USBD MSD ISP

NuMicro® 32 位系列微控制器范例代码介绍

文件信息

代码简述	使用 M451 实作 MSD ISP 功能
BSP 版本	M451 Series BSP CMSIS V3.01.003
开发平台	NuTiny-EVB-M451-LQFP100 V1.3

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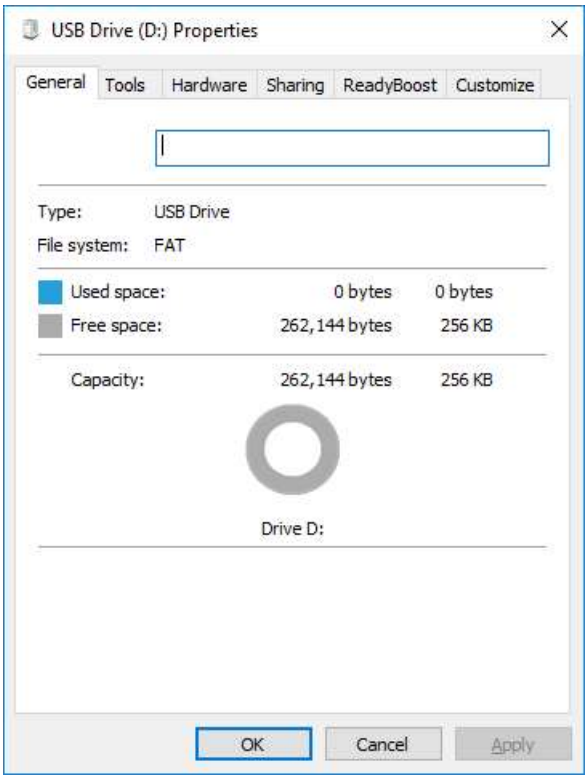
1 功能介绍

1.1 简介

MSD ISP是ISP(In-System Programming)的其中一种方法，本范例程序演示如何透过MSD ISP达到APROM的韧体更新，此法不需要提供PC端工具或是驱动程序。用户只需要将MSD ISP储存装置连接上PC，等待PC辨识出储存装置后，再将韧体档案复制到储存装置就可以完成韧体更新。

1.2 执行结果

开机时，如果特定的GPIO (本范例使用GPA0) 为低电位，M451将会进入韧体更新模式，当MSD ISP储存装置连接上PC，PC会辨识出储存装置，将韧体档案复制到储存装置就可以完成韧体更新。

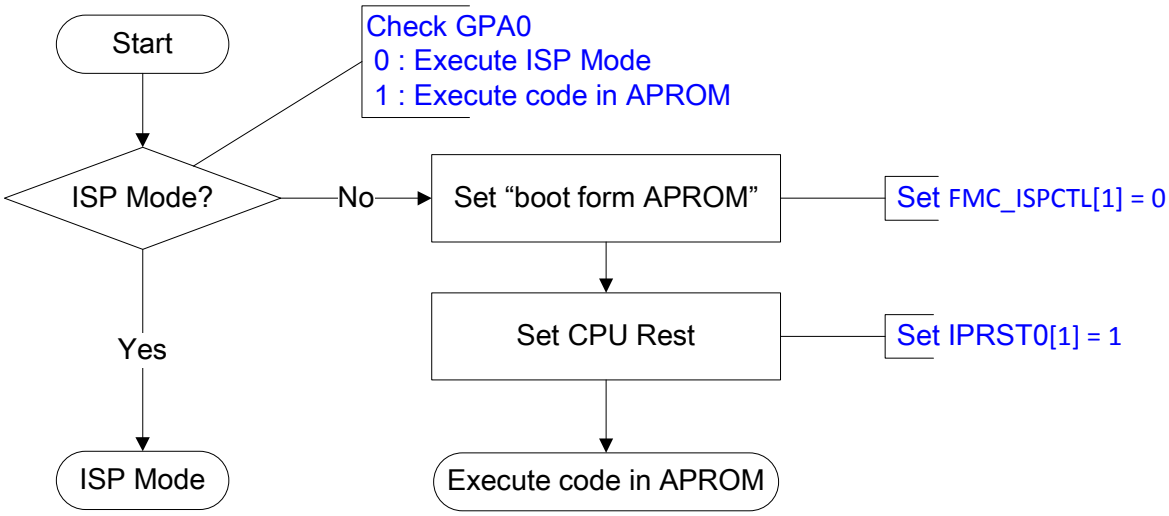


图表 1 MSD ISP 装置

2 代码介绍

2.1 开机流程

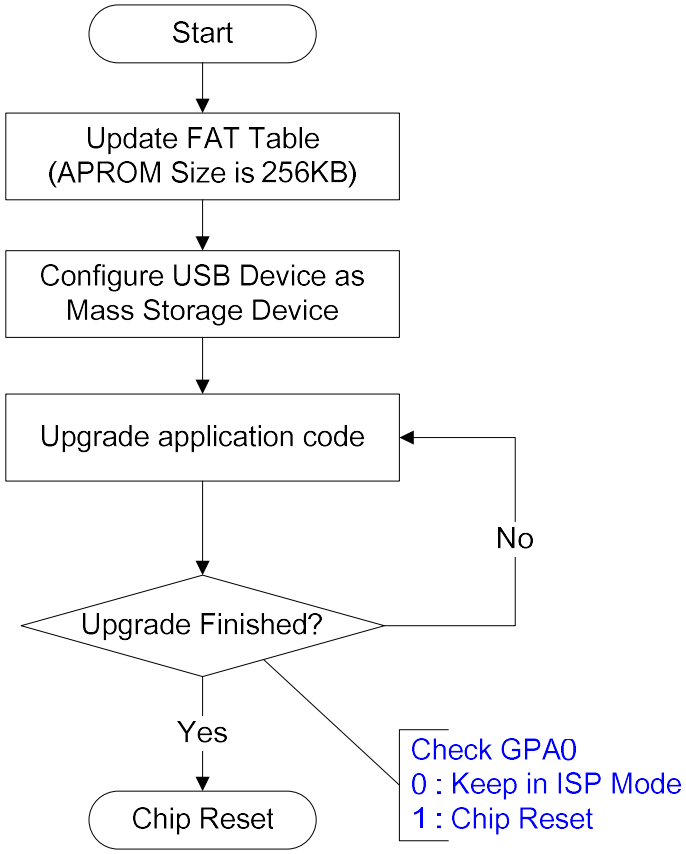
M451 会依照所选定 GPIO 的状态做为进入韧体更新模式或是执行 APROM 韧体的条件。



图表 2 开机流程

2.2 Mass Storage ISP 流程

进入韧体更新模式时，此范例会用 APROM 的容量更新文件分配表(FAT)，再将 USB 装置设定为储存装置，当 MSD ISP 储存装置连接上 PC，PC 会辨识出储存装置，就可以开始执行成韧体更新。当更新完成后，使用者可以透过将选定的 GPIO 设为高电位来重置 M451 并执行 APROM 的韧体。



图表 3 MSD ISP 流程

2.3 USB MSD 端点组态

一个 UBS 装置一定会有一个控制管线(端点 0)，用于控制传输。其他端点可以根据应用而有不同的设定。此范例中的控制管线由装置端硬件的的端点 0 和端点 1 构成，从 USB 主机的角度看来，只会看到端点 0；此范例包含 1 组接口：包含一个的输入端点与一个的输出端点，分别用于输入与输出方向的大量传输(Bulk Transfer)。这些接口和端点的关系列于表格 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 界面与端点组态

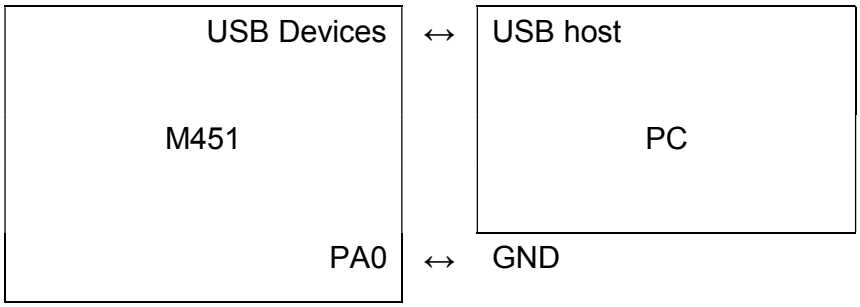
2.4 文件分配表(FAT)与韧体更新

DataFlashRead 负责回复 PC 端储存装置的文件分配表(FAT)，DataFlashWrite 负责将新的韧体写入 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 软件与硬件环境

- 软件环境
  - BSP 版本
    - M451 Series BSP CMSIS v3.01.003
  - IDE 版本
    - Keil uVersion 5.26
- 硬件环境
  - 电路组件
    - NuTiny-EVB-M451-LQFP100 V1.3
    - USB mini USB cable
    - M451 PA0 connect to GND
  - 示意图



4 目录信息

- 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 如何执行范例程序

1. 根据目录信息章节进入 ExampleCode 路径中的 KEIL 文件夹，双击 USBD_MSD_ISP.uvproj。
2. 进入编译模式接口
   a. 编译
   b. 下载代码至内存
   c. 进入 / 离开除错模式
3. 进入除错模式接口
   a. 执行代码

6 修订纪录

Date	Revision	Description
Nov.1, 2019	1.00	1. 初始发布.

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