

HT66FB5x0 / HT68FB5x0 USB Flash ICs ISP Function Development

D/N: AN0328E

Introduction

Most of Holtek's USB Flash MCUs include an ISP function. Among these devices are the A/D type HT66FB5x0 and the I/O type HT68FB5x0. By selecting "with BootLoader" in the HT-IDE3000 Project Settings, the devices can work together with the HOPE3000, I3000 and other tools to update their Flash Program Memory. This application note will introduce how to use the HT-IDE3000, HOPE3000, I3000, USB Workshop and library file "Enable_BootLoder vx.x.lib" to implement ISP programming.

Bootloader and ISP Programming

If the IDE3000 Bootloader function is enabled, it will consume 0.5K Words of Flash ROM space, as shown in Figure 1. For example, the HT66FB550 Flash Memory size is 8K×16 bits, but after the Bootloader function is enabled, it will leave only 7.5K×16 bits space for user programs. The Bootloader Code can be programmed to the ICs only by using the e-WriterPro and HOPE3000. The program is divided into two sections, the Bootloader Code and the User Code. When the ISP programming is required, the device needs to be connected to a PC running the I3000.exe, which will communicate with the Bootloader Code to update the User Code Flash Memory.

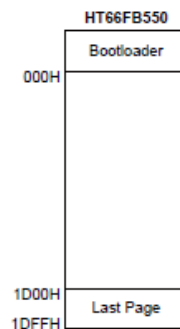


Figure 1 Flash Program Memory Structure with Bootloader

When it is required to run both the User Code and the ISP programs, the device needs to switch to the Bootloader Code to connect to the I3000.exe for ISP programming. To implement this, HOLTEK provides a library file which needs to be added to the project via the IDE3000. When the program detects a condition requesting it to switch to the Bootloader, it will call the subroutine "ENABLE_BL" provided by the library file "Enable_BootLoader vx.x.lib". It will check whether the device has switched to the Bootloader successfully by polling the B_ENABLE_BL_OK flag. If it is successful, then reset the MCU using an external reset or restarting the MCU or intentionally allowing the WDT to overflow, after which the MCU will execute the Bootloader Code. Then connect the device to the PC via the USB interface. If the USB enumeration is successful, then users can use the I3000.exe provided by Holtek to communicate with the Bootloader Code to update the user code.

HT-IDE3000 Settings

The HOLTEK USB Flash ISP function needs to work together with HT-IDE3000 Ver 7.7 or above version to support the Bootloader function settings. When using the HT66FB5x0/HT68FB5x0 series of MCUs to create a project, as figure 2 shows, users can select "with Bootloader" or not. If "with Bootloader" has been selected, then continue and select "Start at ISP mode" or "Start at User mode". After the project has been created, add the library file "Enable_BootLoader vx.x.lib" into the "Project Option".

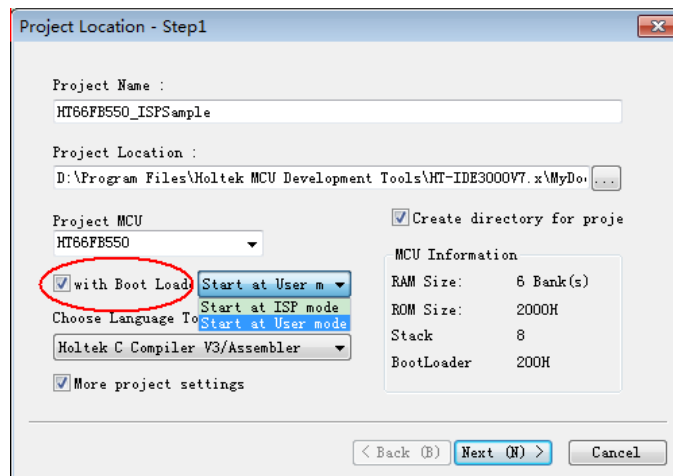


Figure 2 Create a Project with Bootloader Function

If the project has been created without the Bootloader function, as Figure 3 shows, click “Option” → “Project settings” → “Project Option”, select “with Bootloader” and the required start mode, and then add the library file.

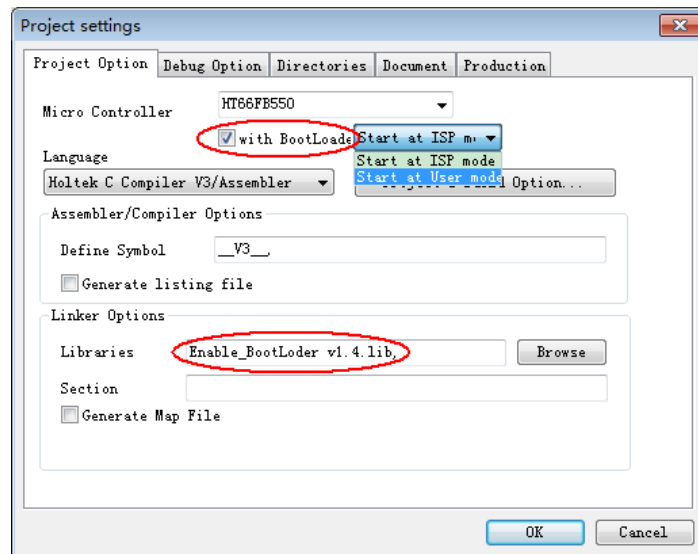


Figure 3 Add the Bootloader and Library File to the created Project

If “Start at ISP mode” has been selected, the program will firstly run the Bootloader Code and the Bootloader will start with the USB enumeration. After the enumeration is successful, ensure to open the I3000 software within a specified time so that the device will be connected, after which ISP programming will be allowed. Otherwise, when the the specified time has passed, the program will automatically run the User Code.

If “Start at User mode” has been selected, the program will firstly run the User Code. In this case, if users want to execute ISP programming, a switch action from the User Code to the Bootloader is needed. This can be achieved by calling a subroutine in the library file. For more details, refer to the application notes HA0321E and HA0322E on the Holtek website.

Note that the HT-IDE3000 software does not support Bootloader simulation.

HOPE3000

Use the HOPE3000 V3.08 or above version, which supports the Bootloader function and contains a misc folder in the installation directory. Send the project MTP file to the IC via the e-WriterPro. The Bootloader Code must be programmed via the e-WriterPro together with the HOPE3000 software. Note that both the e-Link and ISP are not available. So when it is the first time to program the IC, an e-WriterPro is required. Later the User Code can be updated directly via the ISP without an e-WriterPro.

USB Workshop

When “Start at User mode” is selected and an ISP update is required, the program needs to call a subroutine provided by the library file to switch to the Bootloader Code. Users should add a condition mechanism in the program so that when the pre-set condition is met, the subroutine will be called. The pre-set condition can be a key press condition, or an AP can be used to send a switch command to the device via the USB interface. To send a command via an AP, users can use the Holtek USB Workshop to generate Demo Codes and modify them. With regards to the Host code, add a switch command. With regards to the Device code, add a switch command processing code, which means to call the subroutine in the library file and return the result to the Host AP. For more details, refer to the application note “Using the USB Workshop for the HT66FB5x0/HT68FB5x0 to implement switching from User Code to Bootloader Code” on the Holtek website.

I3000 Usage

When the program has switched to the Bootloader Code, connect the device to the I3000.exe on the PC for ISP programming. The specific steps are shown below:

1. Connect the device to the I3000. When the USB device has connected to the PC, execute the I3000.exe. When the “USB Connect” and the “Download Mode” signs on the software interface both show ready, as shown in Figure 4, this means that the device has connected to the I3000 successfully.

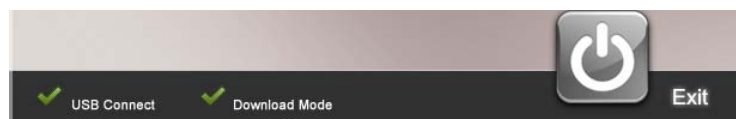


Figure 4 I3000 and Device connected successfully

2. Program the new program’s MTP file. Open the MTP file via the I3000 interface. Click the <Erase> button in the right side of the interface, select “Select All” and click the <OK> button to erase all. Then click the <Program> button to program the MCU. Click the <Verify> button to check whether the code has been programmed to the IC successfully.

3. After programming to the IC successfully, click the <MCU Start> button in the right side of the I3000 interface, as Figure 5 shows and select the MCU start mode. Here the options are similar to the IDE3000 except for the first option, “MCU starts at the bootloader”. Then click the <OK> button.

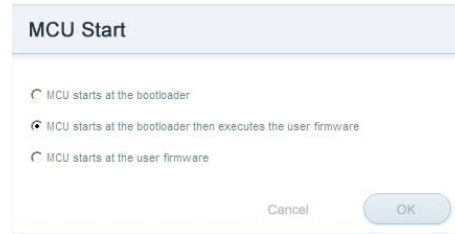


Figure 5 Set up MCU start mode

4. When a process bar “Execute Program...” as shown in Figure 6 appears showing “the machine needs to be rebooted!”, un-plug and re-plug the USB to re-power the MCU. The MCU will start to execute the updated program based on the selected mode. Now the present program update has been completed.

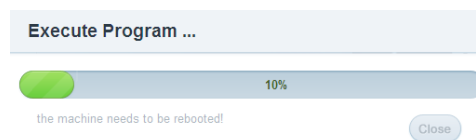


Figure 6 Execute Program ...

ISP Programming Flowchart

According to the above description, the ISP programming steps are shown below:

1. Use the IDE3000 to compile the program, enable the Bootloader and add the library file “Enable_BootLoader vx.x.lib”. After adding a switch to the Bootloader mechanism in the program, by pressing a key or using an AP command processing code to call the subroutine in the library file, the program will switch to the Bootloader Code. The processing code is generated by modifying the USB Workshop Demo Codes.
2. Use the e-WriterPro together with the HOPE3000 software to program the compiled MTP file to the IC. If the Bootloader Code has been programmed into the IC and the program contains the mechanism to switch to the Bootloader, this step can be skipped.
3. If the program is running the user code and an ISP update is required, users can press the pre-set key or use an AP to send a switch command to switch to the Bootloader.
4. After switch to the Bootloader successfully, reset the device to connect to the I3000, program the new program’s MTP file and select the MCU start mode.
5. After the ISP programming, reset the device and run the program based on the selected mode.

Conclusions

This application note has described the ISP programming flowchart using the IDE3000, HOPE3000, USB Workshop, I3000, Enable_Bootloader Library.