

GigaDevice Semiconductor Inc.

GD32W515T-START
User's Guide

Rev1.0

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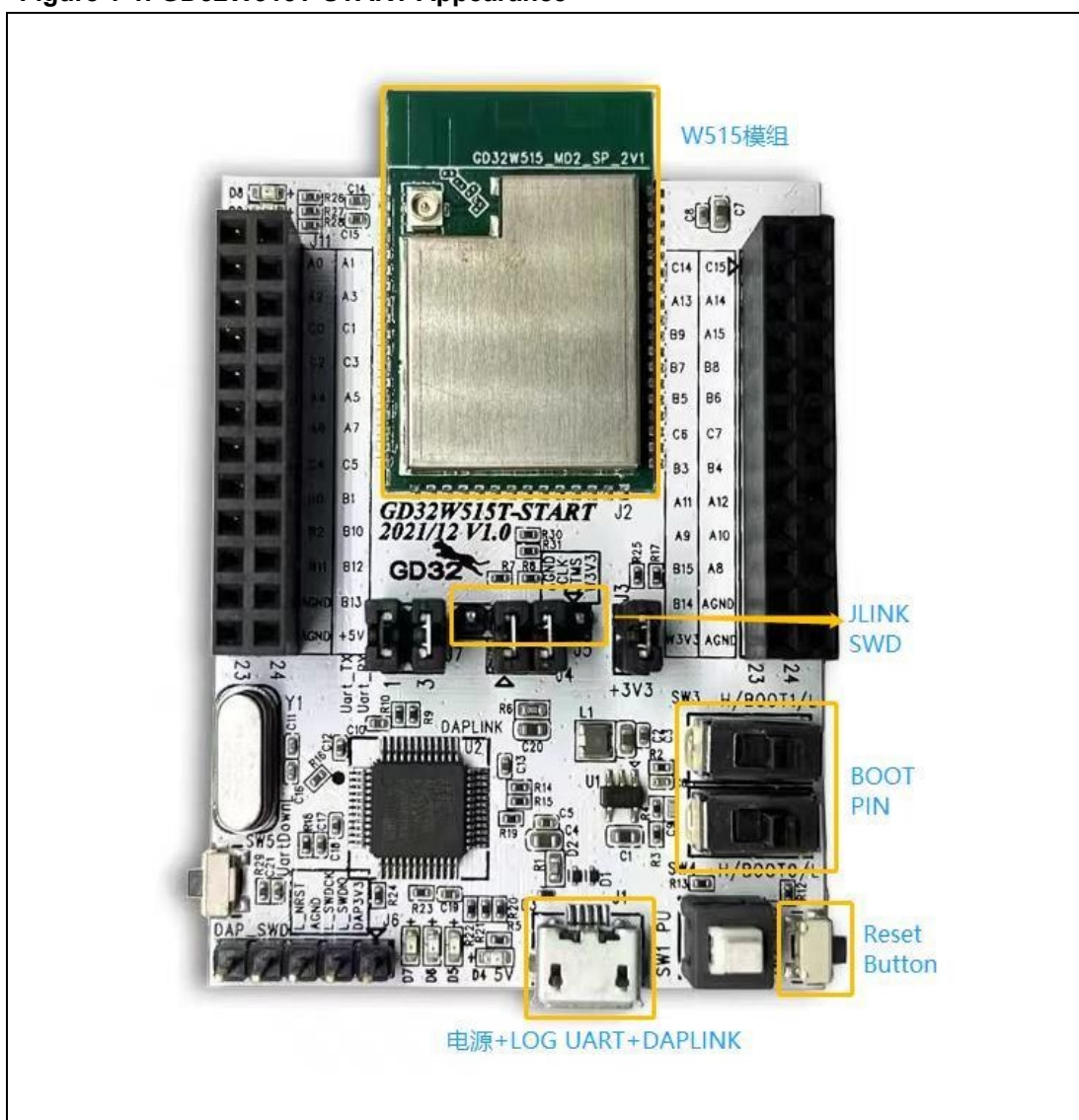
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1. Summary

The GD32W515T-START is an RF performance evaluation board developed for the GD32W515 series of wireless microcontrollers. The core device is the GD32W515T wireless module, which contains a GD32W515 series MCU. The GD32W515 series MCUs adopt the latest Arm® Cortex®-M33 core with a main frequency of up to 180MHz, and the on-chip integrated 2.4GHz single-stream IEEE802.11b / g / n MAC / Baseband / RF module provides advanced baseband and RF performance, which is applicable to a wide range of wireless application scenarios, such as smart appliances, smart homes, industrial interconnections, and communication networks gateway and other wireless application scenarios.

Figure 1-1. GD32W515T-START Appearance



The GD32W515T-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 converts the 5V input from USB to 3.3V to power the GD32W515T_MDx 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 J11.24.

The GD32W515T-START provides test interfaces for all the chip's GPIO ports, as well as the main chip's PU switch and NRST switch, the BOOT0 / 1 switches, the UART interface, the JTAG interface, and the DAP chip's burn-in interface.

Based on the GD32W515T-START, the tests that can be accomplished include but are not limited to: Non-signaling mode Wi-Fi transmitting and receiving RF indicators, signaling mode Wi-Fi transmitting and receiving throughput indicators, Wi-Fi power consumption indicators in various scenarios, FCC / CE / SRRC certification regulations, and other Wi-Fi hardware and software system function and performance testing.

The GD32W515T-START can also help developers to complete the compilation and debugging of applications developed based on the Wi-Fi APIs of the GD32W515 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. GD32W515T-START RF Characterization

Parameter Term	Instructions
Operation Frequency	2412-2483.5MHz
Wi-Fi Specification	IEEE 802.11b / g / n
Data Transmission Rate	11b: 1, 2, 5.5, 11 (Mbps) 11g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbps) 11n: HT20 MCS0-7; HT40 MCS0-7
Antenna Type	PCB Onboard Antenna, Gain 2-3dB External IpeX Antenna

2. Function Pin Assign

This chapter describes each of the GD32W515T-START connections and the main interfaces.

2.1. IO Connection

Table 2-1. GD32W515T-START Connectors and Switch Functions

Interface	Description
J1	Micro USB interface, default serial communication and +5V power supply interface.
J3	GD32W515T 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 J3.2.
J4	Connect to DAP chip L_TMS / L_TCK interface. By default, the PA13 / PA14 pins of the main chip are connected to the L_TMS / L_TCK pins of the DAP chip via shorting caps (i.e., J4.1 / J4.2 are connected to J5.3 / J5.4 respectively), so that the firmware can be burned into the main chip through the DAP chip.
J5	Connect to the main chip PA13 / PA14, as well as the +3.3V supply and GND.
J6	Interface to DAP chip L_SWDIO / L_SWDCCK / L_NRST and other SWD pins, as well as DAP +3.3V power supply test interface and GND interface
J7	The interface to the UART T / RX pins of the main chip PB15(UART1_TX) and PA8 (UART1_RX), and the interface to the L_UART_RX and L_UART_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.
J10	Interfaces to the main chip PA8~PA15 / PB3~PB9 / PB14 / PB15 / PC6 / PC7 / PC14 / PC15 GPIO pins, as well as the module +3.3V power supply test interface and GND interface.
J11	Interface to the main chip PA0~PA7 / PB0~PB2 / PB10~PB13 / PC0~PC3 GPIO pins, as well as +5V interface, GND interface.
SW1	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.
SW2	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.
SW3 / SW4	Connect to the main chip BOOT1(PA14) and BOOT0 pins, Boot mode selection needs to be configured accordingly. Default Boot0 / 1 switches pull-down, that is, the chip default boot from Sip flash.
SW5	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 to the PC via the USB cable, and then release the switch to copy/paste the firmware of the DAP chip to be burned.

2.2. Main Interfaces

Table 2-2. GD32W515T-START Main Interfaces Description

Interface	Description
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.
PA0	IO port that can be configured by the user.
PA1	IO port that can be configured by the user.

Interface	Description
PA2	IO port that can be configured by the user.
PA3	IO port that can be configured by the user.
PC0	IO port that can be configured by the user.
PC1	IO port that can be configured by the user.
PC2	IO port that can be configured by the user.
PC3	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	IO port that can be configured by the user.
PA7	IO port that can be configured by the user.
PC4	IO port that can be configured by the user.
PC5	IO port that can be configured by the user.
PB0	IO port that can be configured by the user.
PB1	IO port that can be configured by the user.
PB2	IO port that can be configured by the user.
PB10	IO port that can be configured by the user.
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.
PB14	IO port that can be configured by the user.
PB15 / UART1_TX	IO port that can be configured by the user; UART TX.
PA8 / UART1_RX	IO port that can be configured by the user; UART RX.
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.
GND	Reference ground.
PA12	IO port that can be configured by the user.
PB3 / JTDO	IO port that can be configured by the user; JTDO pin.
PB4 / JNRST	IO port that can be configured by the user; JNRST pin.
PC6	IO port that can be configured by the user.
PC7	IO port that can be configured by the user.
PB5	IO port that can be configured by the user.
PB6	IO port that can be configured by the user.
PB7	IO port that can be configured by the user.
PB8	IO port that can be configured by the user.
PB9	IO port that can be configured by the user.
BOOT0	Boot mode selection.
PA15 / JTDI	IO port that can be configured by the user; JTDI pin.

Interface	Description
PA13 / JTMS	IO port that can be configured by the user; JTMS pin.
PA14 / JCLK / BOOT1	IO port that can be configured by the user; JCLK pin; Boot mode selection.
PC14	IO port that can be configured by the user.
PC15	IO port that can be configured by the user.
WIFI_3V3	3.3V power supply pin.
GND	Reference ground.

3. Basic Operating

This chapter covers the GD32W515T-START hardware configuration, software configuration and basic usage guidelines.

3.1. Hardware configuration

The START appearance is shown in [Figure 1-1. GD32W515T-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 J7.2 / 4 (main chip UART PIN) and J7.1 / 3 (DAP UART PIN)) respectively with shorting caps.
- JLINK connection: JLINK are connected to the bottom board J5.3 / 2 (main chip JLINK PIN) and J4.1 / 2 (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 switch SW4 on the bottom board.
- --"PU" of PIN should be at high level, which is realized by configuring the switch "SW1" on the bottom board.
- Module antenna switching:
- --Switch the position of the resistor by welding [Figure 1-1. GD32W515T-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 (Ipx) connector and is used for conduction test and radiation test of the external antenna. This document targets on radiation test.
- Module power supply: The DC-DC 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 "J3". Disconnect this shorting cap (from external 3V3 output to J3.2) to test power consumption of the module.

3.2. Software configuration

3.2.1. Drive installation

After the development board hardware and the test system are built, connect the two ends of the USB cable to the development board and PC, respectively. First 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 has an integrated DAPLINK circuit (GD32F303) that can be used with OpenOCD. The DAP chip has integrated UART function, so only one Micro-USB cable is needed for power supply, debugging and log viewing.

Connect the pins JTCK, JTMS, JTDO and JTDI to the lower four pins via shorting caps, and you can download and debug the code via DAPLINK: After installing the DAPLINK driver, you can see the 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 development 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 development board for more efficient downloading and debugging.

Figure 3-2 DAPLINK Folder



3.3. Operation Guide

The [GD32W5 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 GD32W515T-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. AN079 GD32W51x Rapid Development Guide

[GD32W51x Rapid Development Guide](#) aims to guide developers to get started with Wi-Fi development on the corresponding evaluation boards for the GD32W51x series chips. The main content includes the construction of KEIL, IAR and GCC development environments, SDK configuration, and the methods of compiling and debugging SDKs under KEIL, IAR and GCC development environments.

3.3.2. AN100 GD32W51x Wi-Fi Development Guide

[GD32W51x 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 mainly composed of four parts: the use of OSAL API, the use of Wi-Fi Netlink API, the use of Wi-Fi Netif API, and the use of Wi-Fi management related APIs. 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. AN081 GD32W51x Base Commands User Guide

[The GD32W51x Base Commands User Guide](#) aims to introduce the various basic UART-based commands required for Wi-Fi hardware and software system functionality and performance testing of the GD32W51x series chips.

3.3.4. AN080 GD32W51x AT Command User Guide

[The GD32W51x AT Command User Guide](#) aims to guide developers in testing and developing the GD32W51x series chips based on the AT command.

3.3.5. **AN084 GD32W51x Testing Guidelines for RF Indexes and Transmitting and Receiving Power Consumption**

[GD32W51x Testing Guidelines for RF Indexes and Transmitting and Receiving Power Consumption](#) aims to guide developers to evaluate the Wi-Fi transmit and receive RF metrics and corresponding power consumption metrics of the GD32W515T-START in non-signaling mode. The Test Guidelines is about the three parts of the test method of RF metrics using RF tools, the test method of RF metrics 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 GD32W515T-START, as well as common problems and solutions.

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

3.3.6. **AN085 GD32W51x Throughput and Power Consumption Test Guide**

[GD32W51x Throughput and Power Consumption Test Guide](#) aims to guide developers to evaluate the Wi-Fi transmit and receive throughput metrics and various scenario power consumption metrics of GD32W515T-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 regular mode signaling firmware "wifi_signaling_test.bin" for targeted testing. Secondly, it introduces the test methods 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 GD32W515T-START, as well as common problems and solutions.

3.3.7. **AN083 GD32W51x Certification Test Guidelines**

[The GD32W51x Certification Test Guidelines](#) aims to guide developers to evaluate the GD32W515T-START's RF-related FCC / CE / SRRC certification regulations.

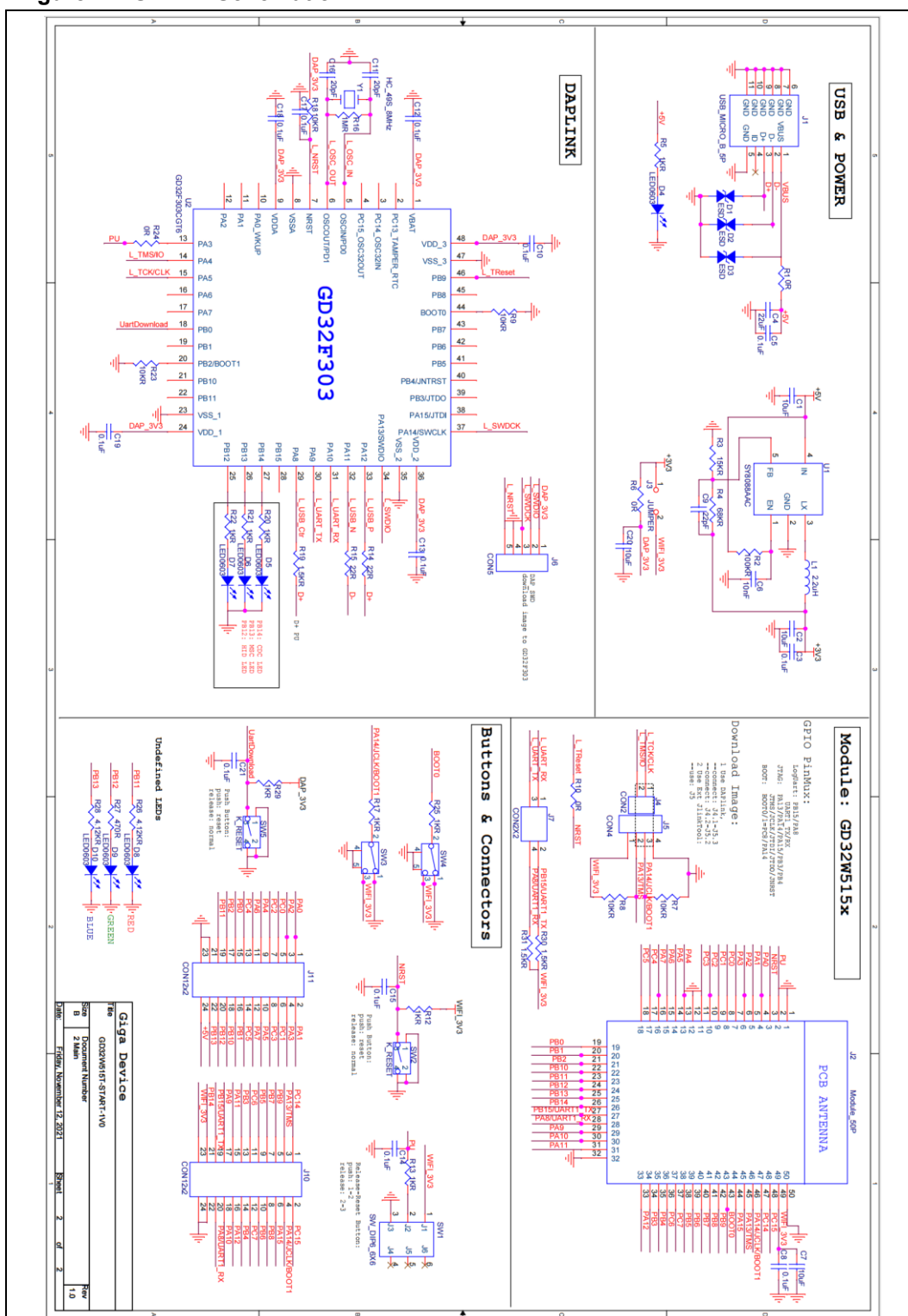
It introduces the methods of using RF tools and serial commands to evaluate the TX / RX indicators of non-signaling modes in each certification, as well as the methods of using serial commands to evaluate the "Blocking" and "Adaptivity" indicators of signaling modes in CE certification. The method of testing "Blocking" and "Adaptivity" indicators of signaling mode in CE certification using serial commands is also introduced.

Meanwhile, the article also introduces the configuration of the test system and the hardware and software of the GD32W515T-START, 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.

Schematic

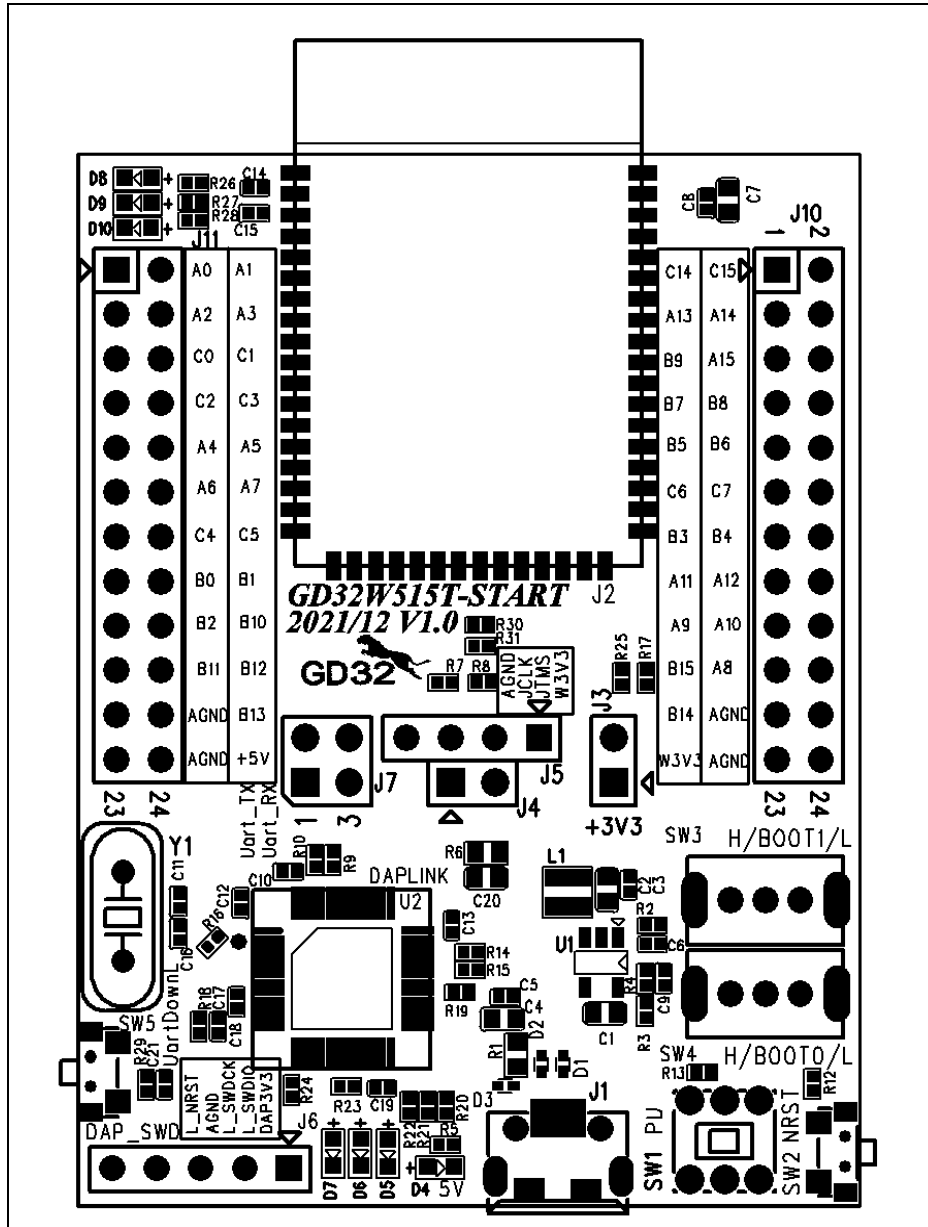
Figure 4-1 START Schematic



5. Layout

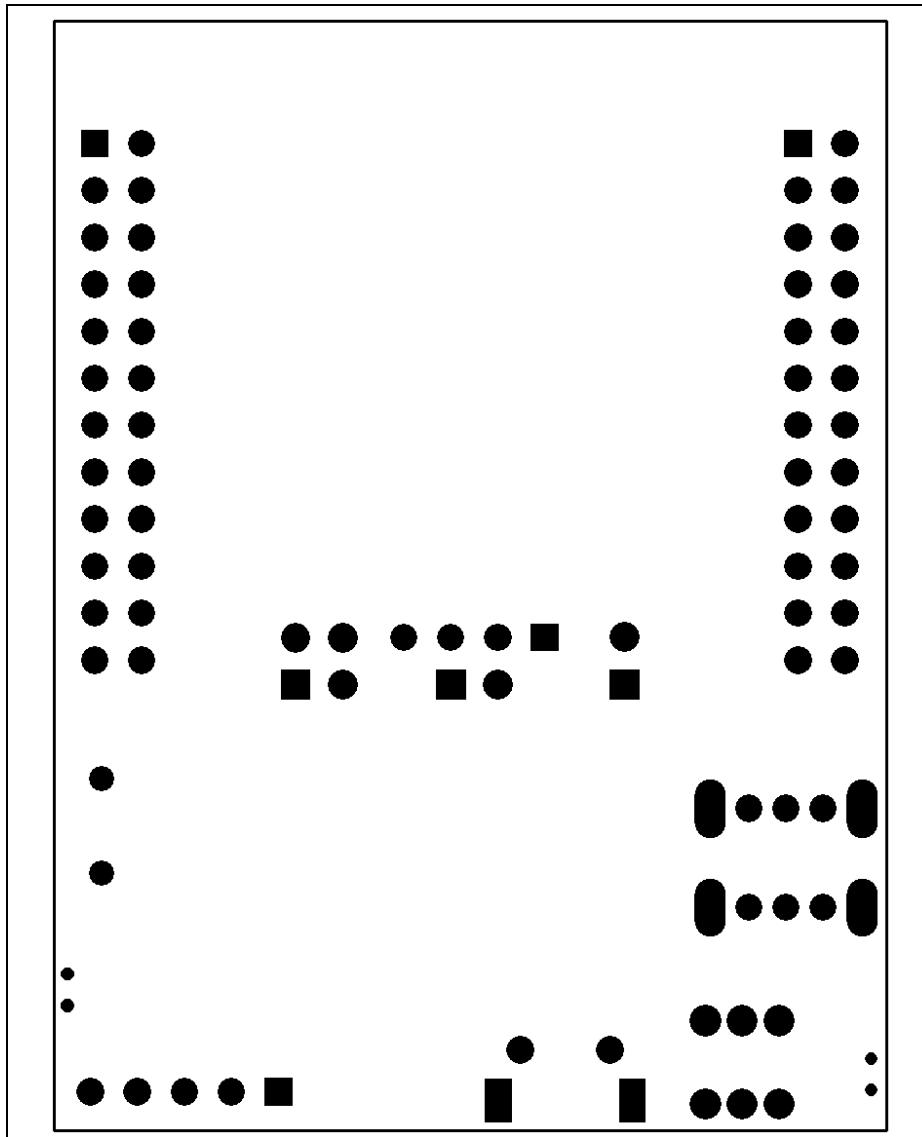
TOP Overlay

Figure 5-1. TOP Overlay



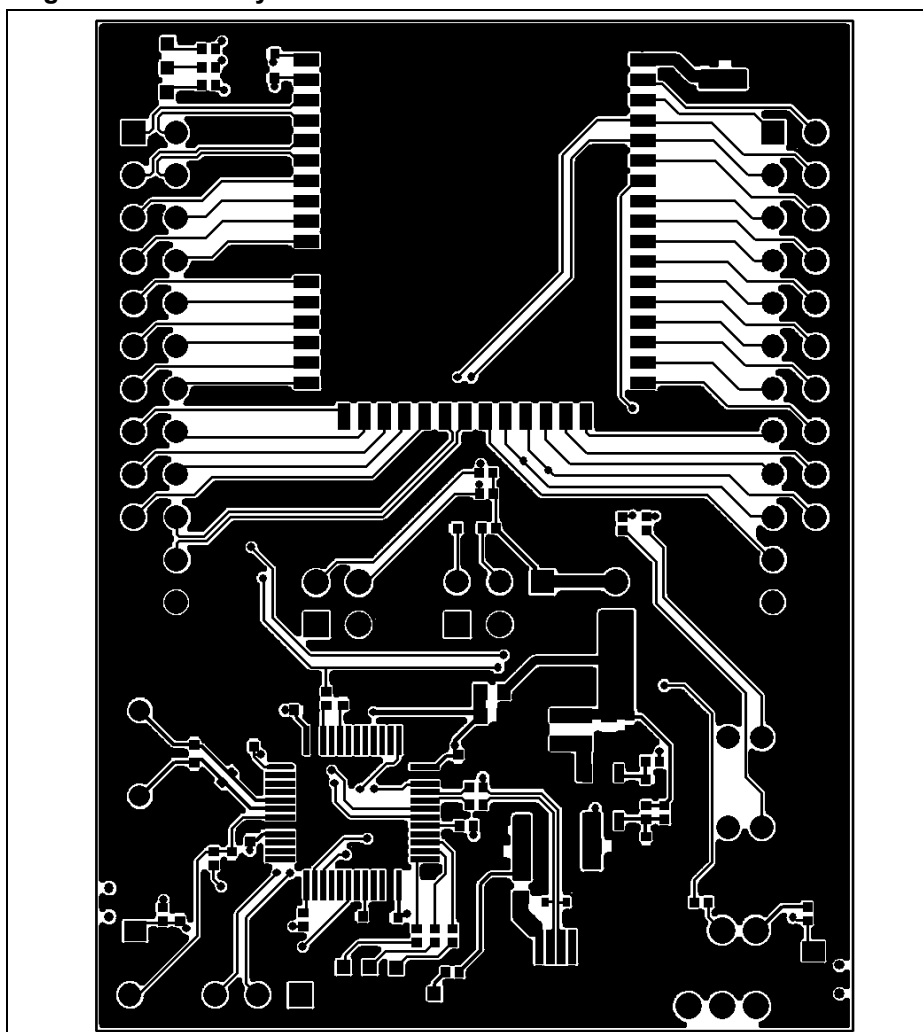
Bottom Overlay

Figure 5-2. Bottom Overlay



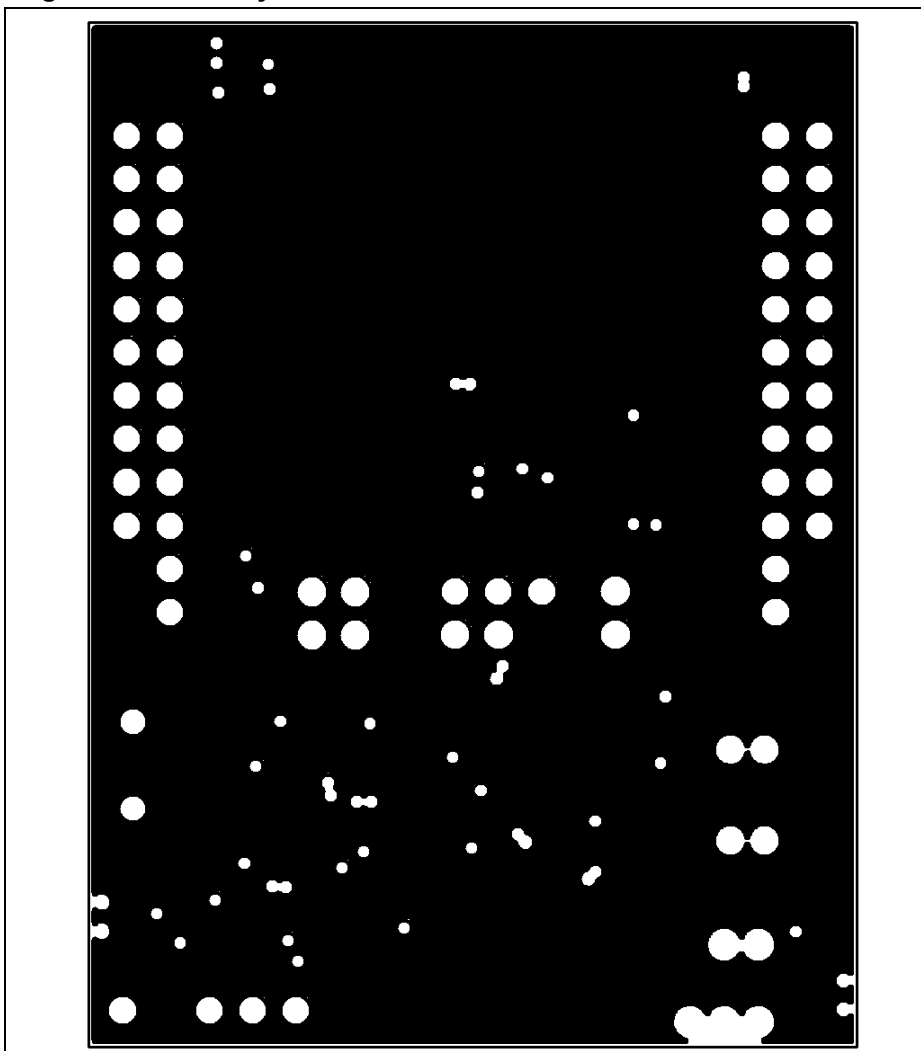
TOP Layer

Figure 5-3. TOP Layer



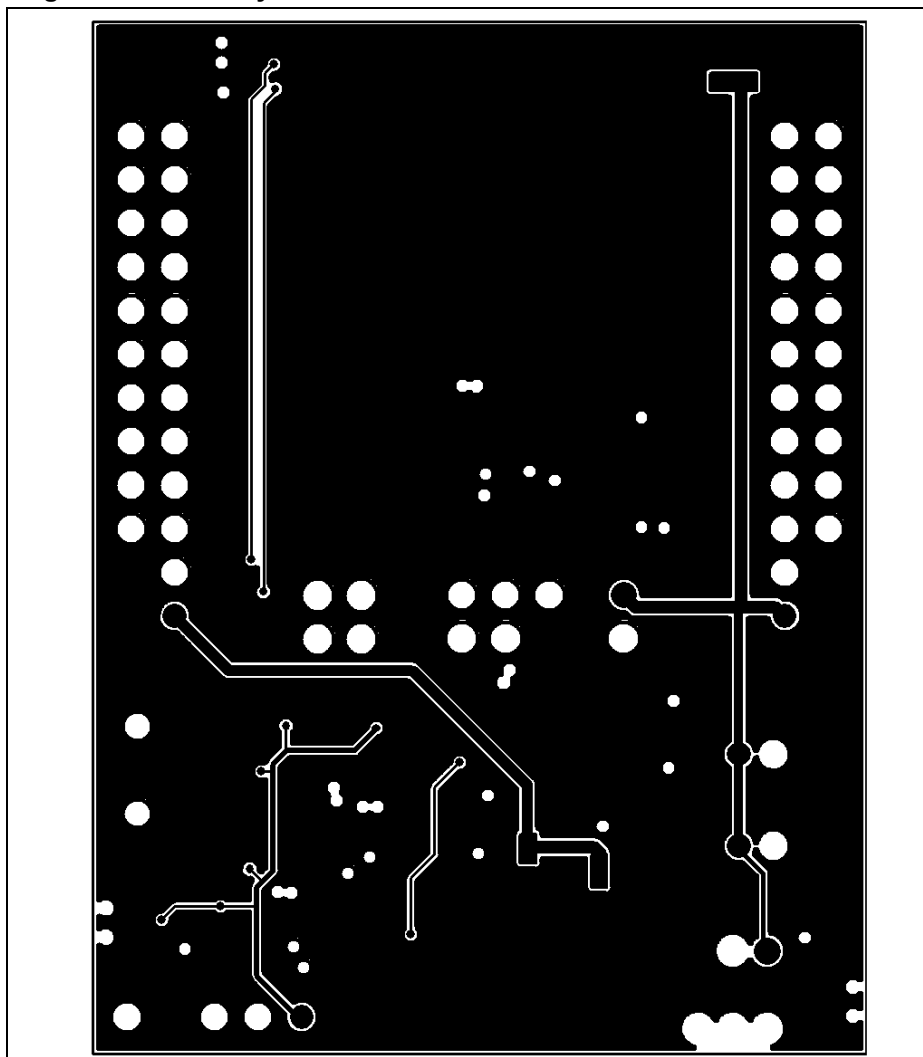
GND Layer

Figure 5-4. GND Layer



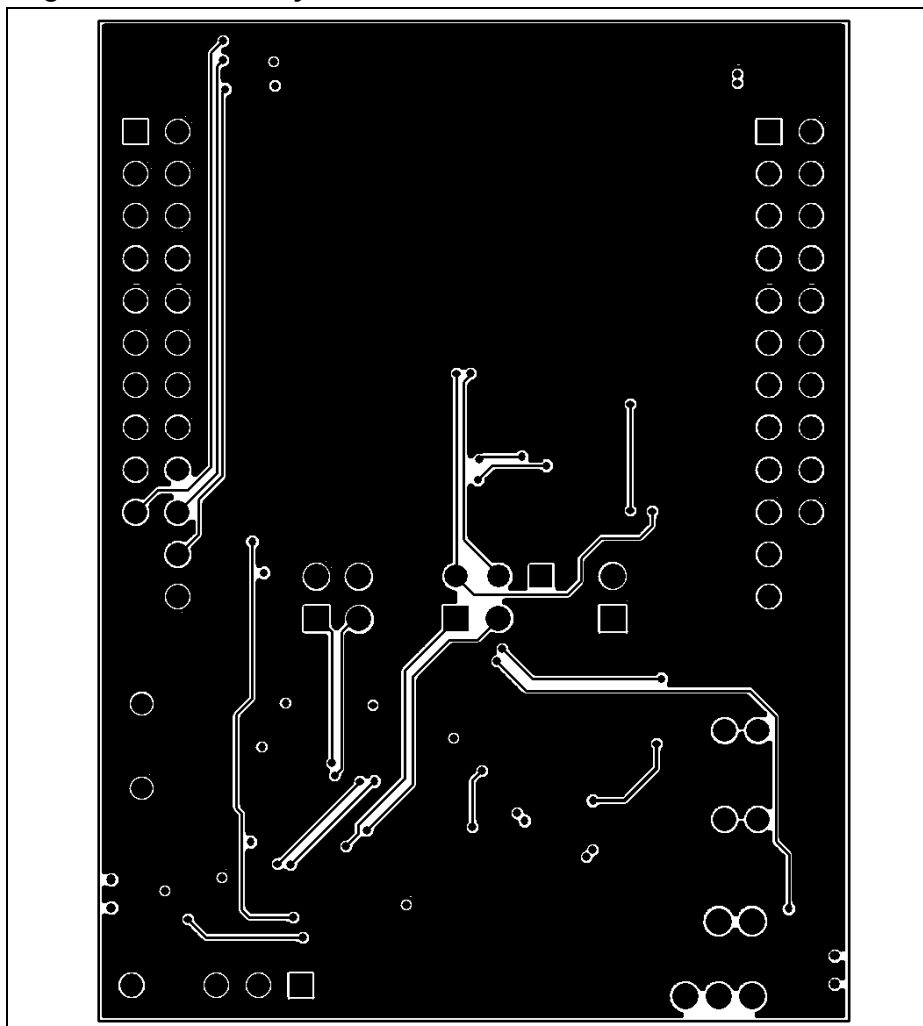
VCC Layer

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	Feb.1, 2024

Important Notice

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