32 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-bandwidth 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: 20 GPIOs, support of ADC, PWM, UART, I2C, SPI
- Onboard PCB antenna for GD32VW553-MINI-IMKx, and external IPEX connector for the GD32VW553-MINI-EMKx
- Operating voltage: 3.0V ~ 3.6V
- Operating temperature: -40 ~ 85°C for grade 6 and -40 ~ 105°C for grade 7

## 2. General description

The GD32VW553-MINI 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-MINI series modules are currently available in four types, based on different antenna type and operating temperature.

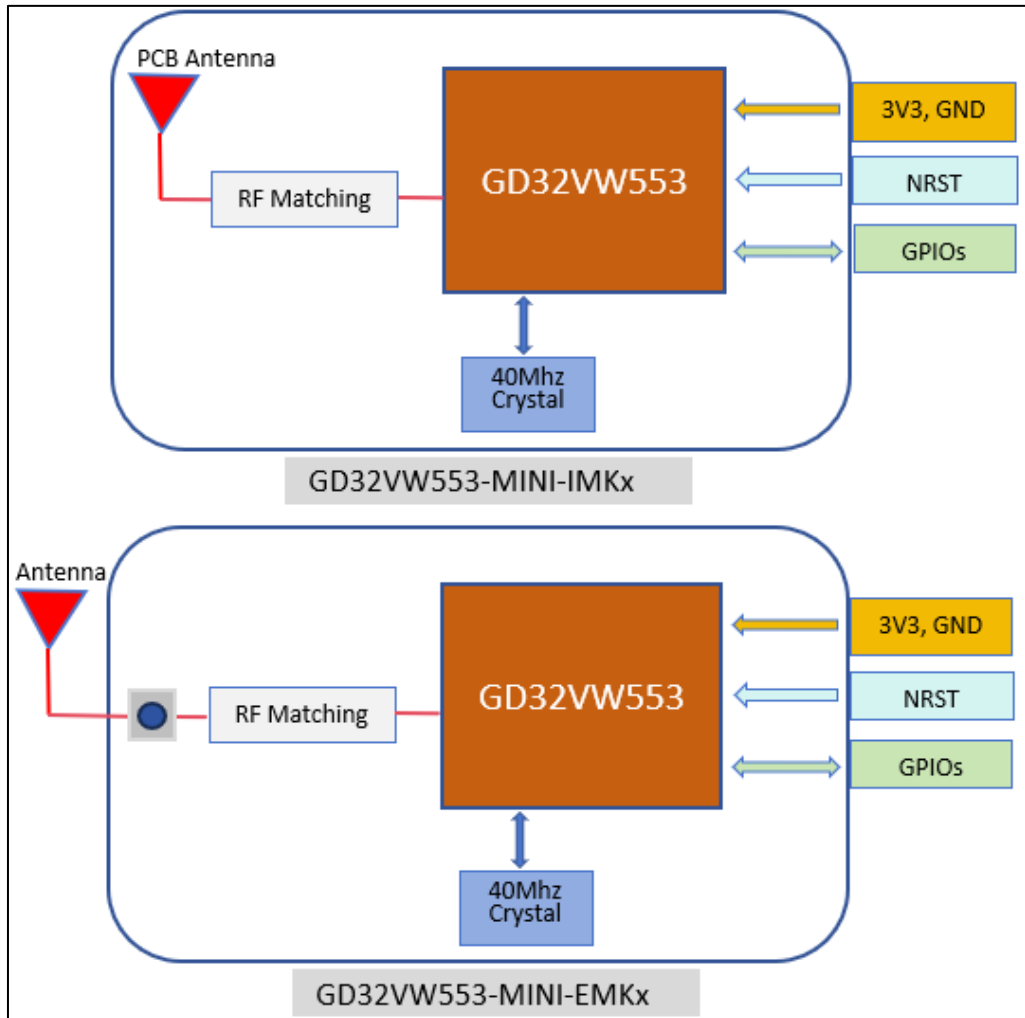
**Table 2-1. Description of module types**

Module Part Number	Flash	Operating Temperature	Antenna Type	Module Size(mm)
GD32VW553-MINI-IMK6	4MB	-40 ~ 85°C	Onboard	15 x 12.4 x 2.4
GD32VW553-MINI-IMK7		-40 ~ 105°C	Onboard	15 x 12.4 x 2.4
GD32VW553-MINI-EMK6		-40 ~ 85°C	External	9.5 x 12.4 x 2.4
GD32VW553-MINI-EMK7		-40 ~ 105°C	External	9.5 x 12.4 x 2.4

### 3. Block diagram

An onboard PCB antenna is used for GD32VW553-MINI-IMKx, while an external antenna with an IPEX connector is used for GD32VW553-MINI-EMKx.

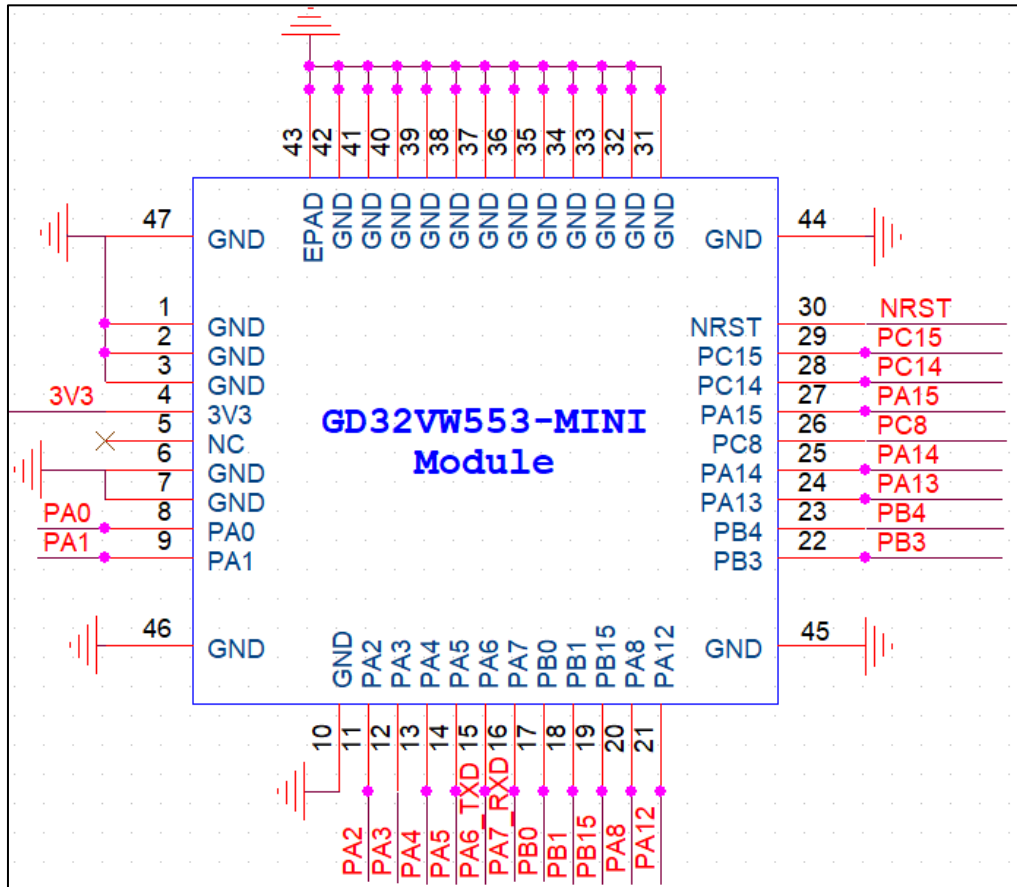
Figure 3-1. Block diagram



## 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
1,2,3,6,7,10,31~47	GND	P	GND
4	3V3	P	3.3V(+/-0.3)
5	NC	---	Not connect
8	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



9	PA1	I/O	Default: PA1 Alternate: USART0_RX, TIMER1_CH1, SPI_MISO, UART1_RTS, EVENTOUT Additional: ADC_IN1
11	PA2	I/O	Default: PA2 Alternate: USART0_CTS, TIMER1_CH2, I2C0_SCL, SPI_SCK, TIMER0_CH0, UART1_TX, EVENTOUT Additional: ADC_IN2
12	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
13	PA4	I/O	Default: PA4 Alternate: UART1_TX, SPI_MOSI, QSPI_SCK, SPI_NSS, TIMER0_CH1, EVENTOUT Additional: ADC_IN4
14	PA5	I/O	Default: PA5 Alternate: UART1_RX, TIMER2_ETI, QSPI_CSN, SPI_MISO, SPI_SCK, TIMER0_CH1_ON, EVENTOUT Additional: ADC_IN5
15	PA6_TXD	I/O	Default: UART2_TX Alternate: TIMER2_CH0, QSPI_IO0, I2C1_SCL, SPI_MISO, SPI_SCK, TIMER0_CH1, TIMER1_CH1, EVENTOUT Additional: ADC_IN6
16	PA7_RXD	I/O	Default: UART2_RX Alternate: I2C1_SDA, TIMER0_CH0_ON, TIMER2_CH1, QSPI_IO1, SPI_NSS, SPI_MOSI, TIMER0_CH1_ON, TIMER1_CH2, EVENTOUT Additional: ADC_IN7, WAKUP2
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	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
19	PB15	I/O	Default: PB15 Alternate: RTC_REFIN, TIMER0_CH2_ON, TIMER2_CH0, I2C0_SCL, I2C1_SCL, UART1_TX,

			USART0_TX, IFRP_OUT , EVENTOUT
20	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
21	PA12	I/O	Default: PA12 Alternate: TIMER0_ETI, TIMER0_CH3, QSPI_IO1, SPI_NSS, USART0_CK, TIMER1_CH2, TIMER16_CH0_ON, EVENTOUT Additional: WKUP3
22	PB3	I/O	Default: JTDO, PB3 Alternate: TIMER1_CH1, QSPI_IO2, USART0_RX, UART1_RX, TIMER15_BRKIN, EVENTOUT
23	PB4	I/O	Default: NJTRST, PB4 Alternate: TIMER1_CH0, TIMER1_ETI, QSPI_IO3, USART0_TX, UART1_TX, EVENTOUT
24	PA13	I/O	Default: JTMS, PA13 Alternate: I2C0_SMBA, I2C1_SCL, USART0_CTS, UART1_CTS, EVENTOUT
25	PA14	I/O	Default: JTCK, PA14 Alternate: I2C1_SMBA, I2C1_SDA, USART0_RTS, UART1_RTS, EVENTOUT
26	PC8	I/O	Default: PC8 Alternate: TIMER2_CH2, I2C0_SDA, I2C1_SDA, USART0_TX, UART1_TX, EVENTOUT Additional: BOOT0
27	PA15	I/O	Default: JTDI, PA15 Alternate: TIMER1_CH0, TIMER1_ETI, I2C0_SCL, I2C1_SCL, USART0_RX, UART1_RX, EVENTOUT Additional: WKUP1
28	PC14	I/O	Default: PC14 Alternate: EVENTOUT Additional: OSC32IN
29	PC15	I/O	Default: PC15 Alternate: IFRP_OUT, EVENTOUT Additional: OSC32OUT
30	NRST	I	Default: NRST

### 4.3. Default Pin usage

Below table lists the default pin usage.

**Table 4-2. Pin Definitions of default Usage**

Pin Name	Function Description
PA6	UART2_TX(Support basic commands, download and log function)
PA7	UART2_RX(Support basic commands, download and log function)
PB15	UART1_TX(Support AT commands)
PA8	UART1_RX(Support AT commands)
PC8	BOOT0
PB1	BOOT1
PA13	JTMS
PA14	JTCK
PA15	JTDI
PB3	JTDO

The definitions of Boot mode are shown in the table below.

**Table 4-3. Boot mode selection**

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

## 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	23.4	dBm
	802.11b /11Mbps	23.4	
	802.11g /6Mbps	22.3	
	802.11g /54Mbps	20.1	
	802.11n, HT20 /MCS0	20.5	
	802.11n, HT20 /MCS7	19.5	
	802.11ax, HE20 /MCS0	21.2	
	802.11ax, HE20 /MCS9	17.6	
Receiver characteristics	Rate	Typical value	Unit
Sensitivity (Pass 802.11 PER spec.)	802.11b /1Mbps	-100.1	dBm
	802.11b /11Mbps	-92.0	
	802.11g /6Mbps	-95.6	
	802.11g /54Mbps	-79.0	
	802.11n, HT20 /MCS0	-95.5	
	802.11n, HT20 /MCS7	-76.5	
	802.11ax, HE20 /MCS0	-95.4	
	802.11ax, HE20 /MCS9	-69.8	
Maximum input Level (Pass 802.11 PER spec.)	802.11b /1Mbps	10	dBm
	802.11b /11Mbps	10	
	802.11g /6Mbps	10	
	802.11g /54Mbps	0.4	
	802.11n, HT20 /MCS0	10	
	802.11n, HT20 /MCS7	-1.1	
	802.11ax, HE20 /MCS0	10	
	802.11ax, HE20 /MCS9	-5.0	
Adjacent Channel Rejection (Pass 802.11 spec.)	802.11b /1Mbps	45.3	dB
	802.11b /11Mbps	45.3	
	802.11g /6Mbps	29.5	

	802.11g /54Mbps	10.3	
	802.11n, HT20 /MCS0	27.8	
	802.11n, HT20 /MCS7	9	
	802.11ax, HE20 /MCS0	24.3	
	802.11ax, HE20 /MCS9	-1.8	

## 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	
<b>Transmitter characteristics</b>		
Transmitter Power Range	-24.0 ~ 15.0 dBm	
<b>Receiver characteristics</b>	<b>Rate</b>	<b>Typical Value (dBm)</b>
Receiver Sensitivity (@ PER=30.8%)	LE 1Mbps	-101.2
	LE 2Mbps	-98.0
	LE 125Kbps	-108.2
	LE 500Kbps	-102.3
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 <sup>(1)(2)(3)</sup>**

Power Mode	Description	Typical value	Unit
Wi-Fi Active	Tx 802.11b, 1Mbps, Pout = 18dBm	323.8	mA
	Tx 802.11b /11Mbps, Pout = 17dBm	311.5	
	Tx 802.11g /6Mbps, Pout = 18dBm	328.8	
	Tx 802.11g /54Mbps, Pout = 15dBm	298.0	
	Tx 802.11n, HT20 /MCS0, Pout = 18dBm	328.3	
	Tx 802.11n, HT20 /MCS7, Pout = 14dBm	286.2	
	Tx 802.11ax, HE20 /MCS0, Pout = 18dBm	330.5	
	Tx 802.11ax, HE20 /MCS9, Pout = 12dBm	270.3	
	Rx 802.11b, 1Mbps, Pin = -90dBm	99.2	
	Rx 802.11b /11Mbps, Pin = -80dBm	99.8	
	Rx 802.11g /6Mbps, Pin = -80dBm	100.8	
	Rx 802.11g /54Mbps, Pin = -70dBm	103.0	
	Rx 802.11n, HT20 /MCS0, Pin = -75dBm	101.0	
	Rx 802.11n, HT20 /MCS7, Pin = -65dBm	102.5	
	Rx 802.11ax, HE20 /MCS0, Pin = -75dBm	101.2	
	Rx 802.11ax, HE20 /MCS9, Pin = -60dBm	109.7	
BLE Active	Tx LE 1Mbps, Pout = -24dBm	124.1	mA

	Tx LE 1Mbps, Pout = 0dBm	134.3	
	Tx LE 1Mbps, Pout = 15dBm	246.8	
	Rx LE 1Mbps, Pin = -80dBm	93.8	
Wi-Fi Sleep	MCU in Run mode	39.5	mA
Mild Sleep	DTIM=1	1.8	mA
	DTIM=3	561.0	uA
	DTIM=10	457.0	uA

- (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 of MINI-I

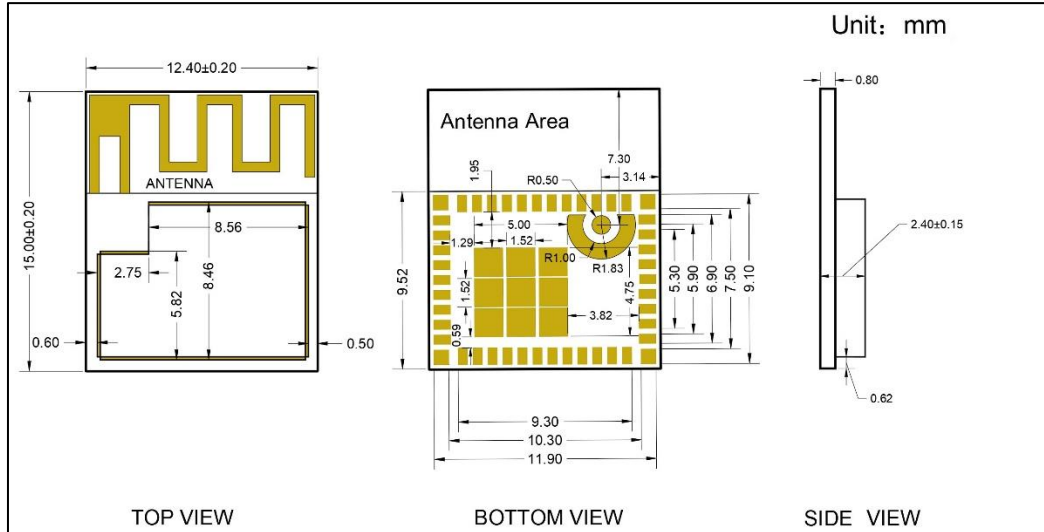
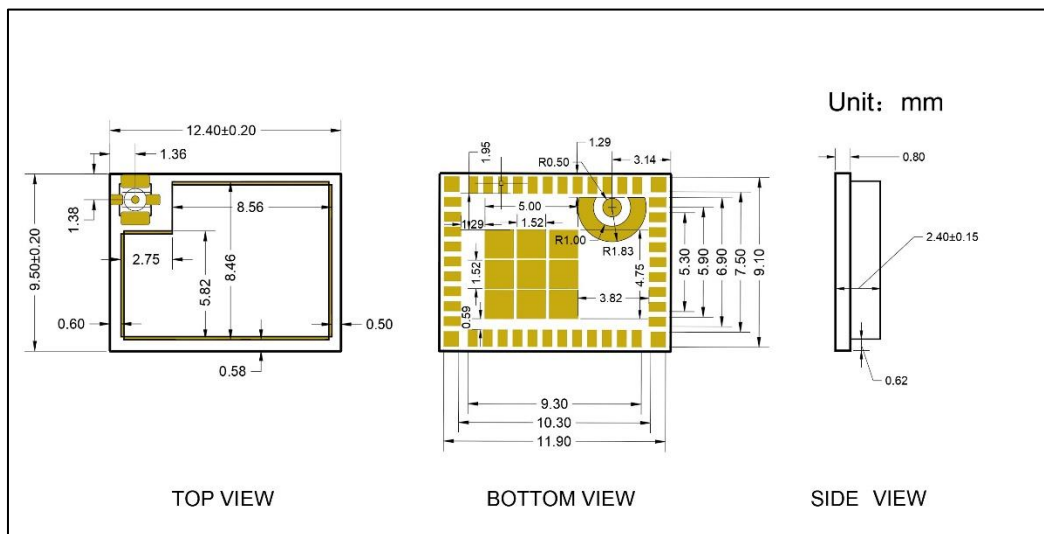


Figure 7-2. Physical dimensions of MINI-E





## 7.2. Layout recommendation

Figure 7-3. Layout recommendation of MINI-I

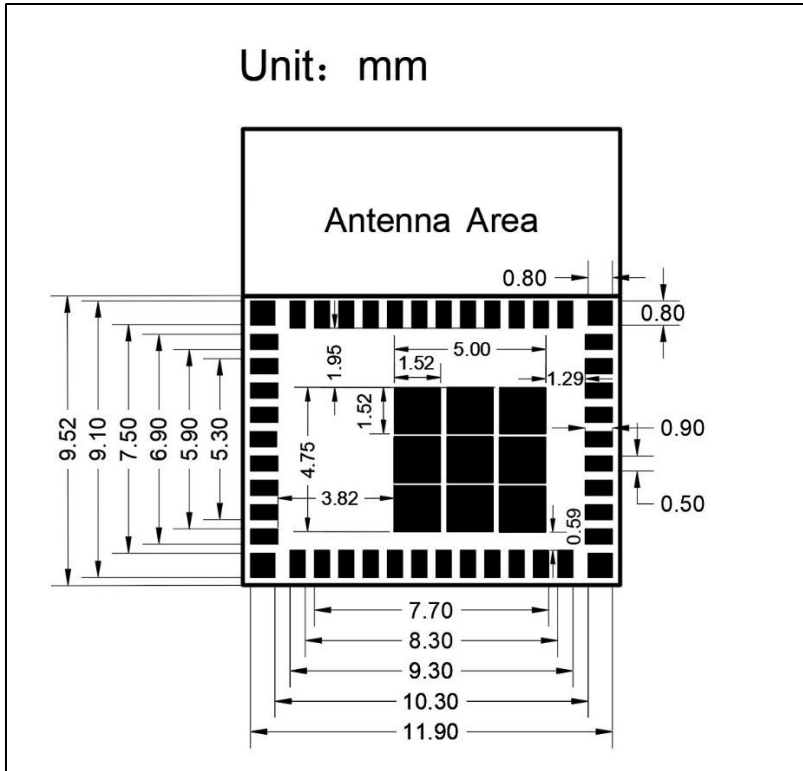
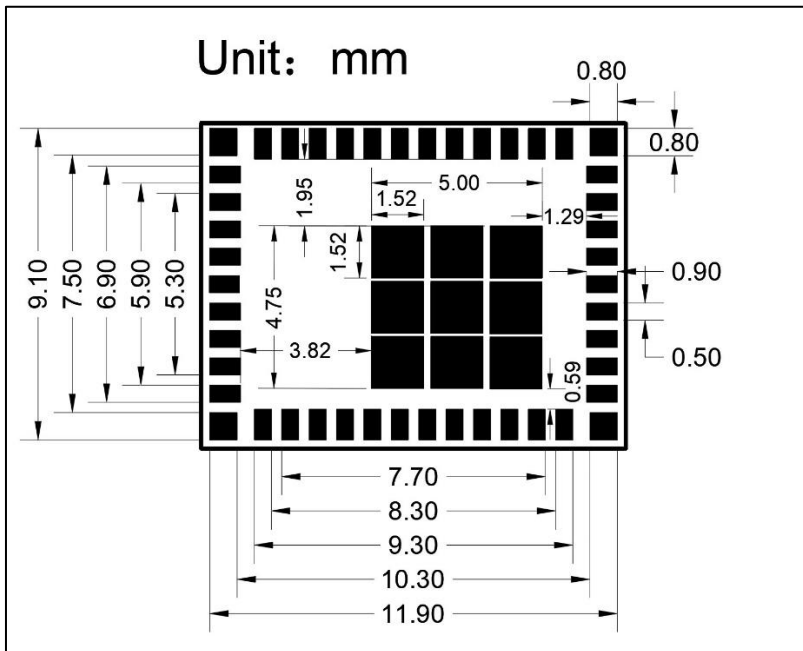
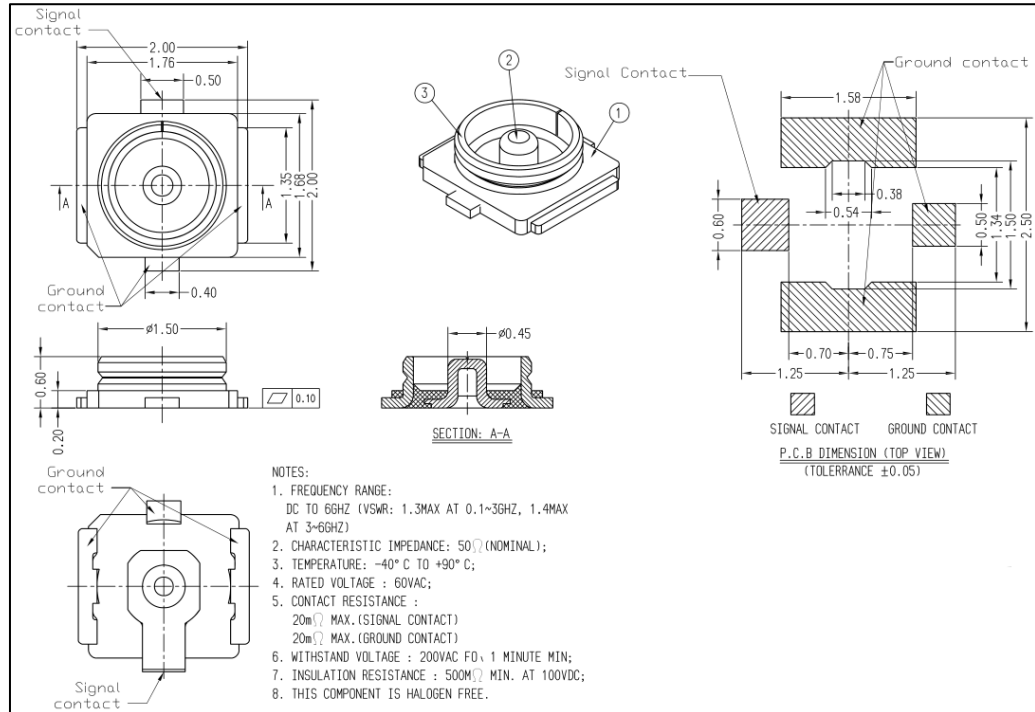


Figure 7-4. Layout recommendation of MINI-E



### 7.3. Dimensions of external antenna connector

Figure 7-5. Dimensions of IPEX connector



## 8. Module Schematic

Below figures show the circuit diagram of the internal components of the modules of GD32VW553-MINI-I and GD32VW553-MINI-E.

Figure 8-1. Module Schematic of GD32VW553-MINI-I

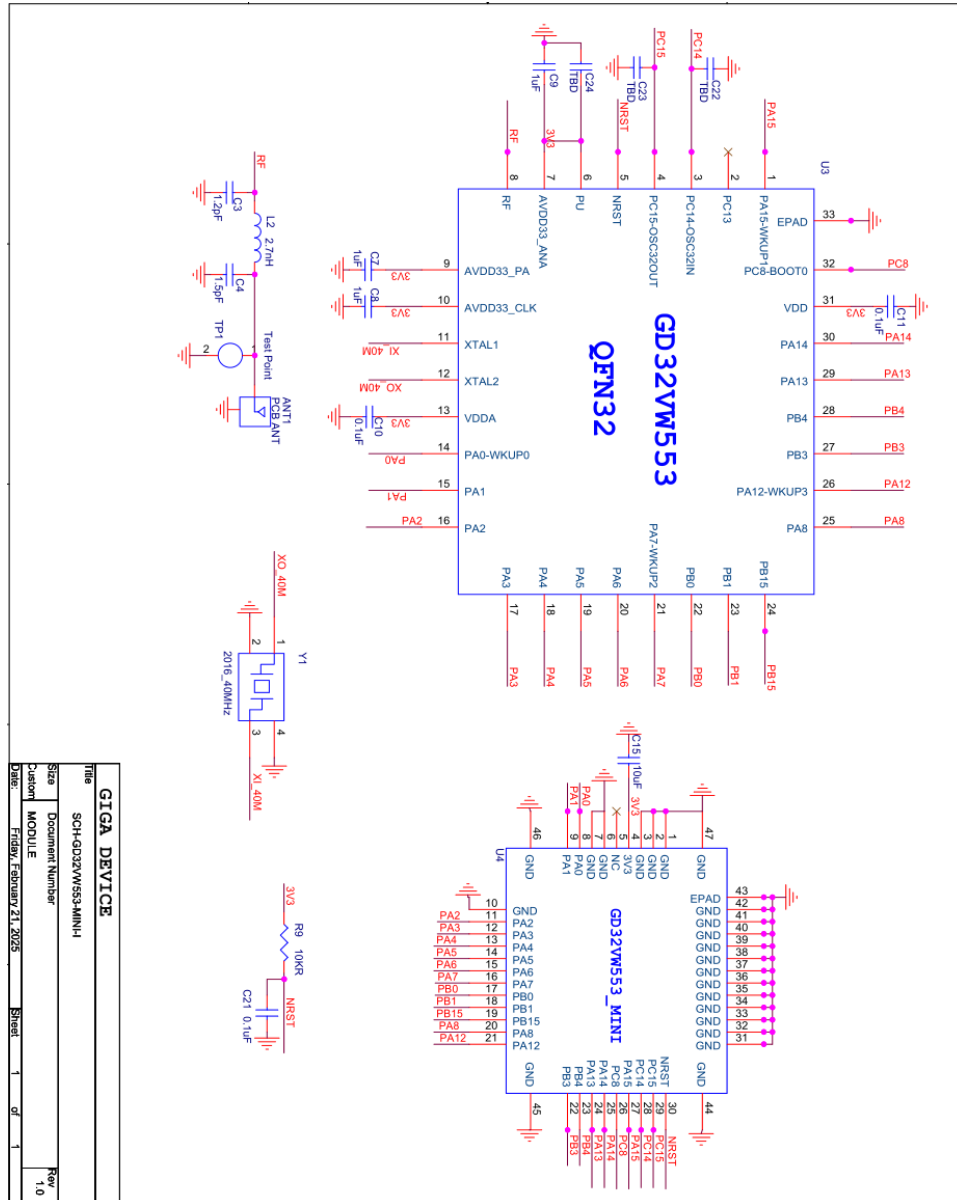
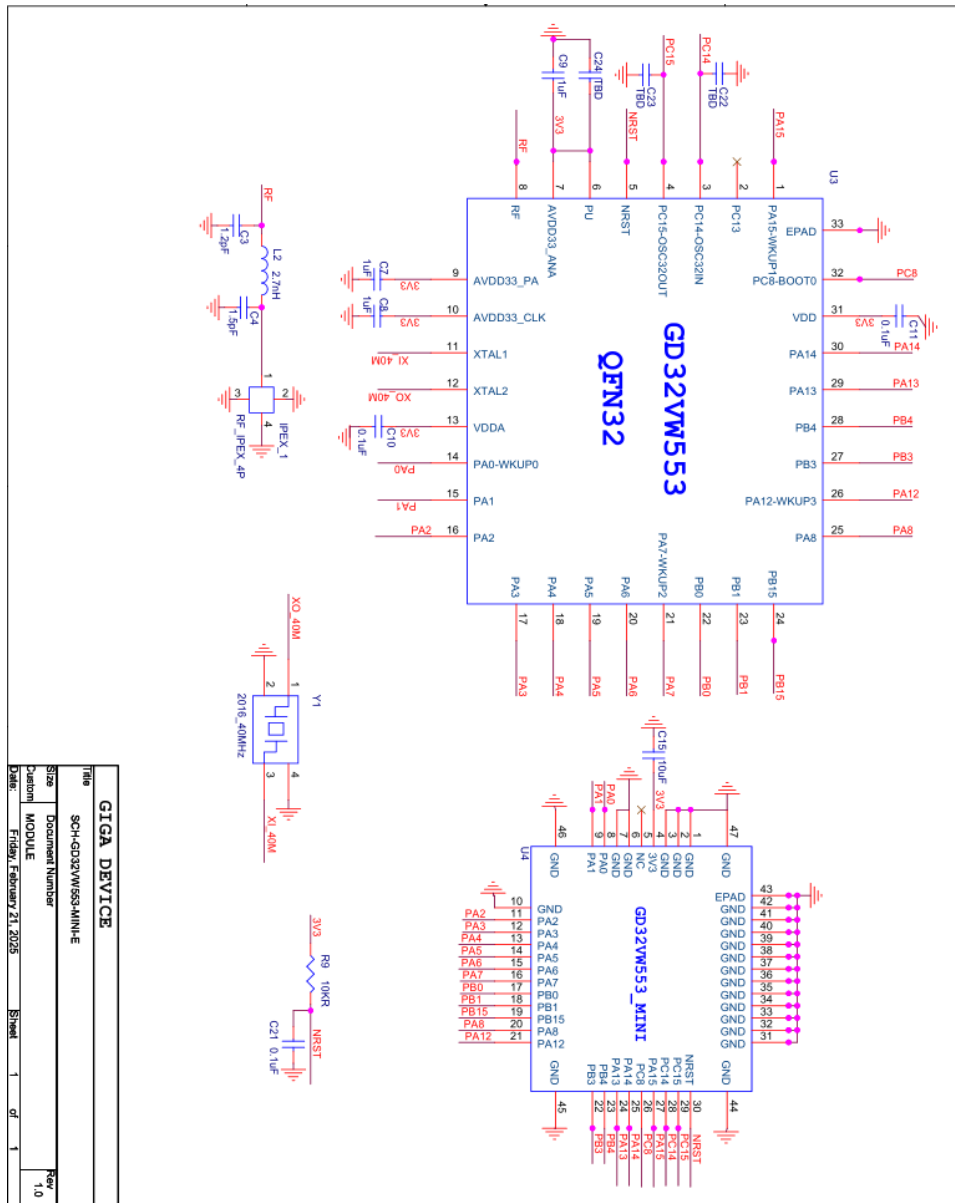


Figure 8-2. Module Schematic of GD32VW553-MINI-E



GIGA DEVICE	
Title	SCH-GD32VW553-MINI-E
Size	Document Number
Custom	MODULE
Date:	Friday, February 21, 2025
Sheet	1 of 1
Rev	1.0

## 9. Peripheral circuit reference design

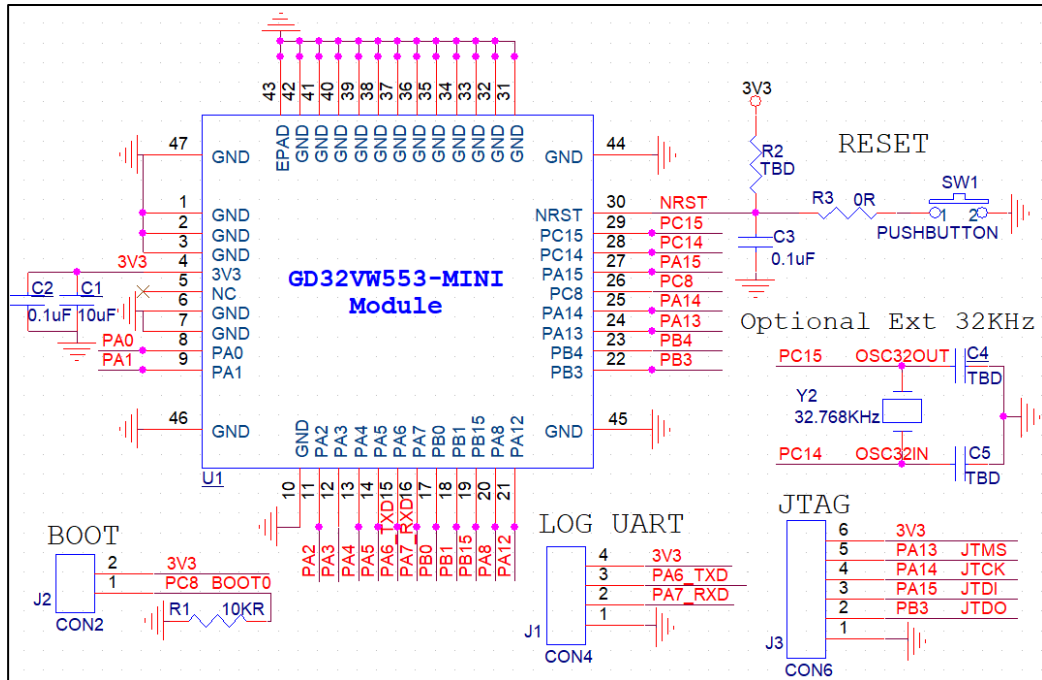
Module pin NRST is the reset pin of the GD32VW553. The chip can operate only when NRST is pulled up. A 0.1uF filter capacitor and a 10K Ohm pull-up resistor have been placed in the module circuit.

The Uart pins(PA6/PA7) are recommended to be connected out, which support functions of basic commands, log output and Uart download. Besides, if AT commands are needed, another pair of Uart pins(PB15/PA8) should be connected out as well.

For normal startup, GD32VW553 needs to be booted from flash, therefore pin BOOT0 needs to be pulled down before NRST power on. For Uart download mode, BOOT0 needs to be pulled up before NRST power on.

The power supply for 3V3 pin must provide a minimum of 500mA, and it is recommended to place a 10uF and a 0.1uF capacitor near this pin.

Figure 9-1. Reference design

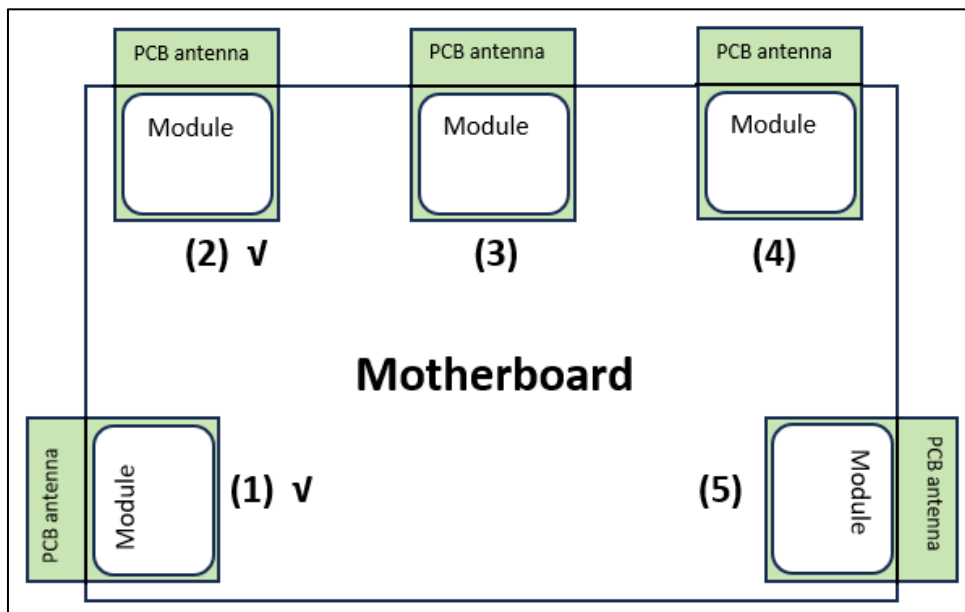


## 10. Requirements for antenna placement

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 10-1. Recommended Placement**



## 11. Recommended reflow profile

**Product Model:** SAC305YM102

**Supplies:** WTO

**Process condition:**

The 1st Ramp up speed: below 4°C.

The Preheat Time(A-B): 60-120S.

The 2nd Ramp up speed: below 4°C.

Peak Temperature: 235-250°C.

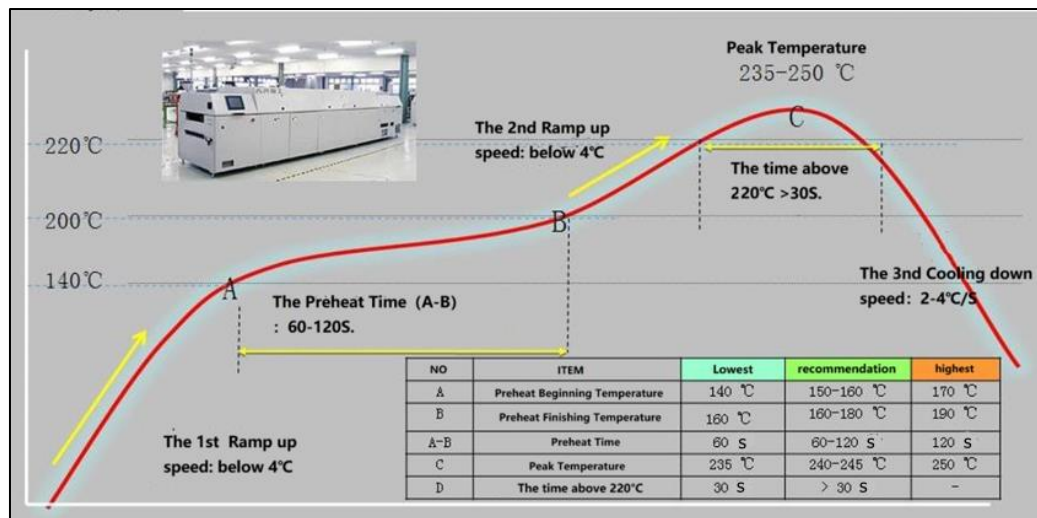
The time above 220°C: 30S.

The 3rd Cooling down speed: 2-4°C/S

**Table 11-1. Reflow process and condition**

No	Item	Min	Recommend	Max
A	Preheat Beginning Temperature	140°C	150-160°C	170°C
B	Preheat Finishing Temperature	160°C	160-180°C	190°C
A-B	Preheat Time	60S	60-120S	120S
C	Peak Temperature	235°C	240-245°C	250°C
D	The time above 220°C	30S	> 30S	-

**Figure 11-1. Recommended reflow profile**



## 12. Package

Figure 12-1. Package detail

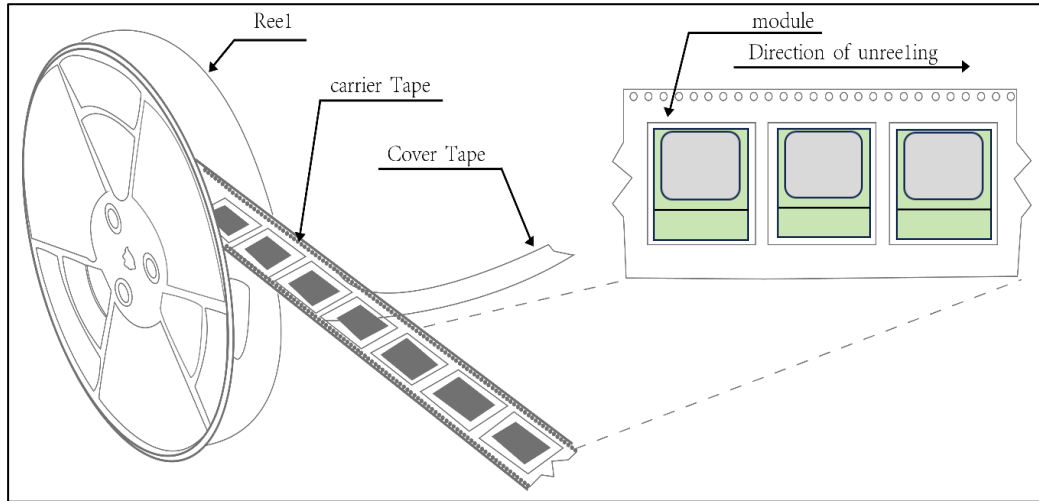


Table 12-1. Package Information

Module Part Number	Package(T/R)	SPQ
GD32VW553-MINI-IMK6	R	800
GD32VW553-MINI-IMK7	R	800
GD32VW553-MINI-EMK6	R	800
GD32VW553-MINI-EMK7	R	800



## 13. 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 <math><40^{\circ}\text{C}</math> and <math><90\%</math> relative humidity (RH).
- b) Environmental condition during the production:  $30^{\circ}\text{C}$  / 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.
- d) Baking is required if either conditions b) or c) are not respected.
- e) Baking is required if the humidity indicator inside the bag indicates 10% RH or more.

## 14. Related Documents and Resources

- [GD32VW553xx Datasheet](#)-- Datasheet of GD32VW553xx Series Wireless MCU
- [GD32VW55x User Manual](#)—User Manual of GD32VW553xx Series Wireless MCU
- [GD32VW553K-START Demo Suites](#)-- User Guide of GD32VW553xx Start Board
- [GD32VW553 Basic Commands User Guide](#)--User Guide of Basic commands for WiFi and BLE functions
- [GD32VW553 AT Command User Guide](#)--User Guide of AT commands for WiFi and BLE functions
- Related Application Note:  
<https://www.gd32mcu.com/cn/download/10?kw=GD32VW5>
- Related Software resources:  
<https://www.gd32mcu.com/cn/download/7?kw=GD32VW5>

## 15. Revision history

Table 15-1. Revision history

Revision No.	Description	Date
1.0	Initial Release	Dec.4 <sup>th</sup> , 2024
1.1	Add module schematic and modify pin description	Feb 25 <sup>th</sup> , 2025

## 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 its 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 its 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.