M487 SPIM访问外部SRAM

NuMicro® 32 位系列微控制器范例代码介绍

文件信息

应用简述	本范例使用 M487 SPIM 接口通过 DMM 模式访问外部 SRAM
BSP 版本	M480_BSP_CMSIS_V3.05.001
开发平台	NuMaker-PFM-M487 V3.0

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1 概述

本示例使用M487通过SPIM（DMM方式）接口访问外部SRAM（VTI7064）。

1.1 原理

VTI7064 是Vilsion公司的64Mbit串行SRAM，支持1.8v和3.3v SPI通讯的SRAM器件。

VTI7064读操作命令（0x03）如图 1-1所示：

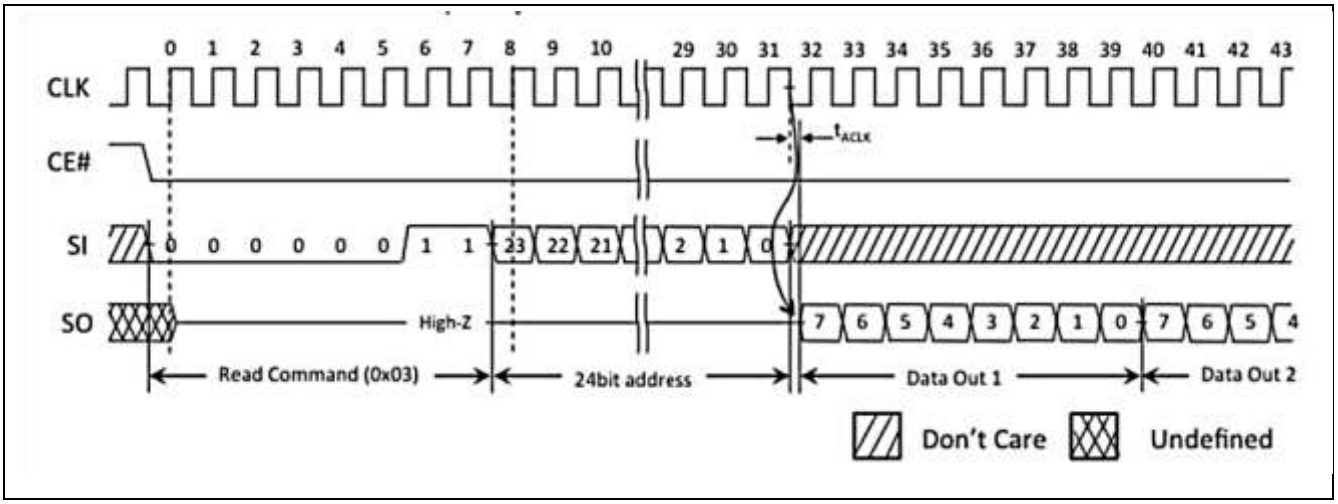

图 1-1 VTI7064 读操作时序图

VTI7064写操作命令（0x02）如图1-2所示：

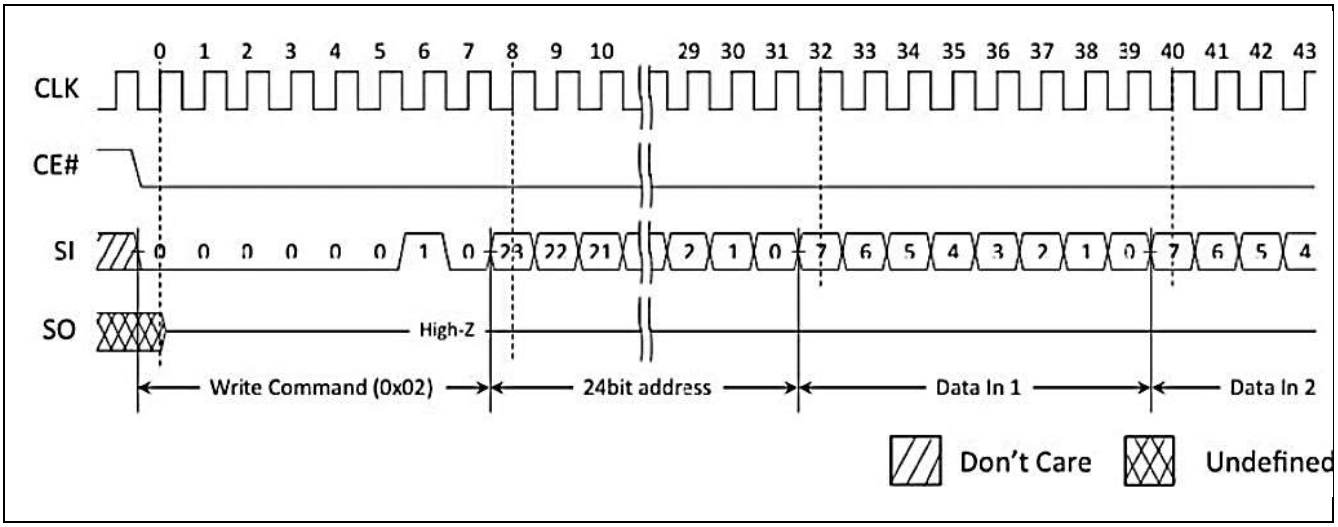

图 1-2 VTI7064 写操作时序图

VTI7064复位操作如下所示：该操作由两个命令组成，分别为复位使能（0x66）和复位（0x99）。

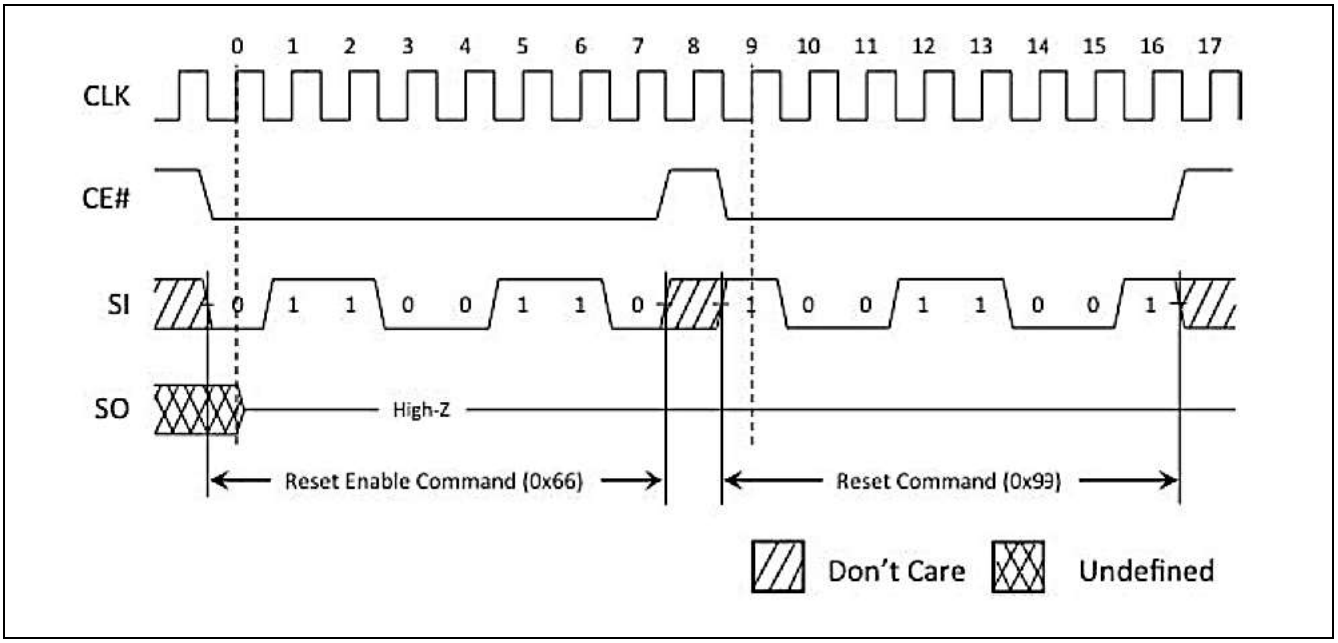

图 1-3 VTI7064 复位操作时序图

备注：图 1-1、图1-2和图1-3来自VTI7064数据手册，关于VTI7064的详细信息请参考VTI7064的数据手册。

本示例使用SPIM接口对外部SRAM（VTI7064）进行访问，在直接内存映射模式下，当MCU设置完CMDCODE (SPIM_CTL0[31:24])命令代码后，控制器会通过AHB访问SRAM，不需要MCU设置相关SRAM命令。

使用NuMaker-PFM-M487开发板，在U6的位置将VTI7064焊接到电路板上就可以通过SPIM接口访问SRAM（VTI7064），VTI7064相关电路图如图 1-4所示。

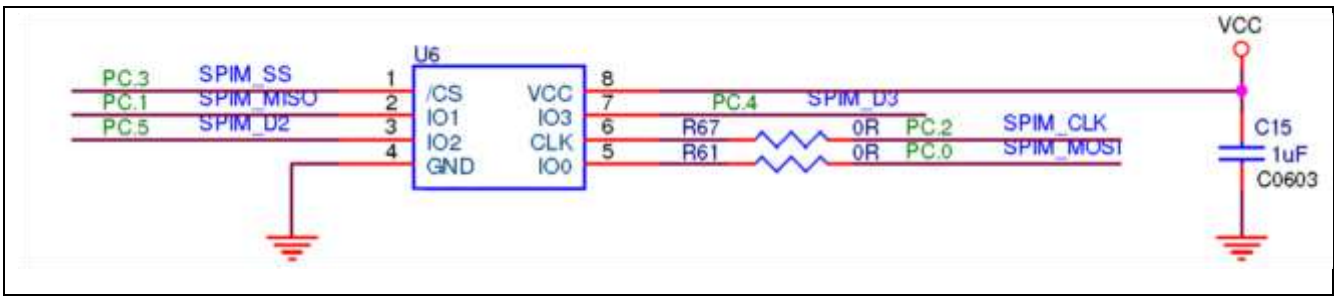

图 1-4 VTI7064 电路图

1.2 执行结果

运行结果如图 1-5所示。可以看到SRAM初始化成功并且往SRAM写入的数据与读出的数据一致。

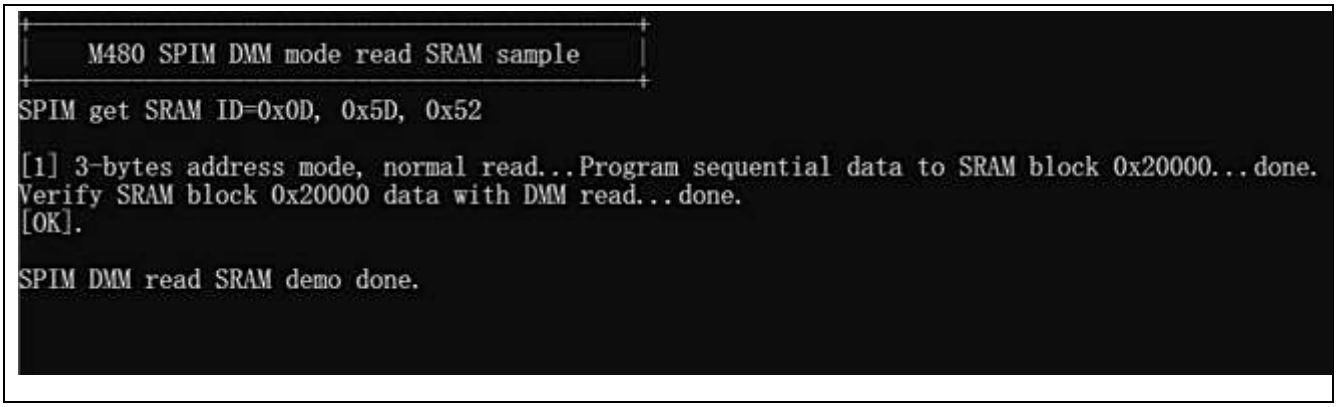

图 1-5 程序运行结果打印

2 代码介绍

初始化 VTI7064，读取 SRAM ID。

```
    if (SPIM_InitSRAM(1) != 0)        /* Initialized SRAM */
    {
        printf("SPIM SRAM initialize failed!\n");
        goto lexit;
    }
    SPIM_ReadSRAMId(idBuf, sizeof(idBuf), 1);
    printf("SPIM get SRAM ID=0x%02X, 0x%02X, 0x%02X\n", idBuf[0], idBuf[1], idBuf[2]);
```

通过 SPIM 接口的 IO 模式往 SRAM 的指定开始地址 0x20000 写数据流。

```
    printf("Program sequential data to SRAM block 0x%x...", TEST_BLOCK_ADDR);
    for (offset = 0; offset < SRAM_BLOCK_SIZE; offset += BUFFER_SIZE)
    {
        pData = (uint32_t *)g_buff;
        for (i = 0; i < BUFFER_SIZE; i += 4, pData++)
            * pData = (i << 16) | (TEST_BLOCK_ADDR + offset + i);
        SPIM_IO_Write_SRAM(TEST_BLOCK_ADDR + offset, 0, BUFFER_SIZE, g_buff, OPCODE_PP, 1,
1, 1);
        }
    printf("done.\n");
```

通过 SPIM 接口的 DMM 模式读取 SRAM 的指定开始地址 0x20000 的数据流，并与写入的数据做比较，如果有不对等的数据就会打印输出 FAILED。

```
     printf("Verify SRAM block 0x%x data with DMM read...", TEST_BLOCK_ADDR);
     SPIM_EnterDirectMapMode(is4ByteAddr, u32RdCmd, 8);
     for (offset = 0; offset < SRAM_BLOCK_SIZE; offset += BUFFER_SIZE)
     {
    memcpy(g_buff, (uint8_t *)(SPIM_DMM_MAP_ADDR + TEST_BLOCK_ADDR + offset), BUFFER_SIZE);
    pData = (uint32_t *)g_buff;
    for (i = 0; i < BUFFER_SIZE; i += 4, pData++)
    {
          if (*pData != ((i << 16) | (TEST_BLOCK_ADDR + offset + i)))
         {
            printf("FAILED!\n");
            printf("SRAM address 0x%x, read 0x%x, expect 0x%x!\n", TEST_BLOCK_ADDR + i,
*pData, (i << 16) | (TEST_BLOCK_ADDR + offset + i));
                    SPIM_ExitDirectMapMode();
                    return -1;
```

```
                }
            }
        }
    printf("done.\n");
```

3 软件与硬件需求

3.1 软件需求

- BSP 版本
  - M480_BSP_CMSIS_V3.05.001
- IDE 版本
  - Keil uVersion 5.35

3.2 硬件需求

- 电路组件
  - NuMaker-PFM-M487 V3.0
  - SRAM VTI7064MSMI
- 示意图

	VCC	↔	VCC	
	SPIM_SS(PC.3)	→	CS	
	SPIM_MISO (PC.1)	↔	IO1	
	SPIM _D2(PC.5)	↔	IO2	
	SPIM _D3(PC.4)	↔	IO3	
	SPIM _CLK(PC.2)	→	CLK	
	SPIM _MOSI(PC.0)	↔	IO0	
	GND	↔	GND	
	M487		SRAM VTI7064	

图 3-1 M487 与 VTI7064 连接图

4 目录信息

EC_M487_SPIM_DMM_SRAM_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
StdDriver	All peripheral driver header and source files
SampleCode	
ExampleCode	Source file of example code

图 4-1 目录信息

5 范例程序执行

1. 根据目录信息章节进入 ExampleCode 路径中的 KEIL 文件夹，双击 *SPIM_DMM_SRAM*.uvproj。
2. 进入编译模式界面
   a. 编译
   b. 下载代码至内存
   c. 进入 / 离开仿真模式
3. 打开串口工具选择对应串口
   a. 按下复位键后查看串口打印信息

6 修订纪录

Date	Revision	Description
2021.12.13	1.00	1. 初始发布.

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