USBD MSD ISP

NuMicro® 32 位系列微控制器範例代碼介紹

文件資訊

代碼簡述	使用 M451 實作 MSD ISP 功能
BSP 版本	M451 Series BSP CMSIS V3.01.003
開發平台	NuTiny-EVB-M451-LQFP100 V1.3

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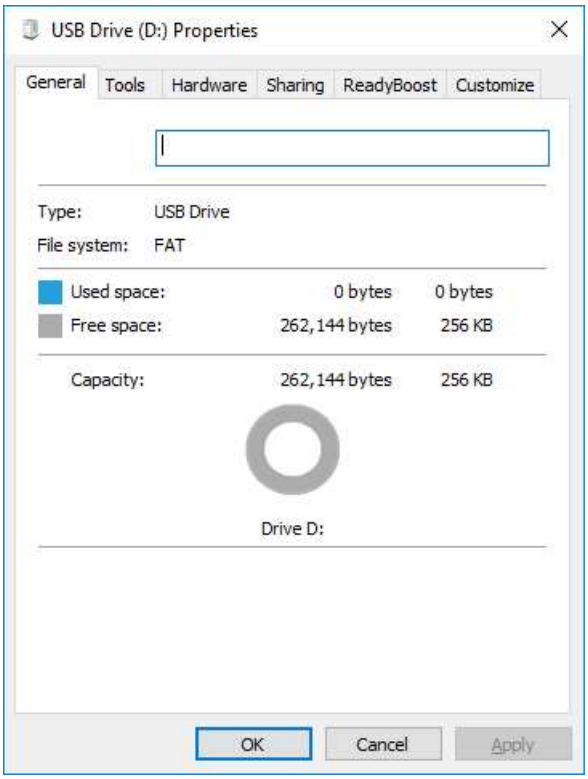
1 功能介紹

1.1 簡介

MSD ISP是ISP(In-System Programming)的其中一種方法，本範例程式演示如何透過MSD ISP達到APROM的韌體更新，此法不需要提供PC端工具或是驅動程式。使用者只需要將MSD ISP儲存裝置連接上PC，等待PC辨識出儲存裝置後，再將韌體檔案複製到儲存裝置就可以完成韌體更新。

1.2 執行結果

開機時，如果特定的GPIO (本範例使用GPA0) 為低電位，M451將會進入韌體更新模式，當MSD ISP儲存裝置連接上PC，PC會辨識出儲存裝置，將韌體檔案複製到儲存裝置就可以完成韌體更新。

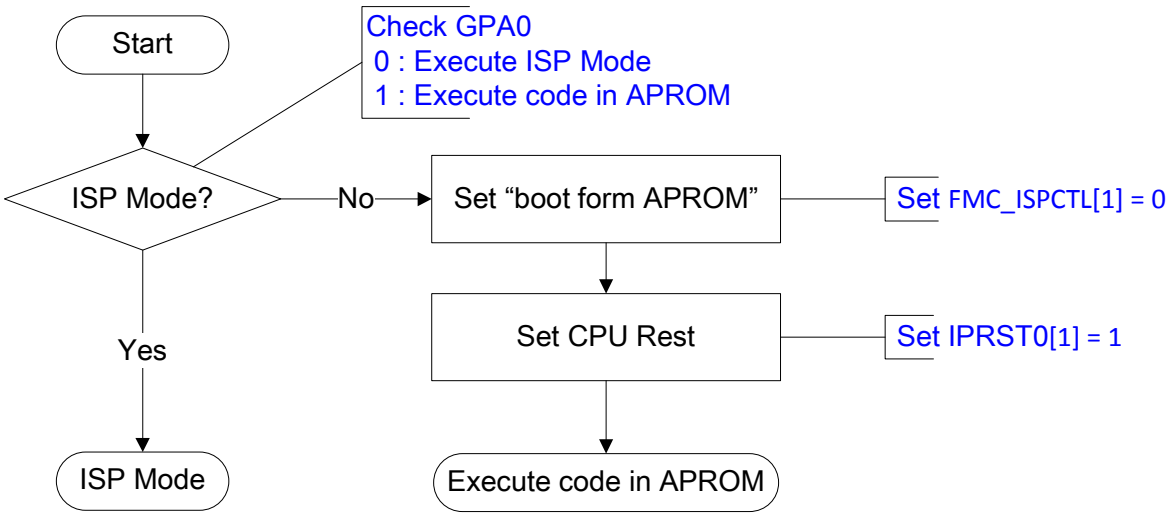


圖表 1 MSD ISP 裝置

2 代碼介紹

2.1 開機流程

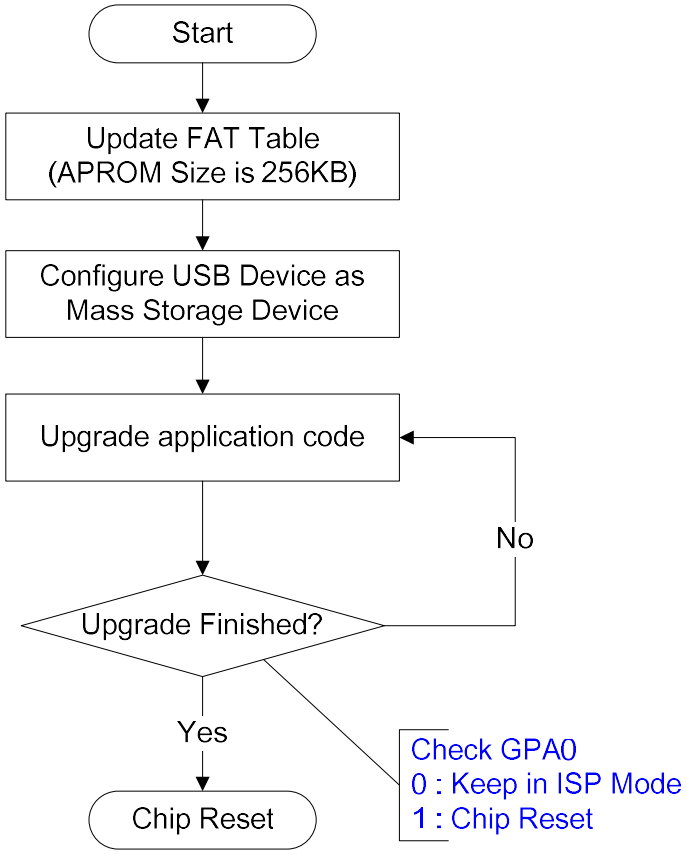
M451 會依照所選定 GPIO 的狀態做為進入韌體更新模式或是執行 APROM 韌體的條件。



圖表 2 開機流程

2.2 Mass Storage ISP 流程

進入韌體更新模式時，此範例會用 APROM 的容量更新檔案配置表(FAT)，再將 USB 裝置設定為儲存裝置，當 MSD ISP 儲存裝置連接上 PC，PC 會辨識出儲存裝置，就可以開始執行成韌體更新。當更新完成後，使用者可以透過將選定的 GPIO 設為高電位來重置 M451 並執行 APROM 的韌體。



圖表 3 MSD ISP 流程

2.3 USB MSD 端點組態

一個 UBS 裝置一定會有一個控制管線(端點 0)，用於控制傳輸。其他端點可以根據應用而有不同的設定。此範例中的控制管線由裝置端硬體的的端點 0 和端點 1 構成，從 USB 主機的角度看來，只會看到端點 0；此範例包含 1 組介面：包含一個的輸入端點與一個的輸出端點，分別用於輸入與輸出方向的大量傳輸(Bulk Transfer)。這些介面和端點的關系列於表格 1。

Function	USB Composite Device	M451 Hardware setting
Control Transfer	Control Pipe endpoint 0: Control IN/OUT	endpoint 0: Control IN endpoint 1: Control OUT
Mass storage device	Interface 0 endpoint 2: Bulk IN endpoint 3: Bulk OUT	endpoint 2: Bulk IN endpoint 3 Bulk OUT

表格 1 MSD 介面與端點組態

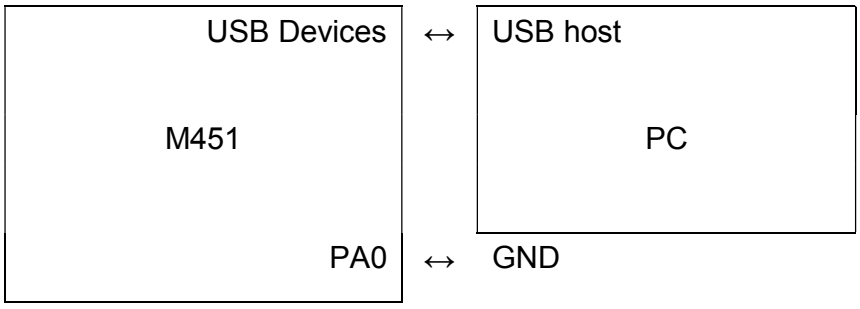
2.4 檔案配置表(FAT)與韌體更新

DataFlashRead 負責回覆 PC 端儲存裝置的檔案配置表(FAT)，DataFlashWrite 負責將新的韌體寫入 APROM。

```
void DataFlashRead(uint32_t u32Addr, uint32_t * u32Buf)
{
    USBD_MemReset((uint8_t *)u32Buf, STORAGE_BUFFER_SIZE);

    if (u32Addr == 0x00000000)
    {
        uint32_t u32Sectors = g_u32u32StorageSize / UDC_SECTOR_SIZE;

        u8FormatData[19] = u32Sectors & 0xFF;
        u8FormatData[20] = (uint8_t)(u32Sectors >> 8);

        USBD_MemCopy((uint8_t *)u32Buf, u8FormatData, sizeof(u8FormatData));

        u32Buf[STORAGE_BUFFER_SIZE/4-1] = 0xAA550000;
    }
    else if ((u32Addr == (RSVD_SEC_CNT * BYTE_PER_SEC)) ||
             (u32Addr == ((RSVD_SEC_CNT + FAT_SZ) * BYTE_PER_SEC)))
    {
        u32Buf[0] = 0x00FFFFF8;
    }

    else if (u32Addr == ((RSVD_SEC_CNT + FAT_SZ * NUM_FAT) * BYTE_PER_SEC)) /* root dir */

    {
        USBD_MemCopy((uint8_t *)u32Buf, u8RootDirData, sizeof(u8RootDirData));
    }
}

void DataFlashWrite(uint32_t u32Addr, uint32_t * u32Buf)
{
    /* This is low level write function of USB Mass Storage */
    if ((u32Addr >= DATA_SEC_ADDR) && (u32Addr < g_u32u32StorageSize))
    {
        u32Addr -= DATA_SEC_ADDR;

        if (g_u8LockBit)
        {
            if ((u32Addr & (FMC_FLASH_PAGE_SIZE - 1)) == 0)
                FMC_ISP(FMC_ISPCMD_PAGE_ERASE, u32Addr, 0);
        }
       /* For Security Lock */
        else if (u32Addr == 0)
        {
            uint32_t i;

            for (i = 0; i < (g_u32u32StorageSize - DATA_SEC_ADDR);
                  i += FMC_FLASH_PAGE_SIZE)
                FMC_ISP(FMC_ISPCMD_PAGE_ERASE, i, 0);
        }
        DataFlashProgramPage(u32Addr, u32Buf);
    }
}
```

3 軟體與硬體環境

- **軟體環境**
  - BSP 版本
    - M451 Series BSP CMSIS v3.01.003
  - IDE 版本
    - Keil uVersion 5.26
- **硬體環境**
  - 電路元件
    - NuTiny-EVB-M451-LQFP100 V1.3
    - USB mini USB cable
    - M451 PA0 connect to GND
  - 示意圖



4 目錄資訊

- EC_M451_USBD_MSD_ISP_V1.00
  - Library — Sample code header and source files
    - CMSIS — Cortex® Microcontroller Software Interface Standard (CMSIS) by Arm® Corp.
    - Device — CMSIS compliant device header file
  - SampleCode
    - ExampleCode — Source file of example code

5 如何執行範例程式

1. 根據目錄資訊章節進入 ExampleCode 路徑中的 KEIL 資料夾，雙擊 USBD_MSD_ISP.uvproj。
2. 進入編譯模式介面
   a. 編譯
   b. 下載代碼至記憶體
   c. 進入 / 離開除錯模式
3. 進入除錯模式介面
   a. 執行代碼

6 修訂紀錄

Date	Revision	Description
Nov.1, 2019	1.00	1. 初始發布.

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