

# Android™ User's Guide

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## 1 Overview

This document provides the technical information related to the i.MX 6 and 7 series SABRE devices:

- Instructions for building from sources and using pre-built images
- Copying the images to a boot media
- Hardware/software configurations for programming the boot media and running the images

This document describes how to configure a Linux® OS build machine and provides the steps to download, patch, and build the software components that create the Android™ system image when working with the sources.

For more information about building the Android platform, see [source.android.com/source/building.html](http://source.android.com/source/building.html).

## 2 Preparation

### 2.1 Setting up your computer

To build the Android source files, use a computer running Linux OS.

You also need to use the 14.04 64-bit version of Ubuntu which are the most tested OS for the Android Lollipop 5.1 build.

## Building the Android platform for i.MX

After installing the computer running Linux OS, check whether you have all the necessary packages installed for an Android build. See "Setting up your machine" on the Android website [source.android.com/source/initializing.html](http://source.android.com/source/initializing.html).

In addition to the packages requested on the Android website, the following packages are also needed:

```
$ sudo apt-get install uuid uuid-dev
$ sudo apt-get install zlib1g-dev liblz-dev
$ sudo apt-get install liblz2-2 liblz2-dev
$ sudo apt-get install lzop
$ sudo apt-get install git-core curl
$ sudo apt-get install u-boot-tools
$ sudo apt-get install mtd-utils
$ sudo apt-get install android-tools-fsutils
```

### NOTE

If you have trouble installing the JDK in Ubuntu, see [community.freescale.com/docs/DOC-98441](http://community.freescale.com/docs/DOC-98441).

To install git, set the name and email as follows:

- `git config --global user.name "First Last"`
- `git config --global user.email "first.last@company.com"`

## 2.2 Unpacking the Android release package

After you have set up a computer running Linux OS, unpack the Android release package by using the following commands:

```
# cd /opt (or any other directory where you placed the android_L5.1.1_2.1.0-
ga_core_source.tar.gz file)
$ tar xzvf android_L5.1.1_2.1.0-ga_core_source.tar.gz
$ cd android_L5.1.1_2.1.0-ga_core_source/code/
$ tar xzvf L5.1.1_2.1.0-ga.tar.gz
```

## 3 Building the Android platform for i.MX

### 3.1 Getting Android source code (Android/kernel/U-Boot)

The Android source code is maintained as more than 100 gits in the Android repository ([android.google.com](http://android.google.com)).

To get the Android source code from Google repo, follow the steps below:

```
$ cd ~
$ mkdir myandroid
$ mkdir bin
$ cd myandroid
$ curl http://commondatastorage.googleapis.com/git-repo-downloads/repo > ~/bin/repo
$ chmod a+x ~/bin/repo
$ ~/bin/repo init -u https://android.google.com/platform/manifest -b android-5.1.1_r1
$ ~/bin/repo sync # this command loads most needed repos. Therefore, it can take several
hours to load.
$ cd ~/myandroid/prebuilts/gcc/linux-x86/arm
$ git clone https://android.google.com/platform/prebuilts/gcc/linux-x86/arm/arm-
eabi-4.6
$ cd arm-eabi-4.6
$ git checkout android-4.4.3_r1
```

**NOTE**

Because the default GCC toolchain from android-5.1.1\_r1 release is GCC4.8, which may have issues on ARM® Linux kernel compiling, the GCC 4.0 from android-4.4.3\_r1 is used to compile the Linux Kernel and U-Boot.

Get L5.1.1\_2.1.0-ga kernel source code from Freescale open source git:

```
$ cd ~/myandroid
$ git clone git://git.freescale.com/imx/linux-2.6-imx.git kernel_imx
# the kernel repo is large. Therefore, this process can take a while.
$ cd kernel_imx
$ git checkout l5.1.1_2.1.0-ga
```

**NOTE**

If you are behind a proxy, use socksify to set socks proxy for git protocol.

If you use U-Boot as your bootloader, clone the U-Boot git repository from Freescale open source git:

```
$ cd ~/myandroid/bootable
$ cd bootloader
$ git clone git://git.freescale.com/imx/uboot-imx.git uboot-imx
$ cd uboot-imx
$ git checkout l5.1.1_2.1.0-ga
```

## 3.2 Patch Freescale core features code package

Apply all the i.MX Android patches by performing the following steps:

1. Assume you have unzipped the i.MX Android release package to /opt/android\_L5.1.1\_2.1.0-ga\_source.

```
$ cd ~/myandroid
$ source /opt/android_L5.1.1_2.1.0-ga_core_source/code/L5.1.1_2.1.0-ga/and_patch.sh
$ help
```

2. You should see that the "c\_patch" function is available.

```
$ c_patch /opt/android_L5.1.1_2.1.0-ga_core_source/code/L5.1.1_2.1.0-ga/
imx_L5.1.1_2.1.0-ga
```

Here, "/opt/android\_L5.1.1\_2.1.0-ga\_source/code/L5.1.1\_2.1.0-ga" is the location of the patches, which is the directory created when you unzip the release package.

"imx\_L5.1.1\_2.1.0-ga" is the branch which is created automatically to hold all patches (only in those existing Google gits).

Choose any branch name instead of "imx\_L5.1.1\_2.1.0-ga".

3. If everything is OK, "c\_patch" generates the following output to indicate the successful patch:

```
*****
Success: Now you can build the Android code for FSL i.MX platform
*****
```

**NOTE**

The patch script (and\_patch.sh) requires some basic utilities like awk/sed. If they are not available on the computer running Linux OS, install them first.

### 3.3 Patch Freescale extended features code

Besides the core features code package, Freescale also provides extended features code packages. These extended features code packages bring more features. The following tables list the extended features code packages.

**Table 1. Extended features code package**

Package name	Package Description
android_L5.1.1_2.1.0-ga_omxplayer_source.tar.gz	Source code package, binaries and scripts for using omx player
android_L5.1.1_2.1.0-ga_wfdsink_source.tar.gz	Source code package to add Freescale Wi-Fi Sink support into the core features code package

To apply android\_L5.1.1\_2.1.0-ga\_omxplayer\_source.tar.gz patches, carry out the following commands:

```
$ cp android_L5.1.1_2.1.0-ga_omxplayer_source.tar.gz ~/myandroid
$ cd ~/myandroid
$ tar xzvf android_L5.1.1_2.1.0-ga_omxplayer_source.tar.gz
```

After unpacking this package, the current build mode is “full”, which means that the omxplayer feature is built into the Android platform.

Use switch\_build\_to.sh to switch between “core” mode and “full” mode.

```
$ ./switch_build_to.sh          (display current mode)
$ ./switch_build_to.sh mode     (mode shall be "core" or "full")
$ ./clean_obj_before_building.sh (clean related binary in the out directory of previous
Android build)
```

#### NOTE

Run this script after running “lunch” and before running “make”.

To apply android\_L5.1.1\_2.1.0-ga\_wfdsink\_source.tar.gz patches, carry out the following commands:

```
$ cd /opt (or any other directory you like)
$ tar xzvf android_L5.1.1_2.1.0-ga_wfdsink_source.tar.gz
$ cp -a android_L5.1.1_2.1.0-ga_wfdsink_source/wfd-proprietary ~/myandroid/device/
```

### 3.4 Building Android images

Building the Android image is performed when the source code has been downloaded (Section 3.1) and patched (Section 3.2 and Section 3.3 if needed).

Commands **lunch** <buildName-buildType> to set up the build configuration and **make** to start the build process are executed.

The build configuration command **lunch** can be issued with an argument Build Name – Build Type string, such as **lunch sabresd\_6dq-user**, or can be issued without the argument presenting a menu of selection.

The Build Name is the Android device name found directory ~/myandroid/device/fsl/. The following table lists the i.MX build names.

**Table 2. Build names**

Build name	Description
evk_6sl	i.MX 6SoloLite Evaluation Kit

*Table continues on the next page...*

**Table 2. Build names (continued)**

Build name	Description
sabreauto_6q	i.MX 6Quad/DualLite/QuadPlus SABRE-AI Board
sabresd_6dq	i.MX 6Quad/DualLite SABRE-SD Board and SABRE Platform
sabresd_6sx	i.MX 6SoloX SABRE-SD Board
sabreauto_6sx	i.MX 6SoloX SABRE-AI Board
sabresd_7d	i.MX 7Dual SABRE-SD Board

The build type is used to specify what debug options are provided in the final image. The following table lists the build types.

**Table 3. Build types**

Build type	Description
user	Production ready image, no debug
userdebug	Provides image with root access and debug, similar to "user"
eng	Development image with debug tools

Android build steps are as follows:

1. Change to the top level build directory.

```
$ cd ~/myandroid
```

2. Set up the environment for building. This only configures the current terminal.

```
$ source build/envsetup.sh
```

3. Execute the Android **lunch** command. In this example, the setup is for the production image of i.MX 6DualQuad SABRE Board/Platform device with user type.

```
$ lunch sabresd_6dq-user
```

4. Execute the **make** command to generate the image.

```
$ make 2>&1 | tee build-log.txt
```

When the **make** command is complete, the build-log.txt file contains the execution output. Check for any errors.

For BUILD\_ID & BUILD\_NUMBER changing, update build\_id.mk in your ~/myandroid directory. For details, see the *Android™ Frequently Asked Questions (FAQ)*.

For i.MX 6Dual/6Quad SABRE-SD and i.MX 6DualLite SABRE-SD boards, the same build configuration is used. The two boards share the same kernel/system/recovery images with the exception of the U-Boot image. The following outputs are generated by default in myandroid/out/target/product/sabresd\_6dq:

- root/: root file system (including init, init.rc). Mounted at /.
- system/: Android system binary/libraries. Mounted at /system.
- data/: Android data area. Mounted at /data.
- recovery/: root file system when booting in "recovery" mode. Not used directly.
- boot-imx6q.img: composite image for i.MX 6Dual/6Quad SABRE-SD. which includes the kernel zImage, ramdisk, board's device tree binary, and boot parameters.
- boot-imx6dl.img: composite image for i.MX 6DualLite SABRE-SD, which includes the kernel zImage, ramdisk, board's device tree binary, and boot parameters.
- boot-imx6q-ldo.img: a composite image for i.MX 6Dual/6Quad 1.2GHZ SABRE-SD, which includes the kernel zImage, ramdisk, board's device tree binary, and boot parameters.
- ramdisk.img: ramdisk image generated from "root/". Not used directly.

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- `system.img`: EXT4 image generated from "system/". It can be programmed to "SYSTEM" partition on SD/eMMC card with "dd".
- `recovery-imx6q.img`: EXT4 image for i.MX 6Dual/6Quad SABRE-SD, which is generated from "recovery/". Can be programmed to the "RECOVERY" partition on SD/eMMC card with "dd".
- `recovery-imx6q-ldo.img`: EXT4 image for i.MX 6Dual/6Quad 1.2GHZ SABRE-SD, which is generated from "recovery/". Can be programmed to "RECOVERY" partition on SD/eMMC card with "dd".
- `recovery-imx6dl.img`: EXT4 image for i.MX 6DualLite SABRE-SD, which is generated from "recovery/". Can be programmed to the "RECOVERY" partition on SD/eMMC card with "dd".
- `u-boot-imx6q.imx`: U-Boot image with no padding for i.MX 6Dual/6Quad SABRE-SD.
- `u-boot-imx6dl.imx`: U-Boot image with no padding for i.MX 6DualLite SABRE-SD.

### NOTE

- To build the U-Boot image separately, see [Building U-Boot images](#).
- To build the kernel uImage separately, see [Building a kernel image](#).
- To build `boot.img`, see [Building boot.img](#).

The default build is configured for internal eMMC boot storage. See [Building Android image for the SD card on the SABRE-SD Board](#) for the configuration steps to make SD card in Slot 3 as the boot storage.

## 3.4.1 Configuration examples of building i.MX devices

The following table shows examples of using the `lunch` command to set up different i.MX devices. After the desired i.MX device is set up, the `make` command is used to start the build.

**Table 4. i.MX device lunch examples**

Build name	Description
i.MX 6Quad/DualLite SABRE-SD Board and Platform	\$ lunch sabresd_6dq-user
i.MX 6Quad/DualLite/QuadPlus SABRE-AI Board	\$ lunch sabreauto_6dq-user
i.MX 6SoloLite EVK Board	\$ lunch evk_6sl-user
i.MX 6SoloX SABRE-SD Board	\$ lunch sabresd_6sx-user
i.MX 6SoloX SABRE-AI Board	\$ lunch sabreauto_6sx-user
i.MX 7Dual SABRE-SD Board	\$ lunch sabresd_7d-user

After the `lunch` command is executed, the **make** command is issued:

```
$ make 2>&1 | tee build-log.txt
```

## 3.4.2 User build mode

A production release Android system image is created by using the **user** Build Type. For configuration options, see Table "Build types" in Section [Building Android images](#).

The notable differences between the **user** and **eng** build types are as follows:

- Limited Android System image access for security reasons.
- Lack of debugging tools.
- Installation modules tagged with user.

- APKs and tools according to product definition files, which are found in PRODUCT\_PACKAGES in the sources folder ~/myandroid/device/fsl/imx6/imx6.mk. To add customized packages, add the package MODULE\_NAME or PACKAGE\_NAME to this list.
- The properties are set as: ro.secure=1 and ro.debuggable=0.
- adb is disabled by default.

The i.MX development tool options are shown below from: [freescale.com/imx6tools](http://freescale.com/imx6tools).

**Table 5. Development tool options**

	i.MX 6Quad	i.MX 6Dual	i.MX 6DualLite	i.MX 6Solo	i.MX 6SoloX	i.MX 6SoloLite	i.MX 7Dual	i.MX 6QuadPlus
SABRE Board for Smart Devices	*	Uses i.MX 6Quad	-	-	*	-	-	-
SABRE Platform for Smart Devices	*	Uses i.MX 6Quad	*	Uses i.MX 6DualLite	-	-	*	-
SABRE for Automotive Infotainment	*	Uses i.MX 6Quad	*	Uses i.MX 6DualLite	-	-	-	*
i.MX 6SoloLite Evaluation Kit	-	-	-	-	-	*	-	-

\* Supported through the superset device (i.MX 6Quad is superset to i.MX 6Dual, i.MX 6DualLite is superset to i.MX 6Solo)

**Table 6. Android system image production build method 1**

i.MX development tool	Description	Image build command
SABRE Board/Platform for Smart Devices	i.MX 6Dual/Quad, i.MX 6DualLite	\$ make PRODUCT-sabresd_6dq-user 2>&1   tee build-log.txt
	i.MX 6SoloX	\$ make PRODUCT-sabresd_6sx-user 2>&1   tee build-log.txt
	i.MX 7Dual	\$ make PRODUCT-sabresd_7d-user 2>&1   tee build-log.txt
SABRE Board for Automotive Infotainment	i.MX 6Dual/Quad/QuadPlus, i.MX 6DualLite	\$ make PRODUCT-sabreauto_6q-user 2>&1   tee build-log.txt
	i.MX 6SoloX	\$ make PRODUCT-sabreauto_6sx-user 2>&1   tee build-log.txt
SoloLite Evaluation Kit	i.MX 6SoloLite	\$ make PRODUCT-evk_6sl-user 2>&1   tee build-log.txt

Another method to create Android System Images is setting the environment and then issuing the make command. To set up the environment, execute the script ~/myandroid/build/envsetup.sh. The lunch command and configuration argument for the Freescale Development Tool is then executed. To start the build, use the make command. The following table lists the lunch configuration values.

**Table 7. Android system image production build method 2**

i.MX development tool	Description	Lunch configuration
SABRE Board/Platform for Smart Devices	i.MX 6Dual/Quad, i.MX 6DualLite	sabresd_6dq-user
	i.MX 6SoloX	sabresd_6sx-user
	i.MX 7Dual	sabresd_7d-user
SABRE for Automotive Infotainment	i.MX 6Dual/Quad , i.MX 6DualLite	sabreauto_6q-user
	i.MX 6SoloX	sabreauto_6sx-user
SoloLite Evaluation Kit	i.MX 6SoloLite	evk_6sl-user

An example for the SABRE Board for Smart Devices i.MX 6Dual/Quad is:

```
$ cd ~/myandroid
$ source build/envsetup.sh
$ lunch sabresd_6dq-user
$ make
```

To create Android platform over-the-air, OTA, and package, the following make target is specified:

```
$ make otapackage
```

For more Android platform building information, see [source.android.com/source/building.html](http://source.android.com/source/building.html).

### 3.4.3 Building Android image for the SD card on the SABRE-SD Board

The default configuration in the source code package takes internal eMMC as the boot storage. It can be changed to make the SD card in SD Slot 3 as the boot storage as follows:

1. Remove /out/target/product/sabresd\_6dq/root directory and boot\*.img.
2. Remove /out/target/product/sabresd\_6dq/recovery directory and recovery\*.img.
3. Build the boot.img and recovery.img as follows:

```
make bootimage BUILD_TARGET_DEVICE=sd
make recoveryimage BUILD_TARGET_DEVICE=sd
```

Follow Section 3.4 to build the images.

### 3.4.4 Building Android images for NAND on the SABRE-AI board

#### i.MX 6QuadPlus/Quad/DualLite/Solo SABRE-AI platform:

The default configuration in the source code package takes SD card as the boot storage for i.MX 6 series SABRE-AI boards.

The default setting can be changed to make the NAND Flash in U19 be the boot storage as shown below:

```
make PRODUCT=sabreauto_6q-user BUILD_TARGET_FS=ubifs
```

#### i.MX 6SoloX SABRE-AI platform:

The default configuration in the source code package takes SD as the boot storage for SABRE-AI. The default setting can be changed to make the NAND Flash in U19 to be the boot storage as shown below:

```
make PRODUCT=sabreauto_6sx-user BUILD_TARGET_FS=ubifs
```

## 3.5 Building U-Boot images

After you set up U-Boot using the steps outlined above, you can find the tool (mkimage) under tools/.

```
$ cd ~/myandroid/bootable/bootloader/uboot-imx
$ export ARCH=arm
$ export CROSS_COMPILE=~myandroid/prebuilts/gcc/linux-x86/arm/arm-eabi-4.6/bin/arm-eabi-
$ make distclean
```

For i.MX 6Quad SABRE-SD:

```
$ make mx6qsabresdandroid_config
$ make
```

For i.MX 6DualLite SABRE-SD:

```
$ make mx6dlsabresdandroid_config
$ make
```

For i.MX 6Solo SABRE-SD:

```
$ make mx6solosabresdandroid_config
```

For i.MX 6Quad SABRE-AI SD:

```
$ make mx6qsabreautoandroid_config
$ make
```

For i.MX 6Quad SABRE-AI NAND:

```
$ make mx6qsabreautoandroid_nand_config
$ make
```

For i.MX 6QuadPlus SABRE-AI SD:

```
$ make mx6qpsabreautoandroid_config
```

For i.MX 6QuadPlus SABRE-AI NAND:

```
$ make mx6qpsabreautoandroid_nand_config
```

For i.MX 6DualLite SABRE-AI SD:

```
$ make mx6dlsabreautoandroid_config
$ make
```

For i.MX 6DualLite SABRE-AI NAND:

```
$ make mx6dlsabreautoandroid_nand_config
$ make
```

For i.MX 6Solo SABRE-AI SD:

```
$ make mx6solosabreautoandroid_config
$ make
```

For i.MX 6Solo SABRE-AI NAND:

```
$ make mx6solosabresdandroid_nand_config
```

For i.MX 6SoloLite EVK SD:

```
$ make mx6slevkandroid_config
```

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For i.MX 6SoloX SABRE-SD SD:

```
$ make mx6sxsabresdandroid_config
```

For i.MX 6SoloX SABRE-AI SD:

```
$ make mx6sxsabreautoandroid_config
```

For i.MX 6SoloX SABRE-AI NAND:

```
$ make mx6sxsabreautoandroid_nand_config  
$ make
```

For i.MX 7Dual SABRE-SD SD:

```
$ make mx7dsabresdandroid_config  
$ make
```

"u-boot.imx" is generated if you have a successful build.

### NOTE

Any image that should be loaded by U-Boot must have a unique image head. For example, data must be added at the head of the loaded image to tell U-Boot about the image (i.e., it's a kernel or ramfs) and how to load the image (i.e., load/execute address). Before loading any image into RAM by U-Boot, you need a tool to add this information and generate a new image which can be recognized by U-Boot. The tool is delivered together with U-Boot. After you set up U-Boot using the steps outlined above, find the tool (mkimage) under tools/. The process of using mkimage to generate an image (for example, kernel image and ramfs image), which is to be loaded by U-Boot, is outlined in the subsequent sections of this document.

## 3.6 Building a kernel image

Kernel image is automatically built when building the Android root file system.

The following are the default Android build commands to build the kernel image:

```
$ export PATH=~/myandroid/bootable/bootloader/uboot-imx/tools:$PATH  
$ cd ~/myandroid/kernel_imx  
$ echo $ARCH && echo $CROSS_COMPILE
```

Make sure that you have those two environment variables set. If the two variables are not set, set them as follows:

```
$ export ARCH=arm  
$ export CROSS_COMPILE=~/myandroid/prebuilts/gcc/linux-x86/arm/arm-eabi-4.6/bin/arm-eabi-  
# Generate ".config" according to default config file under arch/arm/configs.  
# To build the kernel image for i.MX 6Dual/Quad, 6QuadPlus, 6DualLite, 6Solo, 6SoloLite,  
6SoloX, and 7Dual  
$ make imx_v7_android_defconfig  
  
# To build the kernel image for i.MX 6Dual/Quad, 6QuadPlus, 6DualLite, and 6Solo  
$ make uImage LOADADDR=0x10008000  
  
# To build the kernel image for i.MX 6SoloLite  
$ make uImage LOADADDR=0x80008000  
  
# To build the kernel image for i.MX 6SoloX  
$ make uImage LOADADDR=0x80008000  
  
# To build the kernel uImage for i.MX 7Dual  
$ make uImage LOADADDR=0x80008000
```

The kernel images are found in the folders: ~/myandroid/kernel\_imx/arch/arm/boot/zImage and ~/myandroid/kernel\_imx/arch/arm/boot/uImage.

### 3.7 Building boot.img

boot.img and boota are default booting commands.

As outlined in [Running the Android Platform with a Prebuilt Image](#), we use boot.img and booti as default commands to boot, not the uramdisk and uImage we used before.

Use this command to generate boot.img under Android environment:

```
# Boot image for the i.MX 6Dual/6Quad SABRE-SD board
$ cd ~/myandroid
$ source build/envsetup.sh
$ lunch sabresd_6dq-user
$ make bootimage

# Boot image for the i.MX 6Dual/6Quad/6QuadPlus SABRE-AI board
$ source build/envsetup.sh
$ lunch sabreauto_6q-user
$ make bootimage

# Boot image for the i.MX 6SoloLite EVK board
$ source build/envsetup.sh
$ lunch evk_6sl-user
$ make bootimage

# Boot image for the i.MX 6SoloX SABRE-SD board
$ source build/envsetup.sh
$ lunch sabresd_6sx-user
$ make bootimage

# Boot image for the i.MX 6SoloX SABRE-AI board
$ source build/envsetup.sh
$ lunch sabreauto_6sx-user
$ make bootimage

# Boot image for i.MX 7Dual SABRE-SD board
$ source build/envsetup.sh
$ lunch sabresd_7d-user
$ make bootimage
```

## 4 Running the Android Platform with a Prebuilt Image

To test the Android platform before building any code, use the prebuilt images from the following packages and go to "Download Images" and "Boot".

**Table 8. Image packages**

Image package	Description
android_L5.1.1_2.1.0-ga_core_image_6qsabresd.tar.gz	The table below shows the prebuilt image for i.MX 6Dual/6Quad SABRE-SD board and platform and i.MX 6Solo/6DualLite SABRE-SD platform, which has basic Android features.
android_L5.1.1_2.1.0-ga_core_image_6qsabreauto.tar.gz	The table below shows the prebuilt image for i.MX 6Dual/Quad, i.MX 6QuadPlus, and i.MX 6DualLite/Solo SABRE-AI platform, which has basic Android features.

*Table continues on the next page...*

**Table 8. Image packages (continued)**

android_L5.1.1_2.1.0-ga_core_image_6slevk.tar.gz	The table below shows the prebuilt image for the i.MX 6SoloLite EVK board, which has basic Android features.
android_L5.1.1_2.1.0-ga_core_image_6xsabresd.tar.gz	Prebuilt image for the i.MX 6SoloX Sabre-SD board, which has basic Android features.
android_L5.1.1_2.1.0-ga_core_image_6xsabreauto.tar.gz	Prebuilt image for i.MX 6SoloX SABRE-AI board, which has basic Android features.
android_L5.1.1_2.1.0-ga_core_image_7dsabresd.tar.gz	Prebuilt image for i.MX 7Dual SABRE-SD board, which has basic Android features.
android_L5.1.1_2.1.0-ga_full_image_6qsabresd.tar.gz	The table below shows the prebuilt image for i.MX 6Dual/Quad and i.MX 6DualLite SABRE-SD board, which includes Freescale extended features.  For more information and details about the Freescale Extended Feature Packages available for this release, see the <i>Android™ Release Notes (ARN)</i> .
android_L5.1.1_2.1.0-ga_full_image_6qsabreauto.tar.gz	The table below shows the prebuilt image for i.MX 6Dual/Quad, i.MX 6QuadPlus, and i.MX 6DualLite/Solo SABRE-AI board, which includes Freescale extended features.  For more information and details about the Freescale Extended Feature Packages available for this release, see the <i>Android™ Release Notes (ARN)</i> .
android_L5.1.1_2.1.0-ga_full_image_6slevk.tar.gz	Prebuilt image for the i.MX 6SoloLite EVK board, which includes Freescale extended features.
android_L5.1.1_2.1.0-ga_full_image_6xsabresd.tar.gz	Prebuilt image for the i.MX 6SoloX SABRE-SD board, which includes Freescale extended features.
android_L5.1.1_2.1.0-ga_full_image_6xsabreauto.tar.gz	Prebuilt image for i.MX 6SoloX SABRE-AI board, which includes Freescale extended features.
android_L5.1.1_2.1.0-ga_full_image_7dsabresd.tar.gz	Prebuilt image for i.MX 7Dual SABRE-SD board, which includes Freescale extended features.

The following tables list the detailed contents of android\_L5.1.1\_2.1.0-ga\_core\_image\_6qsabresd.tar.gz and android\_L5.1.1\_2.1.0-ga\_full\_image\_6qsabresd.tar.gz image packages.

The table below shows the prebuilt images to support the system boot from eMMC on the i.MX 6Dual/6Quad SABRE-SD board and platform and i.MX 6Solo/6DualLite SABRE-SD platform.

**Table 9. Images for i.MX 6 SABRE-SD board and platform eMMC boot**

SABRE-SD eMMC image	Description
u-boot-imx6q.imx	The bootloader (with padding) for i.MX 6Dual/6Quad SABRE-SD board and platform
u-boot-imx6dl.imx	The bootloader (with padding) for i.MX 6Solo/6DualLite SABRE-SD platform
eMMC/boot-imx6dl.img eMMC/boot-imx6q.img eMMC/boot-imx6q-ldo.img	Boot Image for eMMC
eMMC/system.img	System Boot Image
eMMC/recovery-imx6dl.img eMMC/recovery-imx6q.img eMMC/recovery-imx6q-ldo.img	Recovery Image

The table below shows the prebuilt images to support the system boot from SD on the i.MX 6Dual/6Quad and i.MX 6Solo/6DualLite SABRE-SD boards.

**Table 10. Images for SABRE-SD SD boot**

SABRE-SD SD image	Description
u-boot-imx6q.imx	Bootloader (with padding) for the i.MX 6Dual/Quad SABRE-SD board
u-boot-imx6dl.imx	Bootloader (with padding) for the i.MX 6DualLite SABRE-SD board
SD/boot-imx6dl.img SD/boot-imx6q.img SD/boot-imx6q-ldo.img	Boot image for SD
SD/system.img	System boot image
SD/recovery-imx6dl.img SD/recovery-imx6q.img SD/recovery-imx6q-ldo.img	Recovery image

The following tables list the detailed contents of android\_L5.1.1\_2.1.0-ga\_core\_image\_6qsabreauto.tar.gz and android\_L5.1.1\_2.1.0-ga\_full\_image\_6qsabreauto.tar.gz image packages:

The table below shows the prebuilt images to support the system boot from SD on the i.MX 6Dual/6Quad, i.MX 6QuadPlus, and i.MX 6Solo/6DualLite SABRE-AI boards.

**Table 11. Images for i.MX 6 SABRE-AI SD boot**

SABRE-AI SD image	Description
u-boot-imx6q.imx	Bootloader (with padding) for i.MX 6Dual/6Quad SABRE-AI SD boot
u-boot-imx6dl.imx	Bootloader (with padding) for i.MX 6DualLite SABRE-AI SD boot
u-boot-imx6qp.imx	Bootloader (with padding) for i.MX 6QuadPlus SABRE-AI SD boot
SD/boot-imx6q.img SD/boot-imx6dl.img SD/boot-imx6qp.img	Boot Image for SD
SD/system.img	System Boot Image
SD/recovery-imx6q.img SD/recovery-imx6dl.img SD/recovery-imx6qp.img	Recovery Image

## Running the Android Platform with a Prebuilt Image

The table below shows the prebuilt images to support the system boot from NAND on the i.MX 6Dual/6Quad, i.MX 6QuadPlus, and i.MX 6Solo/6DualLite SABRE-AI board.

**Table 12. Images for i.MX 6 SABRE-AI NAND boot**

SABRE-AI NAND image	Description
u-boot-imx6q-nand.imx	Bootloader (with padding) for i.MX 6Dual/6Quad SABRE-AI NAND boot
u-boot-imx6dl-nand.imx	Bootloader (with padding) for i.MX 6DualLite SABRE-AI NAND boot
u-boot-imx6qp-nand.imx	Bootloader (with padding) for i.MX 6QuadPlus NAND boot
NAND/boot-imx6q-nand.img NAND/boot-imx6dl-nand.img NAND/boot-imx6qp-nand.img	Boot Image for NAND
NAND/android_root.img	System Boot Image
NAND/recovery-imx6q-nand.img NAND/recovery-imx6dl-nand.img NAND/recovery-imx6qp-nand.img	Recovery Image

The following tables list the detailed contents of android\_L5.1.1\_2.1.0-ga\_core\_image\_6slevk.tar.gz image package.

The table below shows the prebuilt images to support the system boot from SD on the i.MX 6SoloLite EVK board.

**Table 13. Images for i.MX 6SoloLite EVK SD boot**

EVK SD image	Description
u-boot-imx6sl.imx	Bootloader (with padding) for the i.MX 6SoloLite EVK board
SD/boot-imx6sl.img	Boot image for SD
SD/system.img	System boot image
SD/recovery-imx6sl.img	Recovery image

The following tables list the detailed contents of the android\_L5.1.1\_2.1.0-ga\_core\_image\_6sxsabresd.tar.gz image package.

The table below shows the prebuilt images to support the system boot from SD on the i.MX 6SoloX SABRE-SD board.

**Table 14. Images for i.MX 6SoloX SABRE-SD SD boot**

i.MX 6SoloX SABRE-SD SD image	Description
u-boot-imx6sx.imx	Bootloader (with padding) for the i.MX 6SoloX SABRE-SD board
SD/boot-imx6sx.img	Boot image for the i.MX 6SoloX SABRE-SD board
SD/system.img	System boot image
SD/recovery-imx6sx.img	Recovery image for the i.MX 6SoloX SABRE-SD board

The following tables list the detailed contents of android\_L5.1.1\_2.1.0-ga\_core\_image\_6sxsabreauto.tar.gz and android\_L5.1.1\_2.1.0-ga\_full\_image\_6sxsabreauto.tar.gz image packages.

The table below shows the prebuilt images to support the system boot from SD on the i.MX 6SoloX SABRE-AI boards.

**Table 15. Images for i.MX 6SoloX SABRE-AI SD**

i.MX 6SoloX SABRE-AI SD image	Description
u-boot-imx6sx.imx	Bootloader (with padding) for i.MX 6SoloX SABRE-AI SD boot.
SD/boot-imx6sx.img	Boot image for SD.
SD/system.img	System boot Image.
SD/recovery-imx6sx.img	Recovery image.

The table below shows the prebuilt images to support the system boot from NAND on the i.MX 6SoloX SABRE-AI boards.

**Table 16. Images for i.MX 6SoloX SABRE-AI NAND boot**

i.MX 6SoloX SABRE-AI NAND image	Description
u-boot-imx6sx-nand.imx	Bootloader (with padding) for i.MX 6SoloX NAND boot
NAND/boot-imx6sx.img	Boot image for NAND
NAND/android_root.img	System Boot image
NAND/recovery-imx6sx.img	Recovery image

The table below shows the prebuilt images to support the system boot from SD on i.MX 7Dual SABRE-SD boards.

**Table 17. Images for i.MX 7Dual SABRE-SD SD boot**

i.MX 7Dual SABRE-SD SD image	Description
u-boot-imx7d.imx	Bootloader (with padding) for the i.MX 7Dual SABRE-SD board
SD/boot-imx7d.img	Boot image for the i.MX 7Dual SABRE-SD board
SD/system.img	System boot image
SD/recovery-imx7d.img	Recovery image for the i.MX 7Dual SABRE-SD board

#### NOTE

boot.img is an Android image that stores zImage and ramdisk together. It also stores other information such as the kernel boot command line, machine name. This information can be configured in corresponding board's BoardConfig.mk. If you use boot.img, you do not need uImage and uramdisk.img.

## 5 Programming Images

The images from the Freescale prebuilt release package or created from source code contain the U-Boot boot loader, system image, and recovery image. At a minimum, the storage devices on the Freescale development system (MMC/SD or NAND) must be programmed with the U-Boot boot loader. The i.MX 6 series boot process determines what storage device to access based on the switch settings. When the boot loader is loaded and begins execution, the U-Boot environment space is then read to determine how to proceed with the boot process. For U-Boot environment settings, see Section [Bootimg](#).

The following download methods can be used to write the Android System Image:

- MFGTool to download all images to MMC/SD card and NAND storage.
- Using dd command to download all images to MMC/SD card.

## 5.1 System on MMC/SD

The images needed to create an Android system on MMC/SD can either be obtained from the release package or be built from source.

The images needed to create an Android system on MMC/SD are listed below:

- U-Boot image: u-boot.imx
- boot image: boot.img
- Android system root image: system.img
- Recovery root image: recovery.img

### 5.1.1 Storage partitions

To create storage partitions, you can use MFGTool as described in the *Android Quick Start Guide (AQSUG)*, or you can use format tools in prebuild dir.

The layout of the MMC/SD/TF card for Android system is shown below:

- [Partition type/index] is which defined in the MBR.
- [Name] is only meaningful in the Android platform. Ignore it when creating these partitions.
- [Start Offset] shows where partition is started, unit in MB.

The SYSTEM partition is used to put the built Android system image. The DATA is used to put applications' unpacked codes/data, system configuration database, etc. In normal boot mode, the root file system is mounted from uramdisk. In recovery mode, the root file system is mounted from the RECOVERY partition.

Partition type/index	Name	Start offset	Size	File system	Content
N/A	BOOT Loader	1 KB	1 MB	N/A	bootloader
Primary 1	Boot	8 MB	16 MB	boot.img format, kernel + ramdisk	boot.img
Primary 2	Recovery	Follow Boot	16 MB	boot.img format, kernel + ramdisk	recovery.img
Logic 5 (Extended 3)	SYSTEM	Follow Recovery	512 MB	EXT4. Mount as /system	Android system files under /system/ dir.
Logic 6 (Extended 3)	CACHE	Follow SYSTEM.	512 MB	EXT4. Mount as /cache.	Android cache for image store of OTA.
Logic 7 (Extended 3)	Device	follow CACHE	8 MB	Ext4. Mount at /vender.	To Store MAC address files.
Logic 8 (Extended 3)	Misc	Follow Device	6 MB	N/A	For recovery store bootloader message, reserve.
Logic 9 (Extended 3)	DATAFOOTE R	Follow Misc	2 MB	N/A	For crypto footer of DATA partition encryption.
Primary 4	DATA	Follow Misc.	Total - Other images	EXT4. Mount at /data.	Application data storage for the system application and for internal media partition in /mnt/sdcard/ dir.

There is a shell script `mksdcard.sh.tar` in `MFGTool-Dir\Profiles\Linux\OS Firmware`.

The script below can be used to partition a SD card as shown in the partition table above:

```
$ cd ~/myandroid/
$ sudo chmod +x ./device/fsl/common/tools/fsl-sdcard-partition.sh
$ sudo ./device/fsl/common/tools/fsl-sdcard-partition.sh -f <soc_name> /dev/sdX
# <soc_name> can be imx6q, imx6dl, imx6sl, imx6sx and imx7d.
```

#### NOTE

- The minimum size of the SD card is 2 GB.
- `/dev/sdX`, the X is the disk index from 'a' to 'z'. That may be different on each computer running Linux OS.
- Unmount all the SD card partitions before running the script.

## 5.1.2 Downloading images with MFGTool

MFGTool can be used to download all images into a target device. It is a quick and easy tool for downloading images. See *Android™ Quick Start Guide (AQSUG)* for a detailed description of MFGTool.

## 5.1.3 Downloading images with dd utility

The Linux utility "dd" on the computer running Linux OS can be used to download the images into the MMC/SD/TF card.

Before downloading, ensure that your MMC/SD/TF card partitions are created as described in [Storage partitions](#).

All partitions can be recognized by the the computer running Linux OS. To download all images into the card, use the commands below:

```
Download the U-Boot image:
# sudo dd if=u-boot.imx of=/dev/sdx bs=1K seek=1; sync
Download the boot image:
# sudo dd if=boot.img of=/dev/sdx1; sync
Download the Android system root image:
# sudo simg2img system.img system_raw.img
# sudo dd if=system_raw.img of=/dev/sdx5; sync
Download the Android recovery image:
# sudo dd if=recovery.img of=/dev/sdx2; sync
```

#### NOTE

`simg2img` is a tool that converts a sparse system image to a raw system image on a Linux host PC and is located in `myandroid/out/host/linux-x86/bin/simg2img`.

## 5.2 System on NAND for the SABRE-AI board

The images needed to create an Android system on NAND are listed below:

- U-Boot image: `u-boot-imx6q-nand.imx`, `u-boot-imx6dl-nand.imx`, `u-boot-imx6solo-nand.imx`
- Boot image: `boot.img`
- Android system root image: `android_root.img`
- Recovery root image: `recovery.img`

The images can either be obtained from the release package or they can be built from source.

## 5.2.1 Storage partitions on NAND

The layout of the NAND for Android system is shown below:

- [Partition type/index] is which defined in the MBR.
- [Name] is only meaningful in the Android platform. Ignore it when creating these partitions.
- [Start Offset] shows where partition is started, unit in MB.

The SYSTEM partition is used to put the built Android system image. The DATA is used to put the application unpacked codes/data, system configuration database, etc. In normal boot mode, the root file system is mounted from uramdisk. In recovery mode, the root file system is mounted from the RECOVERY partition.

Partition type/index	Name	Start offset	Size	File system	Content
MTD0	BOOT Loader	0	64 MB	N/A	bootloader
MTD1	Boot	64 MB	16 MB	boot.img format, kernel + ramdisk	boot.img
MTD2	Recovery	Follow Boot	16 MB	boot.img format, kernel + ramdisk	recovery.img
MTD3(ubi0:system)	SYSTEM	Follow Recovery	360 MB	ubifs. Mount as / system	Android system files under / system/ dir.
MTD3(ubi0:cache)	CACHE	Follow SYSTEM.	512 MB	ubifs. Mount as / cache	Android cache for image store of OTA.
MTD3(ubi0:device)	Vendor	Follow CACHE.	32 MB	ubifs. Mount at / vender	For Store MAC address files.
MTD3(ubi0:data)	Data	follow Vendor	7 GB	ubifs  Mount at /vender.	Application data storage for system application. And for internal media partition, in /mnt/sdcard/ dir.

To create storage partitions, use MFGTool as described in the *Android™ Quick Start Guide (AQSUG)*.

## 5.2.2 Downloading images with MFGTool for NAND

MFGTool can be used to download all images into a target device.

It is a quick and easy tool for downloading images. See *Android™ Quick Start Guide (AQSUG)* for detailed description of MFGTool for NAND.

# 6 Booting

This chapter describes booting from MMC/SD, NAND, TFTP and NFS.

## 6.1 Booting from MMC/SD

This section describes how to boot from MMC/SD on the Freescale SABRE and EVK development tool devices:

- i.MX 6DualQuad SABRE-SD board/platform

- i.MX 6DualQuad/6DualLite SABRE-AI board
- i.MX 6SoloLite EVK board
- i.MX 6SoloX SABRE-SD board

## 6.1.1 Booting from MMC/SD on the i.MX 6DualQuad/6DualLite SABRE-SD board

This section contains boot switch information and steps needed to bootup from MMC/SD.

The following table lists the boot switch settings for different boot methods:

Download mode (MFGTool mode)	(SW6) 00001100 (from 1-8 bit)
eMMC 4-bit (MMC2) boot	(SW6) 11100110 (from 1-8 bit)
eMMC 8-bit (MMC2) boot	(SW6) 11010110 (from 1-8 bit)
SD2 boot	(SW6) 10000010 (from 1-8 bit)
SD3 boot	(SW6) 01000010 (from 1-8 bit)

To boot from eMMC, perform the following operations:

Change the board boot switch to eMMC 4-bit mode and make (SW6) 11100110 (from 1-8 bit). Or change (SW6) 11100110 (from 1-8 bit) for 8-bit boot mode.

The default environment in boot.img is booting from eMMC. If you want to use the default environment in boot.img, use the following command:

```
U-Boot > setenv bootargs
```

To clear the bootargs environment, use the following commands:

```
U-Boot > setenv fastboot_dev mmc2 [eMMC as fastboot device]
U-Boot > setenv bootcmd boota mmc2 [Load the boot.img from eMMC]
U-Boot > setenv bootargs console=ttyMxc0,115200 init=/init video=mxcfb0:dev=ldb,bpp=32
video=mxcfb1:off video=mxcfb2:off video=mxcfb3:off vmlloc=256M androidboot.console=ttyMxc0
consoleblank=0 androidboot.hardware=freescale cma=384M [Optional]
U-Boot > saveenv #[Save the environments]
```

### NOTE

The mmcX value changes depending on the boot mode. These are the correct values:

Hardware port	U-Boot device in software
eMMC	mmc2
SD2	mmc3
SD3	mmc1

bootargs env is an optional setting for booti. The boot.img includes a default bootargs, which is used if there is no definition of the bootargs environment.

Some SoCs on SABRE-SD boards do not have MAC address fused. Therefore, if you want to use FEC in U-Boot, set the following environment:

```
U-Boot > setenv ethaddr 00:04:9f:00:ea:d3 #[setup the
MAC address]
```

## Booting

```
U-Boot > setenv fec_addr 00:04:9f:00:ea:d3          $[setup the
MAC address]
```

To boot from the SD card, perform the following operations:

Change the board boot switch to SD3 boot: (SW6) 01000010 (from 1-8 bit). To clear the bootargs env and set up the booting from SD card in SD slot 3, use the following command:

```
U-Boot > setenv fastboot_dev mmc1 [eMMC as fastboot deivce]
U-Boot > setenv bootcmd boota mmc1 [Load the boot.img from SD card]
U-Boot > setenv bootargs console=ttymx0,115200 init=/init video=mxcfb0:dev=ldb,bpp=32
video=mxcfb1:off video=mxcfb2:off video=mxcfb3:off vmalloc=256M androidboot.console=ttymx0
consoleblank=0 androidboot.hardware=freescale cma=384M #[Optional]
U-Boot > saveenv #[Save the environments]
```

### NOTE

bootargs env is an optional setting for booti. The boot.img includes a default bootargs, which is used if there is no definition of the bootargs environment.

Some SoCs on SABRE-SD boards do not have MAC address fused.

Therefore, if you want to use FEC in U-Boot, set the following environment:

```
U-Boot > setenv ethaddr 00:04:9f:00:ea:d3          #[setup the
MAC address]
U-Boot > setenv fec_addr 00:04:9f:00:ea:d3          $[setup the
MAC address]
```

## 6.1.2 Booting from MMC/SD on the the i.MX 6Dual/Quad/DualLite/QuadPlus SABRE-AI board

This section contains boot switch information and steps needed to bootup from MMC/SD.

The following table lists the boot switch settings for different boot methods on i.MX 6 series SABRE-AI boards.

Download mode (MFGTool mode)	(S3) 0101 (from 1-4 bit)
SD on CPU Board	(S1) 0100100000 (from 1-10 bit) (S2) 0010 (from 1-4 bit) (S3) 0010 (from 1-4 bit)

To boot from SD, perform the following operations:

Change the board boot switch to (S3, S2, S1) 0010, 0010,0100100000 (from 1 bit).

The default environment in boot.img is booting from SD. If you want to use the default environment in boot.img, use the following command:

```
U-Boot > setenv bootargs
```

To clear the bootargs environment, use the following command:

```
U-Boot > setenv bootcmd boota mmc1 #[Load the boot.img from SD]
U-Boot > setenv bootargs console=ttymx3,115200 init=/init video=mxcfb0:dev=ldb,bpp=32
video=mxcfb1:off video=mxcfb2:off video=mxcfb3:off vmalloc=320M androidboot.console=ttymx3
consoleblank=0 androidboot.hardware=freescale cma=384M #[Optional]
U-Boot > saveenv #[Save the environments]
```

**NOTE**

bootargs env is an optional setting for booti. The boot.img includes a default bootargs, which is used if there is no definition of the bootargs environment.

Some SoCs on SABRE-AI boards do not have MAC address fused. Therefore, if you want to use FEC in U-Boot, set the following environment:

```
U-Boot > setenv ethaddr 00:04:9f:00:ea:d3          #[setup the
MAC address]
U-Boot > setenv fec_addr 00:04:9f:00:ea:d3        $(setup the
MAC address]
```

### 6.1.3 Booting from SD on the i.MX 6SoloLite EVK board

Below are the Boot Switch settings to control the boot storage:

Download mode (MFGTool mode)	SW3: 01000000(from 1-8 bit) SW4: 00101100 (from 1-8 bit) SW5: 00000000(from 1-8 bit) Boot_Mode: 10 (from 1-2 bit)
SD boot	SW3: 01000000(from 1-8 bit) SW4: 00101100 (from 1-8 bit) SW5: 00000000(from 1-8 bit) Boot_Mode: 01 (from 1-2 bit)

To boot from SD, perform the following operations:

Change the board Boot\_Mode switch to 01 (from 1-2 bit) and (SW3,4,5) 01000000 0010110000000000 (from 1-8 bit).

The default environment in boot.img is booting from SD. If you want to use default environment in boot.img, use the following command:

```
U-Boot > setenv bootargs
```

To clear the bootargs environment, use the following command:

```
U-Boot > setenv bootcmd boota mmc1
U-Boot > setenv bootargs console=ttyMxc0,115200 init=/init androidboot.console=ttyMxc0
consoleblank=0 androidboot.hardware=freescale #[Optional]
U-Boot > saveenv [Save the environments]
```

**NOTE**

bootargs env is an optional setting for booti. The boot.img file includes a default bootargs, which is used if there is no definition about the bootargs env.

Due to some SoCs on the EVK boards, do not fuse MAC address. Set the following environment to use FEC in U-Boot:

```
U-Boot > setenv ethaddr 00:04:9f:00:ea:d3          [setup the MAC
address]
U-Boot > setenv fec_addr 00:04:9f:00:ea:d3        [setup the MAC
address]
```

### 6.1.4 Booting from SD on the i.MX 6SoloX SABRE-SD board

This section contains boot switch information and steps needed to bootup from SD.

The following table lists the boot switch settings to control the boot storage:

## Booting

Download mode (MFGTool mode)	SW10: 00000000 (from 1-8 bit) SW11: 00111000 (from 1-8 bit) SW12: 01000000 (from 1-8 bit) Boot_Mode: 10 (from 1-2 bit)
SD boot	SW3: 00000000 (from 1-8 bit) SW4: 00111000 (from 1-8 bit) SW5: 01000000 (from 1-8 bit) Boot_Mode: 01 (from 1-2 bit)

To boot from SD, perform the following operations:

Change the board Boot\_Mode switch to 01 (from 1-2 bit) and (SW10, 11, 12) 00000000 00111000 01000000 (from 1-8 bit).

The default environment in boot.img is booting from SD. If you want to use the default environment in boot.img, use the following command:

```
U-Boot > setenv bootargs
```

To clear the bootargs environment, use the following command:

```
U-Boot > setenv bootcmd boota mmc2
U-Boot > setenv bootargs console=ttyMxc0,115200 init=/init androidboot.console=ttyMxc0
consoleblank=0 androidboot.hardware=freescale vmlloc=256M cma=384M [Optional]
U-Boot > saveenv [Save the environments]
```

### NOTE

bootargs env is an optional setting for booti. The boot.img file includes a default bootargs, which is used if there is no definition about the bootargs env.

Due to some SoCs on the SABRE-SD boards, do not fuse MAC address. Set the following environment to use FEC in U-Boot:

```
U-Boot > setenv ethaddr 00:04:9f:00:ea:d3 [setup the MAC
address]
U-Boot > setenv fec_addr 00:04:9f:00:ea:d3 [setup the MAC
address]
```

## 6.1.5 Booting from SD on the i.MX 6SoloX SABRE-AI board

The following table lists the boot switch settings to control the boot storage:

Download mode (MFGTool mode)	SW3: 00001100 (from 1-8 bit) SW4: 01000010 (from 1-8 bit) S1 (Boot_Mode): 0101 (from 1-4bit)
SD boot	SW3: 00001100 (from 1-8 bit) SW4: 01000010 (from 1-8 bit) S1 (Boot_Mode): 0010 (from 1-4bit)

To boot from SD, perform the following operations:

Change the board S1 (Boot\_Mode) switch to 0010 (from 1-4bit) and (SW3, SW4) 00001100 01000010 (from 1-8 bit).

The default environment in boot.img is booting from SD. If you want to use default env in boot.img, use the following command:

```
U-Boot > setenv bootargs
```

To clear the bootargs environment, use the following command:

```
U-Boot > setenv bootcmd boota mmc0
U-Boot > setenv bootargs console=ttyMxc0,115200 init=/init androidboot.console=ttyMxc0
consoleblank=0 androidboot.hardware=freescale vmlloc=400M cma=256M [Optional]
U-Boot > saveenv [Save the environments]
```

**NOTE**

bootargs env is an optional setting for booti. The boot.img file includes a default bootargs, which is used if there is no definition about the bootargs env.

Due to some SoCs on the SABRE-SD boards, do not fuse MAC address. Set the following environment to use FEC in U-Boot:

```
U-Boot > setenv ethaddr 00:04:9f:00:ea:d3 [setup the MAC
address]
U-Boot > setenv fec_addr 00:04:9f:00:ea:d3 [setup the MAC
address]
```

### 6.1.6 Booting from SD on the i.MX 7Dual SABRE-SD board

The following table lists the boot switch settings to control the boot storage:

Download mode (MFGTool mode)	SW4: 00100000 (from 1-8 bit) Boot_Mode: 01 (from 1-2 bit)
SD boot	SW4: 00111000 (from 1-8 bit) Boot_Mode: 10 (from 1-2 bit)

To boot from SD, perform the following operations:

Change the board Boot\_Mode switch to 10 (from 1-2 bit) and SW4 00100000 (from 1-8 bit).

The default environment in boot.img is booting from SD. If you want to use the default environment in boot.img, use the following command:

```
U-Boot > setenv bootargs
```

To clear the bootargs environment, use the following command:

```
U-Boot > setenv bootcmd boota mmc0
U-Boot > setenv bootargs console=ttyMxc0,115200 init=/init androidboot.console=ttyMxc0
consoleblank=0 androidboot.hardware=freescale [Optional]
U-Boot > saveenv [Save the environments]
```

**NOTE**

bootargs env is an optional setting for booti. The boot.img file includes a default bootargs, which is used if there is no definition about the bootargs env.

Due to some SoCs on the SABRE-SD boards, do not fuse MAC address. Set the following environment to use FEC in U-Boot:

## Booting

```
U-Boot > setenv ethaddr 00:04:9f:00:ea:d3      [setup the MAC
address]
U-Boot > setenv fec_addr 00:04:9f:00:ea:d3     [setup the MAC
address]
```

## 6.2 Booting from NAND for the SABRE-AI board

### 6.2.1 Booting from NAND on the i.MX 6Dual/Quad/DualLite/QuadPlus SABRE-AI board

The following table lists the boot switch settings for NAND boot on the i.MX 6DualQuad/6DualLite SABRE-AI boards.

Download mode (MFGTool mode)	(S3): 0101 (from 1-4 bit)
NAND (Micro MT29F64G08AFAAA)	(S3): 0010 (from 1-4 bit) (S2): 0001 (from 1-4 bit) (S1): 0001000000 (from 1-10 bit)

#### Boot from NAND

Change the board boot switch to (S3, S2,S1) 0010, 0001,0001000000 (from 1 bit) on an i.MX 6 series SABRE-AI board.

The default environment in boot.img is booting from NAND. If you want to use the default environment in boot.img, use the following command:

```
U-Boot > setenv bootcmd 'nand read 0x12000000 0x4000000 0x1000000;booti 0x12000000'
#[Load the boot.img from NAND]
U-Boot > setenv bootargs console=ttyMxc3,115200 init=/init video=mxcfb0:dev=ldb,bpp=32
video=mxcfb1:off video=mxcfb2:off video=mxcfb3:off vmalloc=320M androidboot.console=ttyMxc3
consoleblank=0 androidboot.hardware=freescale cma=384M mtdparts=gpmiand: 64m(bootloader) ,
16m(bootimg),16m(recovery), (root) ubi.mtd=4 [Optional]
U-Boot > saveenv [Save the environments]
```

#### NOTE

bootargs env is an optional setting for booti. The boot.img includes a default bootargs, which is used if there is no definition of the bootargs environment.

Some SoCs on SABRE-AI boards do not have MAC address fused.

Therefore, if you want to use FEC in U-Boot, set the following environment:

```
U-Boot > setenv ethaddr 00:04:9f:00:ea:d3      [setup the
MAC address]
U-Boot > setenv fec_addr 00:04:9f:00:ea:d3     [setup the
MAC address]
```

### 6.2.2 Booting from NAND on the i.MX 6SoloX SABRE-AI board

The following table lists the boot switch settings for NAND boot on the i.MX 6SoloX SABRE-AI boards.

Download mode (MFGTool mode)	S1 (Boot_Mode): 0101 (from 1-4 bit)
------------------------------	-------------------------------------

*Table continues on the next page...*

NAND (Micro MT29F64G08AFAAA)	S1 (Boot_Mode): 0010 (from 1-4 bit) SW3: 00000000 (from 1-8bit) SW4: 00000001 (from 1-8bit)
------------------------------	---

## Boot from NAND

Change the board boot switch to (S1, S3,S4) 0010, 00000000,00000001 (from 1bit) on an i.MX 6SoloX SABRE-AI board.

The default environment in boot.img is booting from NAND. If you want to use the default environment in boot.img, use the following command:

```
U-Boot > setenv bootcmd 'nand read 0x80800000 0x4000000 0x1000000;booti0x12000000' #[Load
the boot.img from NAND]
U-Boot > setenv bootargs console=ttymx0,115200 init=/init video=mxcfb0:dev=ldb,bpp=32
video=mxcfb1:off video=mxcfb2:off video=mxcfb3:off vmalloc=256M androidboot.console=ttymx0
consoleblank=0 androidboot.hardware=freescale cma=384M mtdparts=gpminand: 64m(bootloader),
16m(bootimg),16m(recovery), (root)
ubi.mtd=5 [Optional]
U-Boot > saveenv [Save the environments]
```

### NOTE

bootargs env is an optional setting for booti. The boot.img includes a default bootargs, which is used if there is no definition of the bootargs environment.

Some SoCs on SABRE-AI boards do not have MAC address fused.

Therefore, if you want to use FEC in U-Boot, set the following environment:

```
U-Boot > setenv ethaddr 00:04:9f:00:ea:d3 [setup the MAC
address]
U-Boot > setenv fec_addr 00:04:9f:00:ea:d3 [setup the MAC
address]
```

## 6.3 Boot-up configurations

This section explains the common U-Boot environments used for NFS, MMC/SD boot, and kernel command line.

### 6.3.1 U-Boot environment

If you do not define the bootargs environment, it uses the default bootargs inside the image.

- ethaddr/fec\_addr is a MAC address of the board.
- serverip is an IP address of the TFTP/NFS server.
- loadaddr/rd\_loadaddr is the kernel/initramfs image load address in memory.
- bootfile is the name of the image file loaded by "dhcp" command, when you are using TFTP to load kernel.
- bootcmd is the first variable to run after U-Boot boot.
- bootargs is the kernel command line, which the bootloader passes to the kernel. As described in [Kernel command line \(bootargs\)](#), bootargs environment is optional for booti. boot.img already has bootargs. If you do not define the bootargs environment, it uses the default bootargs inside the image. If you have the environment, it is then used.

If you want to use the default environment in boot.img, use the following command to clear the bootargs environment.

- ```
> setenv bootargs
```
- dhcp: get the IP address by BOOTP protocol, and load the kernel image (\$bootfile env) from the TFTP server.
  - booti:

## Booting

booti command parses the boot.img header to get the zImage and ramdisk. It also passes the bootargs as needed (it only passes bootargs in boot.img when it cannot find "bootargs" var in your U-Boot environment). To boot from mmcX, do the following:

```
> booti mmcX
```

To read the boot partition (the partition store boot.img, in this instance, mmcblk0p1), the X is the MMC bus number, which is the hardware MMC bus number, in i.MX 6Dual/6Quad SABRE-SD and i.MX 6Solo/6DualLite SABRE-SD boards. eMMC is mmc3.

Add partition ID after mmcX.

```
> boota mmcX boot # boot is default
> boota mmcX recovery # boot from the recovery partition
```

If you have read the boot.img into memory, use this command to boot from

```
> boota 0xXXXXXXXX
```

- bootm (only works in for the NFS) starts running the kernel. For other use cases, use booti command.
- splashimage is the virtual or physical address of bmp file in memory. If MMU is enabled in board configuration file, the address is virtual. Otherwise, it is physical. See README in U-Boot code root tree for details.
- splashpos sets the splash image to a free position, 'x, y', on the screen. x and y should be positive numbers, which are used as number of pixels from the left/top. Note that the left and top should not make the image exceed the screen size. Specify 'm, m' for centering the image. Usually, for example, '10, 20', '20, m', 'm, m' are all valid settings. See README in U-Boot code root tree for details.
- lvds\_num chooses which LVDS interface, 0 or 1, is used to show the splash image. Note that we only support boot splash on LVDS panel. We do not support HDMI or any other display device.

### 6.3.2 Kernel command line (bootargs)

Depending on the different booting/usage scenarios, you may need different kernel boot parameters set for bootargs.

| Kernel parameter     | Description                                                                                                                                          | Typical value                  | Used when                                                                              |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------|
| console              | Where to output kernel log by printk.                                                                                                                | console=ttyMxc0,115200         | All use cases.                                                                         |
| init                 | Tells kernel where the init file is located.                                                                                                         | init=/init                     | All use cases. "init" in the Android platform is located in "/" instead of in "/sbin". |
| androidboot.hardware | Specifies hardware name for this product. Android init process loads the configuration file init.\$ (androidboot.hardware).rc in the root directory. | androidboot.hardware=freescale | All use cases.                                                                         |
| ip                   | Tells kernel how/whether to get an IP address.                                                                                                       | ip=none<br>or<br>ip=dhcp       | "ip=dhcp" or "ip=static_ip_address" is mandatory in "boot from TFTP/NFS".              |

Table continues on the next page...

| Kernel parameter      | Description                                                                                                                                                                                                                                                                                     | Typical value                                                                                                                        | Used when                                                                                                                                                                                                                        |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       |                                                                                                                                                                                                                                                                                                 | or<br>ip=static_ip_address                                                                                                           |                                                                                                                                                                                                                                  |
| nfsroot               | Where the NFS server/directory is located.                                                                                                                                                                                                                                                      | rootfs=ip_address:/opt/nfsroot,v3,tcp                                                                                                | Used in "boot from tftp/NFS" together with "root=/dev/nfs".                                                                                                                                                                      |
| root                  | Indicates the location of the root file system.                                                                                                                                                                                                                                                 | root=/dev/nfs<br>or<br>root=/dev/mmcblk0p2                                                                                           | Used in "boot from tftp/NFS" (i.e., root=/dev/nfs).<br>Used in "boot from SD" (i.e., root=/dev/mmcblk0p2) if no ramdisk is used for root fs.                                                                                     |
| video                 | Tells kernel/driver which resolution/depth and refresh rate should be used, or tells kernel/driver not to register a framebuffer device for a display device.                                                                                                                                   | video=mxcfb0:dev=ldb,LDB-XGA,if=RGB666,bpp=32<br>or<br>video=mxcfb1:dev=hDMI,1920x1080M@60,if=RGB24,bpp=32<br>or<br>video=mxcfb2:off | To specify a display framebuffer with:<br>video=mxcfb<0,1,2>:dev=<ldb,hDMI>,<LDB-XGA,xres x yresM@fps>,if=<RGB666,RGB24>,bpp=<16,32><br>or<br>To disable a display device's framebuffer register with:<br>video=mxcfb<0,1,2>:off |
| vmalloc               | vmalloc virtual range size for kernel.                                                                                                                                                                                                                                                          | vmalloc=256M                                                                                                                         | vmalloc=<size>                                                                                                                                                                                                                   |
| androidboot.console   | The Android shell console. It should be the same as console=.                                                                                                                                                                                                                                   | androidboot.console=ttyMXC0                                                                                                          | If you want to use the default shell job control, such as Ctrl+C to terminate a running process, you must set this for the kernel.                                                                                               |
| fec_mac               | Sets up the FEC MAC address.                                                                                                                                                                                                                                                                    | fec_mac=00:04:9f:00:ea:d3                                                                                                            | On SABRE-SD board, the SoC does not have MAC address fused in. If you want to use FEC, assign this parameter to the kernel.                                                                                                      |
| cma                   | CMA memory size for GPU/VPU physical memory allocation.                                                                                                                                                                                                                                         | cma=384M                                                                                                                             | It is 256 MB by default.                                                                                                                                                                                                         |
| androidboot.selinux   | Argument to disable selinux check and enable serial input when connecting a host computer to the target board's USB UART port. For details about selinux, see <a href="http://source.android.com/devices/tech/security/selinux/">http://source.android.com/devices/tech/security/selinux/</a> . | androidboot.selinux=disabled                                                                                                         | As Android Lollipop 5.1 CTS requirement: serial input should be disabled by default. Setting this argument enables console serial input, which violates the CTS requirement.                                                     |
| androidboot.dm_verity | Argument to disable the verified boot, which ensures that                                                                                                                                                                                                                                       | androidboot.dm_verity=disabled                                                                                                       | Setting this argument bypasses integrity checking on the system partition. It is recommended to set this argument for internal developer, or the case binary in                                                                  |

## Booting

| Kernel parameter | Description                                                                                                                                                                                                                                          | Typical value | Used when                                           |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------|
|                  | binary in boot partition can only load the certain binary on system partition. See <a href="https://source.android.com/devices/tech/security/verifiedboot/index.html">https://source.android.com/devices/tech/security/verifiedboot/index.html</a> . |               | system partition needs to be changed in developing. |

### 6.3.3 Revision History

Table 18. Revision history

| Revision number | Date    | Substantive changes |
|-----------------|---------|---------------------|
| L5.1.1_2.1.0-ga | 01/2016 | Initial release.    |

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