

HT8 MCU IAP Application Guidelines

D/N: AN0417E

Introduction

Some devices in the HOLTEK MCU range provide an IAP function. IAP, which stands for In-Application Programming. This allows the MCU, by using an internal program, to update its own application program or data sections, without requiring a writer or a PC. This text uses the HT66F70A as an example to show how the IAP function is used. It also includes some special notes for consideration.

Operating Principles

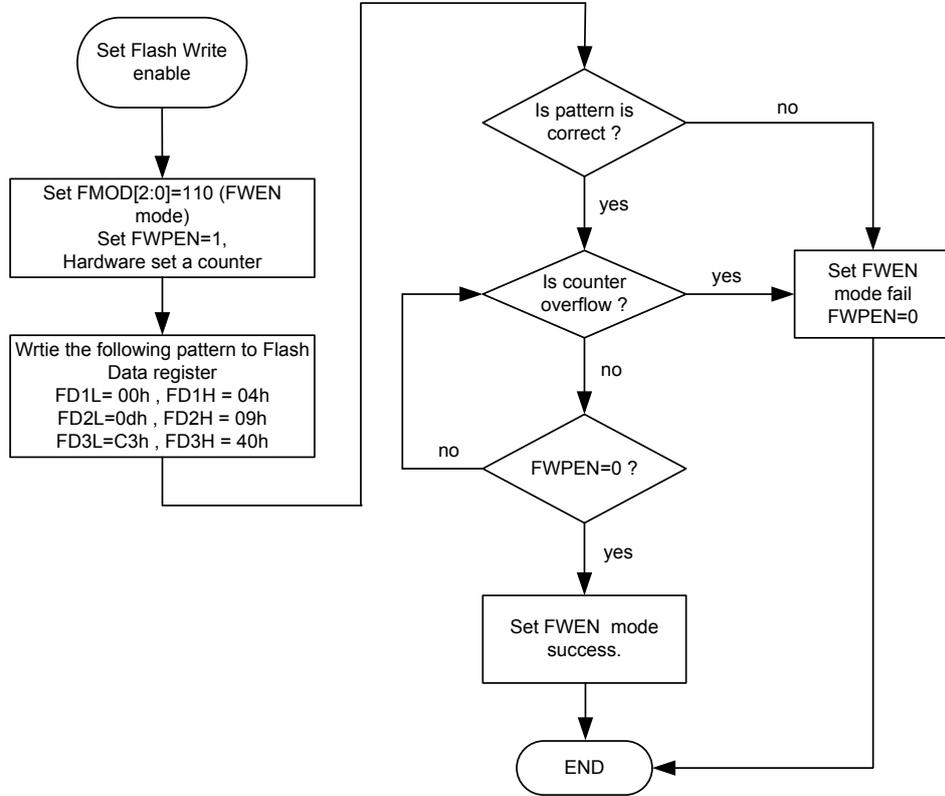
The IAP function is a functional part of the MCU which uses the program itself to control the internal Flash related registers to implement erase, write and read operations to the Flash memory contents. The operations to do this are not complex in nature. The IAP related registers include an address register pair, FARL and FARH, four data register pairs, FDnL and FDnH (n=0~3), and three control registers, FC0, FC1 and FC2. In addition, as the control registers are located in RAM Bank1, they must be indirectly accessed using the MP1L/MP1H and IAR1 registers. The detailed operation steps are as follows.

Flash Memory Write Function Enable Procedure

- Step 1. Write "110" into the FMOD2~FMOD0 bits to select the FWEN mode.
- Step 2. Set the FWPEN bit to "1". Steps 1 and 2 can be executed simultaneously.
- Step 3. Then data with a sequence of 00H, 04H, 0DH, 09H, C3H and 40H must be written into the FD1L, FD1H, FD2L, FD2H, FD3L and FD3H registers respectively.
- Step 4. A counter with a time-out period of 300 μ s will be activated to allow users to write the correct data sequence into the FD1L/FD1H ~ FD3L/FD3H register pairs. The counter clock is derived from the LIRC oscillator.
- Step 5. If the counter overflows or the data is incorrect, the Flash memory write operation will not be enabled and the user must once again repeat the above procedure. After this the FWPEN bit will automatically be cleared to 0 by hardware.
- Step 6. If the data is correct before the counter overflows, the Flash memory write operation will be enabled and the FWPEN bit will automatically be cleared to 0 by the hardware. The CFWEN bit will also be set to 1 by hardware to indicate that the Flash memory write operation is successfully enabled.

Step 7. Once the Flash memory write operation is enabled, the user can change the Flash memory data using the Flash control register.

Step 8. To disable Flash memory write operations, clear the CFWEN bit to 0.

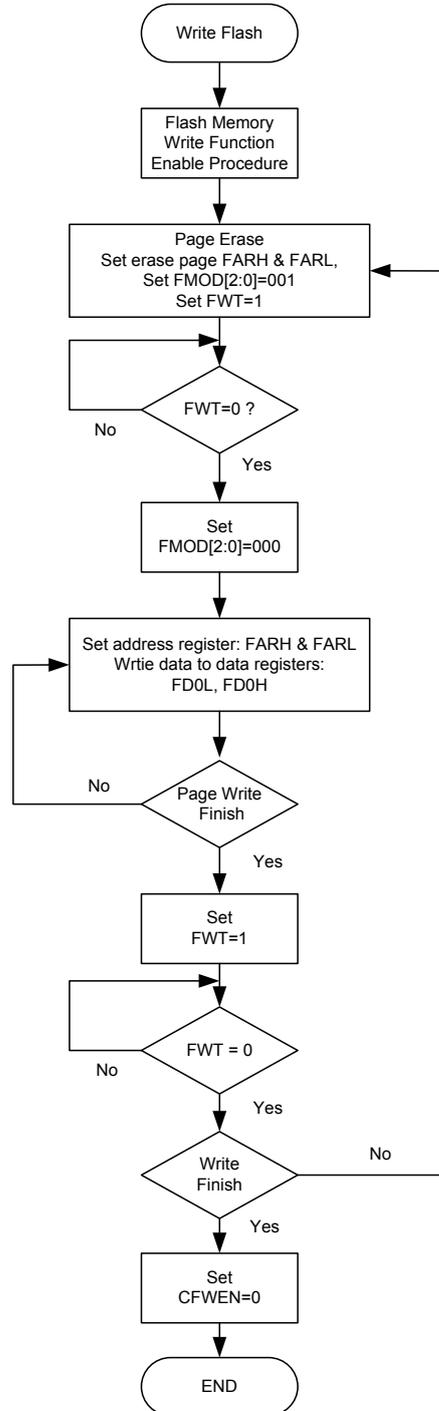


Flash Memory Write Function Enable Procedure

Read/Write Flash Memory

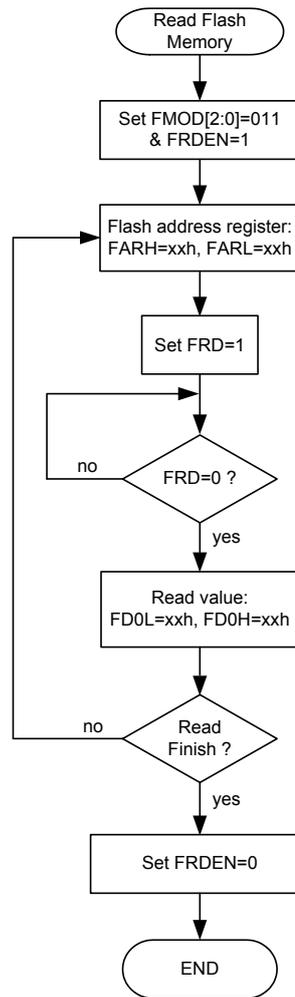
After the Flash memory write function has been successfully enabled using the preceding IAP procedure, users must first erase the corresponding Flash memory block or page and then initiate a Flash memory write operation.

Write Flash Memory Page Flow Chart



Write Flash Memory Procedure

Read Flash Memory Page Flowchart



Read Flash Memory Procedure

Program Example

This program example uses the HT66F70A as an example to implement an erase page, write, read and other basic IAP operations to the Flash memory. The IAP functions are implemented by calling four subroutines for the IAP operations, namely enable, write, read and erase operations. To determine whether the corresponding operation has been successfully implemented, two methods can be used. One method is to use the OCDS to check the ROM window in the IDE3000. Another method is to use the HOPE3000 to check the uploaded data.

The specific operation module programs are provided in the relevant program attachments, IAP_Main.c and IAP_Main.asm.

Programming Considerations

For the MCUs which contain an IAP function, the number of the page erase operation is 32 or 64 words per page, according to the specification selected.

The data register pairs must be written in a certain order with the low byte being written first after which the high byte should be written. Writing data into the high byte register, FD0H, will write both the high and low byte data into a write buffer. This will cause the Flash memory address to increment by one automatically, after which the new address will be loaded into the FARH and FARL registers. However, the user can also directly enter a new address by writing directly to the FARH and FARL registers, after which data will be written to these corresponding addresses. However it is important to note that the address must be in the same page.

A cross-page situation should be avoided. If the address has already reached the boundary of the flash memory, 11111b of the 32 words or 111111b of the 64 words, the address will not be increased and will just stop at the last address of that page, and any write operations will be invalid.

When the address has reached the page boundary of the flash memory, the user will need to setup a new address once again to enter new data.

Data can be written to the Flash memory via the write buffer by setting the FWT bit. After the write procedure has completed within a 2ms time interval, the write buffer and the FWT bit will be automatically cleared by the hardware.

During IAP operations, the MCU will be stopped when a HALT instruction is executed. In the IDE3000, when the IAP operation is debugged using the OCDS, the debug information cannot be displayed accurately, such as IAP operation time.

Conclusion

Using read or write application programs in the Flash memory, and using the IAP function, this text has described the IAP operation procedures and summarised some considerations for their use. Users can implement their desired IAP applications by referring to the specific IAP operation modules.

Program Examples

- C Language Example



IAP_Main.c

- ASM Language Example



IAP_Main.asm

Versions and Modify Information

Data	Author	Issue Release and Modification
2015.12.10	林永雙	First Version

References

Reference file: HT66F70A DataSheet.

For more information, refer to the Holtek's official website www.holtek.com.

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