

GigaDevice Semiconductor Inc.

GD32VW553K-START
User Guide

Rev1.0

Table of Contents

Table of Contents	1
List of Figures	2
List of Tables	3
1. Summary	4
2. Function Pin Assign	6
2.1. IO Connection	6
2.2. Main Interfaces	7
3. Basic Operation	8
3.1. Hardware Configuration	8
3.2. Software Configuration	8
3.2.1. Driver Installation	8
3.2.2. Firmware Download	9
3.3. Operation Guide	10
3.3.1. AN154 GD32VW553 Quick Development Guide	10
3.3.2. AN158 GD32VW553 Wi-Fi Development Guide	10
3.3.3. AN152 GD32VW553 BLE Development Guide	10
3.3.4. AN153 GD32VW553 Basic Commands User Guide	10
3.3.5. AN151 GD32VW553 AT Command User Guide	10
3.3.6. AN149 Test Guidelines for RF Performance and Transceiver Power Consumption of GD32VW553	11
3.3.7. AN150 Test Guidelines for Throughput and Scenario-based Power Consumption of GD32VW553	11
3.3.8. AN146 GD32VW553 Certification Test Guidelines	11
4. Schematic	13
5. Layout	14
6. Revision History	20

List of Figures

Figure 1-1. GD32VW553K-START Appearance.....	4
Figure 3-1. Installation of serial port drive	9
Figure 3-2 DAPLINK Folder	9
Figure 4-1 START Evaluation Board Schematic.....	13
Figure 5-1. TOP Overlay.....	14
Figure 5-2. Bottom Overlay.....	15
Figure 5-3. TOP Layer	16
Figure 5-4. GND Layer	17
Figure 5-5. VCC Layer	18
Figure 5-6. Bottom Layer	19

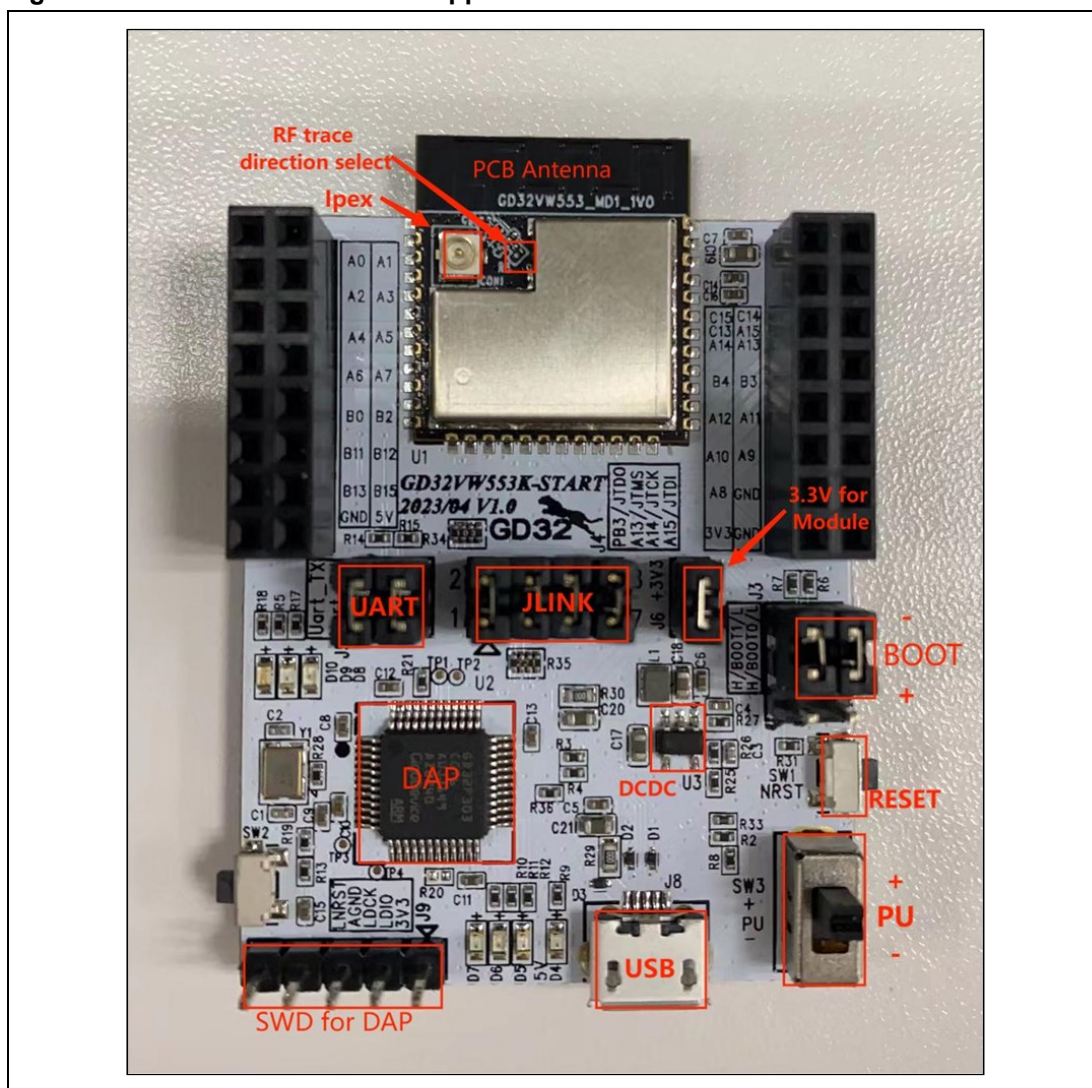
List of Tables

Table 1-1. GD32VW553K-START RF Characterization.....	5
Table 2-1. GD32VW553K-START Connectors and Switch Functions	6
Table 2-2. GD32VW553K-START Main Interfaces Description.....	7
Table 6-1 Revision History	20

1. Summary

The GD32VW553K-START evaluation board is an RF performance evaluation board developed for the GD32VW553 series of dual-mode wireless microcontrollers. The core device is the GD32VW553 wireless module, which contains a GD32VW553 series MCU. The GD32VW553 series MCU adopts a new open-source instruction set architecture RISC-V processor core with a main frequency of up to 160MHz. The integrated 2.4GHz Wi-Fi 6 and Bluetooth LE 5.2 RF module provides advanced baseband and RF performance, which is suitable for a wide range of wireless application scenarios, such as smart home appliances, smart home, industrial interconnection, and communication gateway.

Figure 1-1. GD32VW553K-START Appearance



The GD32VW553K-START is based on a Micro USB interface to power the system and provide serial communication. The DC-DC power supply chip on the START evaluation board converts the 5V input from USB to 3.3V to power the GD32VW553_MD1 wireless module and the DAP chip based on the configuration utilizing the GD32F303, or it can be connected to 5V externally to power the system via J1.16.

The GD32VW553K-START provides test interfaces for all the chip's GPIO ports, as well as the main chip's PU switches and NRST switches, the BOOT0 / 1 interface, the UART interface, the JTAG interface, and the DAP chip's burn-in interface.

Based on the START board, the tests that can be accomplished include but are not limited to: Non-signaling mode Wi-Fi & BLE transmitting and receiving RF indicators test, signaling mode Wi-Fi transmitting and receiving throughput indicators test, Wi-Fi & BLE power consumption indicators test in various scenarios, FCC / CE / SRRC certification regulations test, and other Wi-Fi and BLE hardware and software system function and performance test.

The GD32VW553K-START can also help developers to complete the compilation and debugging of applications developed based on the Wi-Fi and BLE APIs of the GD32VW553K series chips. For more details on the above test and use operation guide, please refer to the [Operation Guide](#) section of this document.

Table 1-1. GD32VW553K-START RF Characterization

Parameter Term	Instructions
Operation Frequency	2400-2483.5MHz
Wi-Fi Specification	IEEE 802.11b / g / n / ax
Data Transmission Rate	11b: 1,2,5.5,11(Mbps) 11g: 6,9,12,18,24,36,48,54(Mbps) 11n: HT20 MCS0-7. 11ax: HE20 MCS0-9. BLE 5.2: 125, 500(Kbps), 1, 2(Mbps)
Antenna Type	PCB Onboard Antenna, Gain 2-3dBi External Ipex Antenna

2. Function Pin Assign

This chapter describes each of the GD32VW553K-START connections and the main interfaces.

2.1. IO Connection

Table 2-1. GD32VW553K-START Connectors and Switch Functions

Interface	Description
J1	Interface to GPIO pins PA0~PA7 / PB0 / PB2 / PB11 / PB12 / PB13 / PB15 of the main chip, as well as +5V interface and GND interface.
J2	Interface to main chip PA8~PA15 / PB3 / PB4 / PC13~PC15 GPIO pins, as well as module +3.3V power supply test interface, GND interface.
J3	Connect to the main chip PC8 (BOOT0) and PB1 (BOOT1) pins, Boot mode selection needs to be configured accordingly. Default Boot0 / 1 use shorting caps pull-down, that is, the chip default boot from Sip flash.
J4	Interface to the JTAG pins of PB3(JTDO) / PA13(JTMS) / PA14(JTCK) / PA15(JTDI) of the main chip, and interface to the JTAG pins of L_TDO / L_TMS / L_TCK / L_TDI of the DAP chip. By default, the above pins of the main chip and the DAP chip are connected by shorting caps, and the firmware can be burned into the main chip by the DAP chip.
J5	The interface to the UART T / RX pins of the main chip PA6 (UART2_TX) and PA7 (UART2_RX), and the interface to the L_UART_RX and L_UART_TX UART R / TX pins of the DAP chip. By default, the above pins of the main chip and the DAP chip are connected via shorting caps, so that serial communication can be done between the DAP chip and the main chip.
J6	GD32VW553 module 3.3V power supply connection port, the default use of short-circuit cap connection. For power consumption test, external 3.3V power supply can be directly connected to J6.2.
J8	Micro USB interface, default serial communication and +5V power supply interface.
J9	Interface to DAP chip L_SWKDIO / L_SWKDCK / L_NRST and other SWD pins, as well as DAP +3.3V power supply test interface and GND interface.
SW1	Connect the module to the NRST pin with GND via a 1K ohm resistor pull-up to 3.3 V. Press and release this switch to Reset the main chip.
SW2	Connect the DAP chip to the UART Download pin and GND via the 1K ohm resistor pull-up to 3.3V, press and hold the switch, connect the START evaluation board to the PC via the USB cable, and then release the switch to copy/paste the firmware of the DAP chip to be burned.
SW3	Connect the module to the PU pin in series with +3.3V power supply (or GND) via a 1K ohm resistor. Switch up toggle, main chip power up, switch down toggle, main chip power down.

2.2. Main Interfaces

Table 2-2. GD32VW553K-START Main Interfaces Description

Interface	Description
PA0	IO port that can be configured by the user.
PA1	IO port that can be configured by the user.
PA2	IO port that can be configured by the user.
PA3	IO port that can be configured by the user.
PA4	IO port that can be configured by the user.
PA5	IO port that can be configured by the user.
PA6 / UART2_TX	IO port that can be configured by the user; UART TX.
PA7 / UART2_RX	IO port that can be configured by the user; UART RX.
PB0	IO port that can be configured by the user.
PB1 / BOOT1	IO port that can be configured by the user; Boot mode selection.
PB2	IO port that can be configured by the user.
GND	Reference ground
PB11	IO port that can be configured by the user.
PB12	IO port that can be configured by the user.
PB13	IO port that can be configured by the user.
PB15	IO port that can be configured by the user.
PA8	IO port that can be configured by the user.
PA9	IO port that can be configured by the user.
PA10	IO port that can be configured by the user.
PA11	IO port that can be configured by the user.
PA12	IO port that can be configured by the user.
PB3 / JTDO	IO port that can be configured by the user; JTDO pin.
PB4 / JNTRST	IO port that can be configured by the user; JNTRST pin.
PA13 / JTMS	IO port that can be configured by the user; JTMS pin.
PA14 / JTCK	IO port that can be configured by the user; JTCK pin.
PC8 / BOOT0	IO port that can be configured by the user; Boot mode select.
PA15 / JTDI	IO port that can be configured by the user; JTDI pin.
PC13	IO port that can be configured by the user.
PC14	IO port that can be configured by the user.
PC15	IO port that can be configured by the user.
NRST	Module enable pin, connect to 3.3V power supply to enable the module.
PU	Module enable pin, connect to 3.3V power supply to enable the module.
3V3	3.3V power supply pin
GND	Reference ground

3. Basic Operation

This chapter covers the GD32VW553K-START hardware configuration, software configuration and basic usage guidelines.

3.1. Hardware Configuration

The START evaluation board appearance is shown in [Figure 1-1. GD32VW553K-START Appearance](#) Among them:

- UART & JLINK functions: The communication function of USB to UART and the firmware burning function of USB to JLINK are realized through the DAP chip circuit on the bottom board, and PC is connected to the USB port of the bottom board through a USB cable.
- Serial port connection: Serial ports are connected to the bottom board J5.2 / 4 (main chip UART PIN) and J5.1 / 3 (DAP UART PIN)) respectively with shorting caps.
- JLINK connection: JLINK are connected to the bottom board J4.2 / 4 / 6 / 8 (main chip JLINK PIN) and J4.1 / 3 / 5 / 7 (DAP JLINK PIN)) respectively with shorting caps.
- Configuration of the main chip mode:
 - "BOOT0" of PIN should be at low level (boot from flash), which is realized by configuring the shorting caps J3.3 and J3.5 on the bottom board.
 - "PU" of PIN should be at high level, which is realized by "pressing" the switch "SW3" on the bottom board.
- Module antenna switching: Switch the position of the resistor by welding [Figure 1-1. GD32VW553K-START Appearance](#) to select the RF signal path of DUT: When the left side of the resistor faces upward, the RF path leads to the PCB antenna and can only be used for radiation test; when the left side of the resistor faces downward, the RF path leads to the RF (Iplex) connector and is used for conduction test or radiation test of the external antenna. This document targets on radiation test.
- Module power supply: The DCDC circuit on the bottom board converts the 5V power input from the USB port into a 3V3 output, and the 3V3 output is connected to the 3V3 pad of the module through the shorting cap "J6". Disconnect this shorting cap (from external 3V3 output to J6.2) to test power consumption of the module.

3.2. Software Configuration

3.2.1. Driver Installation

After the development board hardware and the test system are built, connect the development board and PC via a USB cable. Firstly install the DAPLINK drive "bedWinSerial_16466.rar" on PC: After decompression, double-click the .exe file to start automatic installation. After installation, the serial port device and COM number [Figure 3-1. Installation of serial port drive](#) are displayed in the "Device Manager" on PC. It is recommended to install Windows 10/Windows 7 system on PC.

Figure 3-1. Installation of serial port drive



3.2.2. Firmware Download

The START evaluation board has an integrated DAPLINK circuit (GD32F303) that can be used with OpenOCD. The DAP chip also integrates UART function, so only one Micro-USB cable is needed for power supply, debugging and log viewing at the same time.

Connect the pins JTCK, JTMS, JTDO and JTDI to the lower four pins via shorting caps, so that you can download and debug the code via DAPLINK: After installing the DAPLINK driver, you can find a new "DAPLINK" diskette in the PC - "Explorer" ([Figure 3-2 DAPLINK Folder](#)). After that, you can directly "drag and drop" (or copy and paste) the .bin format firmware provided by GigaDevice to this disk drive and wait for a moment to realize the firmware burning, and then press the "reset" button on the side of the evaluation board to reboot the chip after completion.

However, the above burning method is limited by the ability of the DAP chip, the debugging and downloading speed is relatively slow, so it is also recommended to connect an external GDLINK or JLINK debugger to the JTAG interface of the evaluation board for more efficient downloading and debugging.

Figure 3-2 DAPLINK Folder



3.3. Operation Guide

The [GD32VW5 series MCU resource download page](#) provides complete test and application notes for the chip, most of the test and development descriptions in the notes are based on the GD32VW553K-START to complete, so this operation guide subsection will not repeat the description of the existing contents of the application notes, and will only make a brief introduction of each test and application development guide, and prompt some of the matters that need attention.

3.3.1. AN154 GD32VW553 Quick Development Guide

[GD32VW553 Quick Development Guide](#) aims to guide developers to get started with Wi-Fi and BLE development on the corresponding evaluation boards for the GD32VW553 series chips. The main contents include the building of GD32Eclipse IDE development environment, SDK configuration, compiling and debugging SDK under GD32Eclipse IDE.

3.3.2. AN158 GD32VW553 Wi-Fi Development Guide

[GD32VW553 Wi-Fi Development Guide](#) aims to help developers familiarize themselves with the SDK and develop their own applications using the APIs. The main contents include the Wi-Fi SDK software framework, the startup process, and the introduction of Wi-Fi and related component APIs. The Development Guide is composed of three parts: OSAL API usage, Wi-Fi Netif API usage, and Wi-Fi management related API usage. It also uses a specific use case to introduce how to use the component API to scan wireless networks, connect to APs, start soft AP and connect to Alibaba Cloud and other operations.

3.3.3. AN152 GD32VW553 BLE Development Guide

[GD32VW553 BLE Development Guide](#) aims to help developers familiarize themselves with and develop their own applications using the BLE API. It describes in detail the BLE software framework and the related API interfaces, and introduces BLE Scanning, BLE Broadcasting, BLE GATT server application, and BLE Distribution Networking content with a specific use case.

3.3.4. AN153 GD32VW553 Basic Commands User Guide

[The GD32VW553 Basic Commands User Guide](#) aims to introduce the various basic UART-based commands required for Wi-Fi and BLE hardware and software system functionality and performance testing of the GD32VW553 series chips.

3.3.5. AN151 GD32VW553 AT Command User Guide

[The GD32VW553 AT Command User Guide](#) aims to guide developers in testing and

developing the GD32VW553 series chips based on the AT command.

3.3.6. **AN149 Test Guidelines for RF Performance and Transceiver Power Consumption of GD32VW553**

[The Test Guidelines for RF Performance and Transceiver Power Consumption of GD32VW553](#) aims to guide developers to evaluate the Wi-Fi & BLE transmit and receive RF performance and corresponding power consumption of the GD32VW553K-START in non-signaling mode. The Test Guidelines is about the three parts of the test method of RF performance using RF tools, using serial commands, and the test method of non-signaling RF transmitting and receiving power consumption. The Test Guidelines also introduces the configuration of the test system and the hardware and software of the START board, as well as common problems and solutions.

Note that this test requires burning the RF test firmware with keyword "rf_test".

3.3.7. **AN150 Test Guidelines for Throughput and Scenario-based Power Consumption of GD32VW553**

[Test Guidelines for Throughput and Scenario-based Power Consumption of GD32VW553](#) aims to guide developers to evaluate the Wi-Fi transmitting and receiving throughput performance and various scenario power consumption of GD32VW553K-START in signaling mode.

The Test Guidelines firstly introduces the test method of using serial tools and commands to evaluate the TCP TX / RX and UDP TX / RX throughput metrics in signaling mode, and testers can burn the signaling test firmware with keyword "wifi_signaling_test" for targeted testing. Secondly, it introduces the test methods of power consumption for four scenarios: Wi-Fi off, connecting AP+UDP TX, connecting AP+UDP RX, connecting AP+power saving & DTIM=1.

The Test Guidelines also introduces the configuration of the test system and the hardware and software of the START board, as well as common problems and solutions.

3.3.8. **AN146 GD32VW553 Certification Test Guidelines**

[The GD32VW553 Certification Test Guidelines](#) aims to guide developers to evaluate the START board's RF-related FCC / CE / SRRC certification regulations.

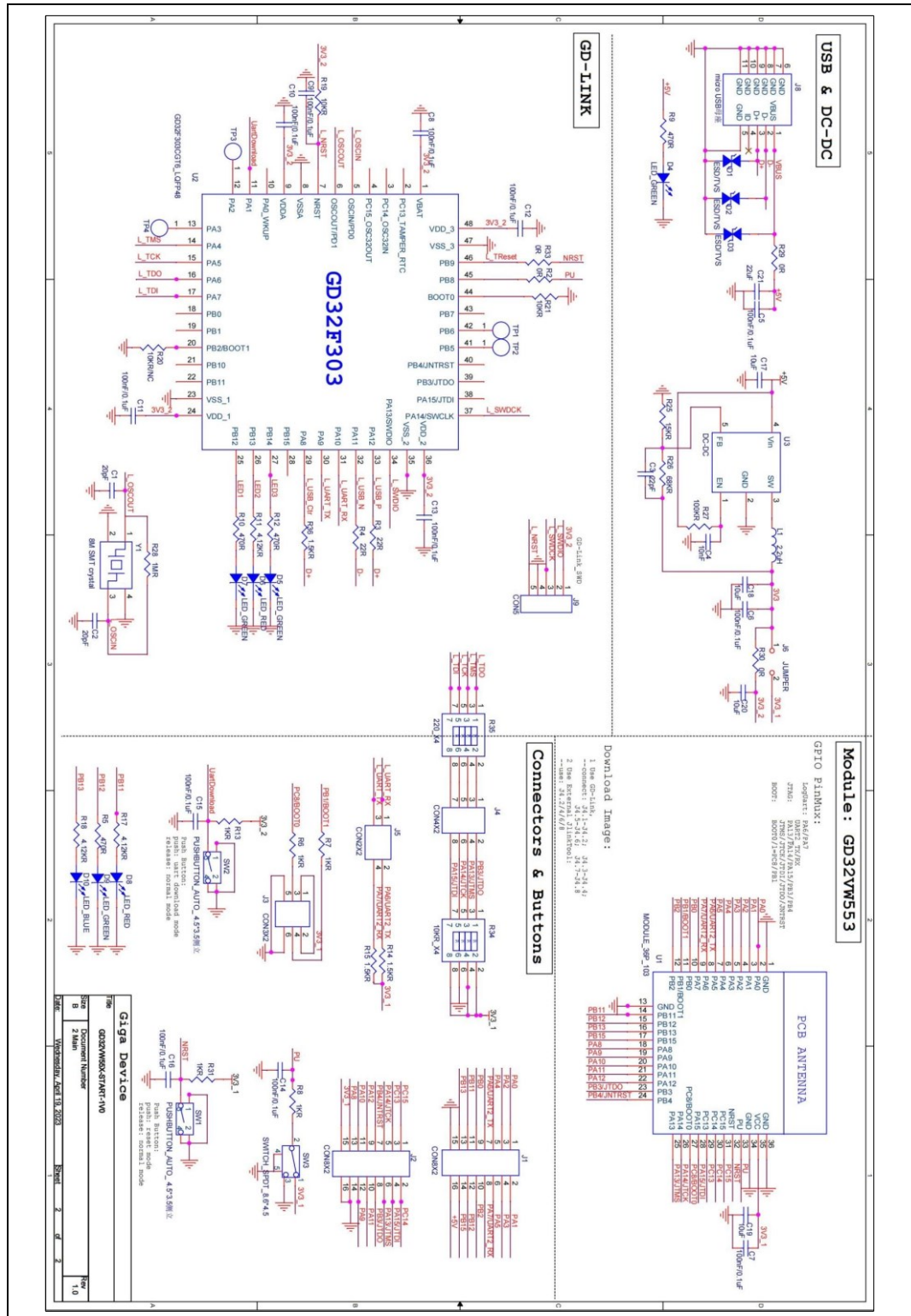
It introduces the methods of using RF tools and serial commands to evaluate the TX / RX indicators of non-signaling modes in each certification, as well as the methods of using serial commands to evaluate the "Blocking" and "Adaptivity" test items of signaling modes in CE certification.

Meanwhile, the article also introduces the configuration of the test system and the hardware and software of the START board, as well as the common problems and solutions.

It should be noted that this test requires burning the corresponding firmware according to the specific test items.

4. Schematic

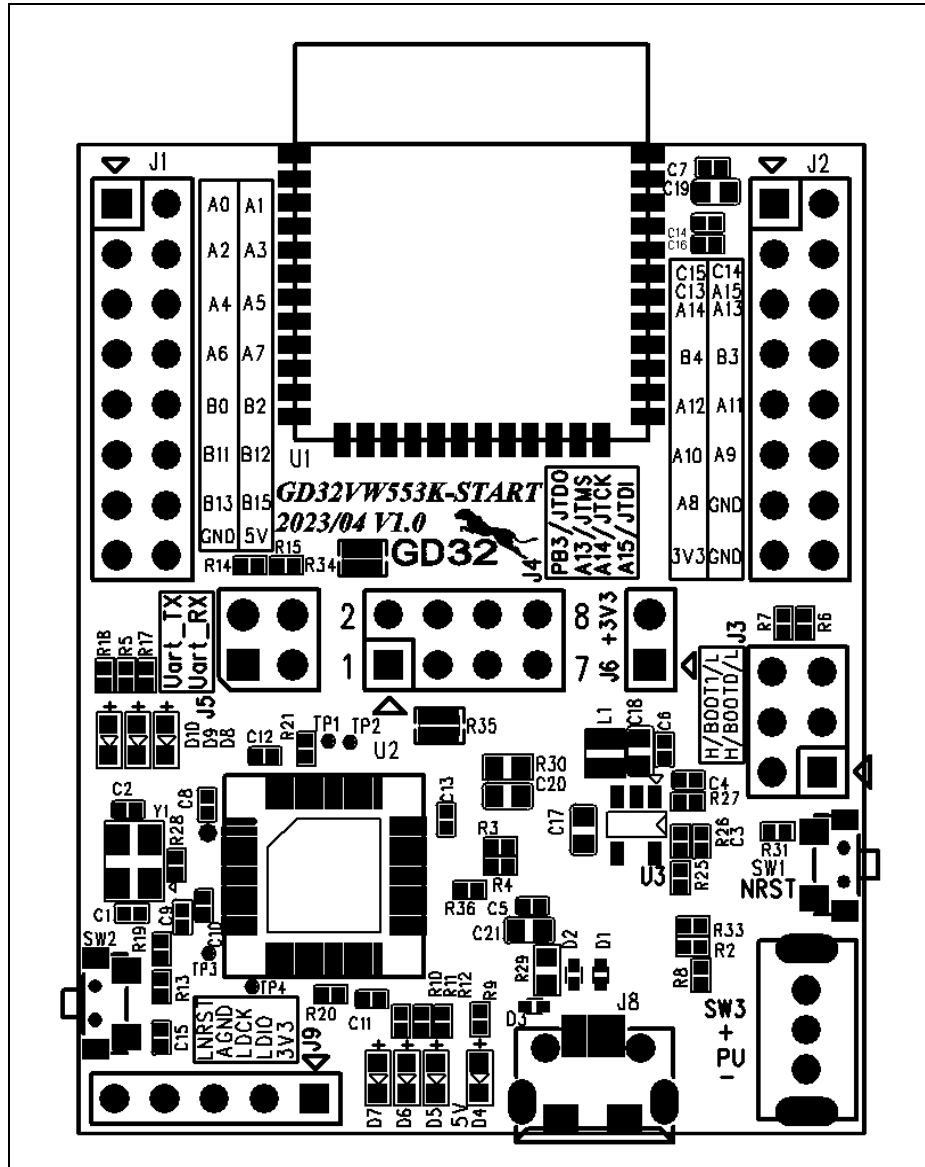
Figure 4-1 START Evaluation Board Schematic



5. Layout

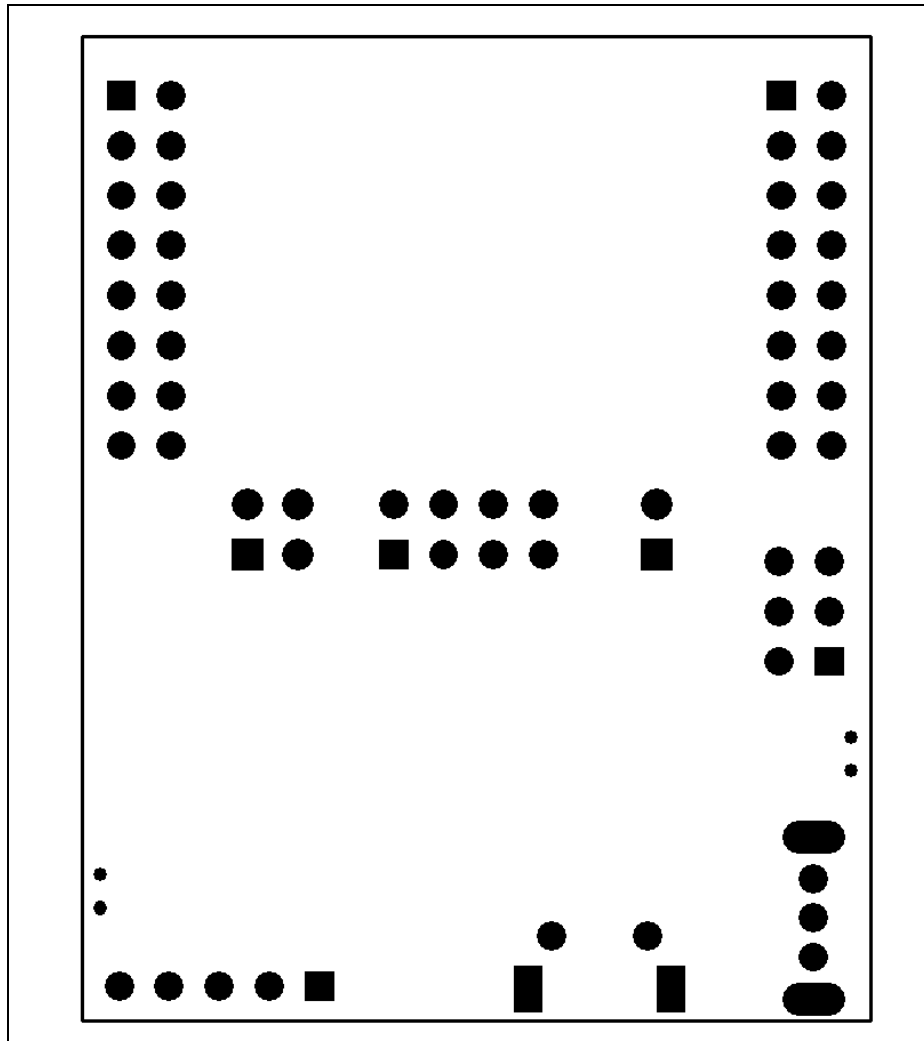
TOP Overlay

Figure 5-1. TOP Overlay



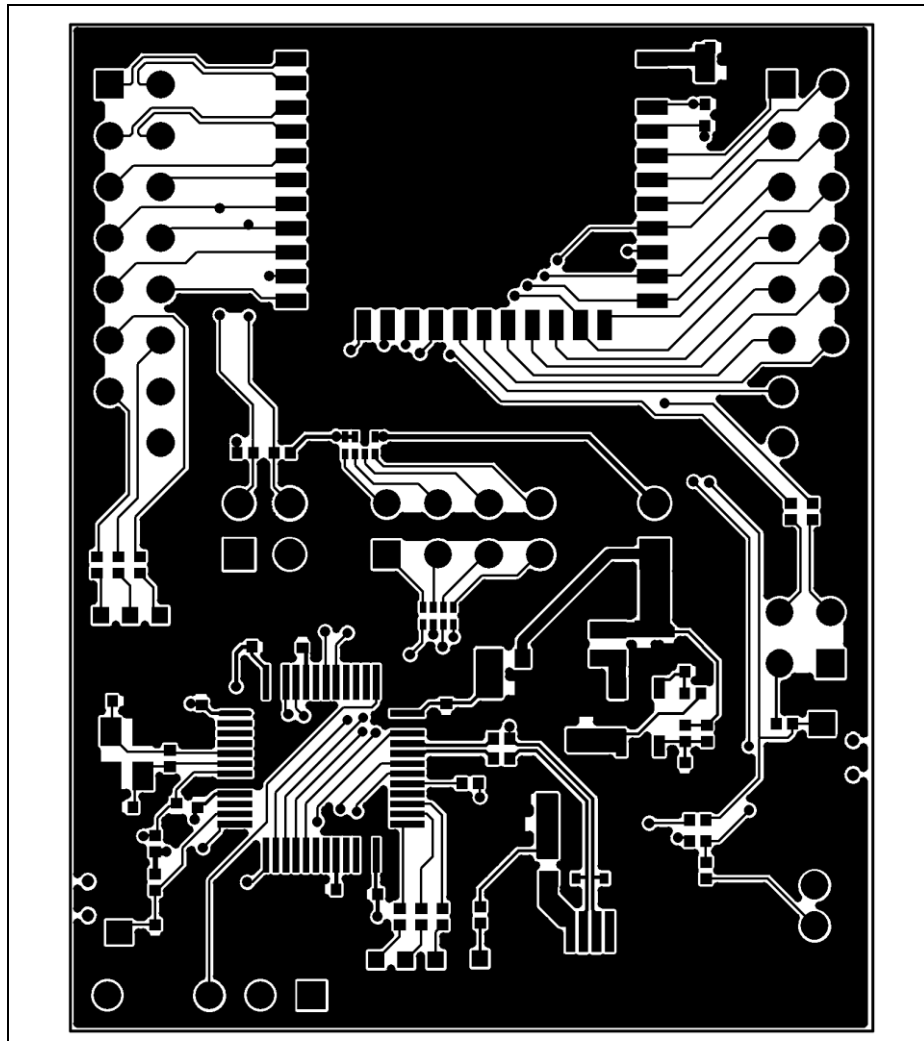
Bottom Overlay

Figure 5-2. Bottom Overlay



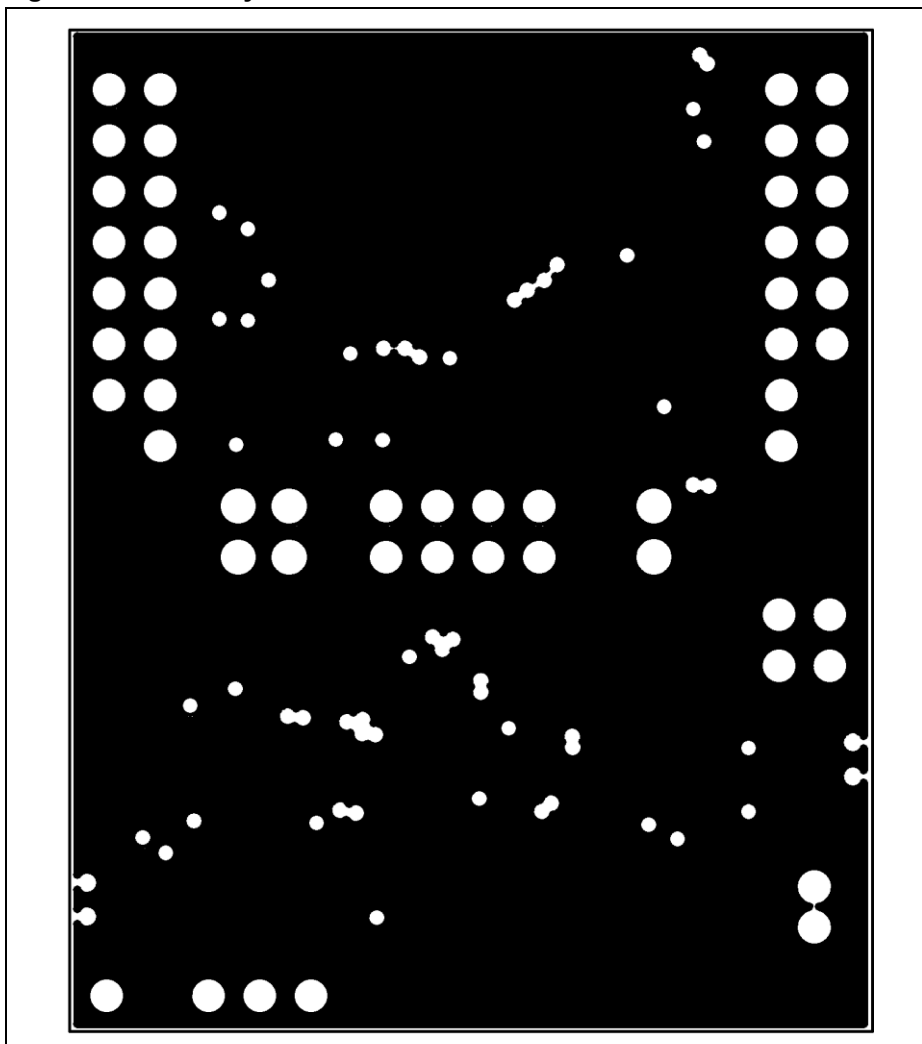
TOP Layer

Figure 5-3. TOP Layer



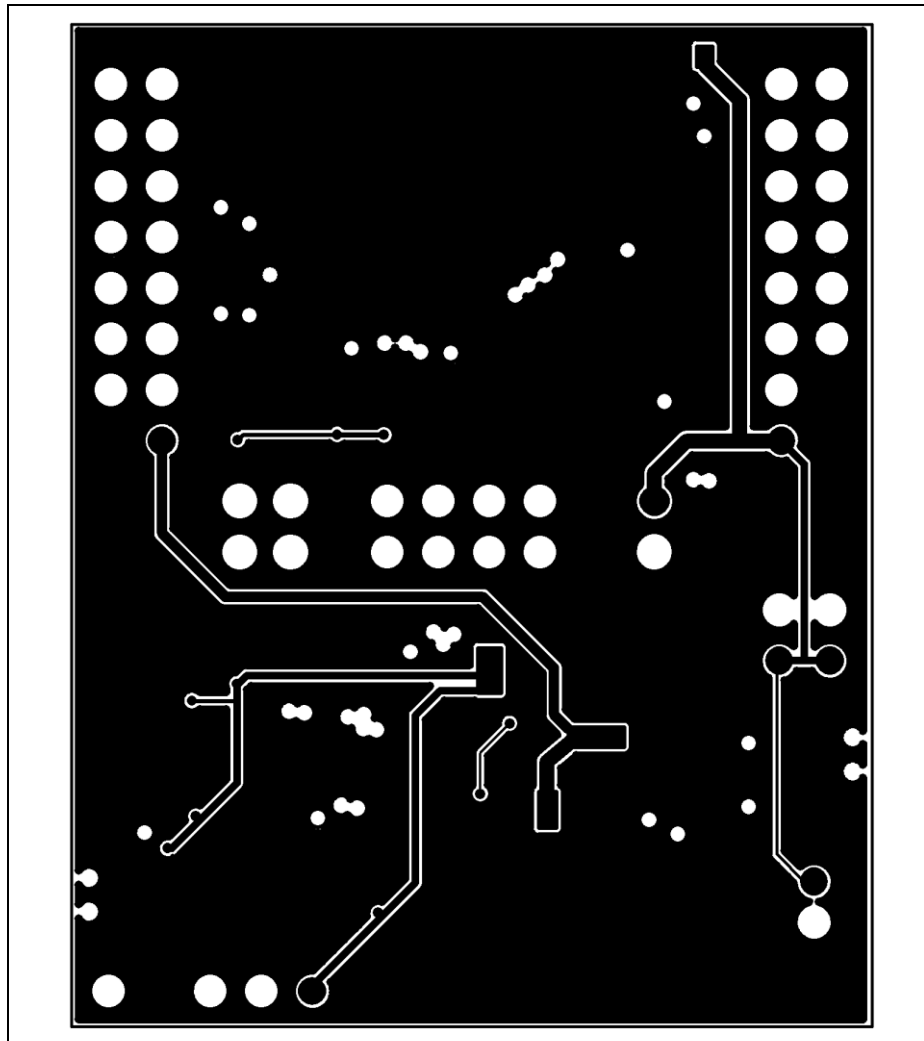
GND Layer

Figure 5-4. GND Layer



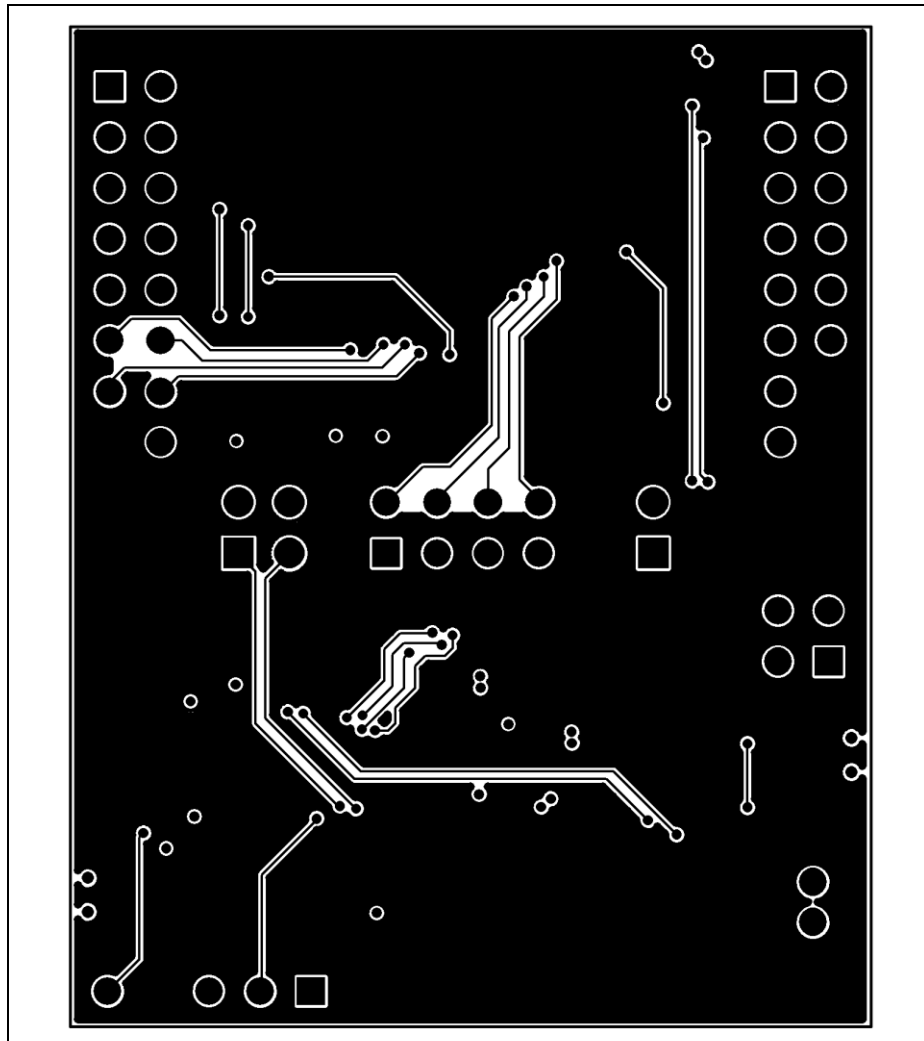
VCC Layer

Figure 5-5. VCC Layer



Bottom Layer

Figure 5-6. Bottom Layer



6. Revision History

Table 6-1 Revision History

Revision No.	Description	Date
1.0	Initial release	1/5/2024

Important Notice

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