# M487 SPIM訪問外部SRAM

NuMicro® 32 位系列微控制器範例代碼介紹

## 文件資訊

| | |
|---|---|
| 應用簡述 | 本範例使用 M487 SPIM 介面通過 DMM 模式訪問外部 SRAM |
| BSP 版本 | M480_BSP_CMSIS_V3.05.001 |
| 開發平台 | NuMaker-PFM-M487 V3.0 |

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# 1 概述

本示例使用M487通過SPIM（DMM方式）介面訪問外部SRAM（VTI7064）。

## 1.1 原理

VTI7064 是Vilsion公司的64Mbit串列SRAM，支援1.8v和3. 3v SPI通訊的SRAM器件。

VTI7064讀操作命令（0x03）如圖1-1所示：

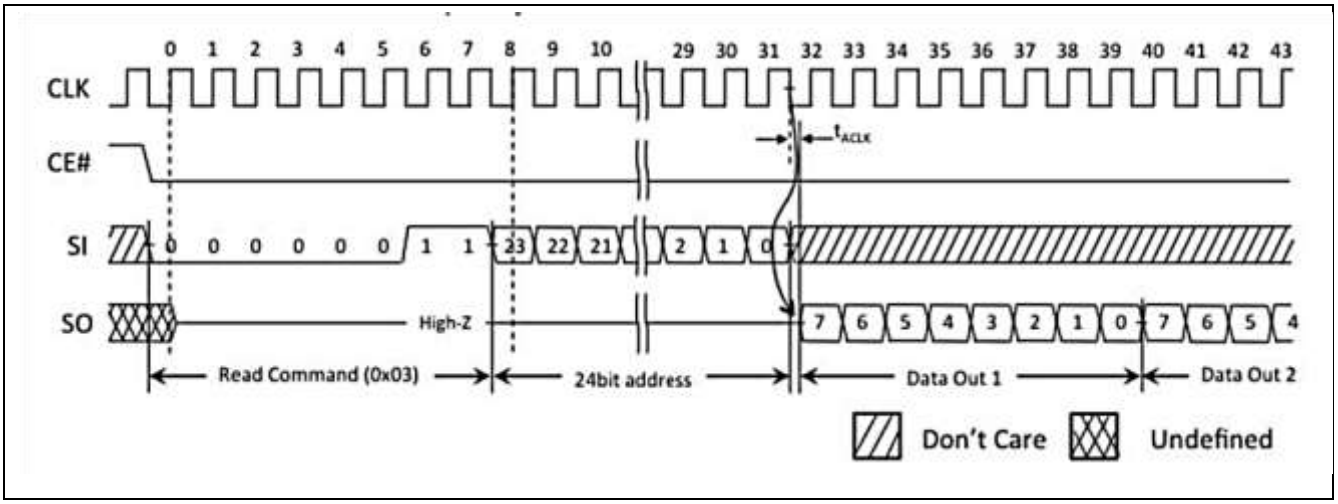


圖 1-1 VTI7064 讀操作時序圖

VTI7064寫操作命令（0x02）如圖1-2所示：

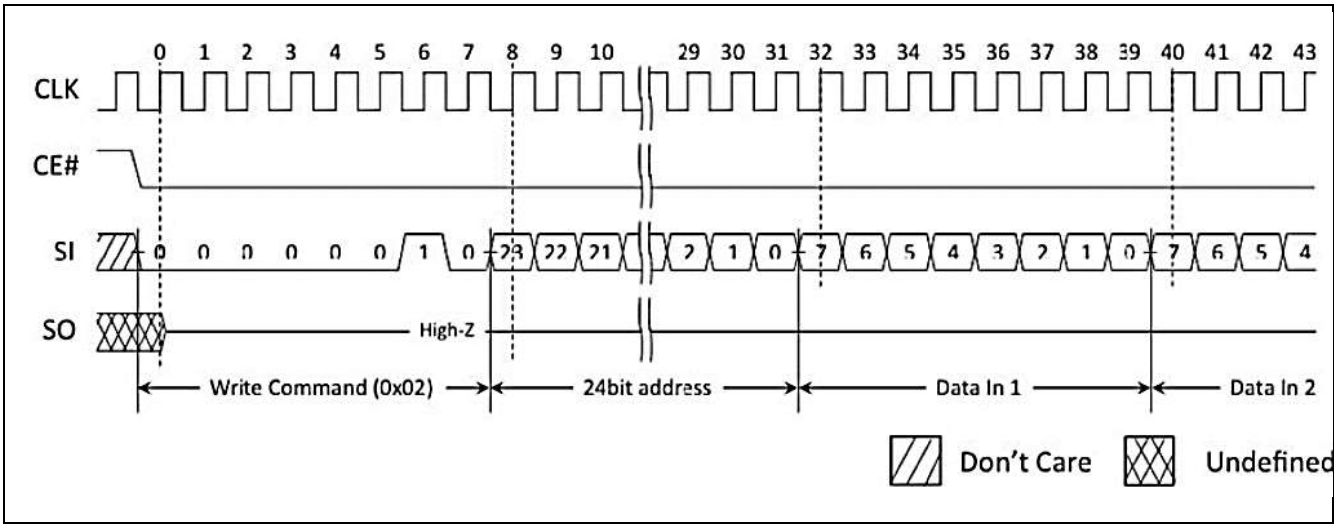


圖 1-2 VTI7064 寫操作時序圖

VTI7064復位操作如下所示：該操作由兩個命令組成，分別為復位使能（0x66）和復位（0x99）。

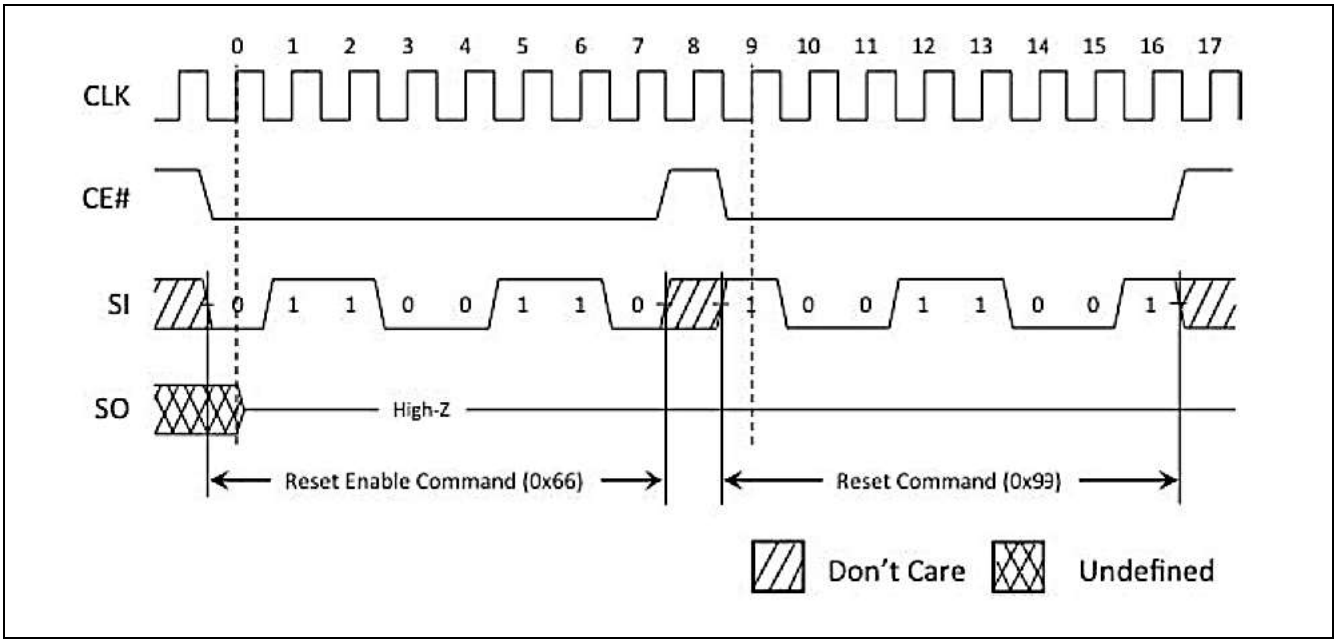


圖 1-3 VTI7064 復位操作時序圖

備註：圖1-1、圖1-2和圖1-3來自VTI7064資料手冊，關於VTI7064的詳細資訊請參考VTI7064的資料手冊。

本示例使用SPIM介面對外部SRAM（VTI7064）進行訪問，在直接記憶體映射模式下，當MCU設置完CMDCODE (SPIM_CTL0[31:24])命令代碼後，控制器會通過AHB訪問SRAM，不需要MCU設置相關SRAM命令。

使用NuMaker-PFM-M487開發板，在U6的位置將VTI7064焊接到電路板上就可以通過SPIM介面訪問SRAM（VTI7064），VTI7064相關電路圖如圖 1-4所示。

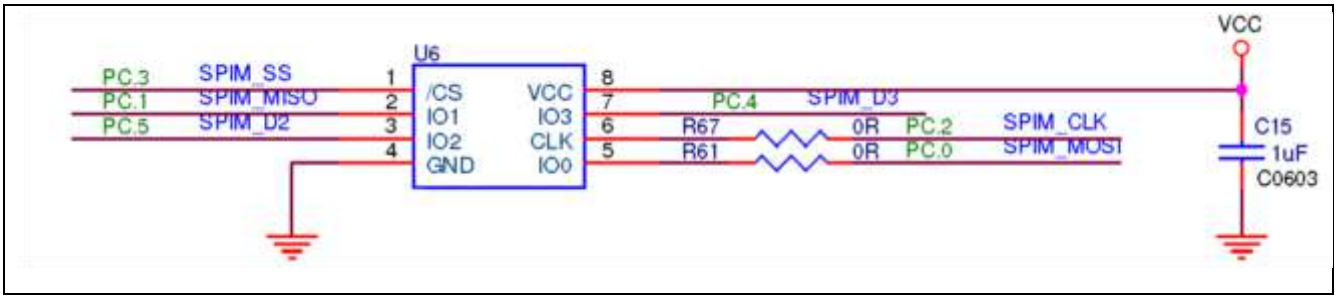


圖 1-4 VTI7064 電路圖

## 1.2 執行結果

運行結果如圖 1-5所示。可以看到SRAM初始化成功並且往SRAM寫入的資料與讀出的資料一致。

```
+-----------------------------------------+
|    M480 SPIM DMM mode read SRAM sample  |
+-----------------------------------------+
SPIM get SRAM ID=0x0D, 0x5D, 0x52

[1] 3-bytes address mode, normal read...Program sequential data to SRAM block 0x20000...done.
Verify SRAM block 0x20000 data with DMM read...done.
[OK].

SPIM DMM read SRAM demo done.
```

圖 1-5 運行結果列印

# 2 代碼介紹

初始化 VTI7064，讀取 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]);
```

通過 SPIM 介面的 IO 模式往 SRAM 的指定開始位址 0x20000 寫入資料。

```
    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");
```

通過 SPIM 介面的 DMM 模式讀取 SRAM 的指定開始位址 0x20000 的資料，並與寫入的資料做比較，如果有不對等的資料就會列印輸出 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 軟體與硬體需求

## 3.1 軟體需求

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

## 3.2 硬體需求

- 電路元件
  - NuMaker-PFM-M487 V3.0
  - SRAM VTI7064MSMI
- 示意圖

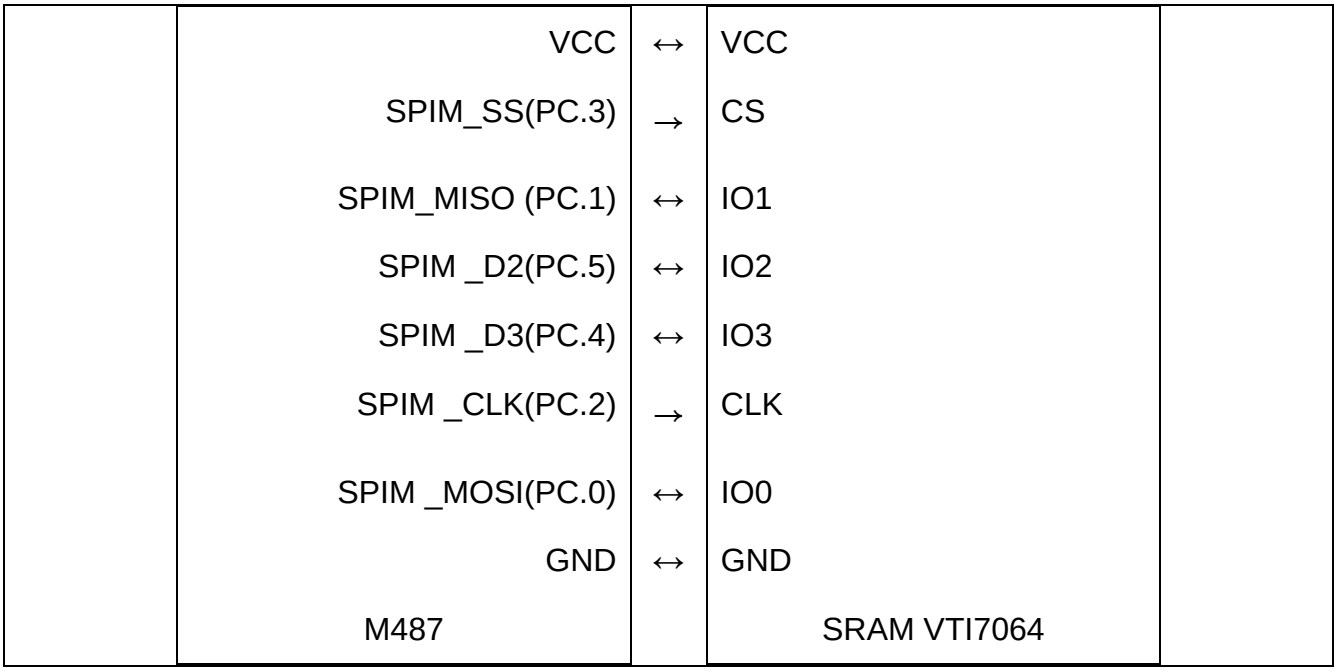


圖 3-1 M487 與 VTI7064 連接圖

# 4 目錄資訊

| | |
|---|---|
| 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 |

圖 4-1 目錄資訊

# 5 範例程式執行

1. 根據目錄資訊章節進入 ExampleCode 路徑中的 KEIL 資料夾，雙擊 *SPIM_DMM_SRAM*.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. 打開串口工具選擇對應串口
   a. 按下復位鍵後查看串口列印資訊

# 6 修訂紀錄

| Date | Revision | Description |
|---|---|---|
| 2021.12.13 | 1.00 | 1. 初始發布. |

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