

TCC893X SD/MMC BOOT GUIDE

TCC893x_SD/MMC_Android 4.4(Kitkat)_v1.01E

Rev. 1.01

Feb 13, 2014

Telechips

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Revision History

Date	Version	Description
2014-02-13	1.01	Android Kitkat Beta Release

TABLE OF CONTENTS**Contents**

1 Introduction	1-1
1.1 Remarks	1-1
2 Prepare Download Image	2-2
2.1 How to Configure Boot Mode(SD/MMC or eMMC) in Bootloader	2-2
2.2 Make Bootloader for SD/MMC or eMMC Boot	2-4
2.3 Kernel Build for SD/MMC or eMMC Boot	2-4
2.4 Android System Build for SD/MMC or eMMC Boot	2-4
3 The Partition Layout	3-5
3.1 The Partition Layout of SD/MMC for Android System	3-5
3.1.1 GPT Partition Layout	3-5
3.1.2 MBR Partition Layout	3-5
3.2 The Partition Size Definition	3-6
3.2.1 GPT Partition Layout	3-6
3.2.2 MBR Partition Layout	3-6
4 How to Select Boot Mode	4-7
4.1 SD/MMC Boot Mode	4-7
4.2 eMMC Boot Mode	4-7
5 Prepare Download with FWDN	5-8
5.1 GPT Partition Layout - eMMC Boot Mode(Hidden Area is NOT used)	5-8
5.2 GPT Partition Layout – SD/MMC Boot Mode, eMMC Boot mode(Use Hidden Area)	5-10
5.3 MBR Partition Layout	5-12
6 SD Slot Usages	6-14
6.1 Location of the SD Slot at Each EVM Board	6-14
6.2 TCC8930 CPU Board(Type 1)	6-14
6.3 TCC8930 CPU Board(Type 2)	6-15
6.4 TCC8933 & TCC8935 CPU Board(Type 1)	6-16
6.5 TCC8933 & TCC8935 CPU Board(Type 2)	6-17
7 Appendix	7-18
7.1 SD3.0 Usage	7-18
7.2 How to choose eMMC Mode(Normal, High-speed, DDR)	7-19

1 Introduction

This document describes how to configure SD/MMC boot in Telechips Android 4.4(Kitkat) Platform.

1.1 Remarks

FWDN v2.44 or higher version must be used to configure SD/MMC partition layout.

2 Prepare Download Image

2.1 How to Configure Boot Mode(SD/MMC or eMMC) in Bootloader

Support two kinds of boot mode: 1) *SD/MMC boot mode*(Figure 2) and 2) *eMMC¹ boot mode*(above eMMC Spec 4.3², Figure 1, 3). The *SD/MMC boot mode* refers that bootloader is stored in normal data partition in which normal code and/or data such as boot(kernel) image, android system image, and user data are stored. The second type of boot mode, *eMMC boot mode*, uses extra boot partition additionally existed only on eMMC device above eMMC Spec 4.3. For example, eMMC device(above eMMC Spec 4.3) can be used for the all of boot mode because it has two kinds of partitions: normal partition and dedicated boot partition. On the contrary to the eMMC device, SD card has only a normal partition. So, if SD card is used as boot device, you have no choice to select boot mode; that is, you must select SD boot mode.

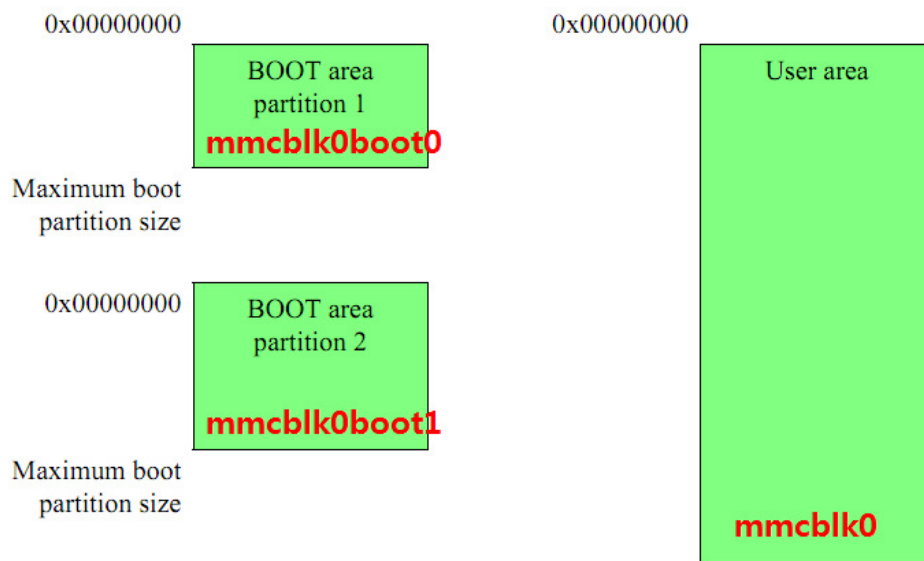


Figure 1. eMMC Default Partition Structure

¹ Generally, MMC and eMMC are meant to same eMMC(embedded MMC) device. To classify different boot mode, however, the terms for SD/MMC boot mode and eMMC boot mode have being used only in Telechips in-variably.

² Refer to the JEDEC strandard document for eMMC, <http://www.jedec.org/>

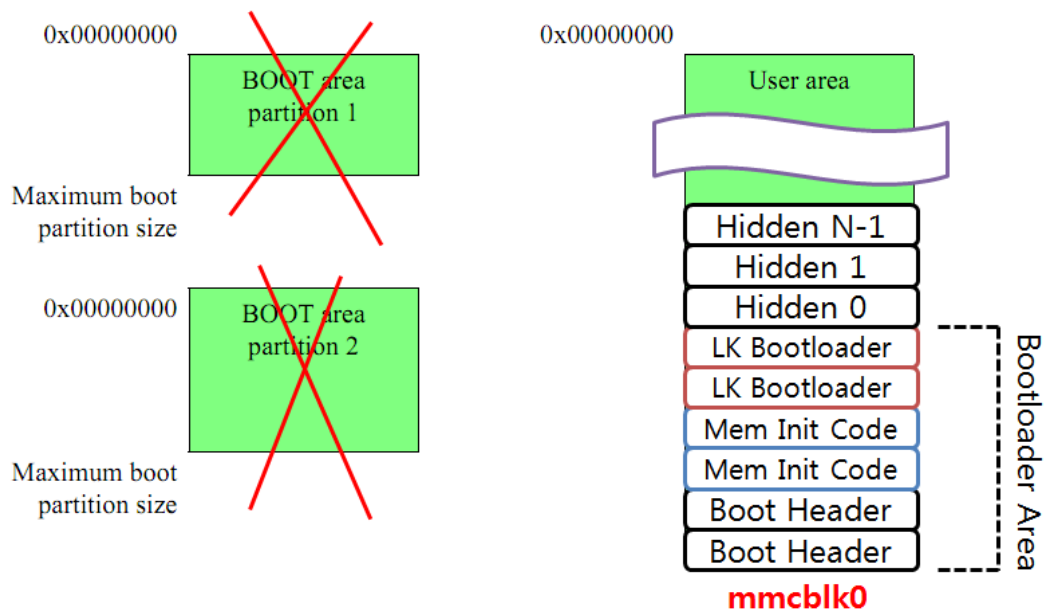


Figure 2. SD/MMC Boot Mode Configuration

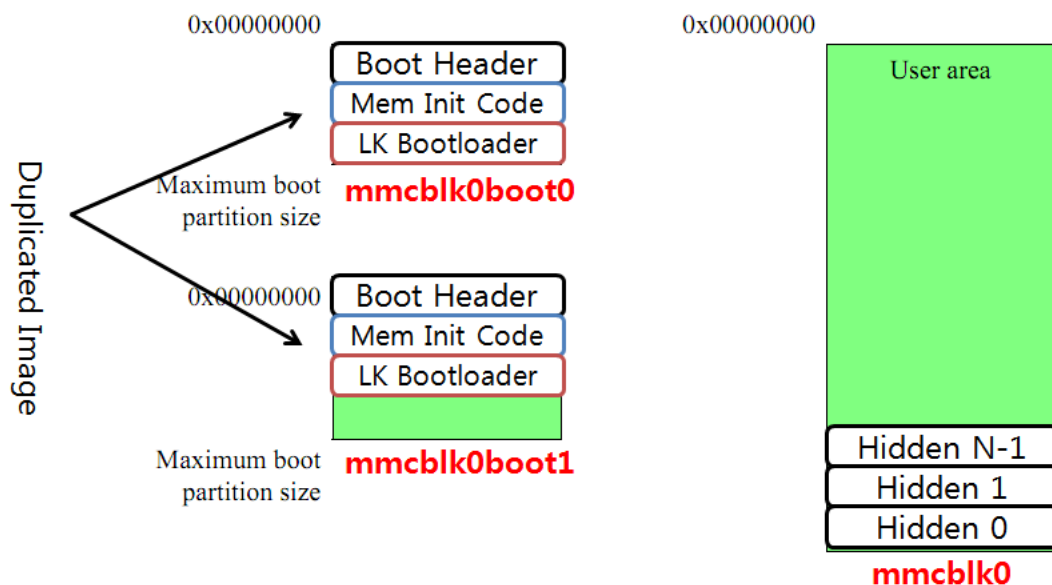


Figure 3. eMMC Boot Mode Configuration

!Caution: When the eMMC boot mode is used, take notice the boot partition size of the eMMC device. If bootloader image size is greater than the boot partition size of the eMMC device, the bootloader image can't be stored on it. Depending on the eMMC manufacturers, the boot partition size differs³. We usually use eMMC device which boot partition size is set at least 1MByte to save bootloader safely. So, please check boot partition size of eMMC device before you decide it to use boot device.

³ Refer to the datasheet of eMMC manufacturers such as Micron, SanDisk, Samsung, Toshiba, and so on.

Location : bootable/bootloader/lk/platform/tcc893x/rules.mk

```

ifneq ($(EMMC_BOOT),1)
DEFINES += BOOTSD_KERNEL_INCLUDE
ifneq ($(filter $(DEFINES),TARGET_TCC8935_DONGLE),)
    ifneq ($(filter $(HW_REV),0x9312 0x9313),)
        DEFINES += FEATURE_SDMMC_MMC43_BOOT
    endif
else
    DEFINES += FEATURE_SDMMC_MMC43_BOOT
endif
endif
"bootable/bootloader/lk/platform/tcc893x/rules.mk"

```

1. Change directory to LK bootloader
\$ cd bootable/bootloader/lk
2. Compile bootloader for TCC893x SD/MMC or eMMC Boot mode
\$ make tcc893x evm emmc

```
1) Enable eMMC Boot
Kernel$ make menuconfig
Device Drivers -> MMC/SD/SDIO card support ->
[*] Teledips SD/MMC Host Controller Driver
[*] Support an eMMC
    eMMC Boot Mode (Normal Mode) --->
    [*] Enable TCC SDHC0
    [*] Enable TCC SDHC1
    [*] Enable TCC SDHC2
    [ ] Enable TCC SDHC3
    [*] Enable TCC SDHC Speed Up
    Enable SD3.0 ((X)) --->
```

[illegible]

- 1). Execute lunch command in android root
- 2). Select full tcc893x-eng mode

2-4

3 The Partition Layout.

3.1 The Partition Layout of SD/MMC for Android System

You should understand how SD/MMC partition layout is configured in Android system before you download Android system images. See the following table of default SD/MMC partition layout.

From Android v4.4(Kitkat), GPT⁴ partition table is used as default configuration. But, MBR partition layout is also supported to maintain compatibility with Android v4.2(Jellybean). If you want to use MBR partition layout, execute following operation:

1. Move Target Device Directory in Android Kitkat
`$ cd device/telechips/<platform>`
2. Overwrite Configuration Files for MBR Partition Layout
`$ cp -rf parttype_mbr/ ./`

3.1.1 GPT Partition Layout

Area	Name	Purpose	File System Type	Mandatory
Boot	Boot Area	Kernel/Ram Disk	Raw	Y
System	Android System	Android System Area	Ext4	Y
Cache	Android Cache	Android Cache Area	Ext4	Y
Recovery	Android Recovery	Recovery Mode Boot Area Kernel/Ram Disk(Recovery Mode)	Raw	Y
Splash	Splash	Boot Screen Image	Raw	Y
Kpanic	Kpanic	Kernel Panic Log	Raw	Y
Misc	Miscellaneous	Recovery Mode related Command (FOTA, Factory Rest)	Raw	Y
Tcc	Telechips Only	Set-top Flash Write	Raw	N
Userdata	Android User Data	Android User Data Application / Database	Ext4	Y

3.1.2 MBR Partition Layout

Area	Name	Purpose	FileSystem	Required
Boot	Boot Area	Kernel / Ram Disk	RAW	Mandatory
System	Android System	Android System Area	EXT4	Mandatory
UserData	Android UserData	Android User Data Application / Database	EXT4	Mandatory
Cache	Android Cache	Android Cache Area	EXT4	Mandatory
Recovery	Android Recovery	Recovery Mode Boot Area Recovery Mode Kernel / Ram Disk	RAW	Mandatory
Kpanic	Kpanic	Kernel Panic Log	RAW	Mandatory
Splash	Splash	Boot Screen Image	RAW	Mandatory
Misc	Miscellaneous	Firmware Update Bootloader Flag	RAW	Mandatory
TCC	Telechips Only	Set-top Flash write	RAW	Optional

⁴ http://en.wikipedia.org/wiki/GUID_Partition_Table

3.2 The Partition Size Definition

This layout is the minimum mandatory partition needed in Android. The optional partitions are not necessarily needed for Android system, and it is also used only for special purpose.

3.2.1 GPT Partition Layout

Area	Size	Partition	File System Type	Mandatory
Boot	15 MByte	mmcblk0p1	Raw	Y
System	650 MByte	mmcblk0p2	Ext4	Y
Cache	150 MByte	mmcblk0p3	Ext4	Y
Recovery	15 MByte	mmcblk0p4	Raw	Y
Splash	5 MByte	mmcblk0p5	Raw	Y
Kpanic	4 MByte	mmcblk0p6	Raw	Y
Misc	1 MByte	mmcblk0p7	Raw	Y
Tcc	1 MByte	mmcblk0p8	Raw	N
Userdata	Remaining Capacity	mmcblk0p9	Ext4	Y

3.2.2 MBR Partition Layout

Area	Size	Partition	FileSystem
Boot	15MB	mmcblk0p1	RAW
System	650MB	mmcblk0p2	EXT4
UserData	Available Size	mmcblk0p3	EXT4
Extended	Extended	mmcblk0p4	Extended
Cache	150MB	mmcblk0p5	EXT4
Recovery	15MB	mmcblk0p6	RAW
Kpanic	5MB	mmcblk0p7	RAW
Splash	4MB	mmcblk0p8	RAW
Misc	1MB	mmcblk0p9	RAW
TCC	1MB	mmcblk0p10	RAW

Linux supports only 4 primary partitions, but we need more than 4 partitions. So, we set the extended partition. The 4th partition from top of the table is extended partition and the remaining 5 partitions(from Recovery to TCC) are logical partition included in the extended partition.

4 How to Select Boot Mode.

As explained previous section, there are two boot modes: SD/MMC and eMMC boot mode. You have to set correct boot mode switch for each boot mode. If you want to know detailed information about boot mode, refer to the boot mode section on tcc893x Specification Document.

4.1 SD/MMC Boot Mode

Pin	Value	Figure
BM2	High (0)	 BM2 BM1 BM0 SBM1 SBM0
BM1	Low (0)	
BM0	High (1)	
SBM1	Low (0)	
SBM0	Low (0)	

4.2 eMMC Boot Mode

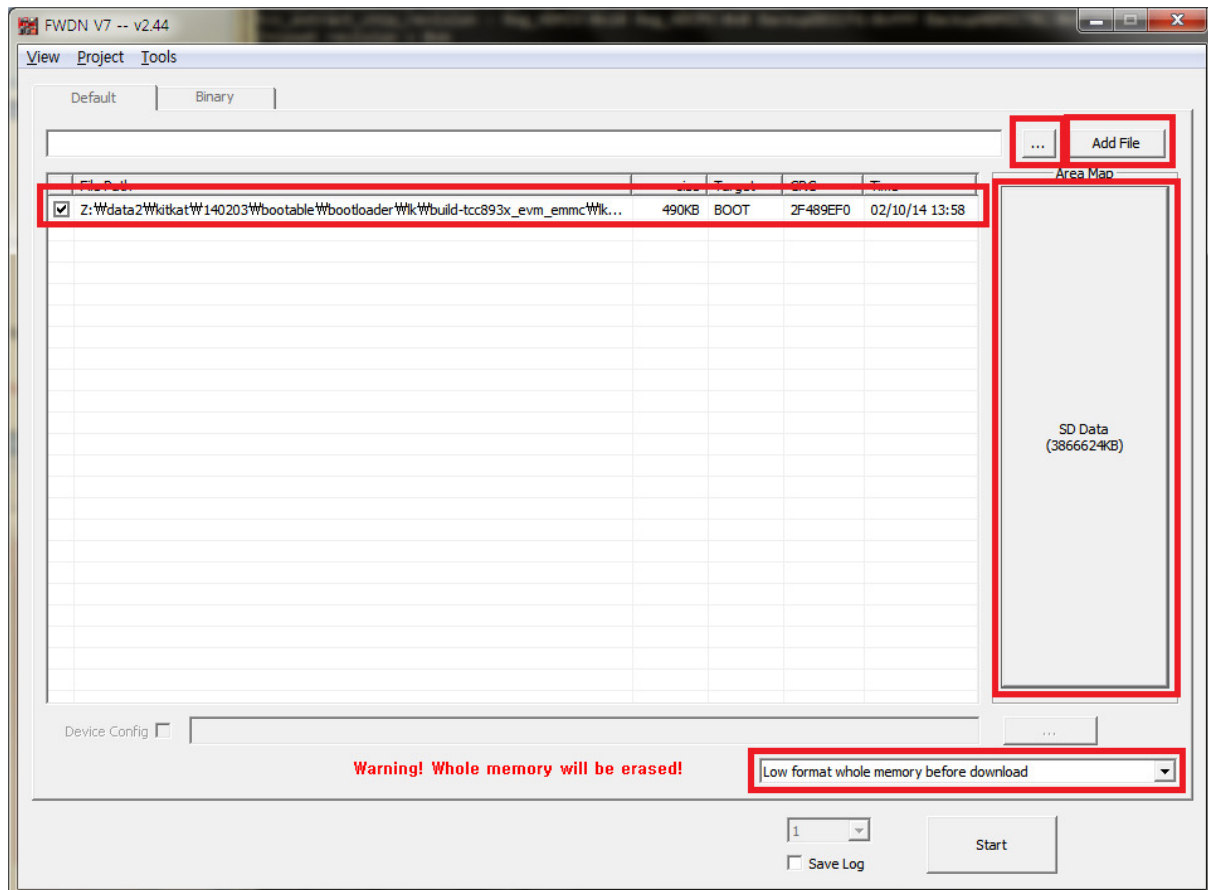
Pin	Value	Figure
BM2	High (1)	 BM2 BM1 BM0 SBM1 SBM0
BM1	Low (0)	
BM0	High (1)	
SBM1	Low (0)	
SBM0	High (1)	

5 Prepare Download with FWDN

For downloading bootloader and Android system images to TCC893x, you have to use FWDN V2.44 or higher version. If you use MBR partition layout, you can also use lower FWDN tool(2.30). This section describes how to prepare and download the images.

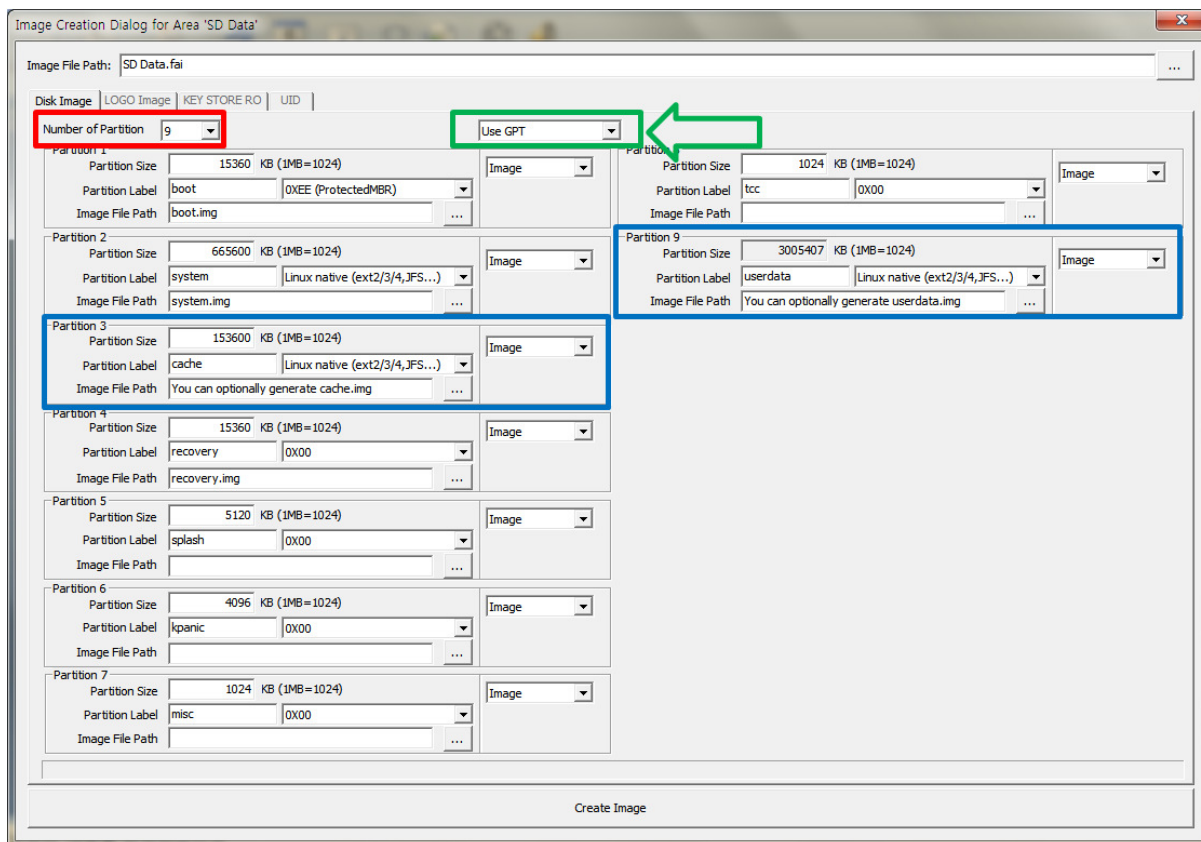
5.1 GPT Partition Layout - eMMC Boot Mode(Hidden Area is NOT used)

*Step 1. Load bootloader image to FWDN, and then attach target devices to FWDN through usb boot mode. If the devices is attached to FWDN successfully, click **SD Data Button***



Step 2. Prepare download images.

Select number of partition, partition size, images and "Use GPT" as following figure. The partition order is same as partition layout described in the previous section. Finally, click **Create Image Button**.



Notice :

Green Box - In this configuration, GPT partition table is stored both at Primary GPT and Secondary GPT area.

Blue Box - You can see partition 3 and partition 9 in the blue box: user data partition and cache partitions. Those image paths are empty. From Android 4.2(JellyBean), if user data and cache partitions are not formatted as ext4 file system format, the system will be operated abnormally. For this reason, if the partitions in the blue box are not formatted as ext4 type, system will format those partitions to the ext4 file system at first boot time. Therefore, system will be rebooted again for initializing Android systems. So FWDN does not write any data to that partition if image file path is empty.

Otherwise, if you want to protect formatting file system during initial boot sequence, add following parameter depending on your storage capacity. This configuration generates 1)userdata.img and 2)cache.img in your \$OUT/ directory. Then choose the images in FWDN tool.

```
BOARD_FLASH_BLOCK_SIZE := 4096
BOARD_SYSTEMIMAGE_PARTITION_SIZE := 681574400 #650MB System
BOARD_USERDATAIMAGE_PARTITION_SIZE := 3077536768
BOARD_CACHEIMAGE_PARTITION_SIZE := 157286400
BOARD_CACHEIMAGE_FILE_SYSTEM_TYPE := ext4
```

```
# Wi-Fi defines
BOARD_USES_REALTEK_WIFI := true
BOARD_USES_BROADCOM_WIFI := false
```

"device/telechips/tcc893x/BoardConfig.mk" [Modified] 147 lines --26%--

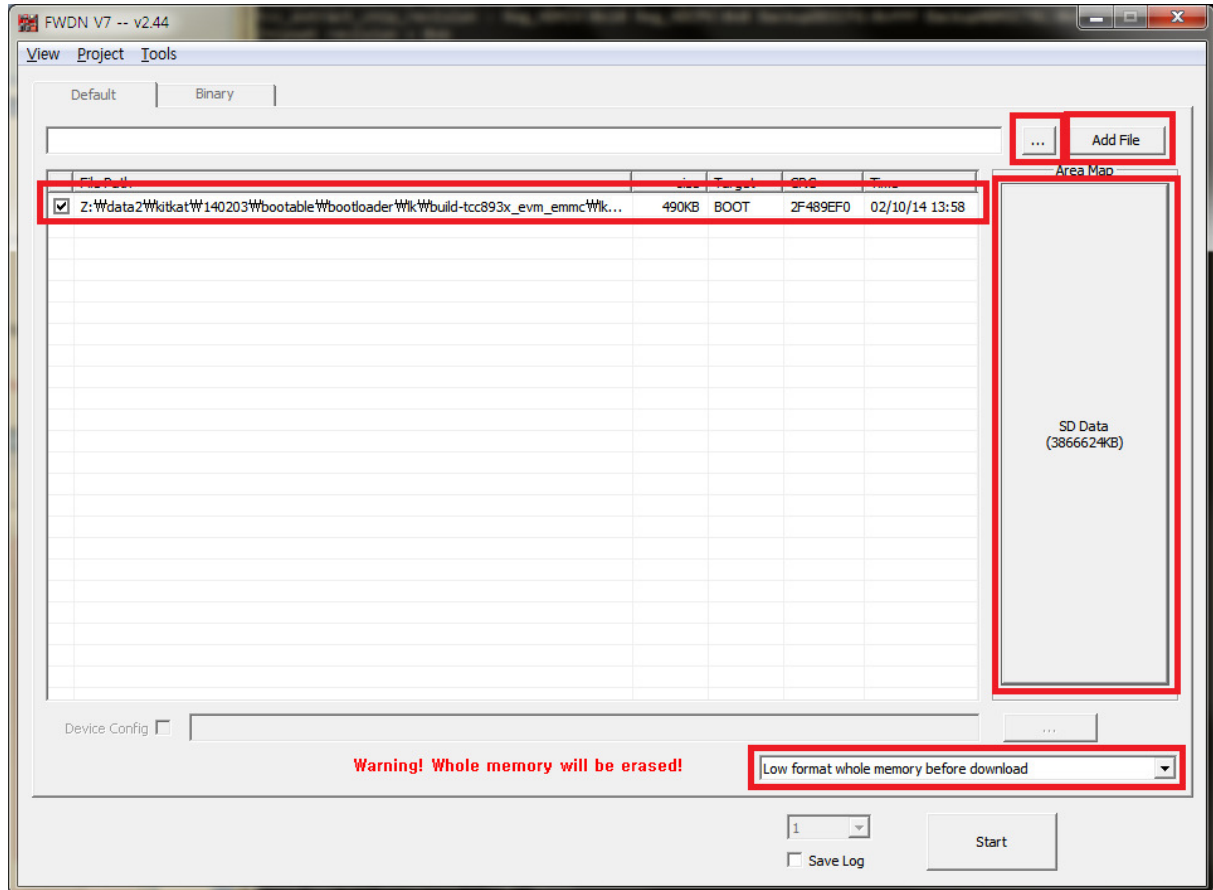
39,0-1

25%

Step 3. If creating image is succeeded, press start button to download the image to the target board.

5.2 GPT Partition Layout – SD/MMC Boot Mode, eMMC Boot mode(Use Hidden Area)

*Step 1. Load bootloader image to FWDN, and then attach target devices to FWDN through usb boot mode. If the devices is attached to FWDN successfully, click **SD Data Button***



Step 2. Prepare download images.

Select number of partition, partition size, images, and and "Use GPT(only Primary)" as following figure. The partition order is same as partition layout described in the previous section. Finally, click **Create Image Button**.

Image Creation Dialog for Area 'SD Data'

Image File Path: SD Data.fai

Disk Image | LOGO Image | KEY STORE RO | UID

Number of Partition: 9

Use GPT (only Primary)

Partition 1: Partition Size 15360 KB (1MB=1024), Partition Label boot, Image File Path boot.img

Partition 2: Partition Size 665600 KB (1MB=1024), Partition Label system, Image File Path system.img

Partition 3: Partition Size 153600 KB (1MB=1024), Partition Label cache, Image File Path You can optionally generate cache.img

Partition 4: Partition Size 15360 KB (1MB=1024), Partition Label recovery, Image File Path recovery.img

Partition 5: Partition Size 5120 KB (1MB=1024), Partition Label splash, Image File Path

Partition 6: Partition Size 4096 KB (1MB=1024), Partition Label kpanic, Image File Path

Partition 7: Partition Size 1024 KB (1MB=1024), Partition Label misc, Image File Path

Partition 8: Partition Size 1024 KB (1MB=1024), Partition Label tcc, Image File Path

Partition 9: Partition Size 3005423 KB (1MB=1024), Partition Label userdata, Image File Path You can optionally generate userdata.img

Create Image

Notice :

Green Box - In this configuration, GPT partition table is stored only at Primary GPT because bootloader and/or hidden data are stored at Secondary GPT table area.

Blue Box - You can see partition 3 and partition 9 in the blue box: user data partition and cache partitions. Those image paths are empty. From Android 4.2(JellyBean), if user data and cache partitions are not formatted as ext4 file system format, the system will be operated abnormally. For this reason, if the partitions in the blue box are not formatted as ext4 type, system will format those partitions to the ext4 file system at first boot time. Therefore, system will be rebooted again for initializing Android systems. So FWDN does not write any data to that partition if image file path is empty.

Otherwise, if you want to protect formatting file system during initial boot sequence, add following parameter depending on your storage capacity. This configuration generates 1)userdata.img and 2)cache.img in your \$OUT/ directory. Then choose the images in FWDN tool.

```
BOARD_FLASH_BLOCK_SIZE := 4096
BOARD_SYSTEMIMAGE_PARTITION_SIZE := 681574400 #650MB System
BOARD_USERDATAIMAGE_PARTITION_SIZE := 3077553152

BOARD_CACHEIMAGE_PARTITION_SIZE := 157286400
BOARD_CACHEIMAGE_FILE_SYSTEM_TYPE := ext4
```

```
# Wi-Fi defines
BOARD_USES_REALTEK_WIFI := true
BOARD_USES_BROADCOM_WIFI := false
```

"device/telechips/tcc893x/BoardConfig.mk" 147 lines --26%--

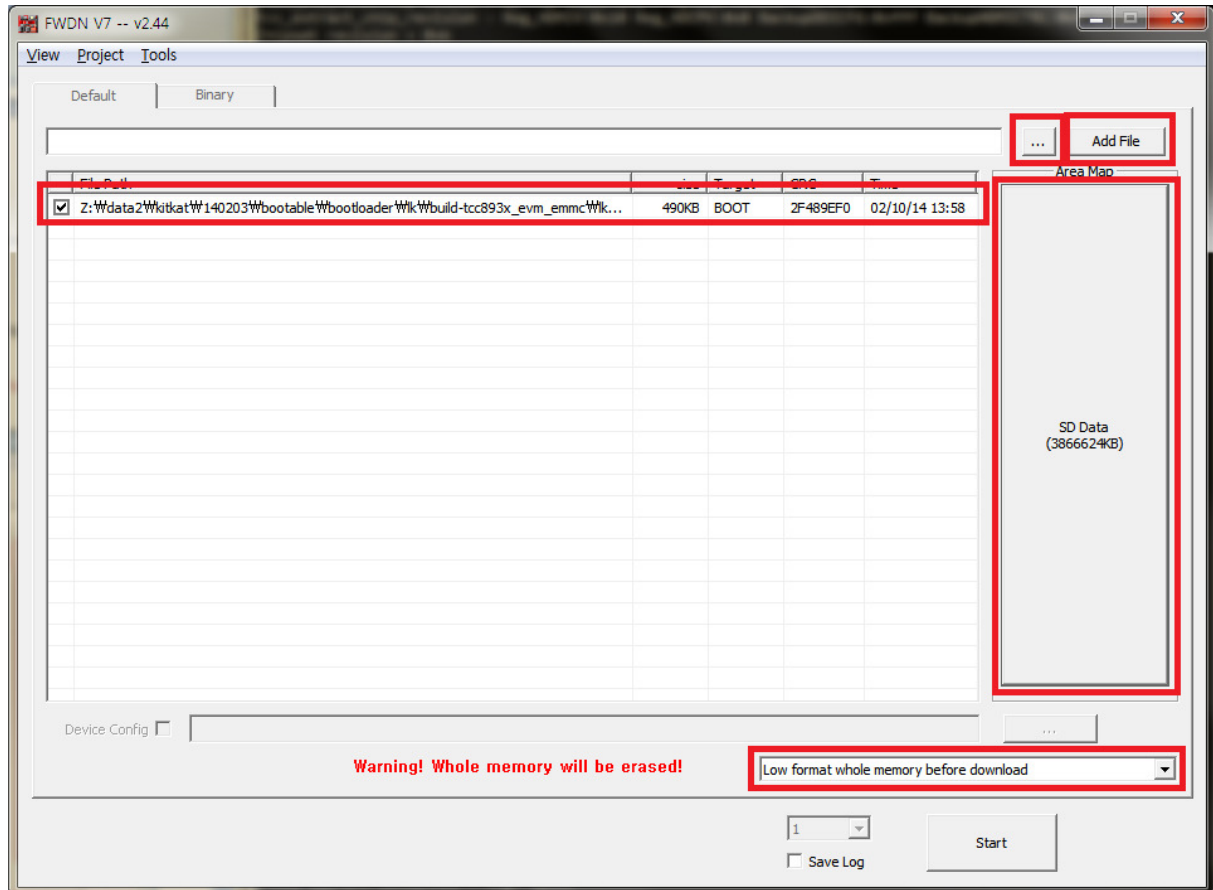
39,0-1

259

Step 3. If creating image is succeeded, press start button to download the image to the target board.

5.3 MBR Partition Layout

*Step 1. Load bootloader image to FWDN, and then attach target devices to FWDN through usb boot mode. If the devices is attached to FWDN successfully, click **SD Data Button***



Step 2. Prepare download images.

Select number of partition, partition size, images, and "Use MBR" as following figure. The partition order is same as partition layout described in the previous section. Finally, click **Create Image Button**.

In this step, take notice to correctly set the size of partition 3(refer to the following Notice description).

Notice :

Green Box – Select "Use MBR".

Blue Box - You can see partition 3 and partition 4 in this box: user data and cache partition. Those image paths are empty. From Android 4.1(JellyBean), if user data and cache partitions are not formatted as ext4 file system format, the system will be operated abnormally. For this reason, if the partitions in the blue box are not formatted as ext4 type, system will format those partitions to the ext4 file system at first boot time. Therefore, system will be rebooted again for initializing Android systems. So FWDN does not write any data to that partition if image file path is empty.

Otherwise, if you want to protect formatting file system during initial boot sequence, add following parameter depending on your storage capacity. This configuration generates 1)userdata.img and 2)cache.img in your \$OUT/ directory. Then choose the images in FWDN tool.

```
BOARD_FLASH_BLOCK_SIZE := 4096
BOARD_SYSTEMIMAGE_PARTITION_SIZE := 681574400 #650MB System
BOARD_USERDATAIMAGE_PARTITION_SIZE := 3077455872

BOARD_CACHEIMAGE_PARTITION_SIZE := 157286400
BOARD_CACHEIMAGE_FILE_SYSTEM_TYPE := ext4

# Wi-Fi defines
BOARD_USES_REALTEK_WIFI := true
BOARD_USES_BROADCOM_WIFI := false
```

"device/telechips/tcc893x/BoardConfig.mk" 147 lines --26%--

39,0-1

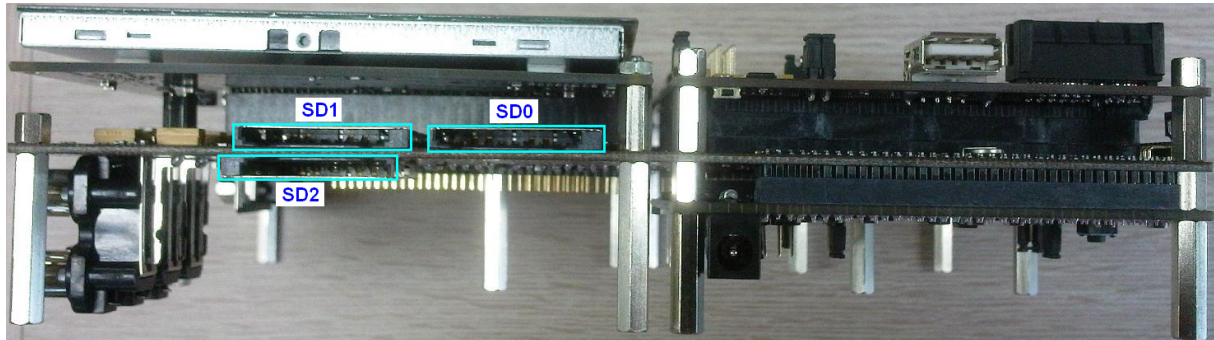
259

Step 3. If creating image is succeeded, press start button to download the image to the target board.

6 SD Slot Usages

6.1 Location of the SD Slot at Each EVM Board

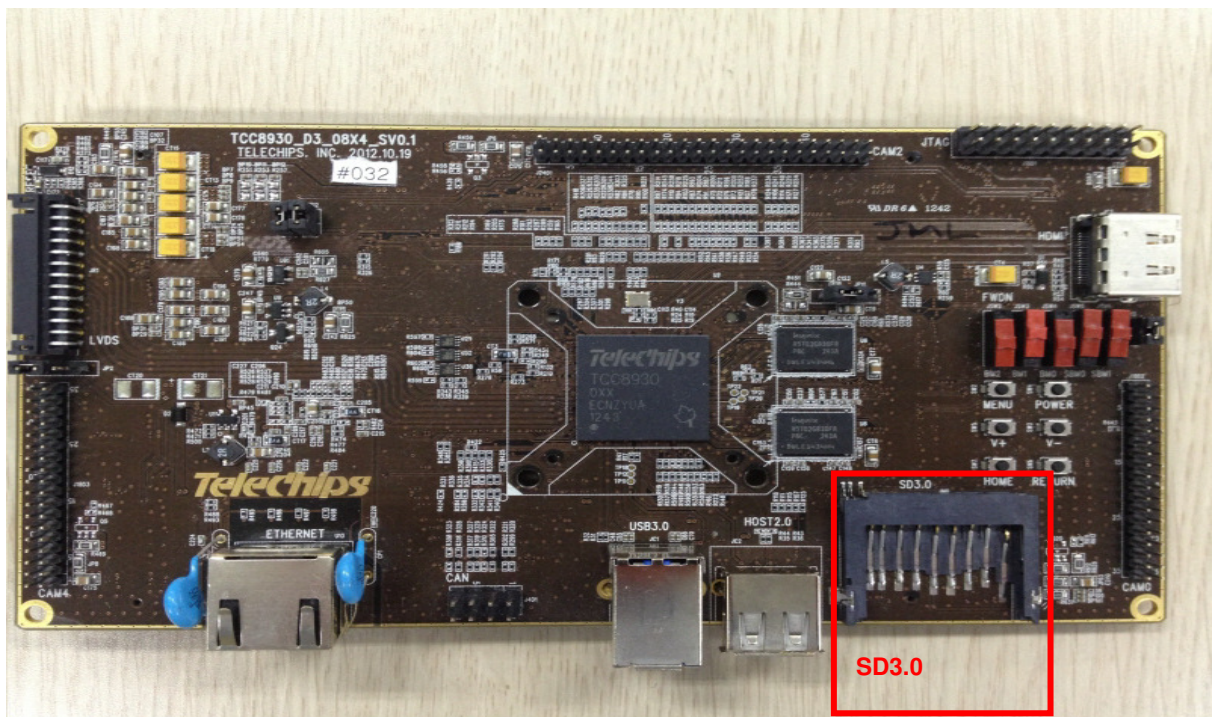
In the TCC893x EVM Board, SD2 slot shown in the below figure is not used.



[Figure 8.1 Telechips EVM Main Board – Left Side]

6.2 TCC8930 CPU Board(Type 1)

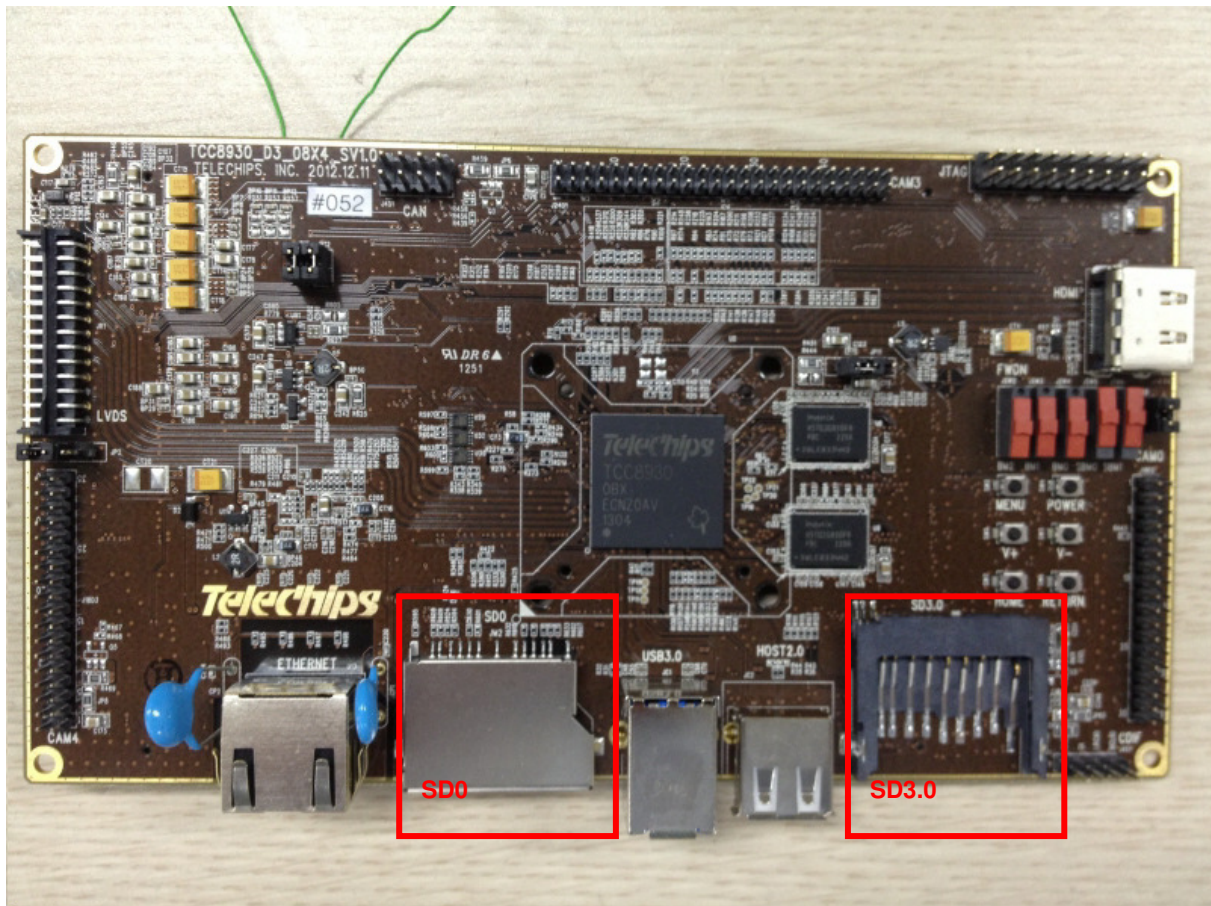
TCC8930 EVM	SD Slot	NAND Boot (Default Setting)	SD/MMC/eMMC boot (Optional)
Main Board	SD0	–	SD/MMC or eMMC (for boot)
	SD1	WiFi	WiFi
	SD2	–	–
CPU Board	SD3.0	SD (External Storage)	SD (External Storage)



[Figure 8.2 TCC8930 CPU Board Type 1]

6.3 TCC8930 CPU Board(Type 2)

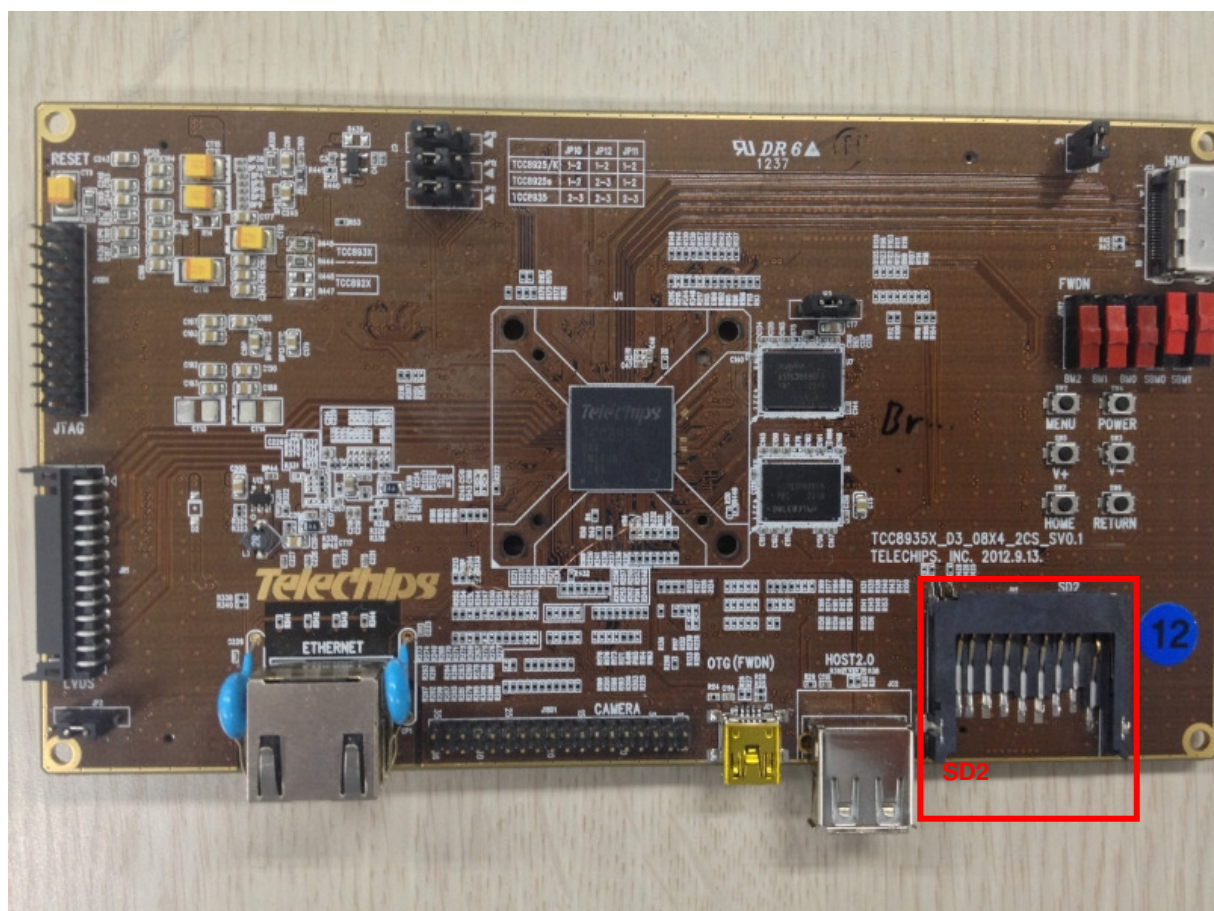
TCC8930 EVM	SD Slot	NAND Boot (Default Setting)	SD/MMC/eMMC boot (Optional)
Main Board	SD0	—	—
	SD1	WiFi	WiFi
	SD2	—	—
CPU Board	SD0	—	SD/MMC or eMMC (for boot)
	SD3.0	SD (External Storage)	SD (External Storage)



[Figure 8.3 TCC8930 CPU Board Type 2]

6.4 TCC8933 & TCC8935 CPU Board(Type 1)

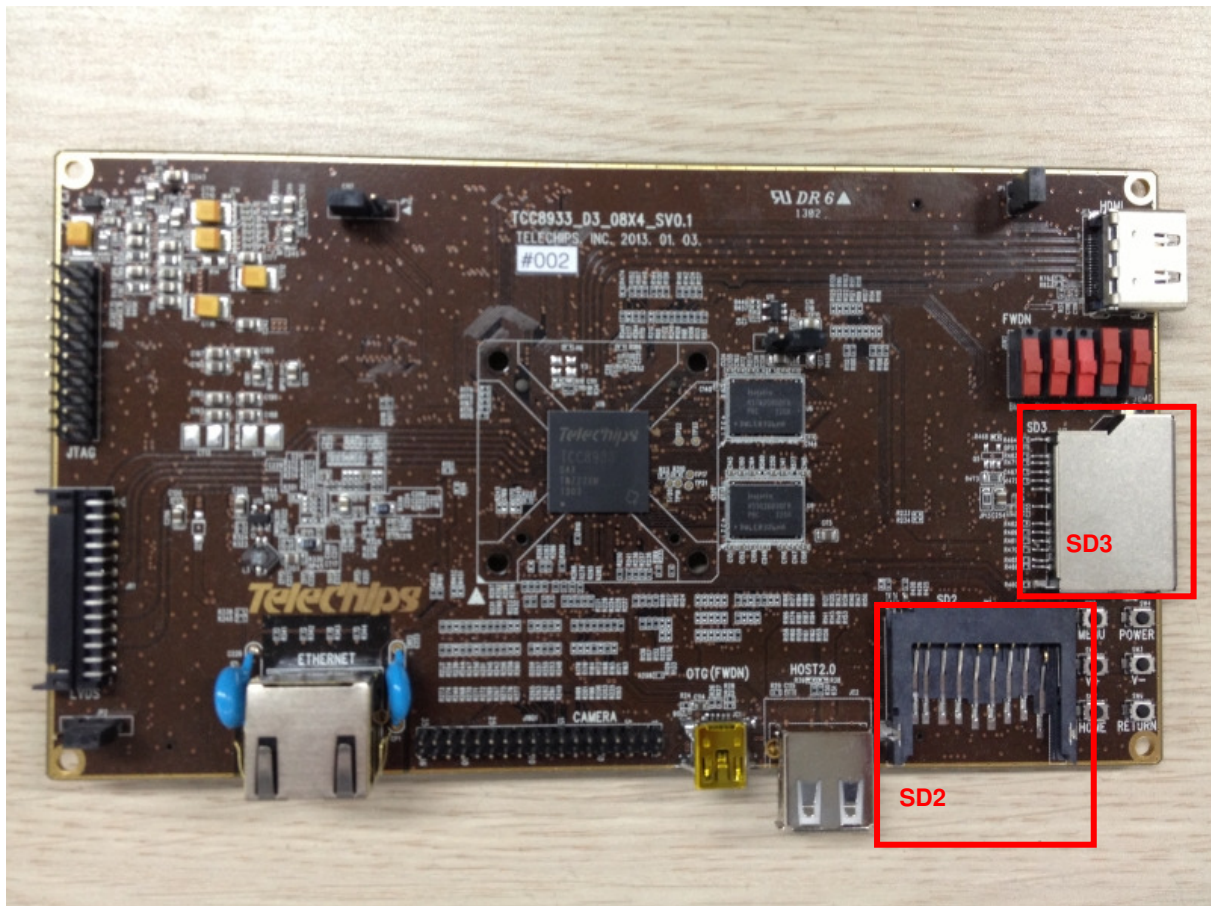
TCC8933 & TCC8935 EVM	SD Slot	NAND Boot (Default Setting)	SD/MMC/eMMC boot (Optional)
Main Board	SD0	WiFi	SD/MMC or eMMC (for boot)
	SD1	—	—
	SD2	—	—
CPU Board	SD2	SD (External Storage)	SD (External Storage)



[Figure 8.4 TCC8933 & TCC8935 CPU Board Type 1]

6.5 TCC8933 & TCC8935 CPU Board(Type 2)

TCC8930 EVM	SD Slot	NAND Boot (Default Setting)	SD/MMC/eMMC boot (Optional)
Main Board	SD0	—	—
	SD1	—	—
	SD2	—	—
CPU Board	SD2	SD (External Storage)	SD (External Storage)
	SD3	WiFi	SD/MMC or eMMC (for boot)



[Figure 8.5 TCC8933 & TCC8935 CPU Board Type 2]

7 Appendix

7.1 SD3.0 Usage

The SD ver3.0, a.k.a. UHS-I, is newly added only on TCC8930 with a slot used for external SD card or wifi. The notable changes of the SD3.0 compared with SD2.0 are like this.

1) The operation voltage is reduced from 3.3V to 1.8V.

2) The maximum operation frequency is extended from 52MHz to 208MHz.

There are four types of SD3.0 specification based on SDR mode:SDR12(~25MHz), SDR25(~50MHz), SDR50(~104MHz), and SDR104(208MHz). However, the SD3.0 mode on TCC8930 is supported until SDR50 mode with maximum 80MHz frequency.

To use the SD3.0, select one of SD3.0 type in the below kernel option.

```
1) Kernel$ make menuconfig
   Device Drivers -> MMC/SD/SDIO card support ->Enable SD3.0->
lqqqqqqqqqqqqqqqqqqqqqqqqqqqqqq Enable SD3.0 qqqqqqqqqqqqqqqqqqqqqqqqqqqk
x Use the arrow keys to navigate this window or press the hotkey of x
x the item you wish to select followed by the <SPACE BAR>. Press x
x <?> for additional information about this option. x
x lqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqk x
x x (X) (X) x x
x x ( ) SDR12 - 1.8V, 25MHz, 12.5MB/sec x x
x x ( ) SDR25 - 1.8V, 50MHz, 25MB/sec x x
x x ( ) SDR50 - 1.8V, 80MHz, 40MB/sec x x
x x ( ) DDR50 - 1.8V, 30MHz x x
x x x x
x mqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqj x
x tqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqU
x <Select> < Help > x
x mqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqqj
```

When a SD3.0 card is inserted to the board successfully, "new ultra high speed" message is shown through serial console like the following figure.

```
[ 192.820000] [mmc] MMC_CAP_UHS_SDR50 is enabled.
[ 192.820000] [mmc] tcc8930_mmc_switch_voltage, Down SD30 voltage from 3.3V to 1.8V...
[ 192.920000] [mmc] tcc_mmc_select_drive_strength, SD_DRIVER_TYPED_C is supported.
[ 192.940000] mmc1: new ultra high speed SDHC card at address e624
[ 192.940000] mmcblk1: mmc1:e624 SU16G 14.8 GiB
[ 192.960000] mmcblk1:
```

NOTICE! You may NOT see the fastest I/O speed of SD3.0 supported in TCC8930 with the highest frequency mode(e.g.SDR50) if your SD3.0 card doesn't support the mode. Refer to the detailed specification and description of SD3.0 at SD card organization⁵.

⁵ <https://www.sdcard.org/home/>

