Mini51 EEPROM Emulation Using Data Flash

Example Code Introduction for 32-bit NuMicro® Family

Information

Application	Data Flash Simulate EEPROM and Write/Read EEPROM
BSP Version	Mini51DE Series BSP CMSIS V3.02.000
Hardware	NuTiny-EVB-Mini51_V2.1

1 Function Description

1.1 Introduction

The purpose of Mini51 EEPROM Emulation Using Data Flash is to allocate a Data Flash region to simulate an EEPROM region, and to provide relative write and read EEPROM function.

1.2 Principle

The NuMicro® Mini51 Series is equipped on-chip embedded Flash for application.
The limitation of write/read flash operation is the access address must be a 32-bit aligned address and the data value is a 32-bit data. Each bit data could be written from 1 to 0 and becomes 1 after erase flash operation completed. The NuMicro® Mini51 Series only supports the page erase operation, and one page size is 512 bytes.

In accessing EEPROM, write/read operation supports byte address alignment, data length is one byte, and each bit data can be written 1 or 0 directly.

In this example code, a specific Data Flash region is allocated to simulate as an EEPROM storage. A SIM_EEPROM_READ function is used to read a 8-bit data from specific EEPROM address, and a SIM_EEPROM_WRITE function is used to write a 8-bit data on specific EEPROM address directly.
Figure 1-1 shows the operation flow of example code to perform write EEPROM.

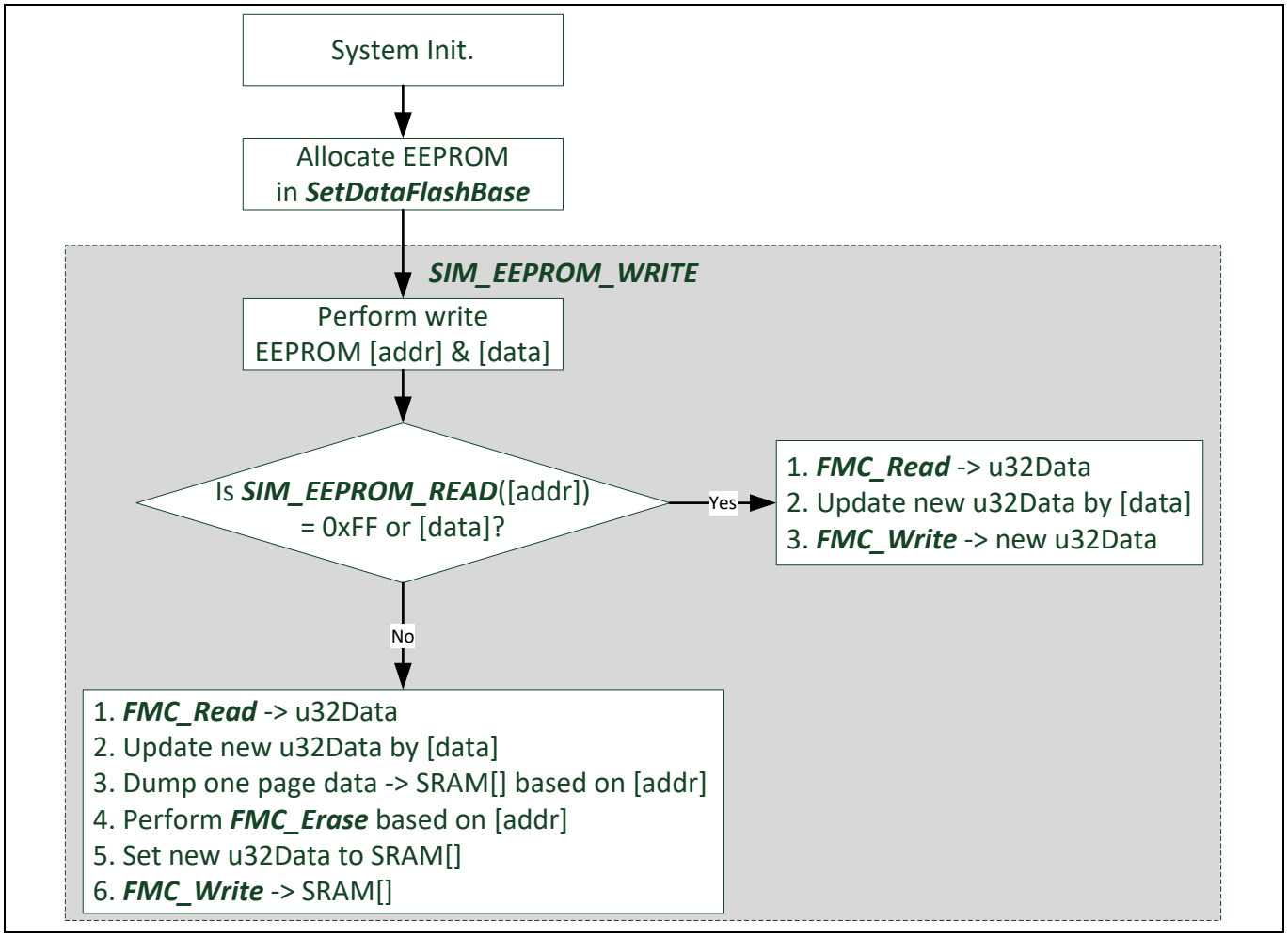


Figure 1-1 Write EEPROM Operation Flow

1.3 Demo Result

The first execution result can be output on UART, baud rate 115200, as shown in Figure 1-2 on PC.

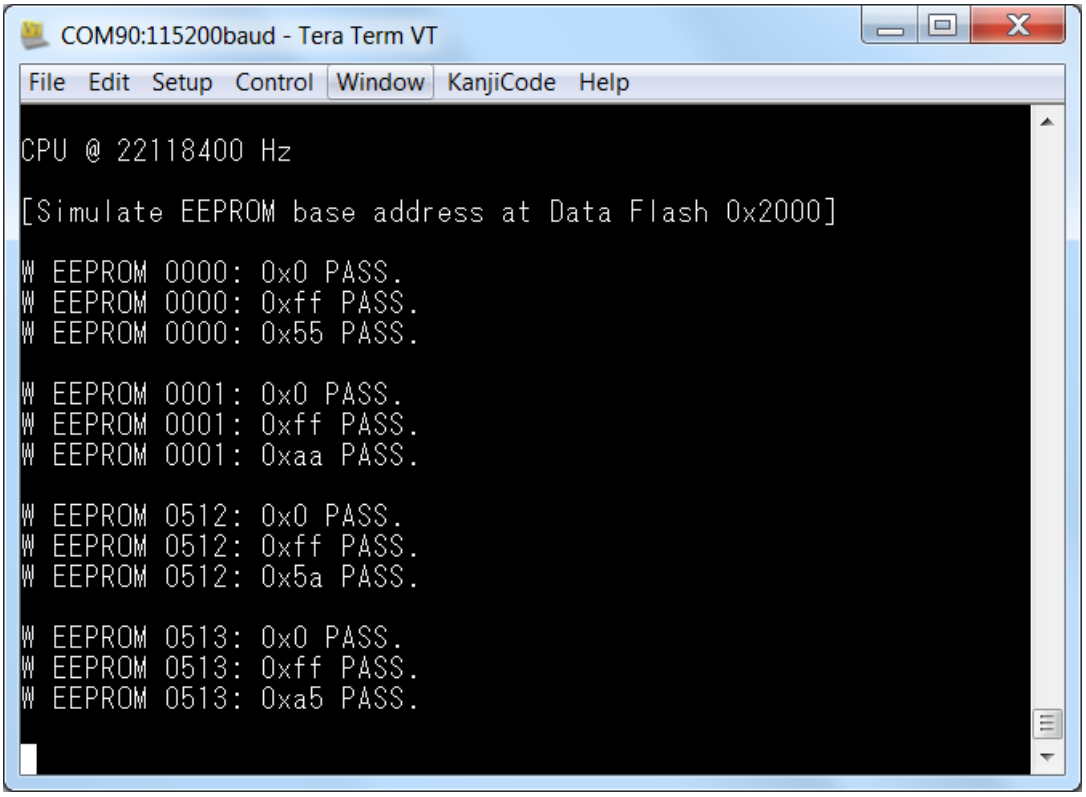


Figure 1-2 Execution Result on UART

2 Code Description

Allocate a Data Flash region to simulate EEPROM storage.

```
int32_t SetDataFlashBase(uint32_t u32DFBA)
{
    uint32_t   au32Config[2];

    /* Read current User Configuration */
    if (FMC_ReadConfig(au32Config, 2) < 0)
    {
        printf("\nRead User Config failed!\n");
        return -1;
    }

    /* Just return when Data Flash has been enabled */
    if ((!(au32Config[0] & 0x1)) && (au32Config[1] == u32DFBA))
        return 0;

    /* Enable User Configuration Update */
    FMC_ENABLE_CFG_UPDATE();

    /* Write User Configuration to Enable Data Flash */
    au32Config[0] &= ~0x1;
    au32Config[1] = u32DFBA;
    if(FMC_WriteConfig(au32Config, 2))
        return -1;

    /* Perform chip reset to make new User Config take effect */
    SYS->IPRSTC1 |= SYS_IPRSTC1_CHIP_RST_Msk;

    return 0;
}
```

Read EEPROM function.

```
uint8_t SIM_EEPROM_READ(uint32_t address)
{
    uint32_t u32Data;

    u32Data = FMC_Read(((address/4)*4) + EEPROM_BASE);
```

```
    return ((u32Data>>((address%4)*8)) & 0xFF);
}
```

Write EEPROM function.

```
void SIM_EEPROM_WRITE(uint32_t address, uint8_t data)
{
    ……
    if((SIM_EEPROM_READ(address)==0xFF) || (SIM_EEPROM_READ(address)==data))
    {
        /* Original flash data is 0xFF, or data is matched.
           Do not perform flash page erase. */
        /* Read original data */
        u32Data = FMC_Read(((address/4)*4) + EEPROM_BASE);
        /* Assign 32-bit updated data */
        u32Data = ~(0xFF<<((address%4)*8));
        u32Data |= (data<<((address%4)*8));
        /* Write updated data */
        FMC_Write((((address/4)*4) + EEPROM_BASE), u32Data);
    }
    else
    {
        /* Need to update one page flash data. Perform flash page erase is mandatory
           before writing updated data. */
        /* Assign 32-bit updated data */
        u32Data = FMC_Read(((address/4)*4) + EEPROM_BASE);
        u32Data &= ~(0xFF<<((address%4)*8));
        u32Data |= (data<<((address%4)*8));
        /* Dump target page data to SRAM buffer */
        u32Start = (EEPROM_BASE + ((address/FMC_FLASH_PAGE_SIZE)*FMC_FLASH_PAGE_SIZE));
        // page-size alignment
        u32End   = (u32Start + FMC_FLASH_PAGE_SIZE);
        pu32DataBuf = (uint32_t *)au32DataBuf;
        for(i=u32Start; i<u32End; i+=4)
        {
            *pu32DataBuf++ = FMC_Read(i);
        }
        /* Erase target page */
        FMC_Erase(EEPROM_BASE+((address/FMC_FLASH_PAGE_SIZE)*FMC_FLASH_PAGE_SIZE));
        /* Set updated data to SRAM buffer */
        au32DataBuf[((address%FMC_FLASH_PAGE_SIZE)/4)] = u32Data;
```

```
        /* Write target flash data from SRAM buffer */
        pu32DataBuf = (uint32_t *)au32DataBuf;
        for(i=u32Start; i<u32End; i+=4)
        {
            FMC_Write(i, *pu32DataBuf++);
        }
    }
}
```

3 Software and Hardware Environment

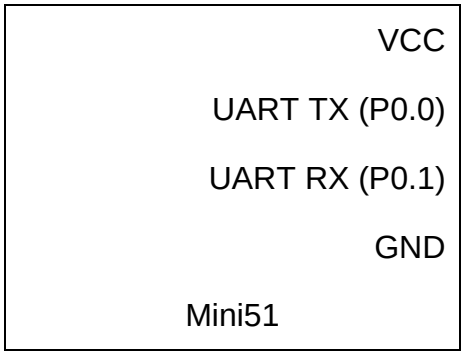
Software Environment

- BSP version
  - Mini51DE Series BSP CMSIS V3.02.000
- IDE version
  - Keil uVersion 5.26

Hardware Environment

- Circuit component
  - NuTiny–EVB–Mini51 V2.1
- Diagram

Connect UART TX (P0.0) pin to PC UART RX for display the execution result of example code on PC.



4 Directory Information

- EC_Mini51_EEPROM_Emulation_Using_Data_Flash_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

5 How to Execute Example Code

1. Browsing into sample code folder by Directory Information (section 4) and double click Simulate_EEPROM.uvproj.
2. Enter Keil compile mode
   a. Build
   b. Download
   c. Start/Stop debug session
3. Enter debug mode
   a. Run

6 Revision History

Date	Revision	Description
Aug 9, 2019	1.00	1. Initially issued.

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