

1T 8051
8-bit Microcontroller

MS51 / ML51 SPROM
User Manual
NuMicro[®] 8051 Series

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1 OVERVIEW

MS51 & ML51 series with an additional include special 128 bytes security protection memory (SPROM) to enhance the security and protection of customer application. To facilitate programming and verification, the Flash allows to be programmed and read electronically by parallel Writer or In-Circuit-Programming (ICP). Once the code is confirmed, user can lock the code for security.

SPROM start address from FF80H, if the last byte (FFFFH) is the lock bit of SPROM, if this byte value is not FFH, whole SPROM can't be read out, include IAP / ICP or MOVC instruction, also can't setting break point when in OCD mode.

2 SPROM FUNCTION DESCRIPTION

2.1 Security Protection Memory (SPROM)

The security protection memory (SPROM) is used to store instructions for security application. The SPROM includes 128 bytes at location address FF80H ~ FFFFH and doesn't support "whole chip erase command". Figure 2.1-1 SPROM Memory Mapping And SPROM Security Mode shows that the last byte of SPROM (address: FFFFH) is used to identify the SPROM code is non-secured or secured mode.

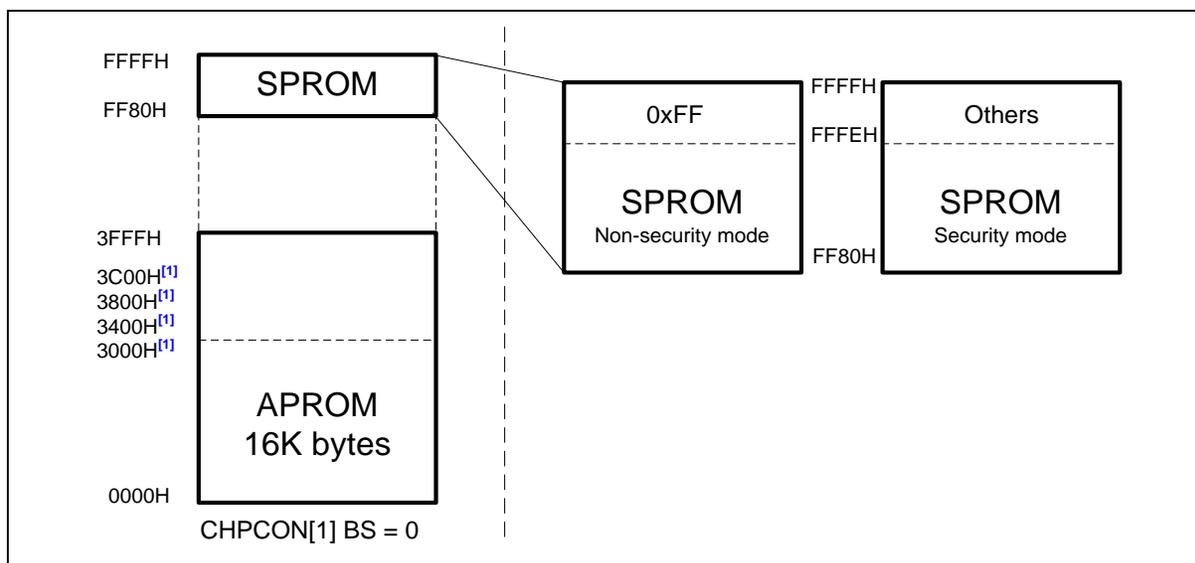


Figure 2.1-1 SPROM Memory Mapping And SPROM Security Mode

(1) SPROM non-secured mode (the last byte is 0xFF). The access behavior of SPROM is the same with APROM and LDROM. All area can be read by CPU or ISP command, and can be erased and programmed by ISP command.

(2) SPROM secured mode (the last byte is not 0xFF). In order to conceal SPROM code in secured mode, CPU only can perform instruction fetch and get data from SPROM when CPU is run at SPROM area. Otherwise, CPU will get all 00H for data access. In order to protect SPROM, the CPU instruction fetch will also get zero value when ICE (OCD) port is connected in secured code. At this mode, SPROM doesn't support ISP program, read or erase.

2.2 How To Coding Sprom Code In Keil Project

Main loop call SPROM code, for example call SPROM function "SPROM_CODE();"

```

18
19
20 void main (void)
21 {
22     ...MODIFY_HIRC_24 ();
23     ...set_IAPUEN_SPMEM; ...//Enable SPROM
24     ...ALL_GPIO_QUASI_MODE; ...//Define in F
25     ...P16_QUASI_MODE;
26     ...UART_Open(24000000,UART0_Timer1,115200);
27     ...ENABLE_UART0_PRINTF;
28     ...while(1)
29     {
30         ... SPROM_CODE ();
31         ...printf ("\n SPTMP=0x%BX", SPTMP);
32         ...Timer0_Delay(24000000,300,1000);
33     }
34
35 }
    
```

SPROM code: File name SPROM.c.

```

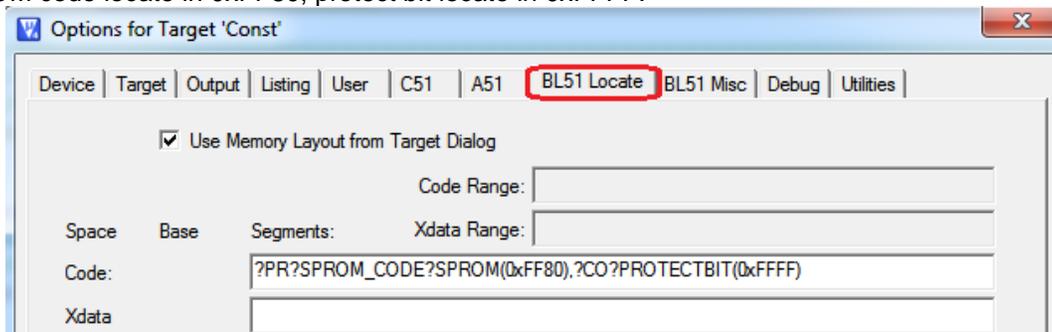
11 //*****
12
13 //*****
14 //..File Function: MS51 locate
15 //*****
16 #include "MS51.h"
17 #include "SPROM.h"
18
19 unsigned char SPTMP=1;
20
21 void SPROM_CODE (void)
22 {
23     ..P12 = ~P12;
24     ..SPTMP++;
25
26 }
27
    
```

SPROM Security bit control code: File name ProtectBit.c.
IF code define as 0xFF for unlock, define as 0x00 for lock SPROM.

```

12
13 //*****
14 //..File Function: N76E003 GPIO demo code
15 //*****
16 #include "MS51.h"
17
18
19 unsigned char code protect [] = {
20     0xFF ...//Setting for un lock status, mark it if need lock
21     0X00 ...//Setting for Lock
22 };
23
    
```

Setting the SPROM address and Protect bit address in options / BL51 Locate.
SPROM code locate in 0xFF80, protect bit locate in 0xFFFF.



To find the option "Code" marco name: check projet.m51 file

Project folder\Lst\project.m51 file

After define the SPROM and SPROM security bit memory mapping
SPROM locate in FF80 and Protectbit locate in FFFF.

77	CODE	0D55H	0010H	UNIT	?CO?MAIN
78	CODE	0D65H	0004H	UNIT	?C_INITSEG
79		0D69H	F217H		*** GAP ***
80	CODE	FF80H	0005H	UNIT	?PR?SPROM_CODE?SPROM
81		FF85H	007AH		*** GAP ***
82	CODE	FFFFH	0001H	UNIT	?CO?PROTECTBIT

Before define the location (without setting address in options)

77	CODE	0D55H	0010H	UNIT	?CO?MAIN
78	CODE	0D65H	0005H	UNIT	?PR?SPROM_CODE?SPROM
79	CODE	0D6AH	0004H	UNIT	?C_INITSEG
80	CODE	0D6EH	0001H	UNIT	?CO?PROTECTBIT

Before download or enter debug mode enable "Update SPROM" is necessary.

Options for Target "Const"

Device | Target | Output | Listing | User | C51 | A51 | BL51 Locate | BL51 Misc | Debug | Utilities

Configure Flash Menu Command

- Use Target Driver for Flash Programming
 - Driver: Nuvoton 8051 Keil C51 Driver
 - Settings: [Settings]
 - Update:
 - Init File: []
- Use External Tool for Flash Programming
 - Command: []
 - Arguments: []
 - Run Independent:

Configure Image File Processing (FCARM):

- Output File: []
- Add Output File to Group: [Source Group 1]
- Image Files Root Folder: []
- Generate:

Nu-Link Driver Setup

Nu-Link:

- Driver Version: 6909r2
- ICE Version: 6909

Debug:

- Max Clock: 400kHz
- Enable PCLK:
- Memory-Access While Running:
 - Enable Memory-Access:
 - Period: 1000 ms

Flash Programming:

- Erase Full Chip
- Erase Used Sectors
- Do Not Erase
- Program Flash
- Verify Flash
- Update SPROM

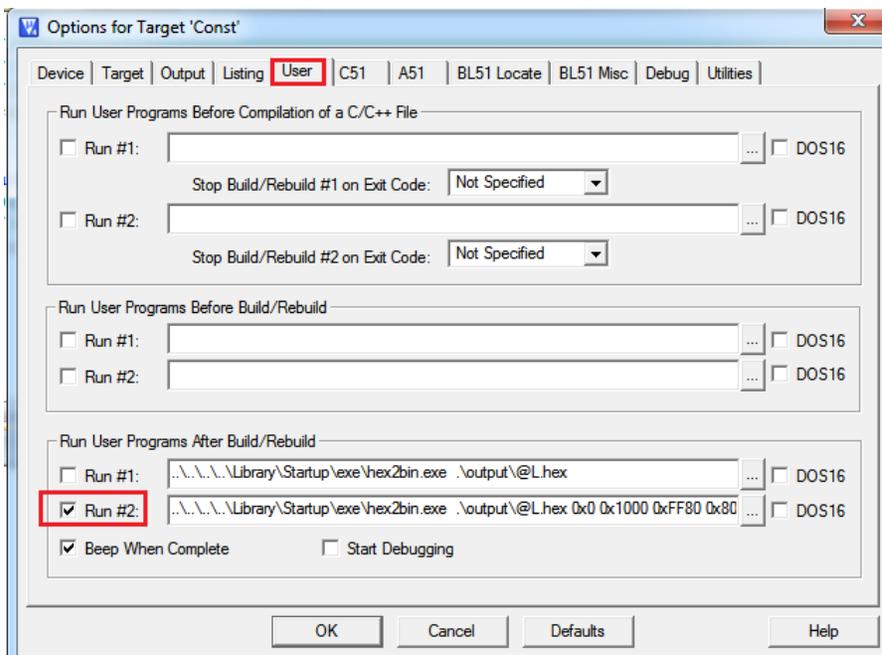
Supporting Forum

- EN: <http://forum.nuvoton.com/>
- SC: <http://www.nuvoton-mcu.com/forum.php>

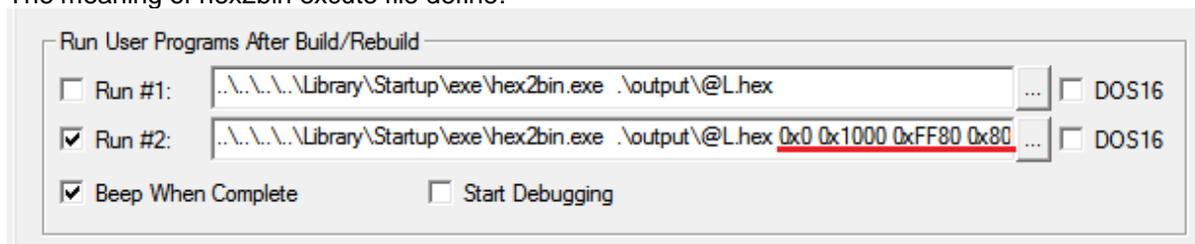
Buttons: OK, Cancel, Defaults, Help

2.3 How To Create The Bin File of APROM and SPROM

Choose run "Options -> User -> Run User Programs After Build/Rebuild as following"



The meaning of hex2bin excute file define:



APROM start address	APROM bin file size define	SPROM start address	SPROM bin file size define
0x0	0x1000	0xFF80	0x80

To fine APROM size check with .m51 file.

For example in this project the APROM size must be larger than 0x0D69.

```

77      CODE   0D55H   0010H   UNIT   ?CO?MAIN
78      CODE   0D65H   0004H   UNIT   ?C_INITSEG
79      CODE   0D69H   F217H   UNIT   *** GAP ***
80      CODE   FF80H   0005H   UNIT   ?PR?SPROM_CODE?SPROM
81      CODE   FF85H   007AH   UNIT   *** GAP ***
82      CODE   FFFFH   0001H   UNIT   ?CO?PROTECTBIT
..
    
```

Note: this hex2bin.exe is only released by nuvoton. Please download nuvoton MS51 BSP package.

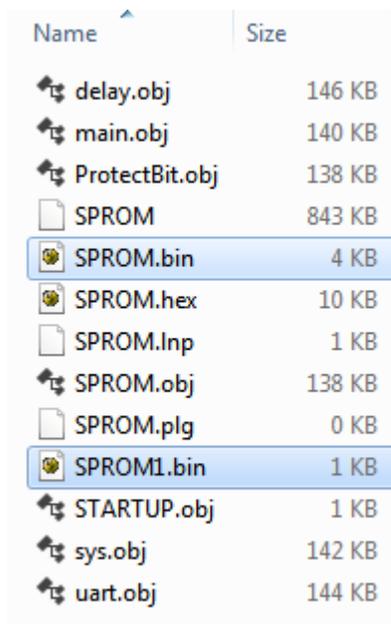
Github: https://github.com/OpenNuvoton/MS51_BSP_KEIL

https://github.com/OpenNuvoton/ML51_BSP_KEIL

Find in "Output" folder to find the bin file

For APROM code: SPROM.bin

For SPROM code: SPROM1.bin



3 REVISION HISTORY

Date	Revision	Description
2019.05.206	1.00	Initial release

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