USBH OTG FS Hands ON

May 2018

STMCU FAE

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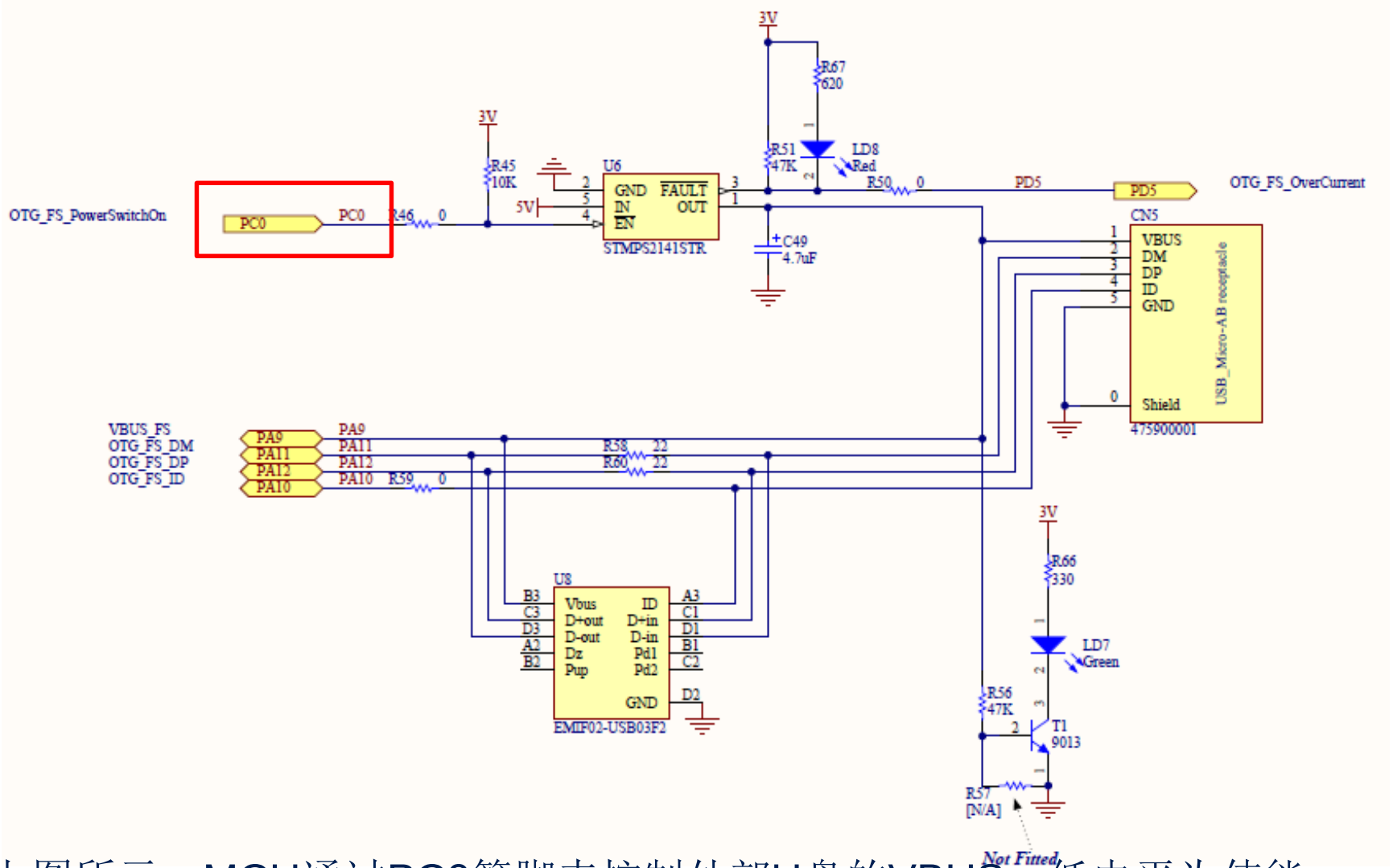
制作一个读取U盘文件系统的工程

- 读取U盘的程序在实际项目中经常会用到，这里我们基于STM32407-Discovery（STM32F407VGT6）探索板来介绍如何创建一个读取U盘的程序。
- 介绍基于CubeMx如何创建一个读取U盘的工程,通过FAT32文件系统创建和读取文件。
- 在这个示例中，我们将通过一个按键来触发文件的读写。

材料准备

- STM32F407-DISC
- CubeMx 4.25.0
- STM32Cube_FW_F4_V1.21.0 lib
- IAR

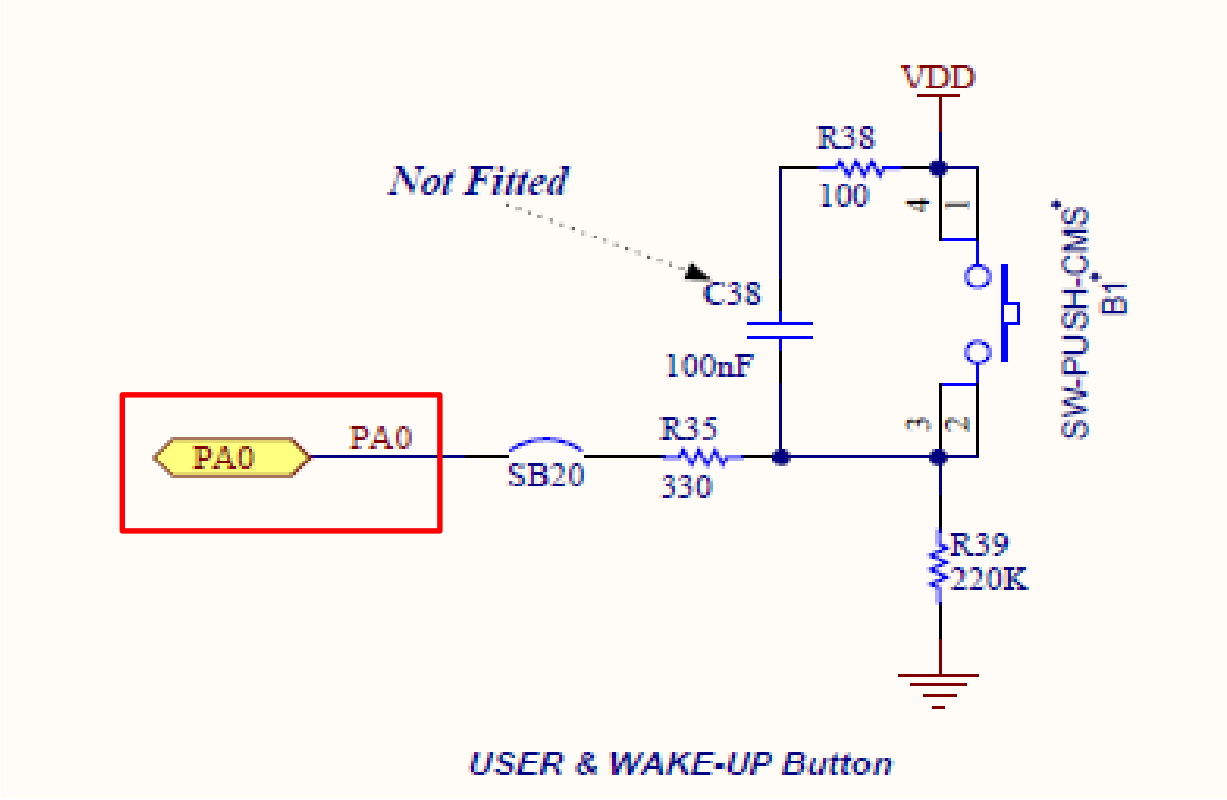
硬件介绍

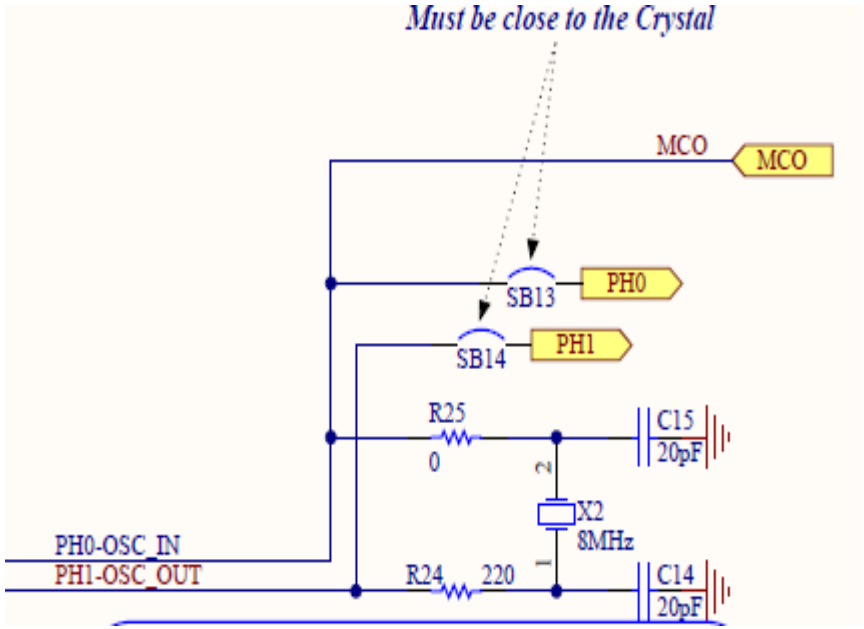


如上图所示，MCU通过PC0管脚来控制外部U盘的VBUS，低电平为使能。

PC0: general gpio and output Low

硬件介绍





HSE= 8MHz

利用上图中的User按键(PA0)来触发文件的读。
PA0: gpio_exit falling edge dection

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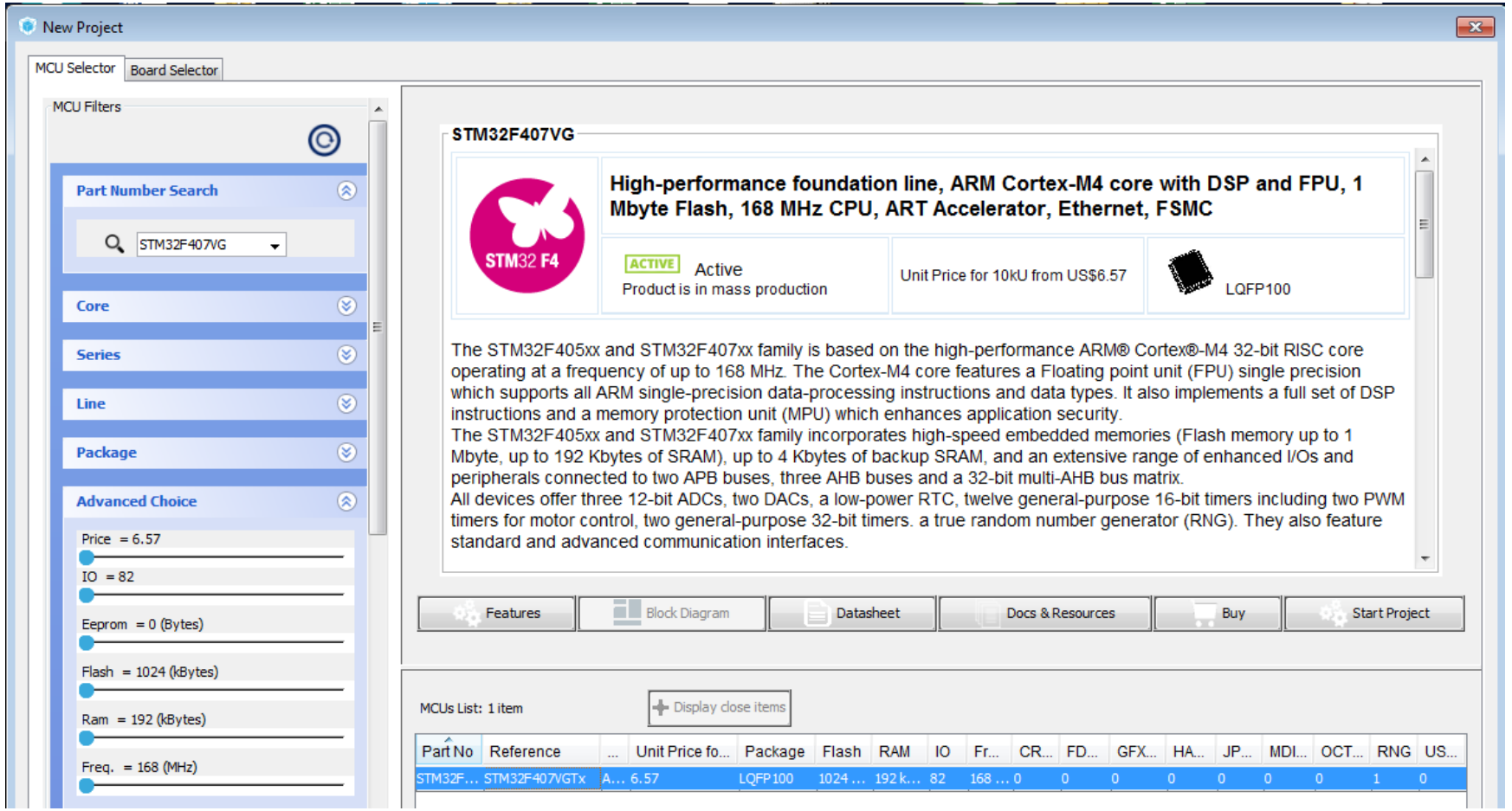
CubeMx新建工程

- 1、打开CubeMX->New Project->Parte Number Search->Double Click



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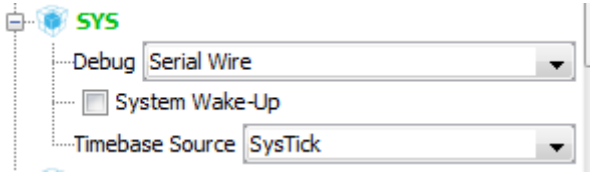
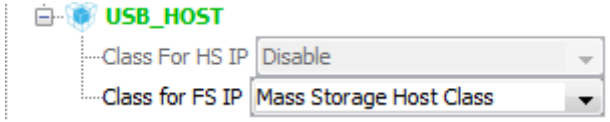
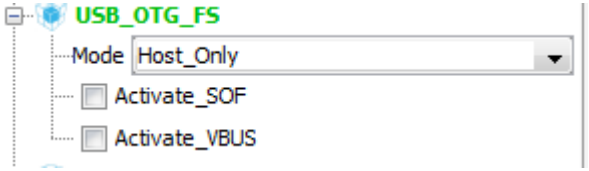
CubeMx新建工程

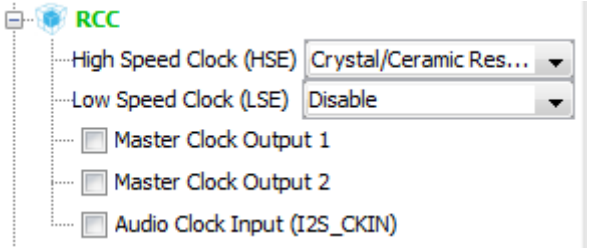
- 2、Pinout label配置相关外设和中间件



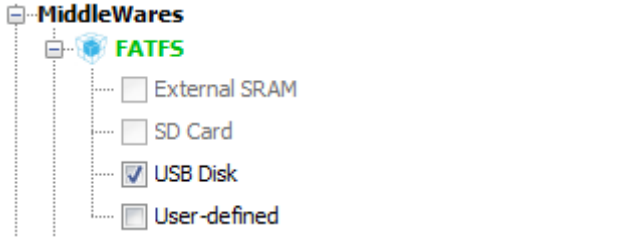
SWD interface

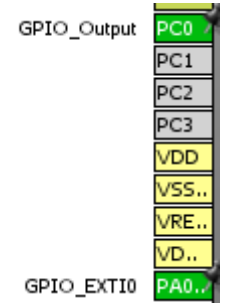






HSE 8MHZ



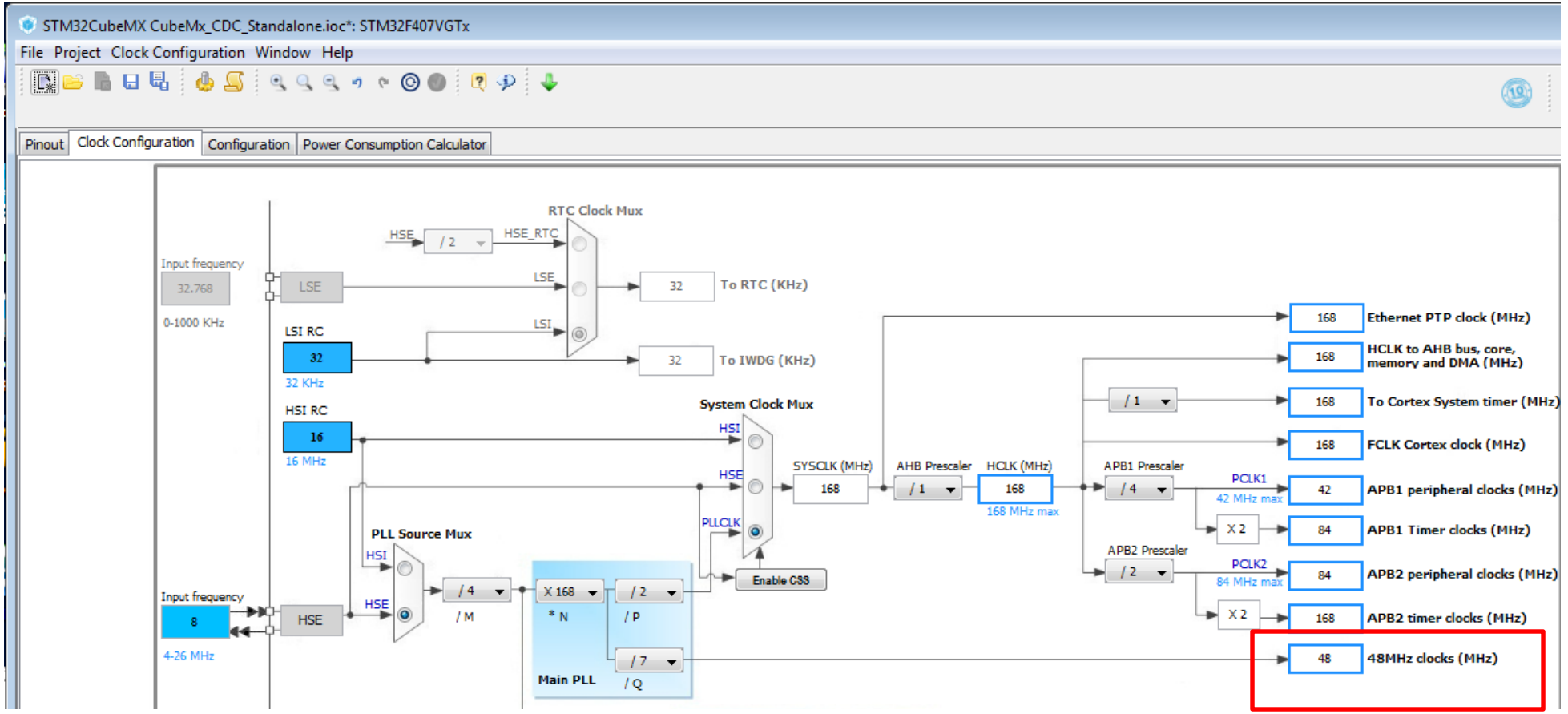


PC0: Vbus EN
PA0：Ext INT

STM32407-DIS探索版使用的是STM32F407VGT6，板上的USB为FS，
因此在pingout页面中使能USB_OTG_FS外设，并设置为Host_Only：

CubeMx新建工程

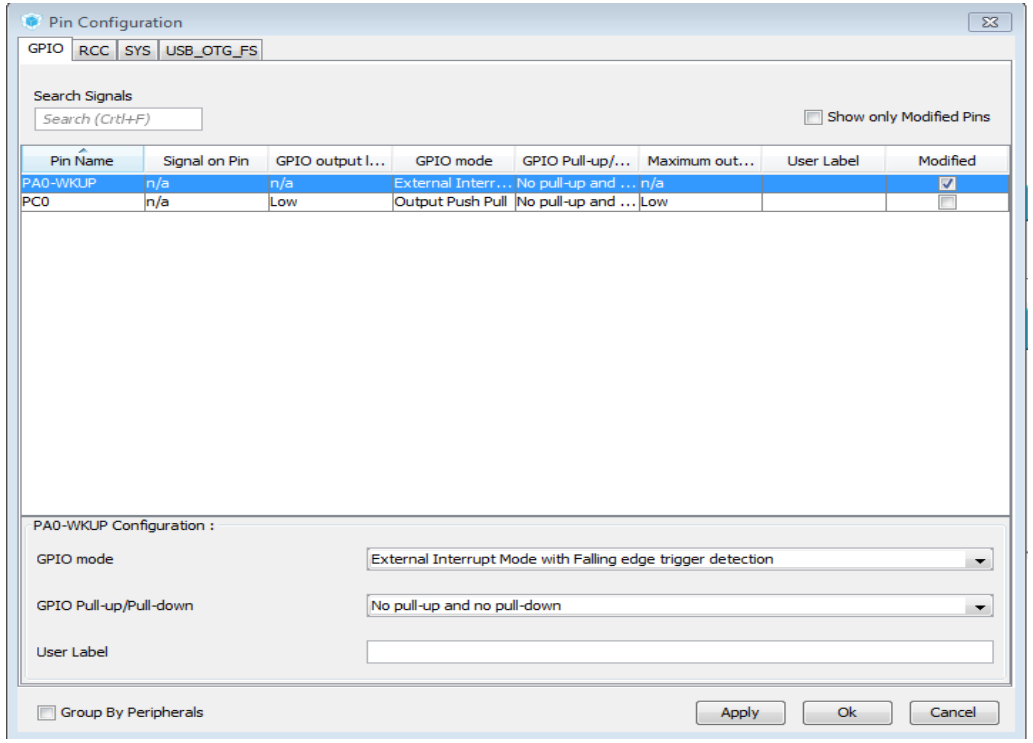
- 3、Clock Configuration label配置系统时钟树



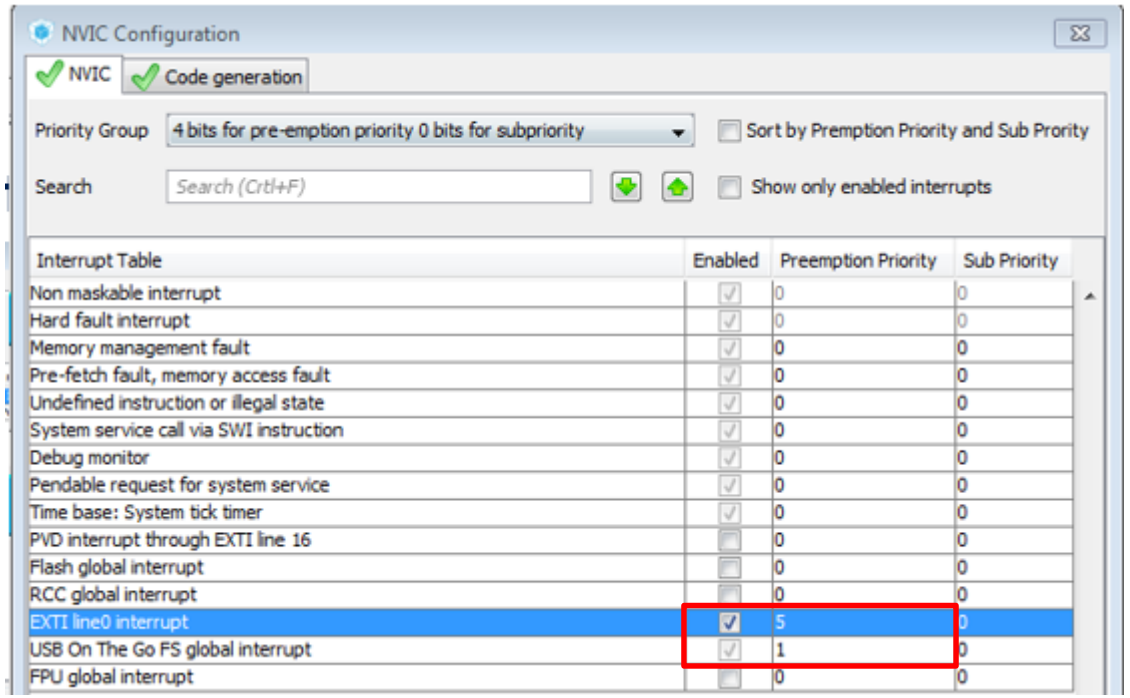
- Note:这里使用的HSE=8Mhz，修改之以匹配于相应的实验板

CubeMX新建工程

- 4、Configuration label配置



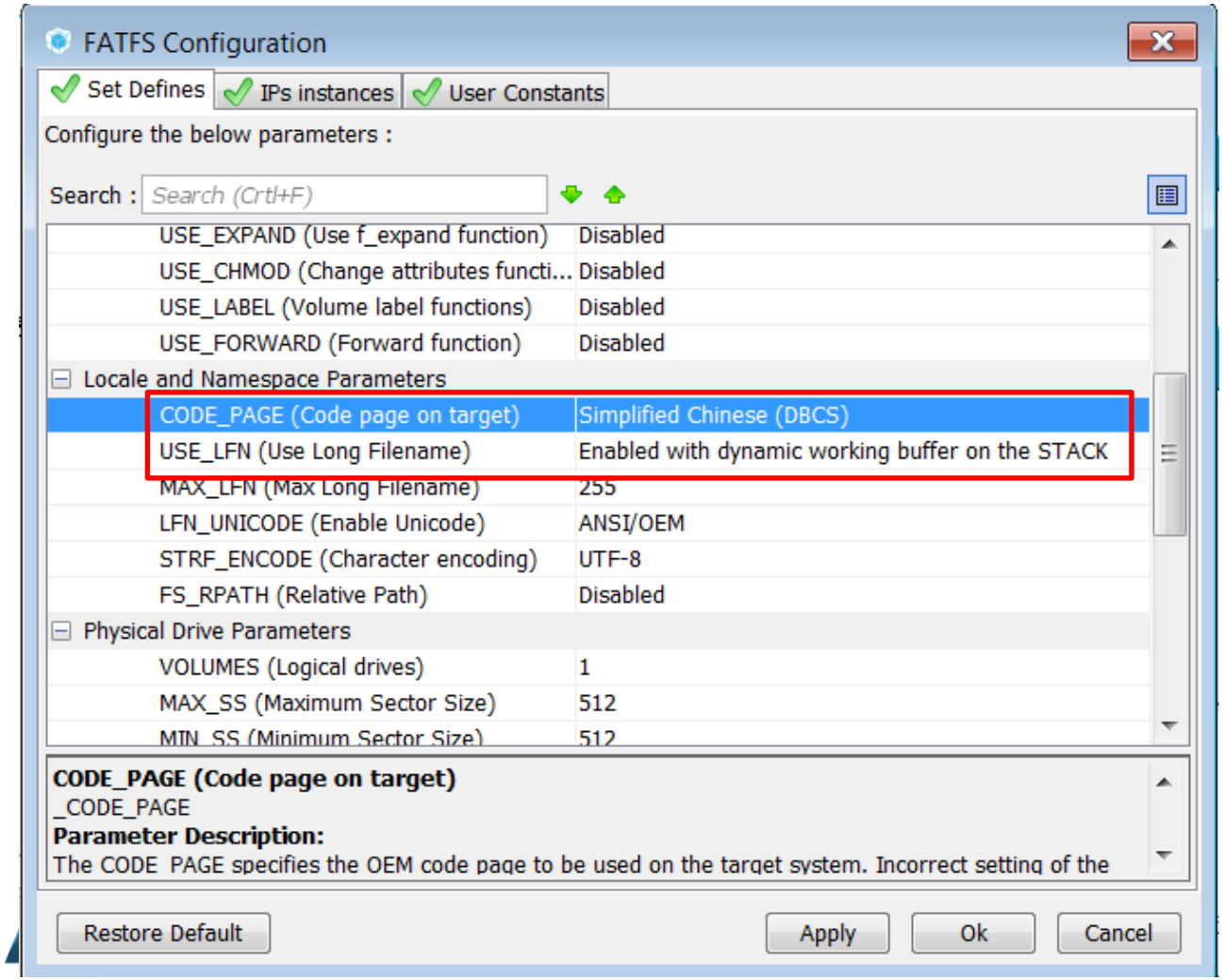
PA0 = 外部中断，下降沿检测



在NVIC中，一定要将USB的中断优先级高于按键中断，否则U盘不能正常读取。设置（前面的Enabled要相应的勾选上）：
USB中断优先级设置为1，
而外部中断10设置为5

CubeMx新建工程

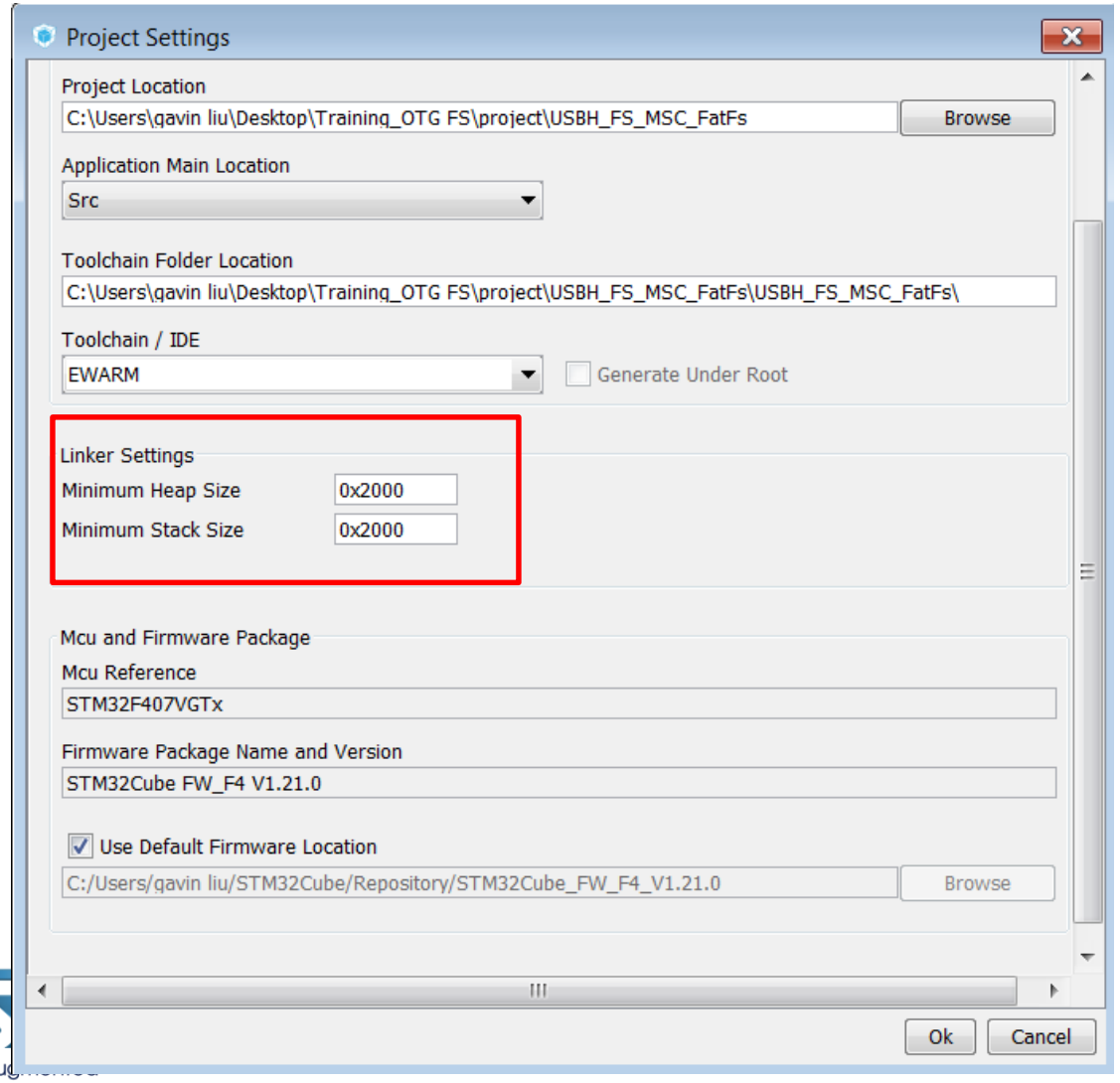
- 4、Configuration label配置



中间件配置方面，其实可以使用默认，不过我们还是修改部分参数。使得支持简体中文和长文件名字。

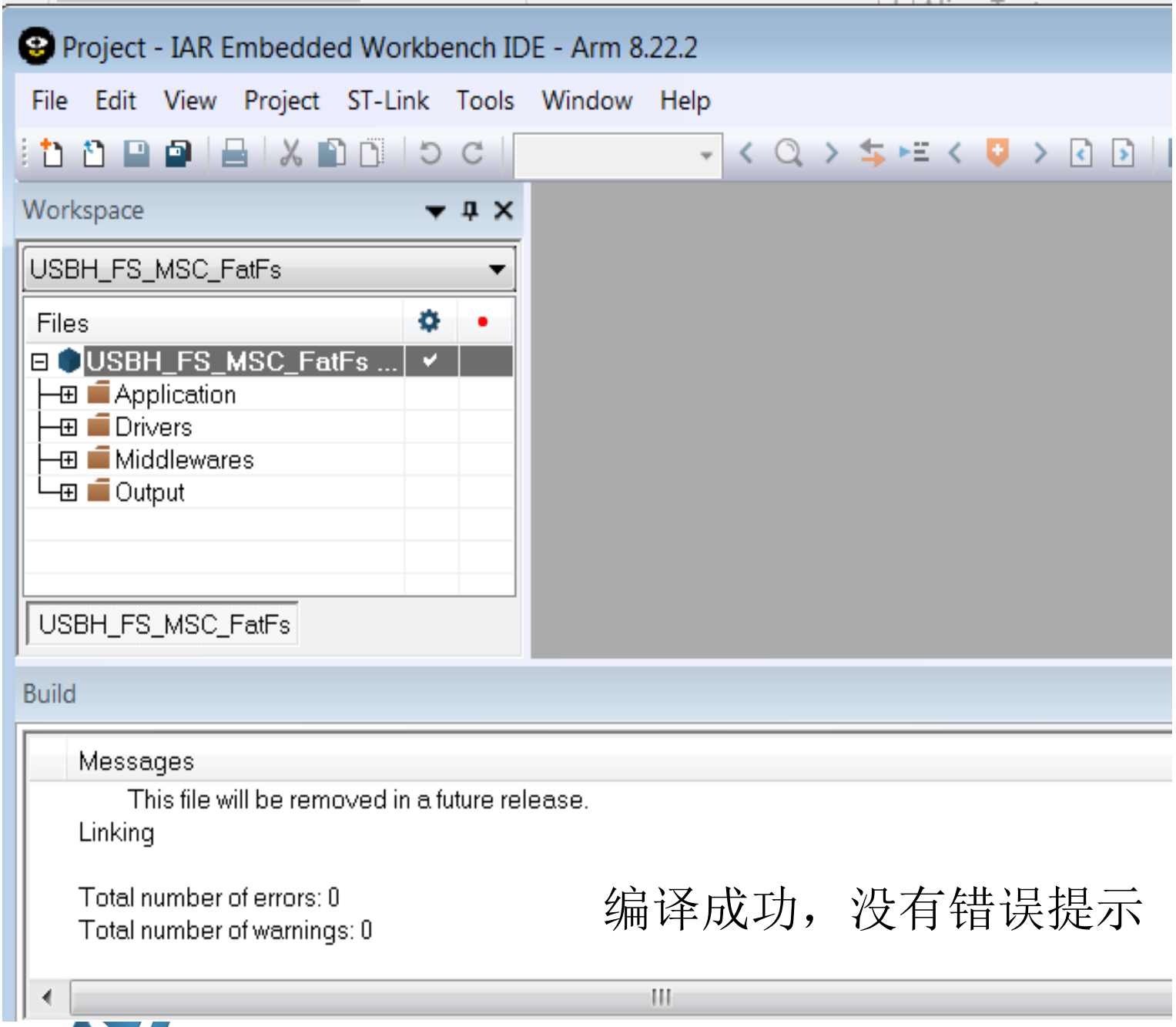
Cube新建工程

- 5、生成工程代码



修改栈和堆的空间大小
都设置为8K（0x2000）

编译生成的代码



编译成功，没有错误提示

添加实验代码

在生成的代码中，首先我们对main函数进行修改，在main函数中我们需要做的工作主要有以下几件：

- 完成系统初始化（CubeMx）
- 使能VBUS(CubeMx)
- 当检测到插入U盘时挂载文件系统
- 当检测到U盘拔出时，卸载文件系统

Main.c

根据不同的USB状态，装载/卸载FatFs

```
extern ApplicationTypeDef Appli_state;
static ApplicationTypeDef pre_state = APPLICATION_IDLE;
FATFS fs;
while (1) {
    MX_USB_HOST_Process();
    if (pre_state != Appli_state){
        switch(Appli_state){
            case APPLICATION_DISCONNECT: //USB flash disk remove
                if(f_mount(NULL, "", 0) != FR_OK){
                    USBH_UsrLog("ERROR : Cannot exit FatFs! \n");
                }
            break;
            case APPLICATION_READY:   //USB flash disk plugin
                 if(f_mount(&fs, "", 0) != FR_OK){
                     break;
                 }
            break;
            default:
            break;
        }
        pre_state = Appli_state;
    } //end if (pre_state != Appli_state)
}
```

Main.c

- User按键触发MSC的读写

```
extern USBH_HandleTypeDef hUsbHostFS;
void HAL_GPIO_EXTI_Callback(uint16_t GPIO_Pin){
    if(USBH_MSC_IsReady(&hUsbHostFS)){
        switch(uer_button_step ++){
            case 0:
                writefile_test();       //写文件测试
            break;

            case 1:
                readfile_test();        //读文件测试
            break;

            default:
            break;
        }
        if(uer_button_step >1){
            uer_button_step =0;
        }
    }
}
```

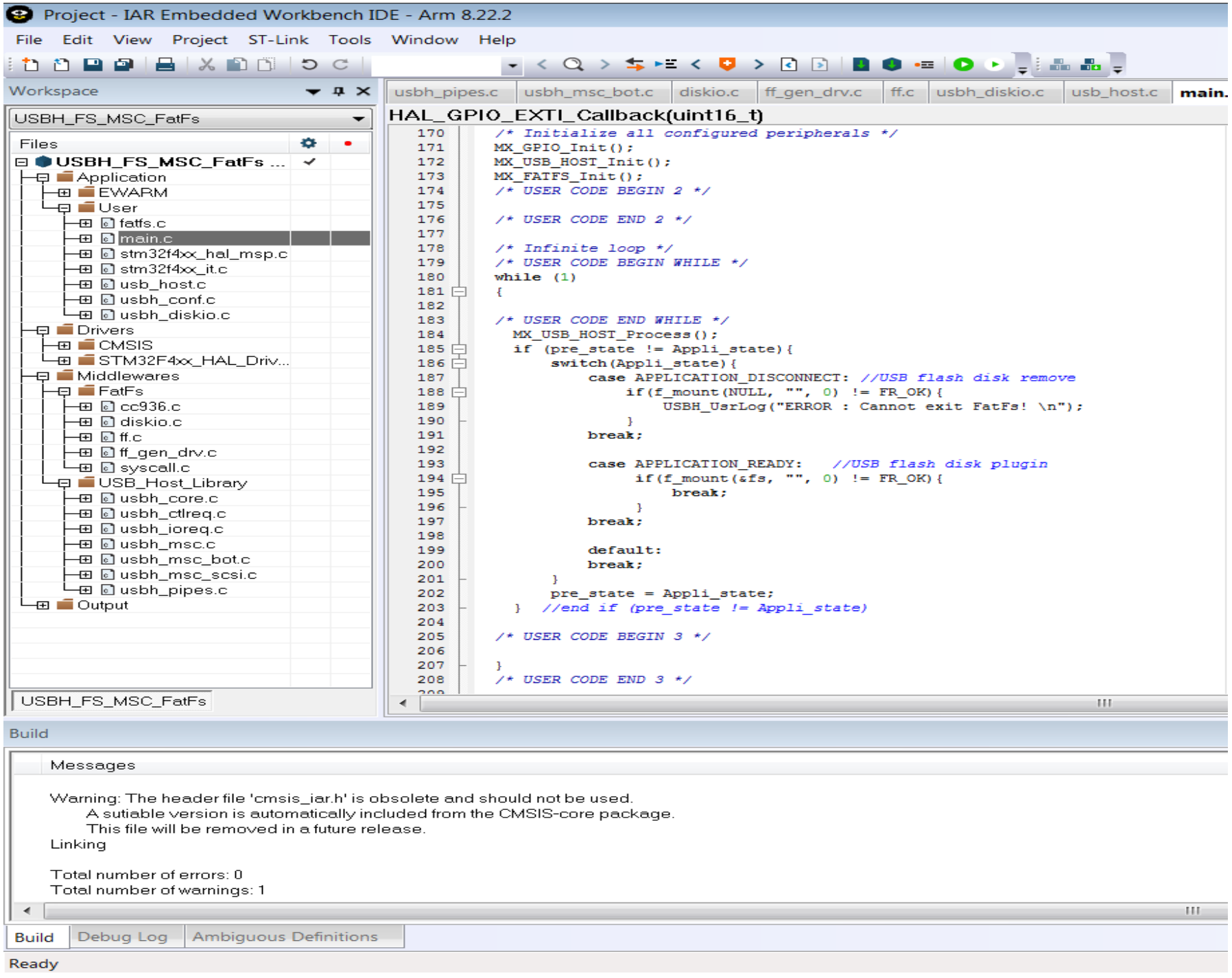
MSC读函数及相关参数定义的测试示例

```
volatile uint32_t byteswritten = 0, bytesread = 0;                  /* File write/read counts */
uint8_t wtext[] = "This is STM32 MSC working with FatFs, GoodGood Study, DayDayUp"; /* File write buffer */
volatile uint8_t uer_button_step =0;

 void readfile_test(void){
    FIL fil;
    FRESULT fr;
    uint8_t rtext[100];                                 /* File read buffer */

    if(f_open(&fil, "0:/mySTtest.txt", FA_READ) != FR_OK){/* Opens an existing file. If not exist, creates a new file. */
        return;
    }else{
        fr = f_read(&fil, rtext, sizeof(rtext), (void *)&bytesread);
        if((bytesread == 0) || (fr != FR_OK)){
            return;
        }else{
            f_close(&fil);
            if((bytesread != byteswritten)){
                return;
            }
        }
    }
}
```

MSC写函数的测试示例

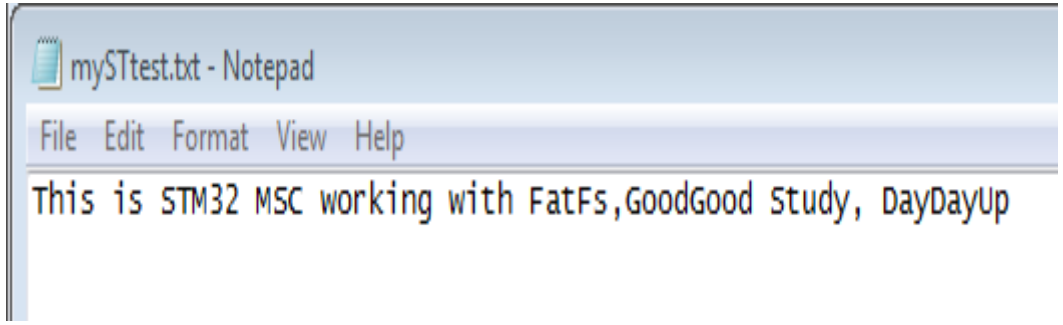
```
void writefile_test(void){
    FIL fil;
    FRESULT fr;

    if(f_open(&fil, "0:/mySTtest.txt", FA_READ | FA_WRITE | FA_CREATE_ALWAYS) != FR_OK){
        return;
    }else{
        fr = f_write(&fil, wtext, sizeof(wtext), (void *)&byteswritten);
        if((byteswritten == 0) || (fr != FR_OK)){
            return;
        }else{
            f_close(&fil);
        }
    }
}
```

编译成功


Project - IAR Embedded Workbench IDE - Arm 8.22.2
File Edit View Project ST-Link Tools Window Help
Workspace
USBH_FS_MSC_FatFs
Files
USBH_FS_MSC_FatFs ...
Application
EWARM
User
fatfs.c
main.c
stm32f4xx_hal_msp.c
stm32f4xx_it.c
usb_host.c
usbh_conf.c
usbh_diskio.c
Drivers
CMSIS
STM32F4xx_HAL_Driv...
Middlewares
FatFs
cc936.c
diskio.c
ff.c
ff_gen_drv.c
syscall.c
USB_Host_Library
usbh_core.c
usbh_ctlreq.c
usbh_ioreq.c
usbh_msc.c
usbh_msc_bot.c
usbh_msc_scsi.c
usbh_pipes.c
Output
USBH_FS_MSC_FatFs
usbh_pipes.c
usbh_msc_bot.c
diskio.c
ff_gen_drv.c
ff.c
usbh_diskio.c
usb_host.c
main.
HAL_GPIO_EXTI_Callback(uint16_t)
170 /* Initialize all configured peripherals */
171 MX_GPIO_Init();
172 MX_USB_HOST_Init();
173 MX_FATFS_Init();
174 /* USER CODE BEGIN 2 */
175
176 /* USER CODE END 2 */
177
178 /* Infinite loop */
179 /* USER CODE BEGIN WHILE */
180 while (1)
181 {
182
183 /* USER CODE END WHILE */
184 MX_USB_HOST_Process();
185 if (pre_state != Appli_state){
186 switch(Appli_state){
187 case APPLICATION_DISCONNECT: //USB flash disk remove
188 if(f_mount(NULL, "", 0) != FR_OK){
189 USBH_UsrLog("ERROR : Cannot exit FatFs! \n");
190 }
191 break;
192
193 case APPLICATION_READY: //USB flash disk plugin
194 if(f_mount(&fs, "", 0) != FR_OK){
195 break;
196 }
197 break;
198
199 default:
200 break;
201 }
202 pre_state = Appli_state;
203 } //end if (pre_state != Appli_state)
204
205 /* USER CODE BEGIN 3 */
206
207 }
208 /* USER CODE END 3 */
Build
Messages
Warning: The header file 'cmsis_iar.h' is obsolete and should not be used.
A sutiable version is automatically included from the CMSIS-core package.
This file will be removed in a future release.
Linking
Total number of errors: 0
Total number of warnings: 1
Build
Debug Log
Ambiguous Definitions
Ready

最后将U盘去下来插入到windows查看，可以正常看到测试文件mySTtest.txt文件内容，这证明结果是OK的。

```
79    uint8_t wtext[] = "This is STM32 MSC working with FatFs,GoodGood Study, DayDayUp"; /* File write buffer */
```



结论

1) 按键的中断EXIT15的优先级一定不能过于USB的中断优先级，否则代码运行到操作文件的时候回卡死！

2)通过CubeMx工具将一个比较复杂的读取文件系统工程大大简化的。

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