GM8136

FLASH

User Guide
Rev.: 1.0
Issue Date: September 2014

REVISION HISTORY

GM8136 Flash User Guide

Date	Rev.	From	To
Sept. 2014	1.0	-	Original

Printed in Taiwan 2014

All information contained in this document is subject to change without notice. The products described in this document are NOT intended for use in implantation or other life support application where malfunction may result in injury or death to persons. The information contained in this document does not affect or change Grain Media's product specification or warranties. Nothing in this document shall operate as an express or implied license or indemnity under the intellectual property rights of Grain Media or third parties. All information contained in this document was obtained in specific environments, and is presented as an illustration. The results obtained in other operating environments may vary.

THE INFORMATION CONTAINED IN THIS DOCUMENT IS PROVIDED ON AN "AS IS" BASIS. In no event will Grain Media be liable for damages arising directly or indirectly from any use of the information contained in this document.

Grain Media, Inc.
5F, No. 5, Li-Hsin Road III, Hsinchu Science Park, Hsinchu City, Taiwan 300, R.O.C.

Grain Media's home page can be found at:
http://www.grain-media.com

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

Introduction to SPI/NAND

This chapter contains the following sections:

1.1 Overview

In the recent market, the NOR Flash memories are priced higher than the SDRAM and SPI/NAND Flash memories. Users are more intended to store the images on a SPI/NAND Flash and execute the main code on an SDRAM.

The content in the SPI/NAND Flash cannot be read as a memory device. To read the boot image from the SPI/NAND Flash, an embedded ROM code is responsible for loading the boot loader, nsboot, from the SPI/NAND Flash into SRAM for execution. SRAM is a readable/writeable memory in MCP100 of GM8136. In order to support the SPI/NAND Flash boot loader, GM8136 is equipped with an internal SRAM buffer. When booting, the first page of the SPI/NAND Flash will be read by the embedded ROM code to perform the validation check. The boot loader body stored in the SPI/NAND Flash memory will be fully loaded into SRAM for execution. Moreover, in the current design, the image size of nsboot cannot exceed 24K bytes.

Generally, the SPI/NAND boot code will copy the contents of the SPI/NAND Flash to SDRAM. Upon completing the copy operation, the main program will be executed on SDRAM.

1.2 Jumper Setting

The GM8136 SPI/NAND system mainly has four jumper setting modes: SPI Boot or NAND Boot, SPI operation mode for SPI or SPI-NAND, SPI Flash 3/4byte type selection, and firmware update mode. For the detailed information of the jumper settings, please refer to the GM8136 data sheet.

The firmware update mode is for programming an image from PC to the on-board SPI/NAND Flash. In this mode, the images can be programmed into the SPI/NAND Flash by using the USB interface with PCTOOL. Please be aware that the jumper setting for the SPI mode or NAND mode must be correctly chosen. There are two jumpers that need to be correctly configured: Firmware update jumper and SPI/NAND jumper.

1.3 Image Layout of SPI Flash

The image layout of the SPI Flash is shown in Figure 1-1Figure 1-. The first image executed in the SPI system is SPI boot, which is located at the second sector of the SPI Flash (The first sector contains a global system header, which is written by PCTOOL). The purpose is to load the burn-in, U-Boot, or Linux image into DDR. Currently, the loaded image is U-BOOT. All system initialization tasks, including the DDR initialization, memory remap, and so on, are done in the boot loader.

An extra image header will be appended with one page size in front of every image. It describes the information of the associated image, such as the image magic number and the image size. In addition to the image header, a global system header will also be required in the top position of a Flash. The system header contains the GM8136 system signature, the image offset of every image, and so on. The image header contains the checksum, size, and name of an image. Currently, the checksum field is useless. The system header and image header individually occupy one page and the image body is next to the header. The structures of the system header and image header are shown in Table 1-1.

Table 1-1. Structures of System Header and Image Header for SPI Flash

Name	Offset (Byte)	Size (Byte)	Description
Signature	0	8	Signature for GM8136, which must be “GM8136”
First image address	8	4	First image offset to be loaded by the SPI boot
First image size	12	4	-
First image reserved	16	4	-
Image 1 address	20	4	Address offset of image 1 specified by PCTOOL
Image 1 size	24	4	Size offset of image 1 specified by PCTOOL
Image 1 name	28	8	Name offset of image 1 specified by PCTOOL
Image 1 reserved	36	4	Unused for image 1
Image N address (N ≤ 10)	40 + (N x 4)	4	Address offset of image N specified by PCTOOL
Image N size	44 + (N x 4)	4	Size offset of image N specified by PCTOOL
Image N name	48 + (N x 4)	8	Name offset of image N specified by PCTOOL
Image N reserved	56 + (N x 4)	4	Unused for image N
pagesz_log2	220	4	Page size in log For example, ‘11’ means 2^{11} = 2048 bytes.
secsz_log2	224	4	Sector size in log
chipsz_log2	228	4	Chip size in log

Name	Offset (Byte)	Size (Byte)	Description
Clk_div	232	4	Clock divider
reserved	236	16	Unused
last_256	252	4	Magic number The last two bytes are 0x55 and 0xAA.

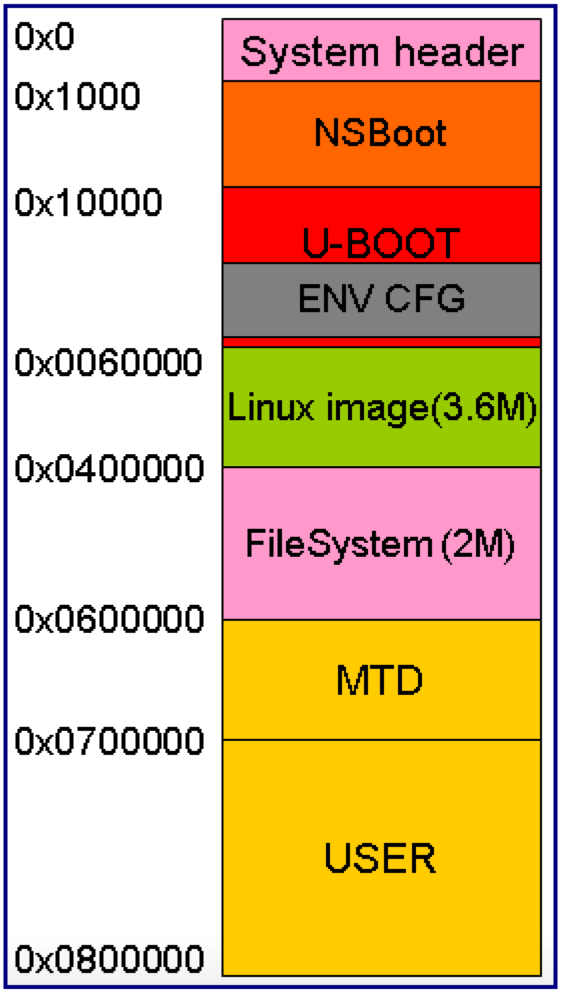


Figure 1-1. Image Layout of SPI Flash

Please note that the contents of the SPI Flash can be erased by the block unit or sector unit, where the block unit is more popular. Users are recommended arranging the locations of all images, except for the SPI boot in the block alignment (Currently, it is 64K alignment). As mentioned above, the SPI boot is located in the second sector and it is not aligned with the block boundary. The SPI boot should be updated every time when users upgrade an image. This image layout is the Grain Media layout. Users not only can modify the layout address or size to meet the user environment, but also add or delete partition after the FS_FA6 image.

1.4 Image Layout of NAND Flash

The image layout of the NAND Flash is shown in Figure 1-2. The first image executed for the NAND system is NAND boot, which is located at the start of NAND Flash. The purpose is to load the burn-in, U-Boot, or Linux image. Currently, it is the U-BOOT image. All system initialization tasks are done in the boot loader. One page for the size of the image header will be appended in front of every image body. It describes the information of the corresponding image, such as the image size. In additional to the image header, a global system header will also be prepared. The system header contains the GM8136 system signature, image offset of every image, and so on. The image header contains the checksum, size, and name of an image. The system header and image header individually occupy one page and the image body is next to the header. The structures of the SPI-NAND system header and image header are shown in Table 1-2.

Table 1-2. System Header and Image Header of SPI-NAND Flash

Name	Offset (Byte)	Size (Byte)	Description
Signature	0	8	Signature for GM8136, which must be “GM8136”
First image address	8	4	First image offset to be loaded by the SPI boot
First image size	12	4	-
First image reserved	16	4	-
Image 1 address	20	4	Address offset of image 1 specified by PCTOOL
Image 1 size	24	4	Size offset of image 1 specified by PCTOOL
Image 1 name	28	8	Name offset of image 1 specified by PCTOOL
Image 1 reserved	36	4	Unused for image 1
Image N address (N ≤ 10)	40 + (N x 4)	4	Address offset of image N specified by PCTOOL
Image N size	44 + (N x 4)	4	Size offset of image N specified by PCTOOL
Image N name	48 + (N x 4)	8	Name offset of image N specified by PCTOOL
Image N reserved	56 + (N x 4)	4	Unused for image N
nand_numblks	220	4	Number of blocks in a chip
nand_numpgs_blk	224	4	Number of pages in a block
nand_pagesz	228	4	Page size in bytes
nand_sparesz_inpage	232	4	Spare size

Name	Offset (Byte)	Size (Byte)	Description
nand_numce	236	4	Number of CE Currently; it is always zero.
Nand_clk_div	240	4	This header indicates the clock div for SPI IP.
Nand_ecc_capability	248	4	ECC capability
nand_sparesz_insect	256	4	Spare size per sector to be used by data
Reserved	272	256	Unused
last_511	508	4	Magic number The last two bytes are 0x55 and 0xAA.

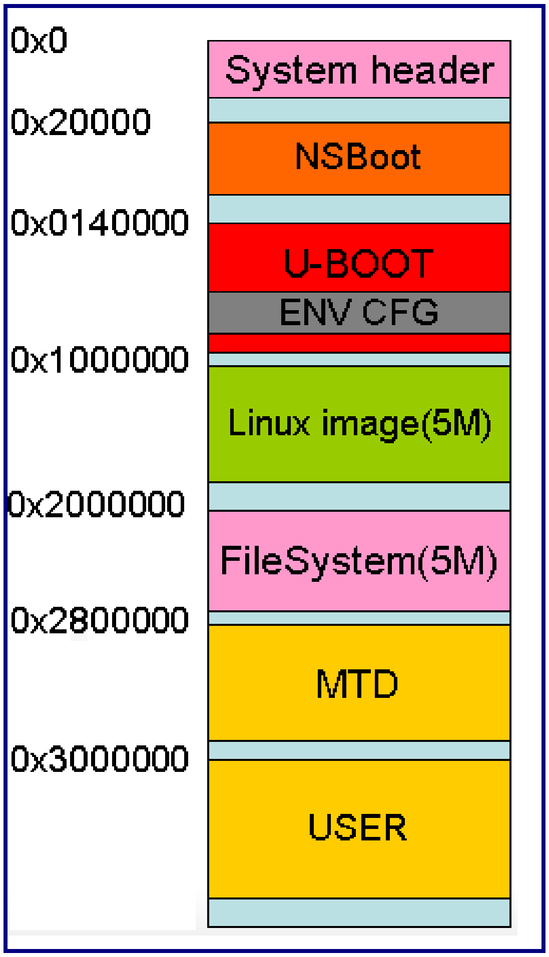


Figure 1-2. Image Layout of NAND Flash

In Figure 1-2, the system header occupies one page and is located in the first block. This image layout is the Grain Media layout. Users can modify the layout address or size to meet the user environment. Users can also add or delete partition after the FS_FA6 image. The blue areas are for bad block buffers. The user image can be bigger than the default image size. (SPI-NAND not has BI table) Please pay attention to the U-Boot partition, ENV_CFG is inside the U-BOOT partition. When the U-BOOT image is updated, all data in ENV_CFG will be gone as well.

1.5 Booting Sequence

1. When booting, the embedded ROM code will be brought up first and reads the jumper setting to recognize the accessed Flash type. After the system header in the Flash is read, the Flash will be checked for valid images. The ROM code checks the signature and 0x55AA of last two bytes in the system header. The signature must be "GM8136". If an error occurs, ROMCODE will break the boot procedure and go to the firmware update mode.
2. Once the system header is verified, the SPI/NAND boot in the next block will be loaded into SRAM and be executed. For the NAND system, the BI table will also be loaded into SRAM for checking the bad block. When SPI boot and NAND boot are called "NSBOOT", it means the NAND boot and SPI boot.
3. NSBOOT reads the system header again to know which one should be executed. Currently, it should be U-BOOT. NSBOOT then copies the image body to DDR (SDRAM) according to the image size in the image header of the loaded image.
4. Upon completion of the copy operation, the loaded image will be executed on SDRAM.

The loaded image can be U-BOOT or any customer image.

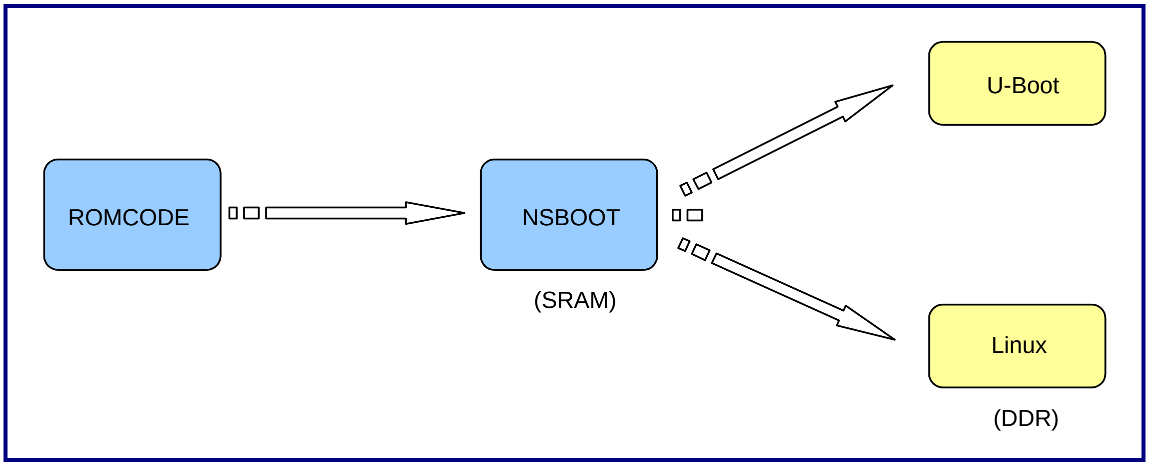


Figure 1-3. Booting Sequence

Chapter 2

Building Images

This chapter contains the following sections:

- 2.1 NSBOOT
- 2.2 U-BOOT
- 2.3 Linux

2.1 NSBOOT

NSBOOT for GM8136 can be found in the “nsboot” directory. In this directory, users can find the precompiled image and source archive.

- Unpack

Users can unpack the source archive by applying the following command:

```
$ tar zxvf nsboot.tar.gz
```

- Modify

Users can modify Makefile to match the user EVB environment (For the customer solution, users should select one to perform with different chip IDs which use different NSBOOT definitions, don’t mix them: The default setting of the PLL3 clock is 540MHz. If users want to set to 594MHz, please add –DPLL3_594.

```
#=== 8136 ==================================
#CPU 885, default setting
MFLAGS = -DSYSTEM_EVB -DGM8136 -DDDR_1180 -DMODE_3 -DDDR_SZ_8136_2Gbx1 #-DPLL3_594

#CPU 860
#MFLAGS = -DSYSTEM_EVB -DGM8136 -DDDR_1140 -DMODE_5 -DDDR_SZ_8136_2Gbx1
#=== 8136S ==================================
#CPU 860, default setting
#MFLAGS = -DGM8136S -DDDR_1140 -DMODE_3 -DDDR_SZ_8136_1Gbx1

#CPU 885
#MFLAGS = -DGM8136S -DDDR_1180 -DMODE_4 -DDDR_SZ_8136_1Gbx1

#CPU 762, DDR 1016
#MFLAGS = -DGM8136S -DDDR_1000 -DMODE_0 -DDDR_SZ_8136_1Gbx1

#CPU 712
#MFLAGS = -DGM8136S -DDDR_950 -DMODE_7 -DDDR_SZ_8136_1Gbx1

#CPU 590
#MFLAGS = -DGM8136S -DDDR_790 -DMODE_2 -DDDR_SZ_8136_1Gbx1
#=== 8135S ==================================
#CPU 712, default setting
#MFLAGS = -DGM8135S -DDDR_950 -DMODE_4 -DDDR_SZ_8135_512Mbx1

#CPU 590
#MFLAGS = -DGM8135S -DDDR_790 -DMODE_1 -DDDR_SZ_8135_512Mbx1
```

- Build

Users can apply the “make” command to build an image:

```
$ make clean;make
```

- Binaries

Once NSBOOT has been successfully compiled, the following files will be created:

File	Description
nsboot	Compiled ELF image
nsboot.bin	NSBOOT boot converted to a raw binary

The nsboot.bin file is used for programming the NAND Flash.

2.2 U-BOOT

U-BOOT for the GM8136 NAND system can be found in the "u-boot" directory. In this directory, users can find the precompiled image and source archive.

- Unpack

Users can unpack the source archive by applying the following command (Replace u-boot-2013.01.tar.gz with the correct file name in the "u-boot" directory if it is not the same):

```
$ tar xvfz u-boot-2013.01.tar.gz
```

Users can change to the created "u-boot" directory by applying the following command (Replace u-boot-2013.01.tar.gz as applicable):

```
$ cd u-boot-2013.01
```

- Build SPI system

Before compiling U-BOOT, the SPI configuration of GM8136 must be enabled. Open the GM8136 U-BOOT configuration file, *"include/configs/gm8136.h"*, and make sure that the "**CONFIG_CMD_SPI**" option is defined and "**CONFIG_SPI_NAND_GM**" is undefined.

```
•    #define CONFIG_CMD_SPI
•    //#define CONFIG_SPI_NAND_GM
```

Then, apply the following command to build an image:

```
$ ./make_8136
```

- Binaries

Once U-BOOT has been successfully compiled, the following files will be created in the “u-boot” directory:

File	Description
u-boot	Compiled ELF image
u-boot.bin	u-boot converted to a raw binary
u-boot.srec	u-boot.bin converted to the Motorola S-records format

- Build NAND system

Before compiling U-BOOT, the NAND configuration of GM8136 must be enabled. Open the GM8136 U-BOOT configuration file, “include/configs/gm8136.h”. If users want to use the SPI-NAND Flash, please make sure that the “**CONFIG_SPI_NAND_GM**” option is defined and “**CONFIG_CMD_SPI**” is undefined.

```
•    //#define CONFIG_CMD_SPI
•    #define CONFIG_SPI_NAND_GM
```

Then, apply the following command to build an image:

```
$ ./make_8136
```

- Binaries

Once U-BOOT has been successfully compiled, the following files will be created in the “u-boot” directory:

File	Description
u-boot	Compiled ELF image
u-boot.bin	U-BOOT converted to a raw binary
u-boot.srec	u-boot.bin converted to the Motorola S-records format

2.3 Linux

Linux for GM8136 can be found in the "Embedded_Linux/source" directory. In this directory, users can find the precompiled image and source archive.

- Unpack

Users can unpack the kernel source and root of the file system archive by applying the following command:

```
$ tar xvfz arm-linux-3.3.tgz
```

Users can change to the created Linux kernel source directory by applying the following command:

```
$ cd linux-3.3-fa
```

- Build

There is a default Linux kernel configure file for GM8136. Before starting an operation, users must copy the file from "arch/ arm/configs/GM8136_defconfig" to ".config" in the top directory of the kernel source tree to build a Linux image.

```
$ cp arch/arm/configs/GM8136_defconfig .config
```

Next, apply the following command to configure the kernel:

```
$ make menuconfig
```

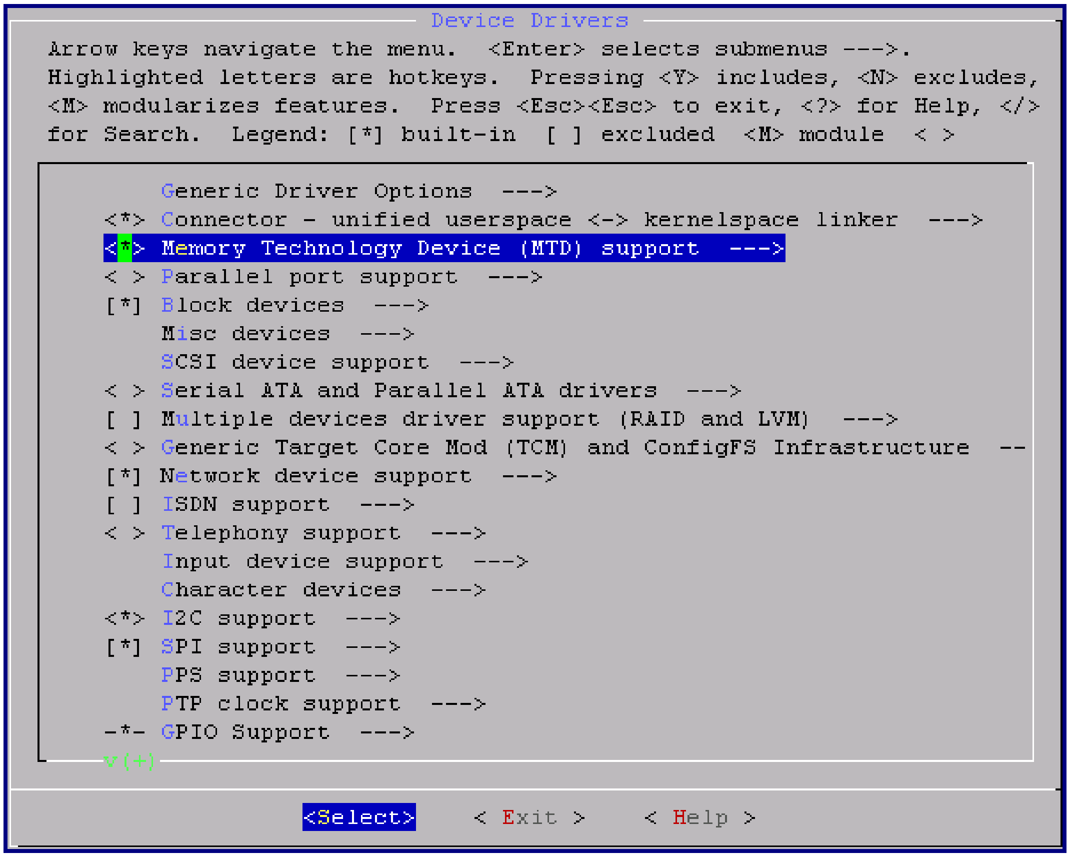
While compiling the kernel, the following items should be selected:

- MTD concatenating support
- MTD partitioning support
- Direct char device access to MTD devices
- Caching block device access to MTD devices
- Size of user Flash partition (KB) (Grain Media only)
- SPI Flash device support
- SPI support
  - ○ Support most SPI Flash chips (Winbond, ...)

- NAND device support
    - SPI-NAND Flash support for Grain Media SoC
    - Use DMA transfer for better CPU performance
    - For NAND driver debugging verbosity, choose 0
- UBI (Unsorted Block Images): Optional

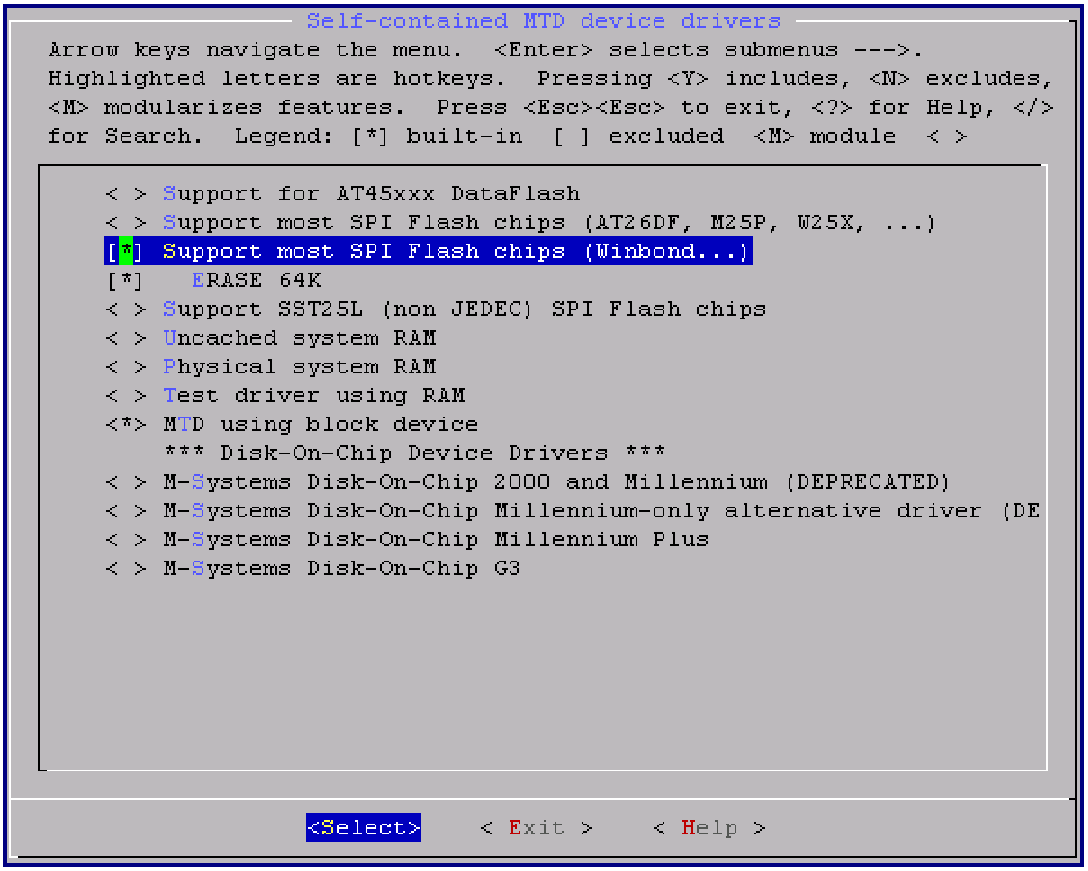
Miscellaneous file systems:

- Journalling Flash File System v2 (JFFS2) support
- JFFS2 write buffer support
- YAFFS2 file system support: Optional
    - Auto-select yaffs2 format
- UBIFS file system support

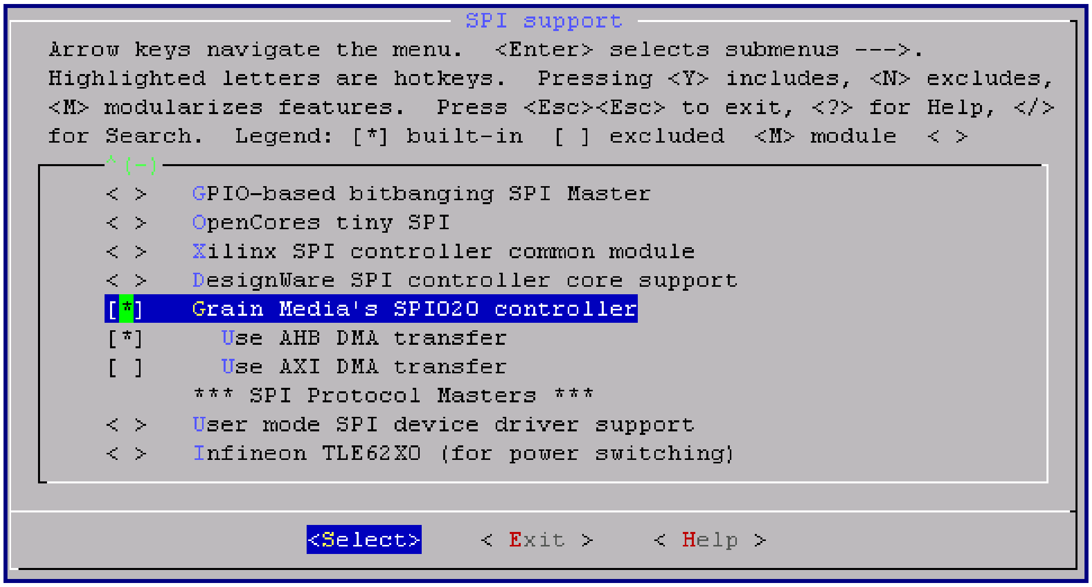


```
                           Device Drivers
  Arrow keys navigate the menu.  <Enter> selects submenus --->.
  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes,
  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </>
  for Search.  Legend: [*] built-in  [ ] excluded  <M> module  < >

            Generic Driver Options  --->
        <*> Connector - unified userspace <-> kernelspace linker  --->
        <*> Memory Technology Device (MTD) support  --->
        < > Parallel port support  --->
        [*] Block devices  --->
            Misc devices  --->
            SCSI device support  --->
        < > Serial ATA and Parallel ATA drivers  --->
        [ ] Multiple devices driver support (RAID and LVM)  --->
        < > Generic Target Core Mod (TCM) and ConfigFS Infrastructure  --
        [*] Network device support  --->
        [ ] ISDN support  --->
        < > Telephony support  --->
            Input device support  --->
            Character devices  --->
        <*> I2C support  --->
        [*] SPI support  --->
            PPS support  --->
            PTP clock support  --->
        -*- GPIO Support  --->
        v(+)

                  <Select>    < Exit >    < Help >
```

Select SPI Flash:

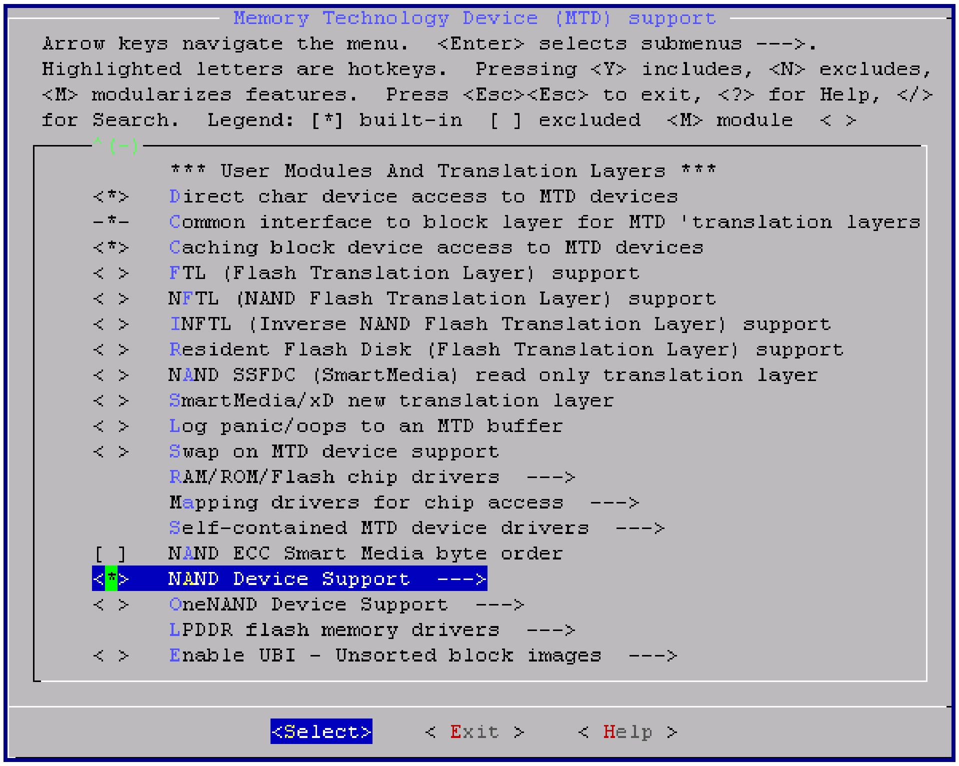


```
                    Self-contained MTD device drivers
  Arrow keys navigate the menu.  <Enter> selects submenus --->.
  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes,
  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </>
  for Search.  Legend: [*] built-in  [ ] excluded  <M> module  < >

      < > Support for AT45xxx DataFlash
      < > Support most SPI Flash chips (AT26DF, M25P, W25X, ...)
      [*] Support most SPI Flash chips (Winbond...)
      [*]   ERASE 64K
      < > Support SST25L (non JEDEC) SPI Flash chips
      < > Uncached system RAM
      < > Physical system RAM
      < > Test driver using RAM
      <*> MTD using block device
          *** Disk-On-Chip Device Drivers ***
      < > M-Systems Disk-On-Chip 2000 and Millennium (DEPRECATED)
      < > M-Systems Disk-On-Chip Millennium-only alternative driver (DE
      < > M-Systems Disk-On-Chip Millennium Plus
      < > M-Systems Disk-On-Chip G3

                 <Select>    < Exit >    < Help >
```

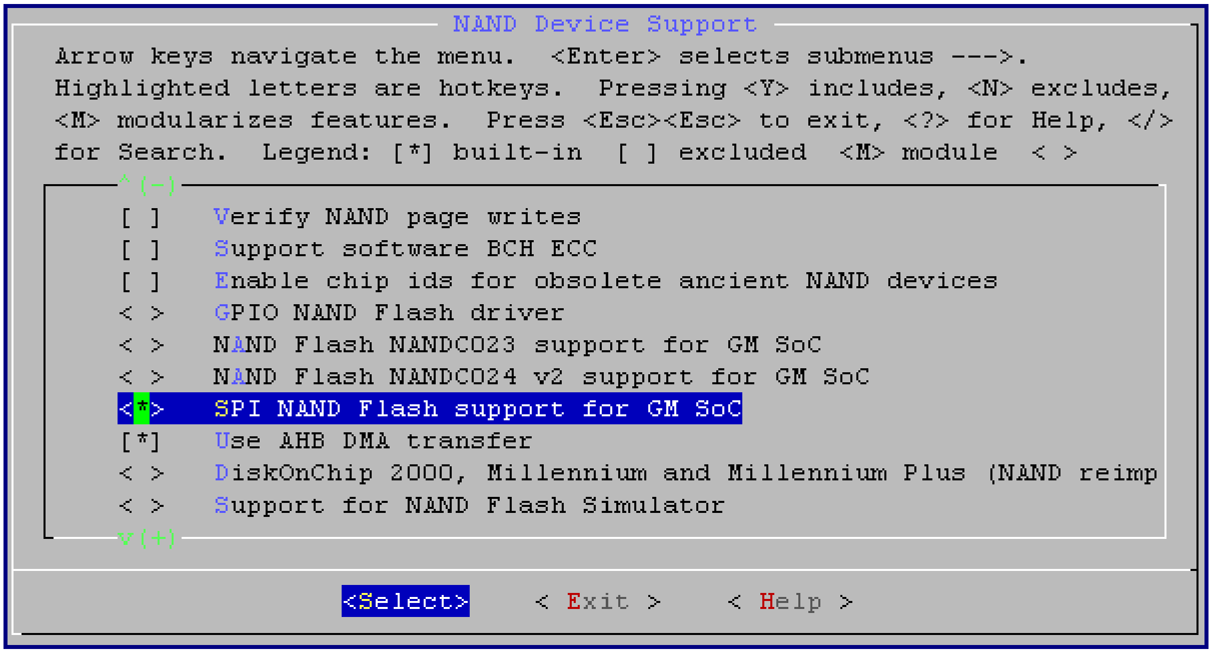


```
                           SPI support
  Arrow keys navigate the menu.  <Enter> selects submenus --->.
  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes,
  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </>
  for Search.  Legend: [*] built-in  [ ] excluded  <M> module  < >
      ^(-)
      < >   GPIO-based bitbanging SPI Master
      < >   OpenCores tiny SPI
      < >   Xilinx SPI controller common module
      < >   DesignWare SPI controller core support
      [*]   Grain Media's SPI020 controller
      [*]     Use AHB DMA transfer
      [ ]     Use AXI DMA transfer
            *** SPI Protocol Masters ***
      < >   User mode SPI device driver support
      < >   Infineon TLE62X0 (for power switching)

                 <Select>    < Exit >    < Help >
```

Select SPI-NAND Flash:

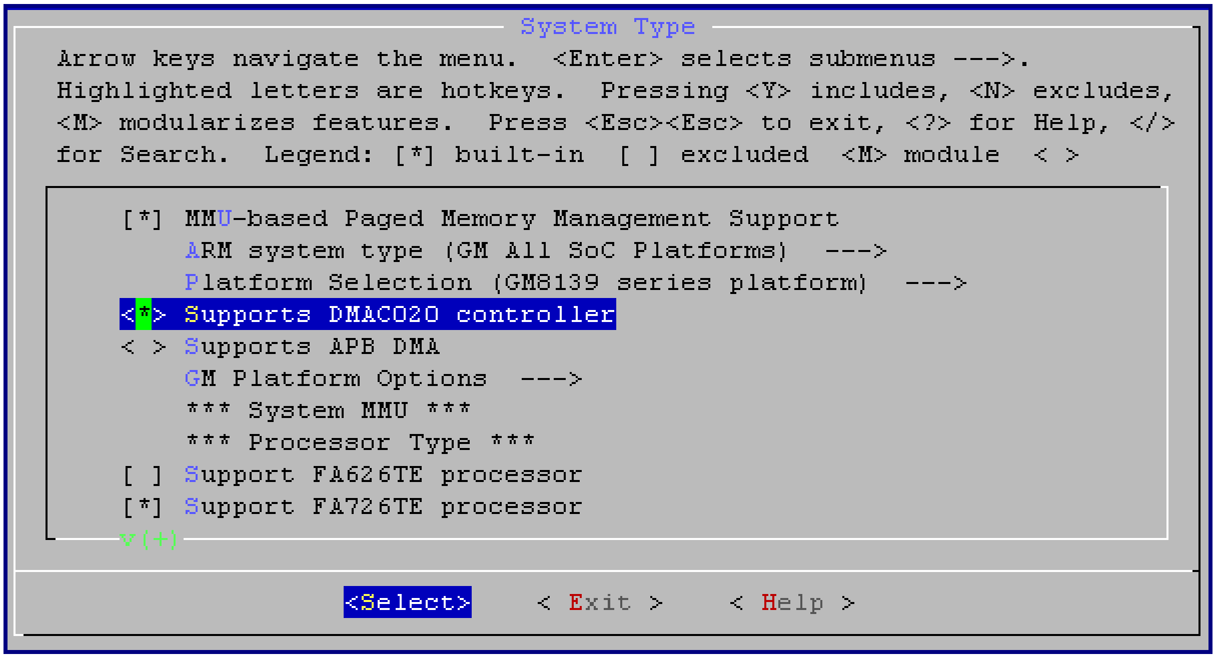


```
                 Memory Technology Device (MTD) support
  Arrow keys navigate the menu.  <Enter> selects submenus --->.
  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes,
  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </>
  for Search.  Legend: [*] built-in  [ ] excluded  <M> module  < >
      ^(-)
               *** User Modules And Translation Layers ***
      <*>    Direct char device access to MTD devices
      -*-    Common interface to block layer for MTD 'translation layers
      <*>    Caching block device access to MTD devices
      < >    FTL (Flash Translation Layer) support
      < >    NFTL (NAND Flash Translation Layer) support
      < >    INFTL (Inverse NAND Flash Translation Layer) support
      < >    Resident Flash Disk (Flash Translation Layer) support
      < >    NAND SSFDC (SmartMedia) read only translation layer
      < >    SmartMedia/xD new translation layer
      < >    Log panic/oops to an MTD buffer
      < >    Swap on MTD device support
             RAM/ROM/Flash chip drivers  --->
             Mapping drivers for chip access  --->
             Self-contained MTD device drivers  --->
      [ ]    NAND ECC Smart Media byte order
      <*>    NAND Device Support  --->
      < >    OneNAND Device Support  --->
             LPDDR flash memory drivers  --->
      < >    Enable UBI - Unsorted block images  --->

                   <Select>    < Exit >    < Help >
```



```
                         NAND Device Support
  Arrow keys navigate the menu.  <Enter> selects submenus --->.
  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes,
  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </>
  for Search.  Legend: [*] built-in  [ ] excluded  <M> module  < >
      ^(-)
      [ ]    Verify NAND page writes
      [ ]    Support software BCH ECC
      [ ]    Enable chip ids for obsolete ancient NAND devices
      < >    GPIO NAND Flash driver
      < >    NAND Flash NANDC023 support for GM SoC
      < >    NAND Flash NANDC024 v2 support for GM SoC
      <*>    SPI NAND Flash support for GM SoC
      [*]    Use AHB DMA transfer
      < >    DiskOnChip 2000, Millennium and Millennium Plus (NAND reimp
      < >    Support for NAND Flash Simulator
      v(+)

                   <Select>    < Exit >    < Help >
```

If the driver selects AHB DMA, users must select “Supports DMAC020 controller”:



```
                              System Type
  Arrow keys navigate the menu.  <Enter> selects submenus --->.
  Highlighted letters are hotkeys.  Pressing <Y> includes, <N> excludes,
  <M> modularizes features.  Press <Esc><Esc> to exit, <?> for Help, </>
  for Search.  Legend: [*] built-in  [ ] excluded  <M> module  < >

      [*] MMU-based Paged Memory Management Support
          ARM system type (GM All SoC Platforms)  --->
          Platform Selection (GM8139 series platform)  --->
      <*> Supports DMAC020 controller
      < > Supports APB DMA
          GM Platform Options  --->
          *** System MMU ***
          *** Processor Type ***
      [ ] Support FA626TE processor
      [*] Support FA726TE processor
      v(+)

                 <Select>    < Exit >    < Help >
```

Configuration is now completed. Next, the kernel and root file system must be updated and compiled. Please enter the following command:

```
$ ./build_uImage_8136
```

- Binaries

After the kernel has been successfully compiled, the image files will be produced and saved in the “arch/arm/boot” subdirectory. The “bootsImage” image can be loaded onto the NAND Flash of the target system.

File	Description
bootsImage	Self-decompressed Linux raw binary

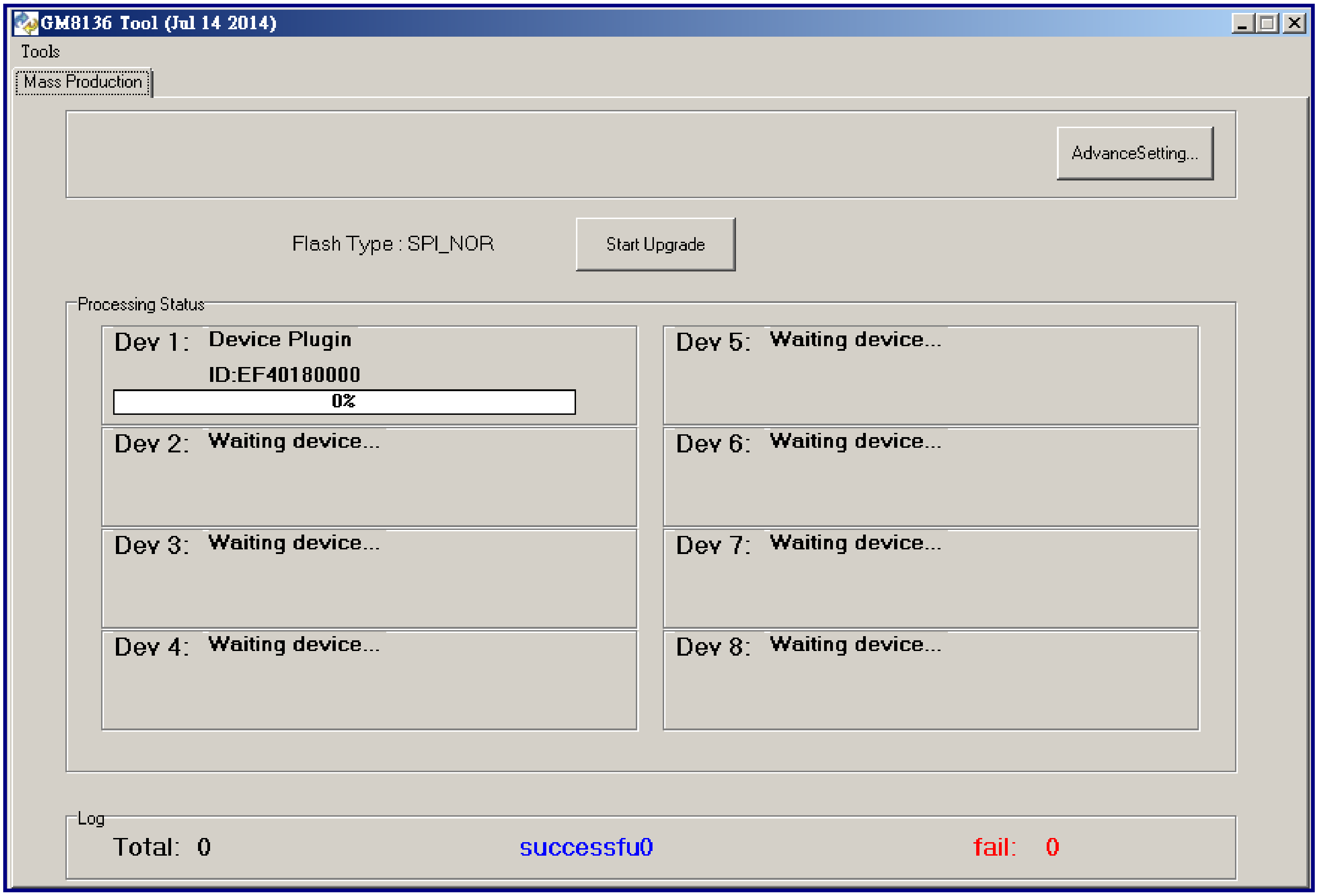
Chapter 3

Programming Images to SPI/NAND

This chapter contains the following sections:

3.1 PCTOOL

PCTOOL is a utility running on the PC host to program data and target the SPI/NAND Flash while the target system is in the firmware update mode. The PCTOOL utility is "fusblink8136.exe". Please power on EVB and plug in the USB line. After the PCTOOL utility is executed, the following window will be shown on PC.



Flash Type : SPI_NOR

Dev 1: Device Plugin
ID:EF40180000
0%

Dev 2: Waiting device...

Dev 3: Waiting device...

Dev 4: Waiting device...

Dev 5: Waiting device...

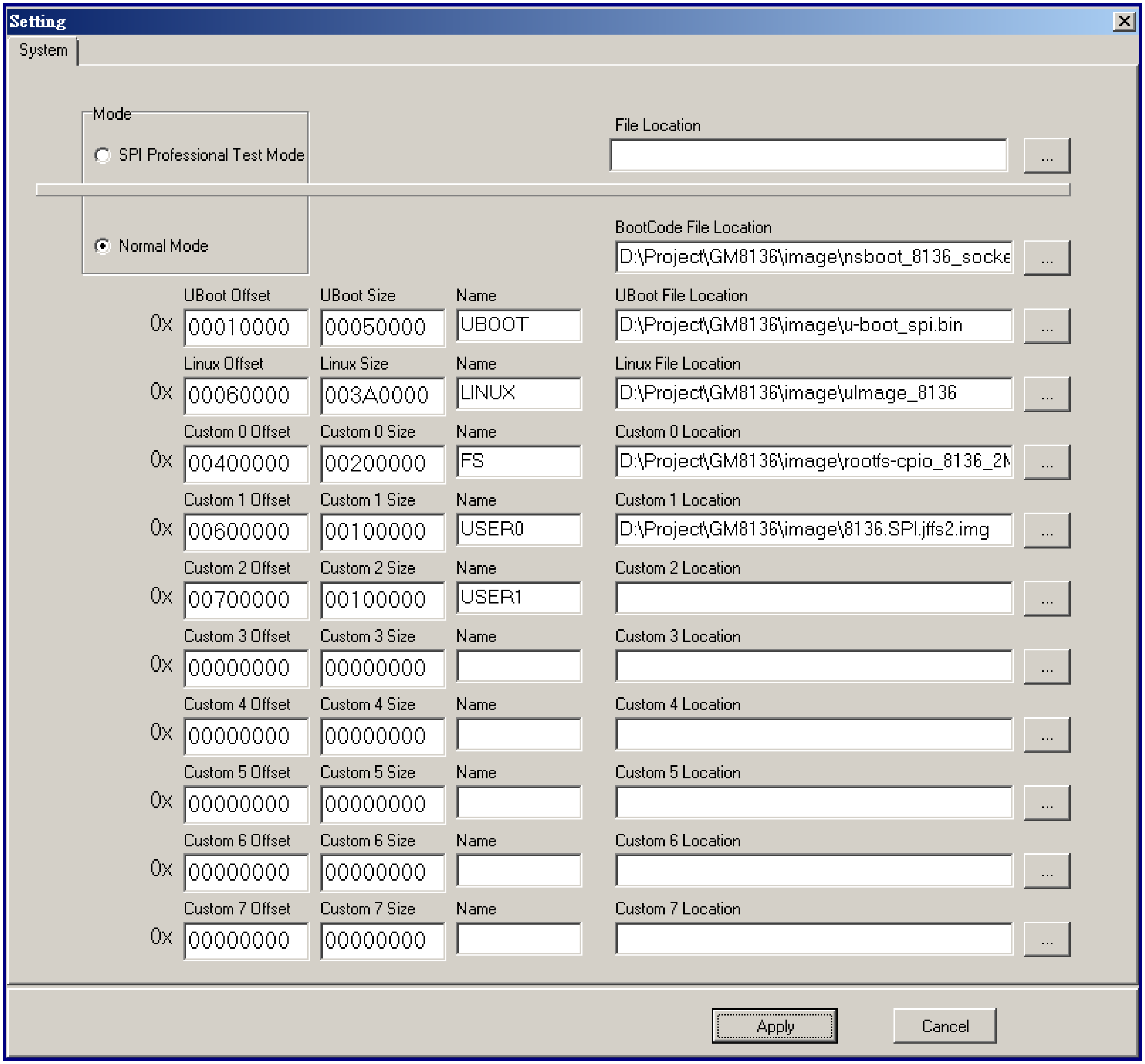
Dev 6: Waiting device...

Dev 7: Waiting device...

Dev 8: Waiting device...

Total: 0 successfu0 fail: 0

If the Flash is detected, the ID of a Flash will always be shown, and the "Flash Type" will show the Flash type –SPI-NOR, or SPI-NAND. The required setting must be set via the "AdvancedSetting…" icon. After pressing the "AdvancedSetting" icon, the window shown on the next page will pop up.



Mode

○ SPI Professional Test Mode

● Normal Mode

File Location

BootCode File Location: D:\Project\GM8136\image\nsboot_8136_socke

UBoot Offset 0x 00010000	UBoot Size 00050000	Name UBOOT	UBoot File Location D:\Project\GM8136\image\u-boot_spi.bin
Linux Offset 0x 00060000	Linux Size 003A0000	Name LINUX	Linux File Location D:\Project\GM8136\image\uImage_8136
Custom 0 Offset 0x 00400000	Custom 0 Size 00200000	Name FS	Custom 0 Location D:\Project\GM8136\image\rootfs-cpio_8136_2N
Custom 1 Offset 0x 00600000	Custom 1 Size 00100000	Name USER0	Custom 1 Location D:\Project\GM8136\image\8136.SPI.jffs2.img
Custom 2 Offset 0x 00700000	Custom 2 Size 00100000	Name USER1	Custom 2 Location
Custom 3 Offset 0x 00000000	Custom 3 Size 00000000	Name	Custom 3 Location
Custom 4 Offset 0x 00000000	Custom 4 Size 00000000	Name	Custom 4 Location
Custom 5 Offset 0x 00000000	Custom 5 Size 00000000	Name	Custom 5 Location
Custom 6 Offset 0x 00000000	Custom 6 Size 00000000	Name	Custom 6 Location
Custom 7 Offset 0x 00000000	Custom 7 Size 00000000	Name	Custom 7 Location

Image assignment:

1. BootCode file: Grain Media has the system board and socket board. The GM8136 system board (Default) uses 256MB as the DDR size, GM8136S and GM8135S system board uses 128MB or 64MB as the DDR size.
2. U-BOOT file: U-BOOT depends on the SPI or NAND Flash type, having two images to be selected. Grain Media selects only one image to meet the Grain Media EVB. The SPI mode image is used by default. U-BOOT will be mapping to MTD0, and U-BOOT env is also at MTD0, if users update MTD0, U-BOOT env will be gone. Users must reconstruct the arguments, if necessary. Otherwise, these arguments will go to the default values.
3. Linux file: Grain Media uses mbootpImage. This image does not include the file system (rootfs).
4. Custom0 file: Grain Media uses the squash file system for the mbootpImage image.
5. Custom1 ~ 5 files: Users can use one for their own.
6. For NAND Flash, PCTOOL has the "Include OOB" icon. If users enable it, it will write OOB (Spare area) into Flash, and the files inputted by users must include these data. Example: Normal page data is 2048bytes. If users do not enable it, PCTOOL will read 2048bytes from the file and write into Flash. If users enable it, PCTOOL will read 2112bytes from the file and write into Flash.

When these files and partition setting are assigned, Linux will set the MTD partition depending on the settings. U-BOOT is MTD0, and so on. The Linux auto-partition message is as follows:

```
Creating 6 MTD partitions on "wb_spi_flash":
0x000000010000-0x000000060000 : "UBOOT"
0x000000060000-0x000000480000 : "LINUX"
0x000000480000-0x000000600000 : "FS"
0x000000600000-0x000000700000 : "USER0"
0x000000700000-0x000000800000 : "USER1"
0x000000000000-0x000001000000 : "ALL"
```

Please specify the image offset for every image and note that the offset address should be the erase unit alignment. The window shown on the next page is the NAND Flash update. If a new SPI Flash comes, users must specify the related parameters in PCTOOL. The parameters will then be passed to Grain Media RomCode at the firmware upgrade stage by PCTOOL. Please change the following file, *PCTOOL/flash/cfg_xxx_xxx.txt*.

Note 1: Address has the alignment issue. Alignment is recommended depending on the Flash block size.

Note 2: Users should assign the image offset from low address to high address. The image addresses should not across each other.

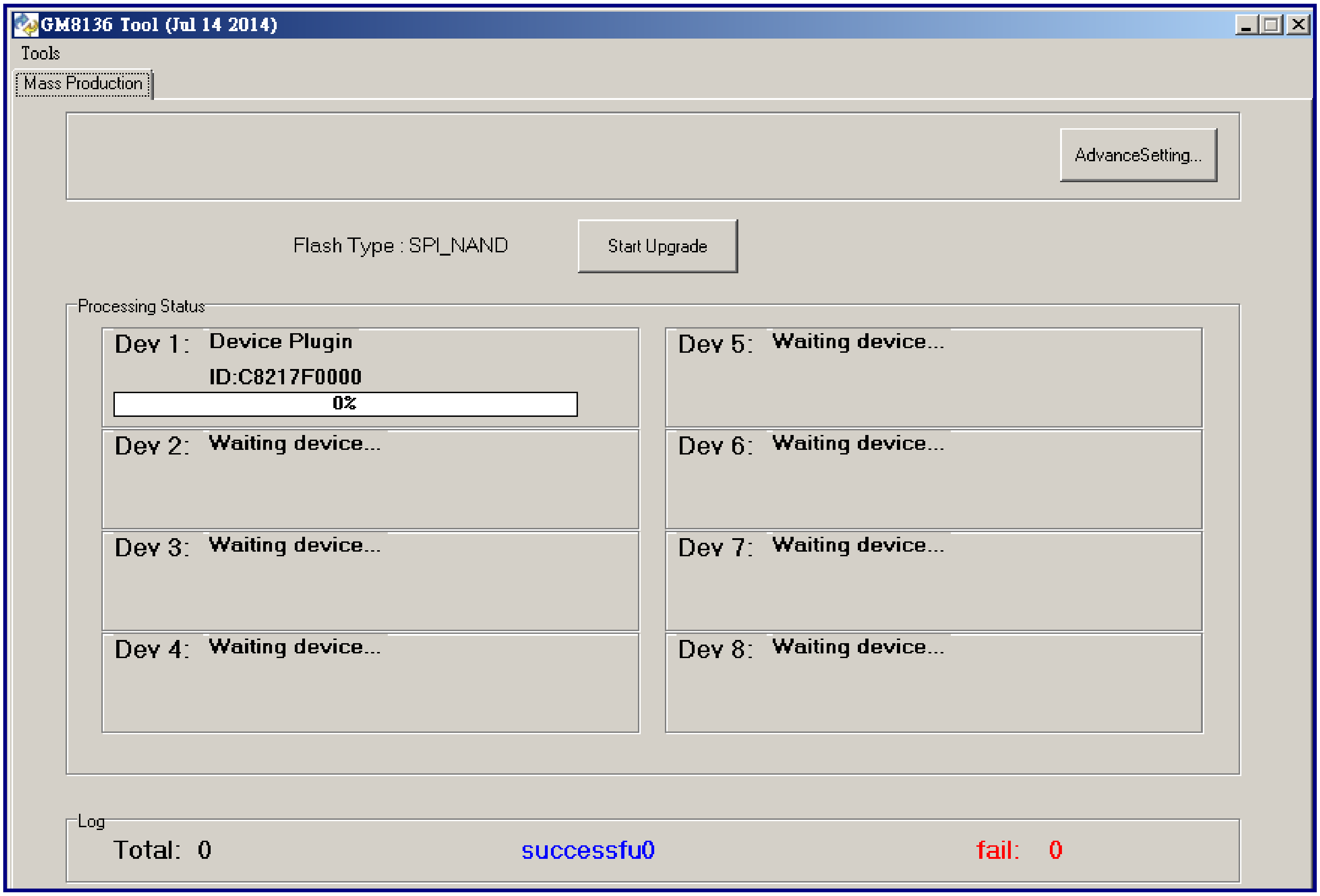
Note 3: If users do not want to use the custom fields, please set the offset and size fields as '0' and do not select file.

Note 4: For the image offset and size, please reserve enough space for future upgrade. If users do not use USB to upgrade a code, the field arrangement will not be modified by other methods and the image loading may have errors.

If users use PCTOOL to burn the SPI image and if the system cannot be booted, please check the following:

1. Please check if it is in the SPI mode.
2. Please check if SPI 3-byte/4-byte jump setting is correct.
3. The chip IDs of MXIC and Winbond 256Mb 3 or 4/pure 4-byte addressing modes are the same. If users use the chip in the 3-byte or 4-byte addressing mode, jump must be set to the 3-byte mode. If users use the chip in the pure 4-byte addressing mode, jump must be set to the 4-byte mode.

Please note that a system header should be in front of the Flash. The specified offset addresses will be updated to the system header.



Flash Type : SPI_NAND

Dev 1: Device Plugin
ID:C8217F0000
0%

Dev 2: Waiting device...

Dev 3: Waiting device...

Dev 4: Waiting device...

Dev 5: Waiting device...

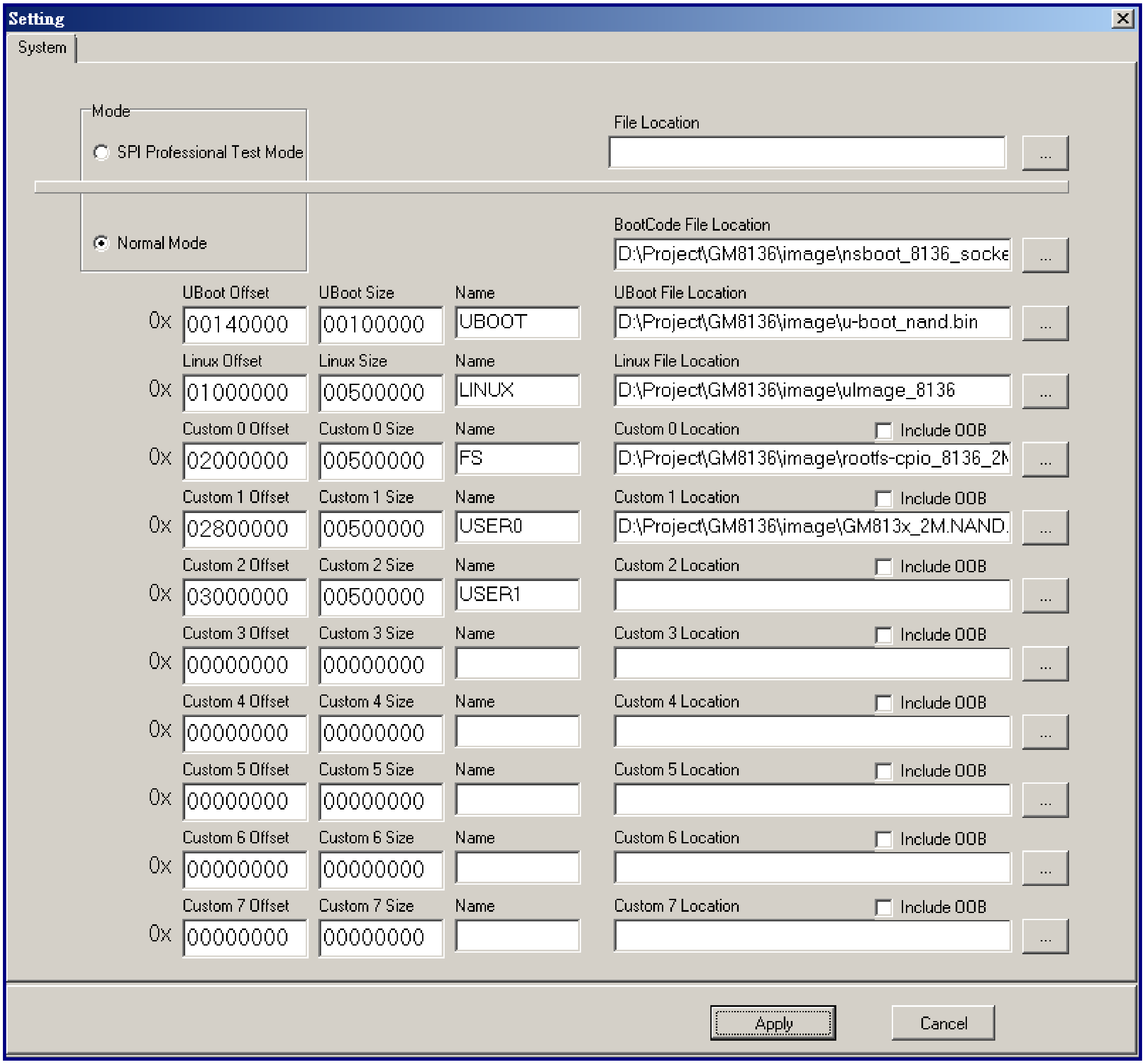
Dev 6: Waiting device...

Dev 7: Waiting device...

Dev 8: Waiting device...

Total: 0 successfu0 fail: 0

When a NAND Flash is detected, the device ID will be the ID of the NAND Flash.



Mode

○ SPI Professional Test Mode

● Normal Mode

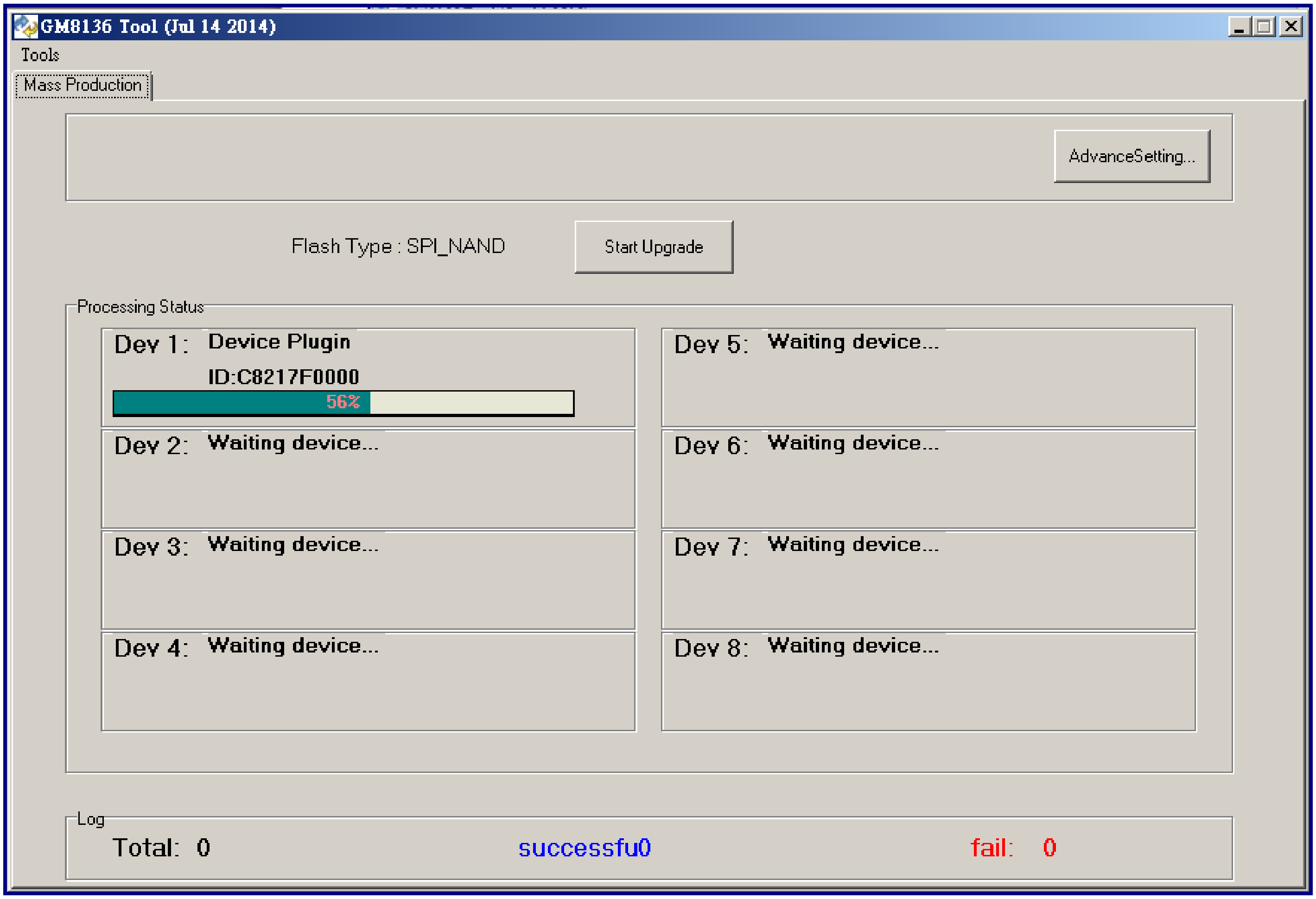
File Location

BootCode File Location: D:\Project\GM8136\image\nsboot_8136_socke

	UBoot Offset	UBoot Size	Name	UBoot File Location	
0x	00140000	00100000	UBOOT	D:\Project\GM8136\image\u-boot_nand.bin	
	Linux Offset	Linux Size	Name	Linux File Location	
0x	01000000	00500000	LINUX	D:\Project\GM8136\image\uImage_8136	
	Custom 0 Offset	Custom 0 Size	Name	Custom 0 Location	□ Include OOB
0x	02000000	00500000	FS	D:\Project\GM8136\image\rootfs-cpio_8136_2M	
	Custom 1 Offset	Custom 1 Size	Name	Custom 1 Location	□ Include OOB
0x	02800000	00500000	USER0	D:\Project\GM8136\image\GM813x_2M.NAND.	
	Custom 2 Offset	Custom 2 Size	Name	Custom 2 Location	□ Include OOB
0x	03000000	00500000	USER1		
	Custom 3 Offset	Custom 3 Size	Name	Custom 3 Location	□ Include OOB
0x	00000000	00000000			
	Custom 4 Offset	Custom 4 Size	Name	Custom 4 Location	□ Include OOB
0x	00000000	00000000			
	Custom 5 Offset	Custom 5 Size	Name	Custom 5 Location	□ Include OOB
0x	00000000	00000000			
	Custom 6 Offset	Custom 6 Size	Name	Custom 6 Location	□ Include OOB
0x	00000000	00000000			
	Custom 7 Offset	Custom 7 Size	Name	Custom 7 Location	□ Include OOB
0x	00000000	00000000			

The window shown above is an example of the NAND Flash.

Every supported Flash has the corresponding configured file located in the PCTOOL/Flash directory. If users need to add a new Flash, please contact the Grain Media service member for this request. Grain Media will add the new Flash for users. The next step, users need to select "Default Image". Users **mus**t choose the "UBoot" item. Once the settings are completed, users should press the "Apply" button; and it will return to the utility main menu. Please press the "Start Upgrade" icon to begin updating the SPI/NAND Flash and the message shown below will appear.



Flash Type : SPI_NAND

Dev 1: Device Plugin
ID:C8217F0000
56%

Dev 2: Waiting device...

Dev 3: Waiting device...

Dev 4: Waiting device...

Dev 5: Waiting device...

Dev 6: Waiting device...

Dev 7: Waiting device...

Dev 8: Waiting device...

Total: 0 successfu0 fail: 0

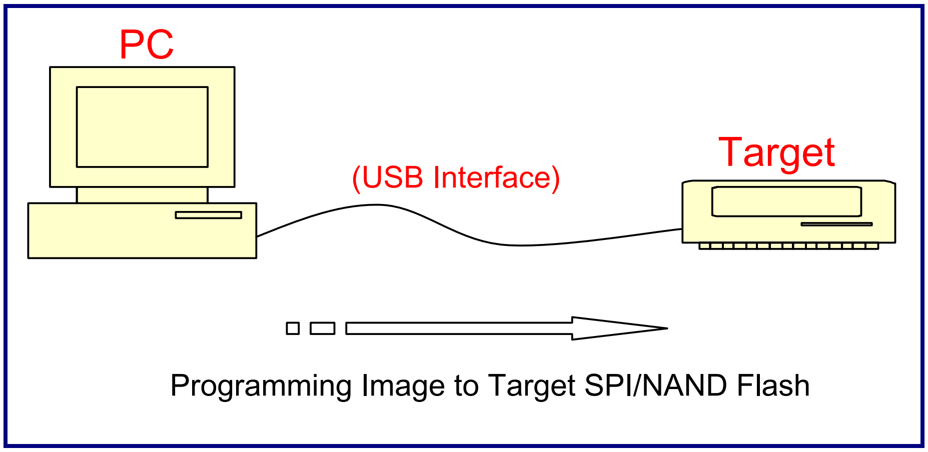


Figure 3-1. NAND Flash Programming by PCTOOL

3.2 Add and modify MTD partition

Driver will auto transfer system header data to MTD partition definition, and PC tool open max fields for customer to set up them. If users want to add or modify by yourself, please modify driver as follow:

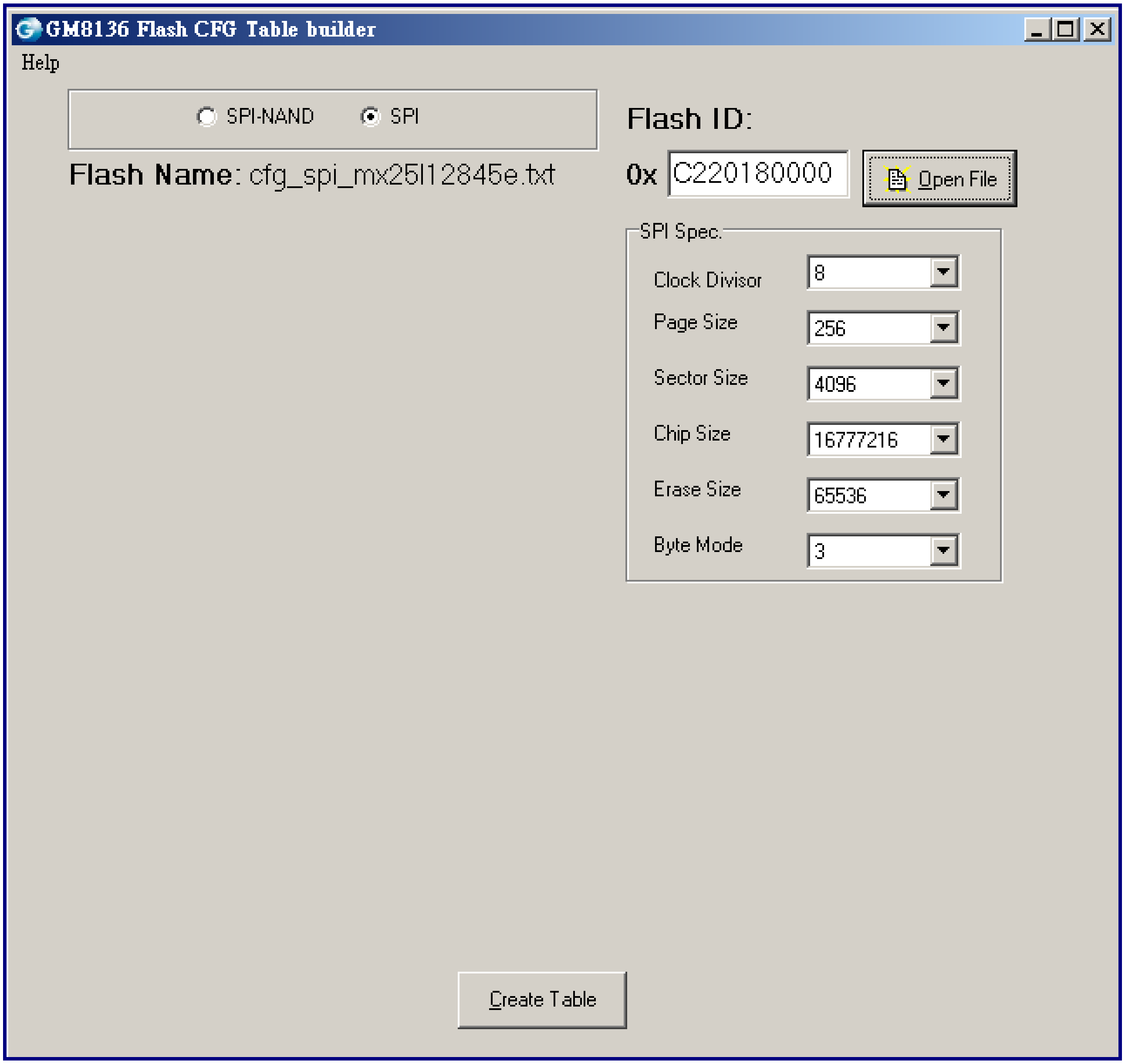
Flash type
(1) SPI NAND
Please modify linux-3.3-fa/drivers/mtd/nand/ftspi020_nand.c
(2) SPI
Please modify linux-3.3-fa/drivers/mtd/devices/spi_flash.c

search "partition_check" string, and set these definition direcly at this API function.
For example:

```
partitions[0].name = "abc";
partitions[0].offset = 0x140000;
partitions[0].size = 0x200000;
```

3.3 Add New SPI Flash in PCTOOL

When upgrading the target firmware, PCTOOL needs to pass the related parameters to the NAND Flash, such as the page size, block size, and so on, to the ROM code embedded in the GM8136 SoC. Therefore, PCTOOL must be able to identify the target Flash to notify the target board what Flash is used. If users want to set the NAND Flash, please click the "NAND" icon. If users want to set the SPI Flash, please click the "SPI" icon.



○ SPI-NAND ● SPI

Flash Name: cfg_spi_mx25l12845e.txt

Flash ID:

0x C220180000

SPI Spec.

Clock Divisor	8
Page Size	256
Sector Size	4096
Chip Size	16777216
Erase Size	65536
Byte Mode	3

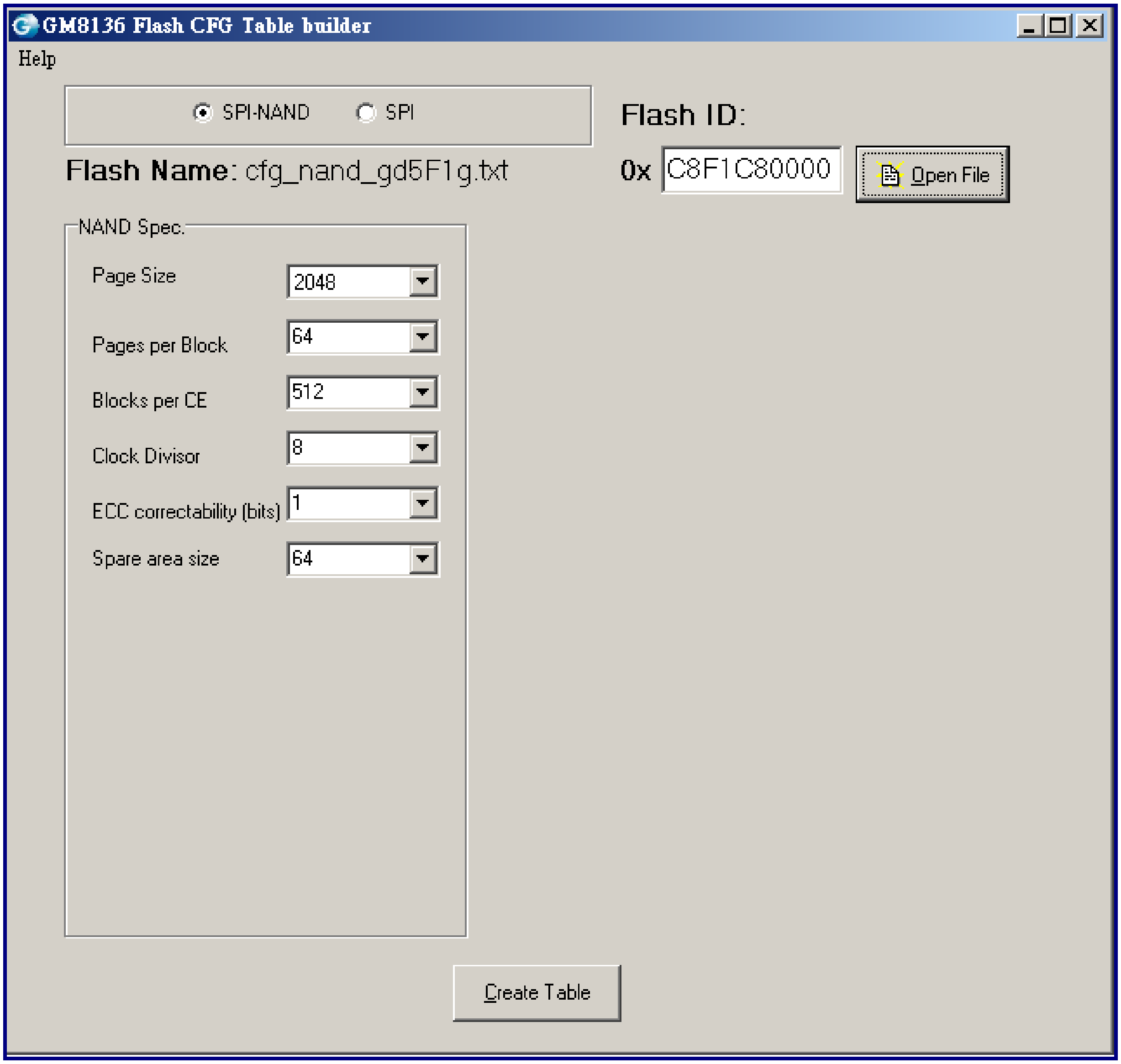
The steps below show users how to create a new Flash in the database of PCTOOL.

1) Find the executable file, *flash/CfgBuilder28.exe*
2) Please click the "SPI" icon.

3) “Clock Divisor” is usually set to 8. “Erase Size” is usually set to 64KB.

4) For the Byte Mode, 16MB is usually the 3-byte mode Flash, 32MB is usually the 4-byte mode Flash.

5) When the user settings are finished, users can click “Create Table” to create the configuration file.



GM8136 Flash CFG Table builder

Help

● SPI-NAND ○ SPI

Flash ID:

Flash Name: cfg_nand_gd5F1g.txt

0x C8F1C80000

NAND Spec.

Page Size: 2048

Pages per Block: 64

Blocks per CE: 512

Clock Divisor: 8

ECC correctability (bits): 1

Spare area size: 64

The steps below show users how to create a new Flash in the database of PCTOOL.

1) Find the executable file, flash/CfgBuilder28.exe

2) Please click the “SPI-NAND” icon.

3) “Clock Divisor” is usually set to 8. “ECC correctability” is usually set to 1 according to the Flash chip data sheet.

When the user settings are finished, users can click “Create Table” to create the configuration file.

3.4 Burn MTD User Area under Linux Environment

If the Flash type is “SPI Flash”, the following steps can be adopted to run MTD:

1. After making MTD into Flash and ready, users can save the MTD data into file,
   cat /dev/mtd1 > mtd.img
2. Use PCTOOL to burn it. The input file is *mtd.img*.

If the Flash type is “NAND Flash”, the following steps can be adopted to run MTD:

1. After making MTD into Flash and ready, users can save the MTD data into file,
   nanddump -p -f mtd.img /dev/mtd0
2. When burning by using PCTOOL, the name of the input file will be *mtd.img*.

3.5 JFFS2 File System for User Section

Grain Media SDK defines one MTD block for “User Section”, which can be used for the boot script, system information, AP configure, or setting information.

```
Creating 5 MTD partitions on "NAND 128MiB 3,3V 8-bit":
0x000000140000-0x000000240000 : "UBOOT"
0x000001000000-0x000001500000 : "LINUX"
0x000002000000-0x000002500000 : "FS"
0x000002800000-0x000002d00000 : "USER0"
0x000003000000-0x000003500000 : "USER1"
```

The MTD block for “User Section” must be formatted and mounted to the JFFS2 file system.

```
flash_eraseall /dev/mtd2
mount /dev/mtdblock2 /mnt/mtd/
```

Users can apply the nanddump command to check whether the MTD OOB data has been successfully created.

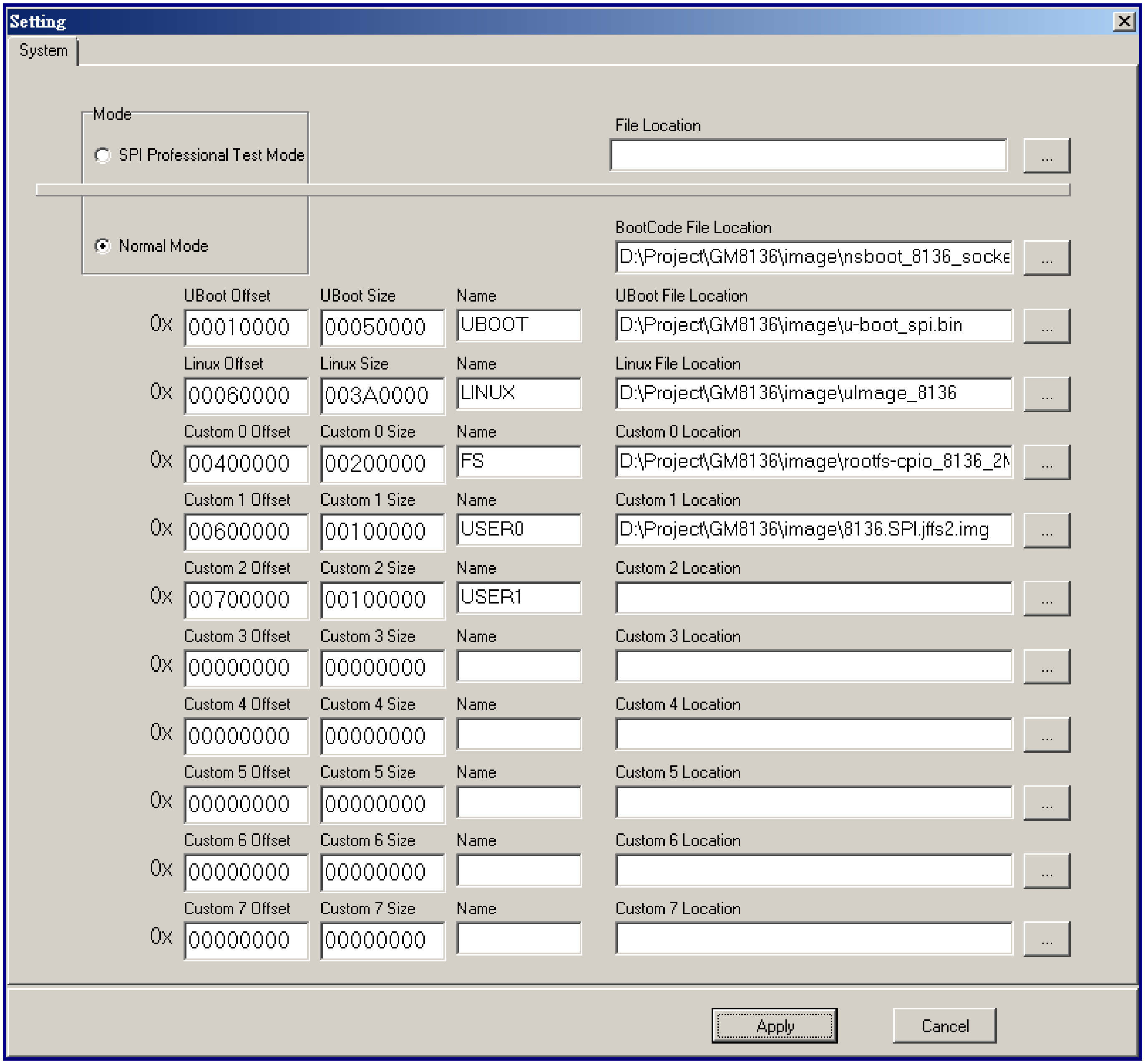
```
/ # nanddump -p /dev/mtd1
Block size 131072, page size 2048, OOB size 64
Dumping data starting at 0x00000000 and ending at 0x06700000...
0x00000000: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
0x00000010: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
0x00000020: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
…
0x000007e0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
0x000007f0: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
  OOB Data: 85 19 03 20 08 00 00 00 ff ff ff ff ff ff ff ff
```

```
   OOB Data: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
   OOB Data: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
   OOB Data: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
 0x00000800: ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff ff
```

Chapter 4

User Section

In the MTD partitions, PCTOOL can be used to set the number of MTDs, start address, size, and name of the MTD partition. MTD can expend up to four user partition areas. Users can decide to burn the selected images. If the image is empty, Linux will build empty MTD partition. Since the partition is not formatted yet, mounting the partition will cause some warning messages. As a result, users should format the MTD partition, read the partition data, and save to one image. Then, PCTOOL should be used to burn the image into the partition. When Linux is booted, mounting the partition will not show any warning message. If the MTD partition address and size are already set, the Linux command cannot be used to modify the setting values. If modifying these settings is required, PCTOOL should be used to burn all setting values again. The SPI setting values are as follows:



Setting

System

Mode

○ SPI Professional Test Mode

● Normal Mode

File Location

BootCode File Location

D:\Project\GM8136\image\nsboot_8136_socke

	UBoot Offset	UBoot Size	Name	UBoot File Location
0x	00010000	00050000	UBOOT	D:\Project\GM8136\image\u-boot_spi.bin
	Linux Offset	Linux Size	Name	Linux File Location
0x	00060000	003A0000	LINUX	D:\Project\GM8136\image\uImage_8136
	Custom 0 Offset	Custom 0 Size	Name	Custom 0 Location
0x	00400000	00200000	FS	D:\Project\GM8136\image\rootfs-cpio_8136_2M
	Custom 1 Offset	Custom 1 Size	Name	Custom 1 Location
0x	00600000	00100000	USER0	D:\Project\GM8136\image\8136.SPI.jffs2.img
	Custom 2 Offset	Custom 2 Size	Name	Custom 2 Location
0x	00700000	00100000	USER1	
	Custom 3 Offset	Custom 3 Size	Name	Custom 3 Location
0x	00000000	00000000		
	Custom 4 Offset	Custom 4 Size	Name	Custom 4 Location
0x	00000000	00000000		
	Custom 5 Offset	Custom 5 Size	Name	Custom 5 Location
0x	00000000	00000000		
	Custom 6 Offset	Custom 6 Size	Name	Custom 6 Location
0x	00000000	00000000		
	Custom 7 Offset	Custom 7 Size	Name	Custom 7 Location
0x	00000000	00000000		

Chapter 5

Add New Flash Chip

(1) If a new SPI chip should be added, users must modify the following files to support this new chip.

U-BOOT

u-boot-2013.01/drivers/mtd/spi/

search eon.c or macronix.c or…to update the user SPI Flash as required

Linux

linux-3.3-fa/drivers/mtd/devices/spi_flash.c

search “common_spi_flash_data” string and update the user SPI Flash as required

(2) If a new SPI-NAND chip should be added, users must modify the following files to support this new chip.

U-BOOT

u-boot-2013.01/drivers/mtd/nand/mamd_ids.c

search “nand_flash_ids” string and update the user Flash as required

Linux

linux-3.3-fa/drivers/mtd/devices/mtd/nand/nand_ids.c
search “nand_flash_ids” string and update the user Flash as required

Chapter 6

Modify JFFS2 Image

If users want to modify the Grain Media xxx.jffs2.img, users can set the commands as the following to add or delete a file.

```
# losetup /dev/loop0 xxx.jffs2.img
# modprobe block2mtd block2mtd=/dev/loop0
# modprobe mtdblock
# mount -t jffs2 -o ro /dev/mtdblock0 mnt
```

Chapter 7

Image Upgrade

Users can use some methods to upgrade the image.

(1) Use PCTOOL to upgrade the image.

(2) Use U-BOOT to upgrade the image, and users can use the U-BOOT Flash command for image upgrade.

(3) Use Linux to upgrade the image, users can refer to Quick_Start.pdf for the detailed information.

Note: For the NAND Flash, the devices may have blocks that are invalid when they are shipped from the factory, and these blocks should be avoided. If users want to add new bad blocks, users can use markbad to inform the driver to avoid of using them. The driver will not take the initiative to mark the bad blocks.

Block 0 contains the bad block message, and each NAND chip is different. Users should not copy the “A” chip image that includes block 0 to the “B” chip image.