

GigaDevice MCU Team	Version	20 Pages
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	Name : GigaDevice All-In-One Programmer User Manual	

GigaDevice All-In-One Programmer User Manual

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1. Introduction

1.1 Function description

The GD32 All-In-One Programmer serves as a versatile instrument, empowering users to manipulate the flash memory or fine-tune Giga Device MCUs by means of various serial peripherals such as USART, USB, I2C, SPI and more.

Through this remarkable tool, users are enabled to effortlessly transfer the application program onto the internal flash memory or secure chip, among other functionalities.

Moreover, this software exhibits the capability to facilitate multi-serial ISP downloads, thus enhancing programming efficiency during the product's mass production phase.

1.2 Purpose

To mitigate the inconvenience arising from disparate downloading methods, the development of GD32 All-In-One Programmer took place.

This software, designed to be user-friendly and convenient, simplifies the downloading procedure. By simply clicking on the intuitive UI interface, users gain the ability to manipulate both flash memory and GD32 MCUs effortlessly.

Furthermore, the incorporation of the multi-serial ISP download function significantly enhances the efficiency of batch program downloads.

1.3 Operating environment

Operating System: Windows 7/Windows 10 64-bit

Processor: Intel Core i3-9100 clocked at 3.6GHz

Screen Resolution: A minimum resolution of 962x699 pixels is required.

1.4 Jargon and Contraction

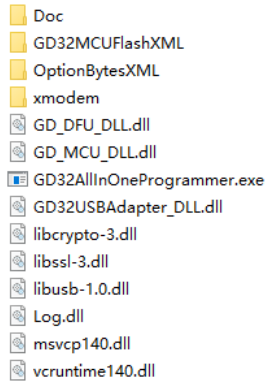
- USART: The Universal Synchronous Asynchronous Receiver Transmitter, abbreviated as

USART, represents a comprehensive, bidirectional serial transceiver module capable of synchronous and asynchronous communication. This highly versatile interface facilitates seamless serial data exchange.

- I2C: The Inter-Integrated Circuit, commonly known as I2C, offers an industry-standard two-line serial interface for communication purposes. It employs a pair of serial lines: the Serial Data Line (SDA) and the Serial Clock Line (SCL).
- USB: Universal Serial Bus, widely referred to as USB, transcends the boundaries of mere computer and peripheral connections. It bestows upon users the power to explore a vast realm of novel PC experiences.
- DFU: Device Firmware Upgrade, denoted as DFU, enables users to download codes onto microcontroller units (MCUs) without having to physically remove them from the printed circuit board (PCB).
- HID : Human Interface Device, a category of devices used to interact with a computer via USB (Universal Serial Bus).
- IAP: In Application Program, commonly abbreviated as IAP, empowers users to download codes onto MCUs without necessitating their removal from the PCB.
- EFUSE: Electronic Fuse, known as EFUSE, denotes a type of one-time programmable memory that acts as a permanent, irreversible fuse.
- OTP: One-Time Programmable memory, abbreviated as OTP, signifies a type of memory that can be programmed only once, rendering subsequent modifications impossible.

1.5 Package composition

The Package contains the following files and folders:



The package encompasses the following files and directories:

1. The "Doc" folder: This directory houses the user manual for the software.
2. The "GD32MCUFlashXML" folder: Within this folder, you will find the XML files pertaining to each series of MCUs.
3. The "OptionBytesXML" folder: This directory contains the XML files associated with each series of MCUs.
4. The "xmodem" folder: This directory includes the GD32W515 fast download algorithm files.
5. Executable (EXE) file: This is the software's runnable file.

2. Running

This software is designed to run on PCs and compatible computers, specifically on Windows platforms. It does not require any additional setup process. Simply clicking the software icon is all that is needed to initiate its operation.

3. Using Details

The primary window consists of three tabs, accessible through the tab item located in the upper left corner.

1. Single Serial Port Tab: This tab enables multiple connections, facilitates flash operations, and allows for option byte configuration. Among them, USB DFU IAP Ex only supports flash upload and download functions, but it can support downloading to external storage when used in conjunction with the corresponding USB firmware library.
2. SuperBatch Tab: By utilizing the SuperBatch tab, users can simultaneously download programs to multiple devices. It supports hot-plugging of devices and enables continuous

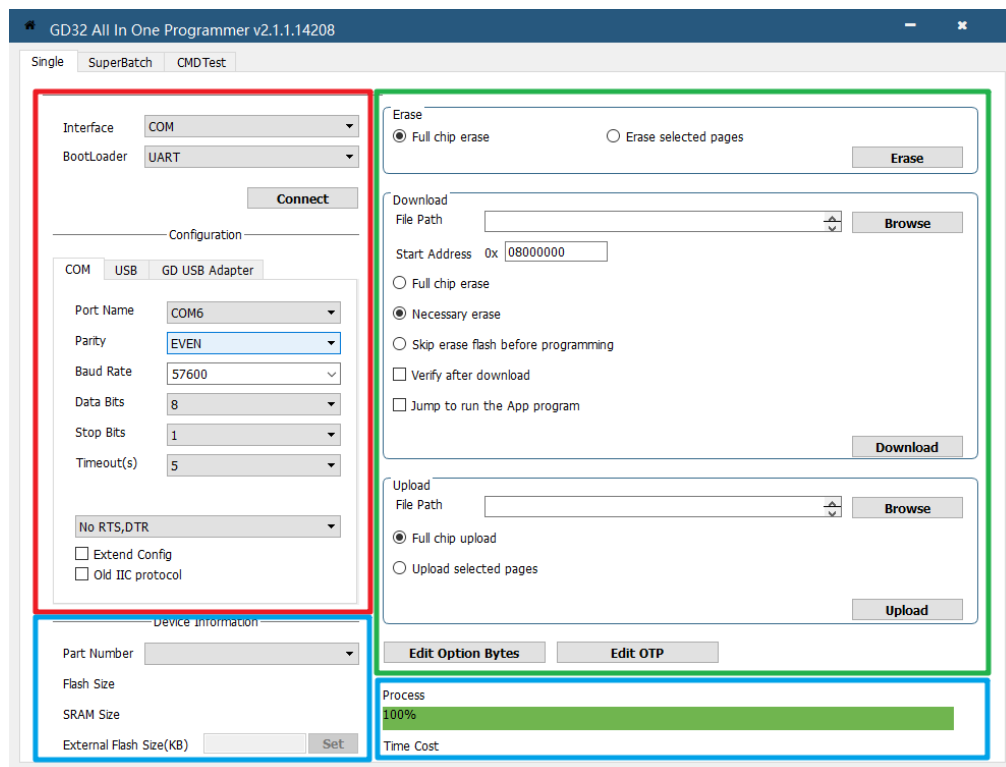
programming of multiple devices. This feature significantly enhances the efficiency of device programming.

3. CMDTest Tab: The CMDTest tab offers a convenient one-click solution to detect UART programming process commands.

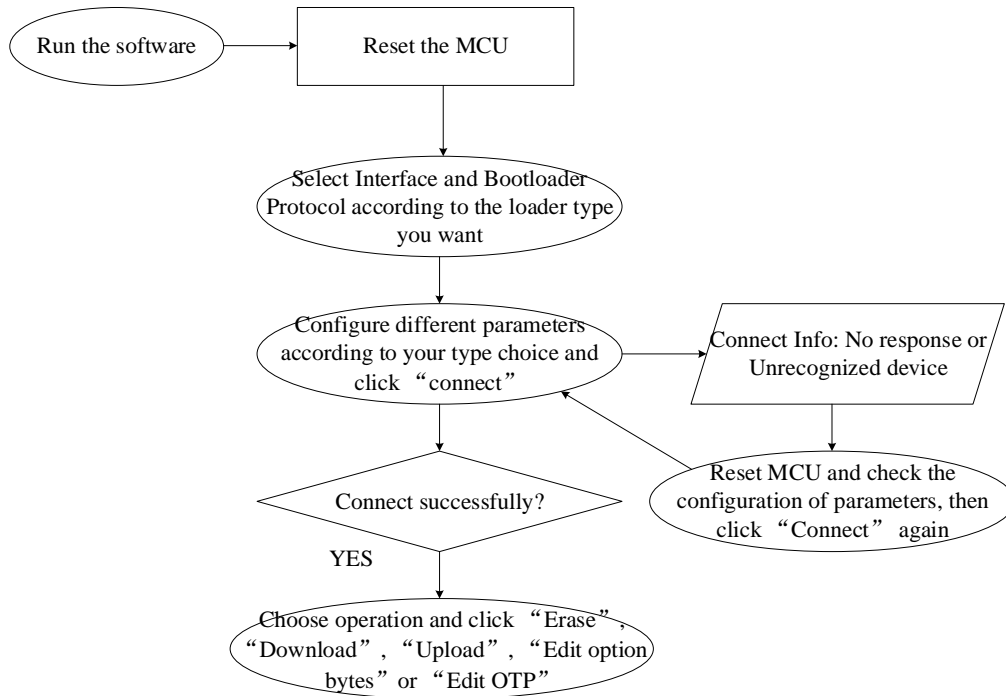
3.1 Single serial port tab

The layout of the single serial port tab comprises three distinct sections:

1. Connection Setting (highlighted in red): This section allows for the selection of the programming method and the configuration of connection parameters.
2. Operation Setting (highlighted in green): The operation setting section provides functions for erasing, downloading, uploading, and option byte editing.
3. Information Display (highlighted in blue): In this section, chip information, operation process, and progress are displayed.



3.1.1 Flowchart of Operation



3.1.2 Download Type Selection

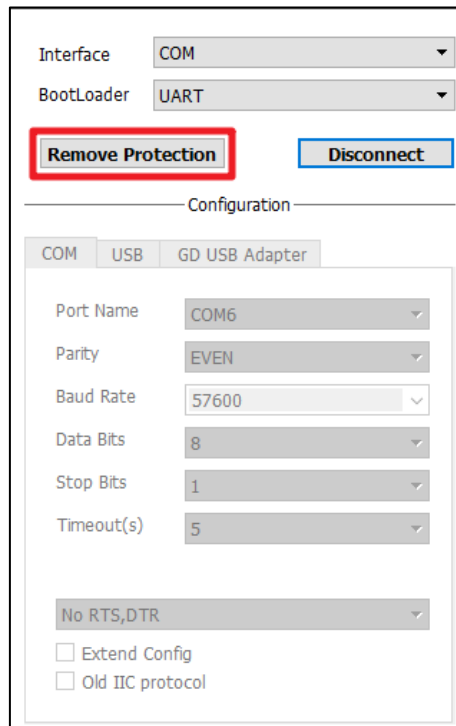
The software offers various interface options, including "COM," "USB," and "GD ISP Bridge." Correspondingly, it provides different bootloader protocol options such as "USART," "I2C," "OSPI," and "DFU." Users are required to first select the appropriate connection type based on their needs. Then, they can configure different parameters within the respective tabs corresponding to their chosen interface.

The image displays three screenshots of the software's configuration window, each showing a different interface and bootloader protocol selection.

- Left Screenshot (COM Interface):** The 'Interface' dropdown is set to 'COM' and the 'BootLoader' dropdown is set to 'UART'. The 'Configuration' section for 'COM' is active, showing fields for Port Name (COM6), Parity (EVEN), Baud Rate (57600), Data Bits (8), Stop Bits (1), and Timeout(s) (5). There are also checkboxes for 'No RTS,DTR', 'Extend Config', and 'Old IIC protocol'.
- Middle Screenshot (USB Interface):** The 'Interface' dropdown is set to 'USB' and the 'BootLoader' dropdown is set to 'DFU'. The 'Configuration' section for 'USB' is active, showing a 'Device' dropdown menu.
- Right Screenshot (GD ISP Bridge Interface):** The 'Interface' dropdown is set to 'GD ISP Bridge' and the 'BootLoader' dropdown is set to 'CAN'. The 'Configuration' section for 'GD ISP Bridge' is active, showing a 'Device' dropdown menu with the value '966983890237' and a 'Baud Rate' dropdown menu with the value '125000'.

3.1.3 Readout Protection status

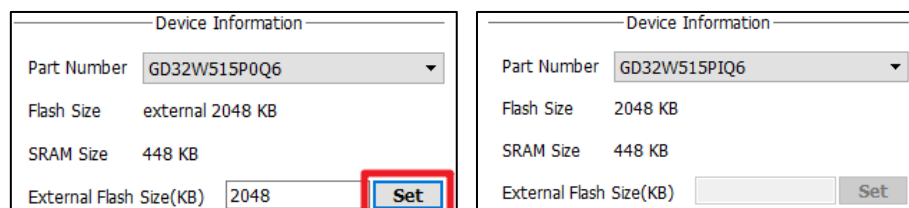
Upon establishing a connection, the figure below illustrates the readout protection status. If the MCU has been configured with readout protection, the user must click on the "Remove Protection" button first. Subsequently, they should wait for the MCU's readout protection to be successfully removed before proceeding to the next step. However, if there is no readout protection enabled, the button will remain hidden.



The screenshot shows the 'Configuration' tab of the GigaDevice All-In-One Programmer. At the top, 'Interface' is set to 'COM' and 'BootLoader' is set to 'UART'. Below these, the 'Remove Protection' button is highlighted with a red rectangular box, and the 'Disconnect' button is visible to its right. The 'Configuration' section has three tabs: 'COM', 'USB', and 'GD USB Adapter'. The 'COM' tab is active, showing settings for 'Port Name' (COM6), 'Parity' (EVEN), 'Baud Rate' (57600), 'Data Bits' (8), 'Stop Bits' (1), 'Timeout(s)' (5), and 'No RTS,DTR'. At the bottom, there are two checkboxes: 'Extend Config' and 'Old IIC protocol', both of which are unchecked.

3.1.4 External Flash Settings

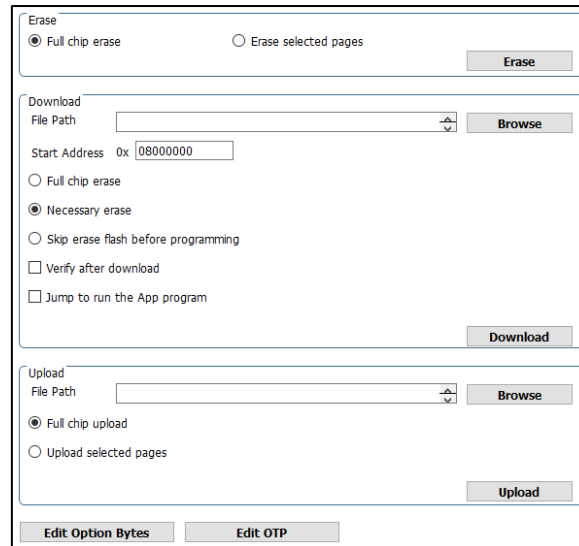
The figure below depicts the process of setting the external Flash size for the 0-Flash MCU. To initialize the MCU Flash information, the user needs to enter the size of the external storage and click the "Set" button. It is important to note that this function will be disabled if the size of the MCU's Flash is already set and not equal to 0.



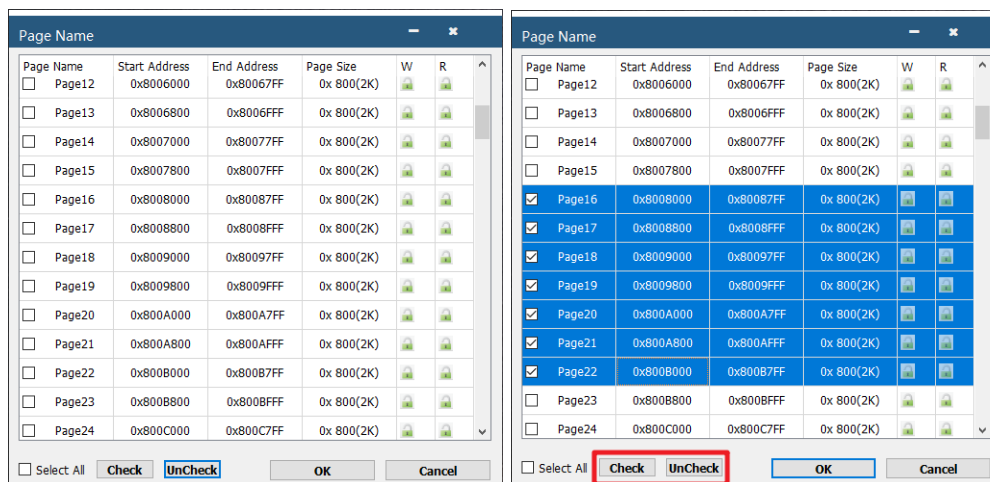
The figure consists of two side-by-side screenshots of the 'Device Information' window. Both windows show 'Part Number' as 'GD32W515P0Q6', 'Flash Size' as 'external 2048 KB', and 'SRAM Size' as '448 KB'. The left window shows 'External Flash Size(KB)' as '2048' with a red box around the 'Set' button. The right window shows 'External Flash Size(KB)' as an empty field with the 'Set' button disabled (grayed out).

3.1.5 Operation Selection

The software offers multiple operation options, including download, upload from flash, and edit option bytes.



The "Erase" option allows users to erase the entire chip or selectively erase specific pages. If the "Erase selected pages" option is chosen, a "Select pages" dialog will appear, as shown in the figure below. Users can select multiple pages by clicking the left mouse button, and use the "Check" or "Uncheck" buttons to select or deselect individual pages. Additionally, there is a "Select All" checkbox that enables users to select or deselect all pages at once.



Page Name	Start Address	End Address	Page Size	W	R
<input type="checkbox"/> Page12	0x8006000	0x80067FF	0x 800(2K)		
<input type="checkbox"/> Page13	0x8006800	0x8006FFF	0x 800(2K)		
<input type="checkbox"/> Page14	0x8007000	0x80077FF	0x 800(2K)		
<input type="checkbox"/> Page15	0x8007800	0x8007FFF	0x 800(2K)		
<input type="checkbox"/> Page16	0x8008000	0x80087FF	0x 800(2K)		
<input type="checkbox"/> Page17	0x8008800	0x8008FFF	0x 800(2K)		
<input type="checkbox"/> Page18	0x8009000	0x80097FF	0x 800(2K)		
<input type="checkbox"/> Page19	0x8009800	0x8009FFF	0x 800(2K)		
<input type="checkbox"/> Page20	0x800A000	0x800A7FF	0x 800(2K)		
<input type="checkbox"/> Page21	0x800A800	0x800AFFF	0x 800(2K)		
<input type="checkbox"/> Page22	0x800B000	0x800B7FF	0x 800(2K)		
<input type="checkbox"/> Page23	0x800B800	0x800BFFF	0x 800(2K)		
<input type="checkbox"/> Page24	0x800C000	0x800C7FF	0x 800(2K)		

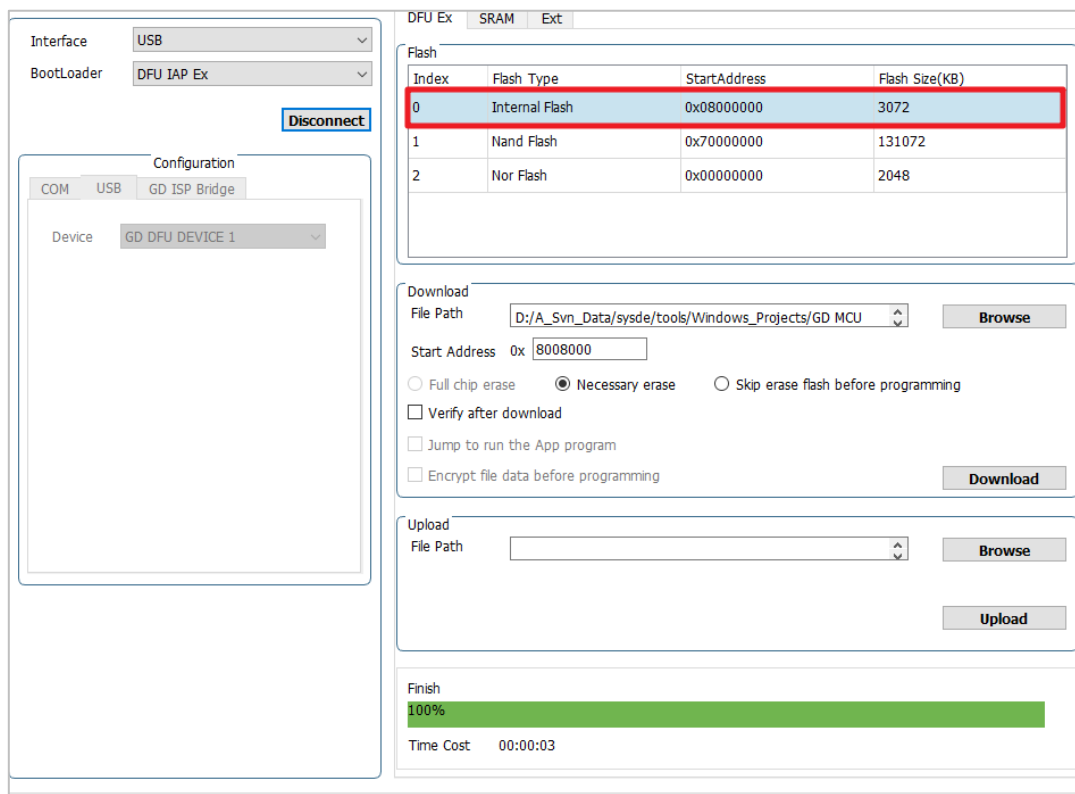
The "Download" option enables users to transfer bin or hex files to the MCU. Users have the choice to either "Erase necessary page" or "Erase all pages" before the download process. They can also select whether to perform a verification process after the download is complete.

The "Upload" option allows users to retrieve data from the MCU by either reading the entire chip or selected pages. The data can be saved as a bin or hex file. If the "Upload selected pages" option is selected, a "Select pages" dialog will appear, allowing users to choose the specific pages they wish to read.

The "Edit option bytes" option permits users to configure the option bytes of the MCU.

The "Edit OTP" option provides users with the capability to configure the one-time programmable memory block.

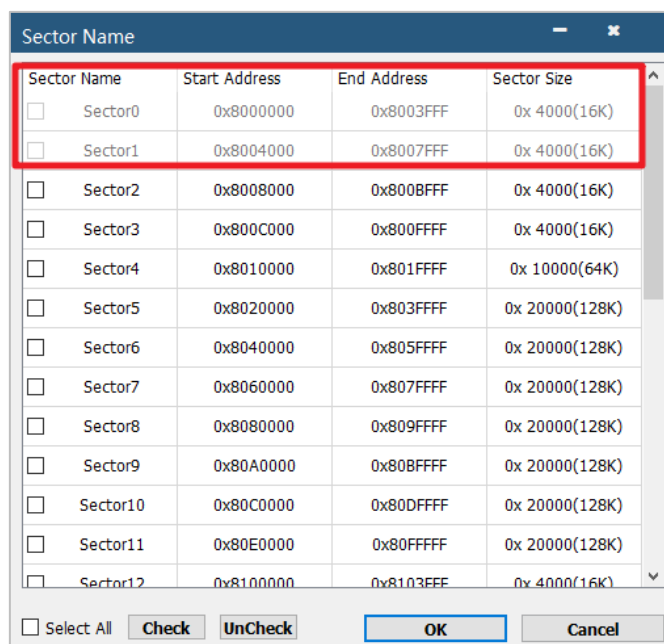
When switching to DFU IAP Ex, the software interface is as follows: clicking Flash Type automatically inputs the download address and supports the post-download verification function. Double-clicking Flash Type allows you to select a specific Sector for upload, where the gray area represents the IAP BootLoader region.



The screenshot displays the software interface for the DFU IAP Ex mode. On the left, the 'Interface' is set to 'USB' and the 'BootLoader' is 'DFU IAP Ex'. A 'Disconnect' button is visible. Below this, the 'Configuration' section shows 'COM', 'USB', and 'GD ISP Bridge' tabs, with 'Device' set to 'GD DFU DEVICE 1'. The main right panel has tabs for 'DFU Ex', 'SRAM', and 'Ext'. The 'Flash' section contains a table with the following data:

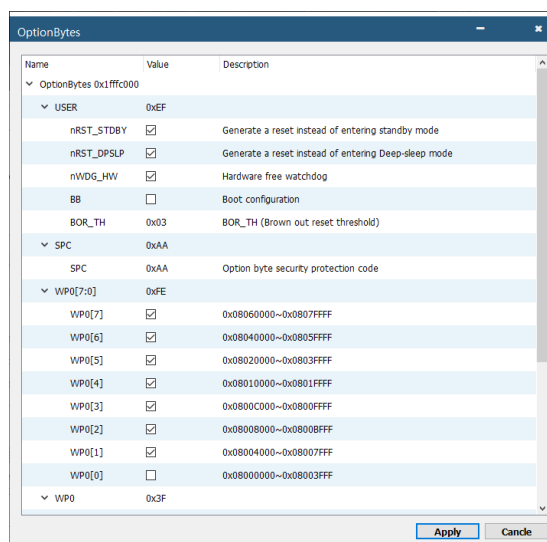
Index	Flash Type	StartAddress	Flash Size(KB)
0	Internal Flash	0x08000000	3072
1	Nand Flash	0x70000000	131072
2	Nor Flash	0x00000000	2048

The first row (Index 0) is highlighted with a red border. Below the table, the 'Download' section includes a 'File Path' field with a browse button, a 'Start Address' field set to '0x 8008000', and three radio buttons: 'Full chip erase', 'Necessary erase' (selected), and 'Skip erase flash before programming'. There are also checkboxes for 'Verify after download', 'Jump to run the App program', and 'Encrypt file data before programming', along with a 'Download' button. The 'Upload' section has a 'File Path' field with a browse button and an 'Upload' button. At the bottom, a 'Finish' status bar shows '100%' completion with a green progress bar and a 'Time Cost' of '00:00:03'.



3.1.6 Configure Option Bytes

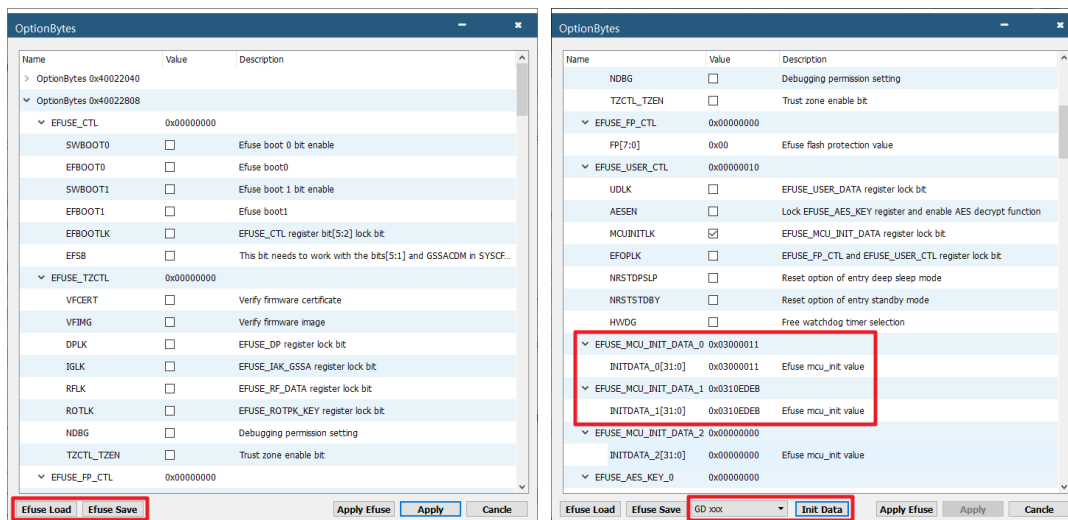
When clicking on the "Edit option bytes" button, a dialog box will be displayed, as depicted in the figure below. This dialog box provides users with a graphical user interface (UI) to configure the option bytes. Users can check or edit the values associated with the option bytes within this dialog box.



3.1.7 Configure EFUSE Data

If the MCU supports the EFUSE function, the option bytes dialog also allows for the

configuration of EFUSE data. Users can make adjustments to the EFUSE settings within the same option bytes dialog. To apply the configured EFUSE data, simply click the "Apply Efuse" button.



The EFUSE data can be imported and exported, allowing for efficient configuration of EFUSE settings. It is important to note that EFUSE data can only range from 0 to 1.

For 0-flash MCUs, a user customization function is available. Users can pre-record the external Flash product information in the "ExternalStorage.xml" document. This enables convenient and swift configuration of the values for EFUSE_MCU_INIT_DATA_0 and EFUSE_MCU_INIT_DATA_1. The preset model information will be displayed in the comboBox. By clicking the "Init Data" button, the displayed values will be updated to the preset values.

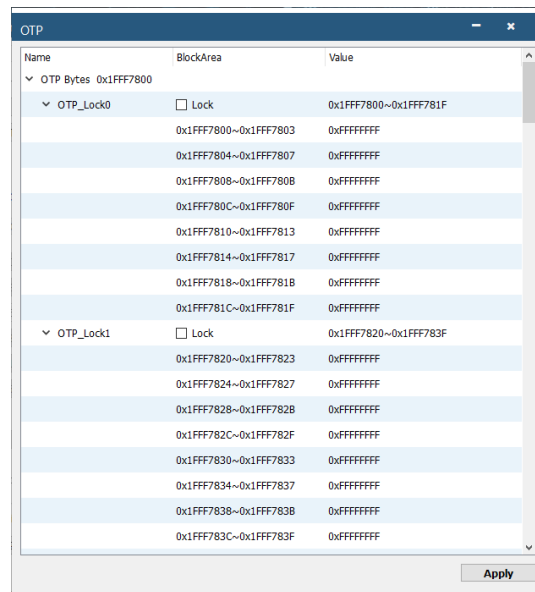
The XML file path for the "ExternalStorage.xml" document is ".\OptionBytesXML\ExternalStorage.xml".

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<StorageInfo Num="2">
  <!-- The first record is the default -->
  <Storage Model="GD xxx">
    <EFUSE_MCU_INIT_DATA_0 Field="INITDATA_0[31:0]" Value="0x03000011"/>
    <EFUSE_MCU_INIT_DATA_1 Field="INITDATA_1[31:0]" Value="0x0310EDEB"/>
  </Storage>
  <Storage Model="Default">
    <EFUSE_MCU_INIT_DATA_0 Field="INITDATA_0[31:0]" Value="0x00000000"/>
    <EFUSE_MCU_INIT_DATA_1 Field="INITDATA_1[31:0]" Value="0x00000000"/>
  </Storage>
</StorageInfo>
```

3.1.8 Configure OTP Data

If the MCU supports the OTP (One-Time Programmable) function, clicking the "Edit OTP" button will open a dialog. The display within the dialog will vary based on the specific characteristics of the OTP. This dialog provides users with a user-friendly interface (UI) to configure

the OTP. Users can check or edit the values associated with the OTP within the dialog, allowing for customization as needed.



3.1.9 Encrypted Download based EFUSE Key

If the MCU supports the FMC (Flexible Memory Controller) internal RTDEC (Real-Time Data Encryption) function, there are additional options available during the programming process.

By checking the "Encrypt file data before programming" option, users can enable encryption for the file data. They can select the KEY (16 bytes) and IV (12 bytes) to be used for encryption. Once this option is enabled, the software will encrypt the file data and program the encrypted data when the "Download" button is clicked.

If the "Configure Efuse key and iv after download" option is checked, the software will automatically configure the Efuse key and FMC IV for the MCU after the programming process is completed.

Download

File Path

Browse

Start Address
0x 8270000

☒ Full chip erase
☐ Necessary erase
☐ Skip erase flash before programming

☐ Verify after download

☐ Jump to run the App program

☒ Encrypt file data before programming
☐ Configure Efuse key and iv after download

Key Path

Browse

IV Path

Browse

Download

3.1.10 OSPI programming

You have the option to employ the "OSPI" BootLoader for programming OSPI0/OSPI1 if the target MCU supports this capability. Prior to initiating a "Download" or "Upload" operation, you should arrange the OSPI configurations and pin details. Additionally, you can refer to the "Default Pins" for utilizing the default configuration of the MCU.

Interface
COM
BootLoader
OSPI

Disconnect

Configuration

COM
USB
GD ISP Bridge

Port Name
COM3
Parity
EVEN
Baud Rate
57600
Data Bits
8
Stop Bits
1
Timeout(s)
5

No RTS,DTR
☐ Extend Config
☐ Old IIC protocol

Device Information

Part Number
GD32H759IMK6
Flash Size
3840 KB
SRAM Size
1024 KB
External Flash Size(KB)

Set

Configuration

OSPI
OSPI0
1 line
2 division frequency

OSPI0_P0_NCS
GPIOA
GPIO_PIN_1
GPIO_AF_1
GPIO_OSPEED_60MHZ

1 OSPI0_P0_CLK GPIOA GPIO_PIN_0 GPIO_AF_0 GPIO_OSPEED_12MHZ
2 OSPI0_P0_NCS GPIOA GPIO_PIN_1 GPIO_AF_1 GPIO_OSPEED_60MHZ

Add

Delete

Clear

☐ Default Pins

Config

Operation

Download File
D:/OSPIx.bin

Browser

Start Address
0x 90000000

Download

Upload File
D:/OSPIx.bin

Browser

Upload Address
0x 90000000 ~ 9FFFFFFF

Upload

Log

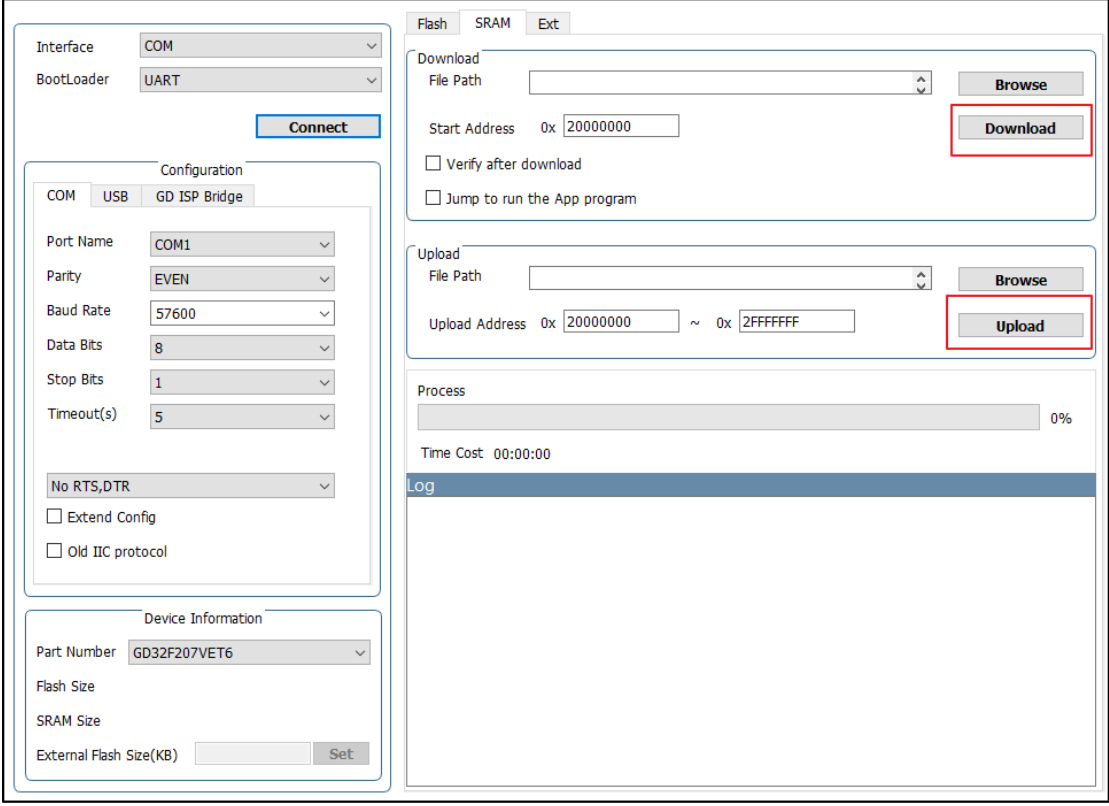
2023-08-31 16:50:29 Config OSPIx successful
2023-08-31 16:50:29 Config Pin1 successful
2023-08-31 16:50:29 Config Pin2 successful
2023-08-31 16:50:29 Config OSPIx pins successful

Clear

Current Stage:Config parameters, Current Progress : 100.0%, Time Cost: 0.0s

3.1.11 SRAM programming

If the target MCU supports this Feature, you can download and upload the SRAM area of the target MCU. When you use the download function, first you need to select a data file, the file have two formats: hex form and bin form. Secondly, you need to confirm starting address. Finally, click the Download button to complete SRAM download operation. When you use the upload function, first you need to determine the upload data storage path. Secondly, you need to determine the start address and end address. Finally, click the Upload button to complete SRAM upload operation.



The screenshot shows the GigaDevice All-In-One Programmer interface with the SRAM tab selected. The interface is divided into several sections:

- Interface:** COM (selected), UART (selected), and a Connect button.
- Configuration:** COM, USB, and GD ISP Bridge tabs. The COM tab is active, showing settings for Port Name (COM1), Parity (EVEN), Baud Rate (57600), Data Bits (8), Stop Bits (1), Timeout(s) (5), No RTS,DTR (selected), Extend Config (unchecked), and Old IIC protocol (unchecked).
- Device Information:** Part Number (GD32F207VET6), Flash Size, SRAM Size, and External Flash Size(KB) with a Set button.
- Download:** File Path (with a Browse button), Start Address (0x 20000000), and a Download button (highlighted with a red box). There are also checkboxes for "Verify after download" and "Jump to run the App program".
- Upload:** File Path (with a Browse button), Upload Address (0x 20000000 ~ 0x 2FFFFFFF), and an Upload button (highlighted with a red box).
- Process:** A progress bar showing 0% completion and a Time Cost of 00:00:00.
- Log:** A section for displaying log messages.

3.2 SuperBatch tab

This function allows for hot-plugging of devices and facilitates continuous downloading.

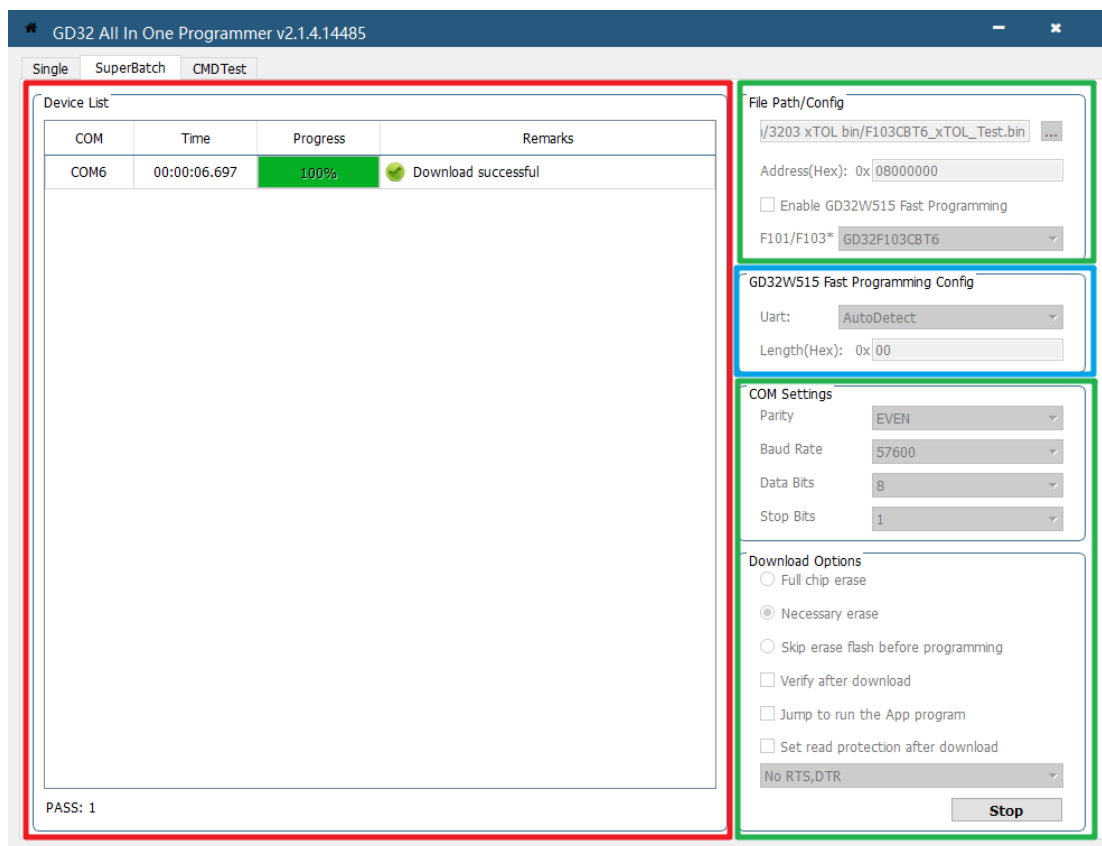
The layout of the SuperBatch tab comprises three distinct sections:

1. Device List (highlighted in red): This section displays all available serial devices and provides information about the ongoing download process.

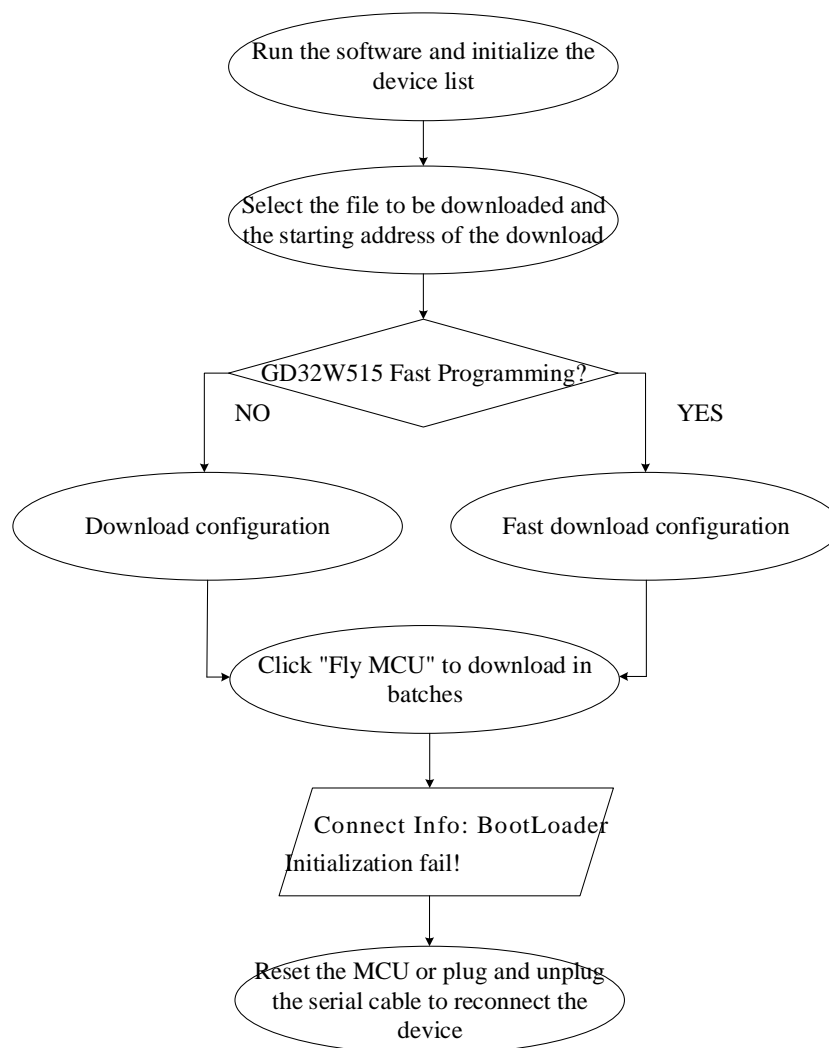
2. Download Options (highlighted in green): In this section, users can select the file path for downloading, choose the start address, switch to GD32W515 fast programming mode, configure

erasing settings during download, enable data verification, and set read protection, among other options.

3. GD32W515 Fast Programming (highlighted in blue): A specialized fast download algorithm has been developed for the GD32W515 series, enabling quick programming of GD32W515 devices.



3.2.1 Flowchart of Operation



3.2.2 Continuous Program download

Once the downloaded file is selected and the download address is set, users can proceed to configure the download options. This includes setting the erase operation during download, enabling data verification, specifying the APP startup behavior, and defining read protection after download.

After ensuring that the download configuration is accurate, users can initiate the continuous batch download process by clicking the "Fly MCU" button.

If the target chip corresponds to a specific model, users must manually select the model before initiating the programming process. Failure to do so will result in a prompt message stating "Init MCU failed!"

GD32F101T4U6	GD32F103T4U6
GD32F101T6U6	GD32F103T6U6
GD32F101T8U6	GD32F103T8U6
GD32F101TBU6	GD32F103TBU6
GD32F101C4T6	GD32F103C4T6
GD32F101C6T6	GD32F103C6T6
GD32F101C8T6	GD32F103C8T6
GD32F101CBT6	GD32F103CBT6
GD32F101R4T6	GD32F103R4T6
GD32F101R6T6	GD32F103R6T6
GD32F101R8T6	GD32F103R8T6
GD32F101RBT6	GD32F103RBT6
GD32F101V8T6	GD32F103V8T6
GD32F101VBT6	GD32F103VBT6

3.2.3 GD32W515 Fast Programming Mode

Upon enabling the "Enable GD32W515 Fast Programming" option, users gain access to configure the fast download function. However, other configuration functions will be disabled when utilizing this feature.

Users can select the UART number used by the device. If unsure, they can opt for the default auto-detect option. The "Length" parameter refers to the length of the downloaded file. When set to 0, the programming will be performed based on the file size. Conversely, when set to a non-zero value, the programming will be executed according to the specified size.

File Path/Config

E:/测试bin/KEIL-image-all-1.0.1.bin

...

Address(Hex): 0x08000000

☒ Enable GD32W515 Fast Programming

F101/F103*

GD32W515 Fast Programming Config

Uart:

AutoDetect

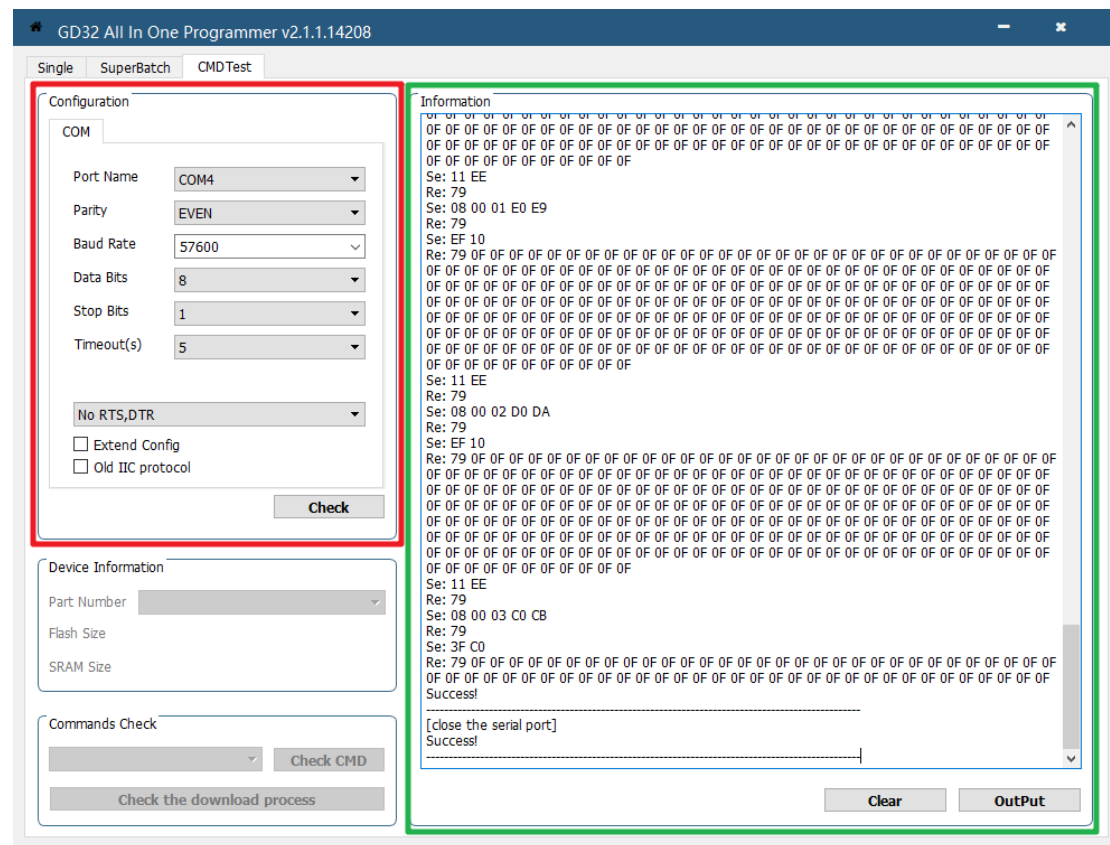
Length(Hex): 0x00

3.3 CMDTest tab

The CMDTest tab is divided into two sections:

1. Device Configuration (highlighted in red): This section allows users to establish a connection with the bootloader by configuring the serial port information. It involves setting up the necessary parameters to establish communication with the target device.

2. Information Display (highlighted in green): In this section, all commands are tested during the download process, and the sending and receiving information is displayed. Users can observe the information exchanged between the software and the device as part of the testing and verification process.



The CMDTest tab offers the following functionality:

1. Check: This option allows for a one-key query of all commands and displays the process information, including the operation process, sending and receiving data, and results.

2. Clear: Clicking this button clears all the content in the message box.

3. Output: This option exports all the content in the message box to a TXT file, allowing users to save it to a specified path.

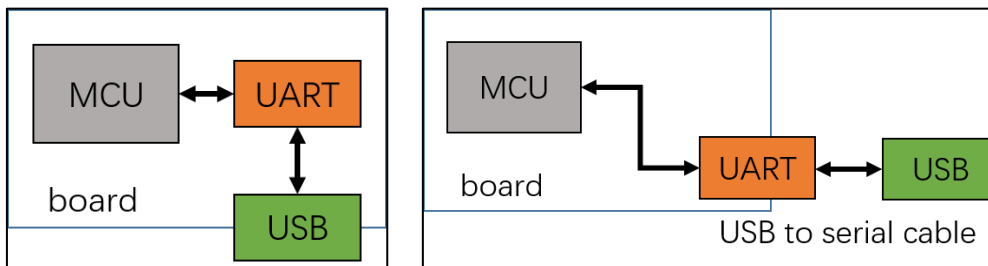
The purpose of this tab is to assist developers in examining the bootloader commands of the chip. It encompasses chip connection, bootloader initialization, and basic command verification. **It's important to note that the erase command will remove the code stored in flash memory.**

However, it should be noted that the models listed in the table in section 3.3.2 are not supported in this context.

4. Attentions

Here are some important points to note:

- When connecting the software to the device, ensure that the device is set to the BOOT working mode, where BOOT1 is set to 0 and BOOT0 is set to 1. However, if using IAP-related protocols, the device needs to be set to user mode, which generally sets BOOT1 to 0 and BOOT0 to 0 when the chip is powered off.
- After setting device read protection through the Option bytes, it is necessary to disconnect the device, reset the MCU, and then reconnect it in order to proceed with subsequent operations.
- Among them, USB DFU IAP Ex only supports flash upload and download functions, but it can support downloading to external storage when used in conjunction with the corresponding USB firmware library.
- In the SuperBatch tab, enable the continuous download function. If the USB-to-serial port circuit is integrated on the development board, it allows for hot-plugging of the device without unplugging the wire. The software will establish a handshake with the new device to perform the download operation (as shown on the left side of the interface). However, if the software is connected to the device through a USB-to-serial cable, the entire cable needs to be unplugged and then plugged back in for the software to establish a handshake with the new device (as shown on the right side of the interface).



- When continuously programming the GD32W515, it is recommended to use the normal

mode for small-sized downloaded files. However, for larger files exceeding 15KB, it is advisable to utilize the fast programming mode. The programming efficiency may vary depending on the specific usage conditions. To determine the most suitable method for batch programming, it is recommended to test the download time using both modes and select the more efficient option accordingly.

- Under the new protocol, in-Application Program (IAP) features support erasing, downloading, uploading, and editing option bytes. When using the software, please use the latest firmware library.

5. Update

To download software and resources from the official GD32 MCU website, please visit the following URL:

Official website: <https://gd32mcu.com/>

On the website, you should be able to find the necessary software, documentation, libraries, tools, and other resources related to GD32 MCUs. Make sure to explore the website and navigate to the appropriate sections to download the desired materials.

6. Q&A

Q1: If you face a "BootLoader Initialization fail!" error, try the following:

A1: Attempt to resolve the issue by disconnecting and reconnecting the device, followed by re-establishing the handshake between the device and the software.

Q2: In case the erasing and programming process fails, resulting in an unknown device state or the inability to proceed despite a seemingly normal display:

A2: It is likely that there is an issue with device communication. Try resetting the device and retrying the process.