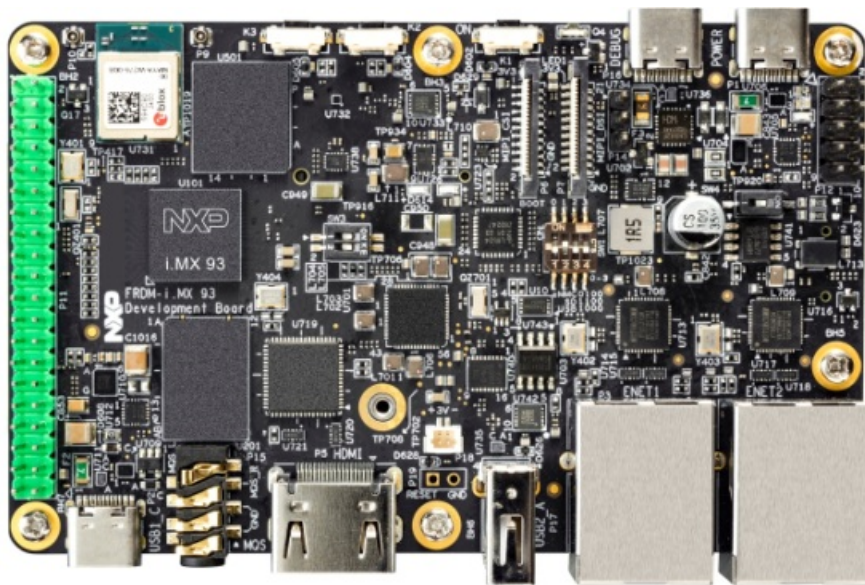


NXP UG10195 FRDM i.MX 93 Development Board User Guide

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UG10195
i.MX FRDM Software User Guide
Rev. 1.0 — 20 December 2024
User guide

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UG10195 FRDM i.MX 93 Development Board

Document information

Information	Content
Keywords	UG10195, i.MX, LF6.6.36_2.1.0, Yocto, FRDM-IMX93
Abstract	This document describes how to build an image for an i.MX FRDM board by using a Yocto Project build environment and provides steps to install and run the image on an i.MX FRDM board.

Overview

i.MX Freedom Development (FRDM) software release contains prebuilt images, documentation, and i.MX FRDM Yocto layer for i.MX FRDM boards.

This document describes how to build an image for an i.MX FRDM board by using a Yocto Project build environment and provides steps to install and run the image on an i.MX FRDM board. It also covers special i.MX FRDM features and how to use them.

i.MX FRDM layer contains Yocto recipes to support i.MX FRDM boards. It is based on i.MX Yocto Project and i.MX Software Release LF6.6.36_2.1.0. For more information on the i.MX Software Release, see [IMXLINUX webpage](#).

1.1 Audience

This document is intended for software, hardware, and system engineers who are planning to use the product, and for anyone who wants to know more about the product.

1.2 Supported boards

Currently only the FRDM-IMX93 platform is supported.

1.3 References

This release includes the following references and additional information:

- [FRDM-IMX93 Quick Start Guide](#): The document provides the steps to start the board quickly.
- [FRDM-IMX93 Board User Manual](#): The document provides system setup, configurations, and detailed information on the design.
- *MX Linux Release Notes* (document [RN00210](#)): The document provides the release information.
- *MX Linux User's Guide* (document [UG10163](#)): The document provides information on installing U-Boot and Linux OS and using i.MX-specific features.

- *MX Yocto Project User's Guide* (document [UG10164](#)): The document describes the board support package (BSP) for NXP development systems using Yocto Project to set up host, install the tool chain, and build source code to create images.
- *MX Porting Guide* (document [UG10165](#)): The document provides instructions on porting the BSP to a new board.
- *MX Machine Learning User's Guide* (document [UG10166](#)): The document provides the machine learning information.
- *GoPoint for MX Applications Processors* (document [GPNTUG](#)): The document explains how to run GoPoint for i.MX Applications Processors.

1.4 Release contents

This release consists of the following:

- Documentation
- Prebuilt binaries:
 - SD card prebuilt image for the release target SoC
 - Kernel and device tree file (.dtb)
 - Boot images
 - Rootfs
- MX FRDM Yocto project release layer on [GitHub](#)

The i.MX FRDM software releases are named imx-frdm-x.y. Where:

- <x.y>: Semantic versioning specification; x is the major version and y is the minor Table 1 lists the contents included in each package.

Table 1. Release contents

Component	Description
Linux OS Kernel and device trees	6.6.36
U-Boot	v2024.04
SD card images	Prebuilt images for target i.MX FRDM boards
i.MX FRDM layer	To build images for target i.MX FRDM boards

i.MX FRDM layer available at [GitHub](#), aims to release the updated or new Yocto Project recipes and machine configurations for i.MX FRDM platform, which are stored in layers as follows:

- meta-imx-bsp: Updates meta-imx/meta-imx-bsp layer for the MX FRDM platform.
 - Linux Kernel recipe: Resides in the recipes-kernel folder and integrates Kernel patches for the MX FRDM platform.
 - U-Boot recipe: Resides in the recipes-bsp folder and integrates U-Boot patches for MX FRDM platform.
- meta-nxp-demo-experience: Updates meta-nxp-demo-experience layer to add MX FRDM platform support.
- meta-nxp-connectivity: Updates meta-nxp-connectivity layer to add Matter support for the MX FRDM platform.

1.4.1 Kernel and device trees

Table 2 describes the Kernel and device trees included in this release. A list of device tree files is provided to work with different accessories.

Table 2. Kernel and device tree configurations

Filename	Description
imx93-11x11-frdm.dtb	The default dtb supports HDMI Display, MIPI CSI, onboard Wi-Fi/Bluetooth, and so on.
imx93-11x11-frdm-tianma-wvga-panel.dtb	24-bit parallel supports 5-inch Tianma LCD
imx93-11x11-frdm-dsi.dtb	MIPI DSI supports a 7-inch Waveshare LCD
imx93-11x11-frdm-ov5640.dtb	MIPI CSI supports OV5640 sensors
imx93-11x11-frdm-mt9m114.dtb	Parallel CSI supports MT9M114
imx93-11x11-frdm-aud-hat.dtb	Audio dtb for MX93AUD-HAT
imx93-11x11-frdm-8mic.dtb	Audio dtb for 8MIC-RPI-MX8

1.5 Instructions to get the AP1302 firmware

To get the AP1302 firmware from ON Semiconductor GitHub, perform the following steps:

1. Download the firmware image from [ap1302_60fps_ar0144_27M_2Lane_awb_tuning.bin](#)
2. Rename it as fw.
3. Create a folder imx/camera/ under /lib/firmware.
4. Copy fw to the target board under /lib/firmware/imx/camera.

1.6 UART output

Using the Linux PC's default CDC-ACM driver, the UART of FRDM-IMX93 can experience abnormal input/ output when the UART cable is replugged.

To resolve this issue, follow the instructions as below:

1. Git Clone https://github.com/WCHSoftGroup/ch343ser_linux.git
2. Compile the CH343 Linux driver, remove the CDC-ACM driver, and then install the CH343 Linux driver
3. To use Minicom, ensure that you have upgraded it to version 9: http://ftp.hk.debian.org/debian/pool/main/m/minicom/minicom_2.9-5_amd64.deb
4. Connect to Minicom/PuTTY by using /dev/CH343USB0

The Windows driver can be downloaded from: https://www.wch.cn/downloads/CH343SER_EXE.html.

Introduction

i.MX FRDM boards are low-cost platform designed to show the most commonly used features of the i.MX applications processor in a small and low-cost package, which helps developers to get familiar with the processor before investing a large amount of resources in more specific designs.

For information on FRDM-IMX93 board, see [FRDM-IMX93 webpage](#).

This document describes a method to integrate i.MX FRDM support into the NXP i.MX Linux BSP. The Yocto Project is an open source collaboration focused on embedded Linux OS development. For more information on the Yocto Project, see www.yoctoproject.org.

Getting started

The i.MX FRDM platform comes with a pre-built NXP Linux binary demo image flashed on the eMMC. Without modifying the binary inside, booting from the eMMC provides a default system with certain features for building other applications on top of Linux OS.

One can also copy images (U-Boot, Linux Kernel, device tree, and rootfs) to a boot device and set the boot switches to boot that device. This section describes how to set switches for booting and deploy images.

3.1 Basic terminal setup

Access to the i.MX FRDM's serial console UART is available via a CH343 USB serial interface. Connect the USB "DEBUG" port to a USB port on a host computer. CH343 drivers are available on Linux, Mac OS X, and Windows platforms. The first enumerated USB serial port is attached to the i.MX FRDM Cortex-A (U-Boot, Linux) serial console.

Connect a USB cable from the DEBUG port to the computer for console output, respectively with the following setup:

- Bits per second = 115200
- Data = 8 bits
- Parity = None
- Stop = 1 bit
- Flow control = None

3.2 Boot switch

The i.MX 93 processor provides multiple boot configurations, which can be selected using SW1 on the FRDM-IMX93 board, or by the boot configuration stored on the internal eFuse of the processor. On the FRDM-IMX93 board, the default Boot mode is from the eMMC device (SW1[1:4] is set to 0100). The other boot device is a microSD connector, which must set SW1[1:4] to 1100. To enter USB serial download, set SW1[1:4] to 1000.

Table 3 shows the switch settings for BOOT_MODE on the FRDM-IMX93 board.

Table 3. Boot mode switch settings

SW1[1:4]	BOOT_MODE[3:0]	Boot core	Boot device
1000	0001	Cortex-A	Serial downloader (USB)
0100	0010	Cortex-A	uSDHC1 8-bit eMMC 5.1
1100	0011	Cortex-A	uSDHC2 4-bit SD3.0

3.3 Downloading a pre-built image

The latest pre-built images for i.MX 93 FRDM are available on the [FRDM-IMX93 webpage](#).

An SD card image file .wic.zst contains a partitioned image (with U-Boot, Kernel, rootfs, and so on) suitable for booting the corresponding hardware.

3.4 Universal update utility

Universal update utility (UUU) runs on Windows, Linux OS, FWIW, or Mac OS X (not tested yet) host and is used to download images to different devices on an i.MX board.

To use the UUU for i.MX 9, follow the instructions below:

1. Download UUU version 5.125 or higher from <https://github.com/NXPmicro/mfgtools/releases>.
 - On Windows, exe can be downloaded and directly used.
 - On Linux and Mac OS X, uuu can be downloaded and stored to a /usr/local/bin
2. Connect a USB cable from a computer to the board's USB OTG/Type C port for
3. Connect a USB cable from the USB Type-C connector labeled "DEBUG" to a host computer for accessing the serial console described in Section 3.2.

4. Set the boot pin to Serial download mode, see Section2.

Table 4 shows the boot switch settings for FRDM-IMX93 to enter Serial download mode.

Table 4. Set up download mode for FRDM-IMX93

Switch	D1	D2	D3	D4
SW1	ON	OFF	OFF	OFF

5. Burn the image:

To burn a single-boot image and rootfs to SD card, run the following command:

To burn a single-boot image and rootfs to eMMC, run the following command:

6. To boot the board, change the boot switch and reset the board.

Table 5. eMMC Boot mode on i.MX 93 FRDM

Switch	D1	D2	D3	D4
SW1	OFF	ON	OFF	OFF

Table 6. SD Boot mode on i.MX 93 FRDM

Switch	D1	D2	D3	D4
SW1	ON	ON	OFF	OFF

For detailed instructions on how to use UUU, see <https://github.com/nxp-imx/mfgtools/wiki>.

3.5 Preparing an SD/MMC card to boot

This section describes the steps to prepare an SD/MMC card to boot up an i.MX board using a Linux host machine.

3.5.1 Copying the full SD card image

An SD card image file .wic.zst contains a partitioned image (with U-Boot, Kernel, rootfs, and so on) suitable for booting the corresponding hardware.

To flash an SD card image, run the following command:

```
zstdcat <image_name>.wic.zst | sudo dd of=/dev/sd<partition> bs=1M conv=fsync
```

For more information on flashing, see section “Preparing an SD/MMC card to boot” in *i.MX Linux User's Guide* (document [UG10163](#)).

3.5.2 Copying a bootloader image

This section describes how to load only the bootloader image when the full SD card image is not used. To copy the U-Boot image to the SD/MMC card, run the following command:

```
$ sudo dd if=<boot image> of=/dev/sdx bs=1k seek=<offset> conv=fsync
```

Where:

<offset> is 32 for MX 9.

3.6 Running Linux OS on the target

This section describes how to run a Linux image on the target using U-Boot.

The basic procedure for running Linux OS on an i.MX board is as follows. This document uses a specific set of environment variable names to make it easier to describe the settings.

1. Power on the board.
2. When U-Boot begins printing to the console, type a character to halt the automatic boot countdown.
3. Save the environment setup:

```
u-boot=> saveenv
```

4. Run the boot command:

```
u-boot=> run bootcmd
```

The commands `env default -f -a` and `saveenv` can be used to return to the default environment.

3.7 Running the Arm Cortex-M image

Some Arm Cortex-M core applications exist from the public Yocto builds. Here is an example to boot the Arm Cortex-M core on FRDM-IMX93:

1. Boot up the board to U-Boot, and load the Arm Cortex-M core image from the SD card to run:

```
=> fatload mmc 1:1 ${loadaddr} imx93-11x11-evk_m33_TCM_rpmsg_lite_str_echo_rtos.bin  
=> cp.b ${loadaddr} 0x201e0000 ${filesize}  
=> bootaux 0x1ffe0000 0
```
2. Append `clk_ignore_unused` in U-Boot `mmccargs` environment before booting
3. Boot to Linux.
4. After login, ensure that the `imx_rpmsg_tty` Kernel module is inserted (`lsmod`) or insert it (`modprobe imx_rpmsg_tty`).
5. After the boot process succeeds, the Arm Cortex-M33 terminal displays the following information:
RPMSG String Echo FreeRTOS RTOS API Demo...
Nameservice sent, ready for incoming messages...
6. After the Linux RPMsg tty module has been installed, the Arm Cortex-M33 terminal displays the following information:
Get Message From Master Side : "hello world!" [len : 12]
7. The user can then input an arbitrary string to the virtual RPMsg tty using the following echo command on Cortex-A terminal:

```
echo test > /dev/ttyRPMSG<num>
```

Where:<num> is the allocated ttyRPMsg channel Find this number in the file system using a `ls` command.
8. The Cortex-M33 terminal displays the received string content and its length, as shown in the log:
Get Message From Master Side : "test" [len : 4] Get New Line From Master Side
The i.MX 93 Cortex-M33 demo is available on the NXP Yocto Project mirror and it can also be retrieved using the following command on the Linux OS:
wget <https://www.nxp.com/lqfiles/NMG/MAD/YOCTO/imx93-m33-demo-2.16.000.bin>

The Cortex-M MCUXpresso SDK is distributed by the MCUXpresso Web Builder tool. To obtain the MCUXpresso SDK for the Cortex-M core of your i.MX SoC, visit <http://mcuxpresso.nxp.com>.

Image build using Yocto

4.1 Host setup

To achieve the Yocto Project's expected behavior in a Linux host machine, install the packages and utilities described below. An important consideration is the hard disk space required in the host machine. For example, when building on a machine running Ubuntu, the minimum hard disk space required is about 50 GB. Provide at least 120 GB, which is enough to compile all backends together. For building machine learning components, at least 360 GB is recommended.

The recommended minimum Ubuntu version is 20.04 or later. The latest release supports Chromium v91, which requires an increase to the `ulimit` (number of open files) to 4098.

4.1.1 Docker

i.MX is now releasing Docker setup scripts in [imx-docker](#). To set up a host build machine using Docker, follow the instructions in the README.

4.1.2 Host packages

A Yocto Project build requires specific packages to be installed for the build that are documented under the Yocto Project. Install the essential host packages on your build host. For information on image build using the Yocto Project, see [Yocto Project Quick Build](#).

The following command installs the host packages:

```
$ sudo apt install gawk wget git diffstat unzip texinfo gcc build-essential chrpath socat cpio python3 python3-pip python3-pexpect xz-utils debianutils iputils-ping python3-git python3-jinja2 python3-subunit zstd liblz4-tool file locales libacl1
```

The configuration tool uses the default version of grep on your build machine. If a different version of grep is present in your path, it can cause build failure. To avoid this failure, rename the special version to a name that does not contain grep.

4.1.3 Setting up the repo utility

Repo is a tool built on top of Git that simplifies managing projects with multiple repositories, even if they are hosted on different servers.

To install the repo utility, perform the following steps:

1. Create a bin folder in the home directory:

```
$ mkdir ~/bin (this step may not be needed if the bin folder already exists)
$ curl https://storage.googleapis.com/git-repo-downloads/repo > ~/bin/repo
$ chmod a+x ~/bin/repo
```

2. To ensure that the ~/bin folder is in your PATH variable, add the following line to the .bashrc file:

```
$ export PATH=~/bin:$PATH
```

4.2 Yocto project setup

To set up the Yocto project, perform the following steps:

1. Ensure that Git is set up properly with the commands below:

```
$ git config --global user.name "Your Name"
$ git config --global user.email "Your Email"
$ git config --list
```

The i.MX Yocto Project BSP release directory contains a sources directory, which contains the recipes for building one or more build directories, along with a set of scripts used to set up the environment.

The recipes required to build the project are sourced from the community i.MX Yocto Project and i.MX FRDM layer, which are downloaded into the sources directory. This ensures that all necessary recipes are set up to build the project.

2. The following example shows how to download the i.MX Yocto Project Community BSP recipe layers and i.MX FRDM layer. For this example, a directory called imx-yocto-bsp is created for the project. Any other name can be used instead of this name.

Download i.MX Yocto Release:

```
$ mkdir imx-yocto-bsp
$ cd imx-yocto-bsp
$ repo init -u https://github.com/nxp-imx/imx-manifest -b imx-linux-scarthgap
-m imx-6.6.36-2.1.0.xml
$ repo sync
```

3. When this process is completed, the source code is checked out into the directory imx-yocto-bsp/ sources.
4. Perform repo synchronization, with the command repo sync periodically to update to the latest code.

If errors occur during repo initialization, try deleting the .repo directory and running the repo initialization command again. The repo init is configured for the latest patches in the line.

5. Integrate i.MX FRDM layer into i.MX Yocto Project:

```
$: cd ./sources
$: git clone https://github.com/nxp-imx-support/meta-imx-frdm.git
$: cd meta-imx-frdm
$: git checkout imx-frdm-1.0
```

Image build

This section provides detailed information on the process for building an image.

5.1 Build configurations

i.MX FRDM provides a script imx-frdm-setup.sh that simplifies the setup for i.MX FRDM machines. To use the script, the name of the specific machine to be built and the desired graphical backend must be specified. The script sets up a directory and the configuration files for the specified machine and backend.

The following are i.MX machine configuration files (i.MX 9) that can be selected:

imx93-11x11-lpddr4x-frdm or imx93frdm

Each build folder must be configured in such a way that they only use one distro. Each time the variable DISTRO_FEATURES is changed, a clean build folder is needed. Distro configurations are saved in the local.conf file in the distro setting and are displayed when the bitbake command is running.

The list of distro configurations are as follows:

- fsl-imx-wayland: Pure Wayland graphics.
- fsl-imx-xwayland: Wayland graphics and X11; X11 applications using EGL are not supported.

If no distro file is specified, the XWayland distro is set up as default.

To set preferred versions and providers, users can create their own distro file based on one of these configurations to customize their environment without updating the local.conf.

The syntax for the imx-frdm-setup.sh script is shown below:

```
$ DISTRO=<distro name> MACHINE=<machine name> source sources/meta-imx-frdm/
tools/imx-frdm-setup.sh -b <build dir>
```

Where:

- DISTRO=<distro configuration name> is the distro, which configures the build environment, and it is stored in meta-imx/meta-imx-sdk/conf/distro
- MACHINE=<machine configuration name> is the machine name, which points to the configuration file in conf/machine in meta-imx-frdm
- -b <build dir> specifies the name of the build directory created by the imx-frdm-setup.sh script

When the script is run, it prompts the user to accept the EULA. Once the EULA is accepted, the acceptance is stored in local.conf inside each build folder and the EULA acceptance query is no longer displayed for that build folder.

After running the script, it creates the working directory specified with the -b option. The conf folder is created containing the files bblayers.conf and local.conf.

The <build dir>/conf/bblayers.conf file contains all the metalayers used in the i.MX Yocto Project release and i.MX FRDM release.

The local.conf file contains the machine and distro specifications:

```
MACHINE ??= 'imx93frdm'
DISTRO ?= 'fsl-imx-xwayland'
ACCEPT_FSL_EULA = "1"
```

Where:

- The MACHINE configuration can be changed by editing this file, if necessary.
- ACCEPT_FSL_EULA in the local.conf file indicates that you have accepted the conditions of the EULA.

5.2 Choosing an image

The Yocto Project provides some images that are available on different layers.

Table 7 lists various key images, their contents, and the layers that provide the image recipes.

Table 7. Image recipes

Image name	Target
core-image-minimal	A small image that only allows a device to boot
imx-image-core	Core image with basic graphics and no multimedia
imx-image-multimedia	Image with multimedia and graphics without any Qt content
imx-image-full	Image with multimedia, machine learning, and Qt

5.3 Building an image

The Yocto Project build uses the bitbake command. For example, bitbake <component> builds the named component. Each component build has multiple tasks, such as fetching, configuration, compilation, packaging, and deploying to the target rootfs. The bitbake image build gathers all the components required by the image and build in order of the dependency per task. The first build is the toolchain along with the tools required for the components to build.

The following command is an example of how to build an image:

```
$ bitbake imx-image-full
```

5.4 BitBake options

The bitbake command used to build an image is bitbake <image name>. More parameters can be used for specific activities described below. BitBake provides various useful options for developing a single component. To run with a BitBake parameter, the command looks as follows:

```
bitbake <parameter> <component>
```

Where:

- <component> is a desired build package.

Table 8 provides some BitBake options.

Table 8. BitBake options

BitBake parameter	Description
-c fetch	Fetches if the downloads state is not marked as done.
-c cleanall	Cleans the entire component build directory. All the changes in the build directory are lost. The rootfs and state of the component are also cleared. The component is also removed from the download directory.
-c deploy	Deploys an image or component to the rootfs.
-k	Continues to build components even if a build break occurs.
-c compile -f	Do not change the source code directly under the temporary directory. If changes are made, the Yocto Project cannot rebuild it unless this option is used. Use this option to force a recompile after the image is deployed.
-g	Lists a dependency tree for an image or component.
-DDD	Turns on debug 3 levels deep. Each D adds another level of debug.
-s, --show-versions	Shows the current and preferred versions of all recipes.

5.5 Build scenarios

To build a BSP image for FRDM-IMX93, execute the following commands:

1. Download i.MX Linux Yocto Release:

```
$: mkdir ${MY_YOCTO} # this directory will be the top directory of the Yocto source code
$: cd ${MY_YOCTO}
$: repo init -u https://github.com/nxp-imx/imx-manifest -b imx-linux-scarthgap -m
imx-6.6.36-2.1.0.xml
$: repo sync
```

2. Integrate meta-imx-frdm recipes into the Yocto code base:

```
$: cd ./sources
$: git clone https://github.com/nxp-imx-support/meta-imx-frdm.git
$: cd meta-imx-frdm
$: git checkout imx-frdm-1.0
```

3. Change to the top directory of the Yocto source code and execute the command below to set up environment for build:

```
#For i.MX93 FRDM
$: MACHINE=imx93frdm DISTRO=fsl-imx-xwayland source sources/meta-imx-frdm/tools/imx-frdm-setup.sh
-b frdm-imx93
```

4. To generate Yocto images, run the following command:

```
$: bitbake imx-image-full
```

After executing previous commands, the Yocto images are generated at <build directory>/tmp/deploy/images. You can now use the zstd and dd commands or UUU tool to flash the images to a microSD card.

Matter support

This repository also contains Yocto recipes to add Matter support based on i.MX Matter 2024 Q3. For more information on i.MX Matter 2024 Q3, see <https://github.com/nxp-imx/meta-nxp-connectivity>. To build the Yocto image with an integrated OpenThread Border Router, perform the following steps:

1. Run the following commands:

#Install the repo utility:

```
$: mkdir ~/bin
```

```
$: curl http://commondatastorage.googleapis.com/git-repo-downloads/repo > ~/bin/repo
```

```
$: chmod a+x ~/bin/repo
```

```
$: export PATH=${PATH}:~/bin
```

#Download i.MX Software Release 2024 Q3:

```
$: mkdir ${MY_YOCTO} # this directory will be the top directory of the Yocto source code
```

```
$: cd ${MY_YOCTO}
```

```
$: repo init -u https://github.com/nxp-imx/imx-manifest -b imx-linux-scarthgap -m
```

```
imx-6.6.36-2.1.0.xml
```

```
$: repo sync
```

#Download i.MX Matter Release 2024 Q3:

```
$: cd ${MY_YOCTO}/sources/meta-nxp-connectivity
```

```
$: git remote update
```

```
$: git checkout imx_matter_2024_q3
```

#Integrate meta-imx-frdm recipes into the Yocto code base:

```
$: cd ${MY_YOCTO}/sources
```

```
$: git clone https://github.com/nxp-imx-support/meta-imx-frdm.git
```

```
$: cd meta-imx-frdm
```

```
$: git checkout imx-frdm-1.0
```

2. Run i.MX Linux Yocto Project setup:

Change the current directory to the top directory of the Yocto source code and execute the command below:

#For i.MX93 FRDM:

```
$: MACHINE=imx93frdm-iwxxx-matter DISTRO=fsl-imx-xwayland source sources/meta-imx-frdm/tools/imxfrdm-matter-setup.sh bld-xwayland-imx93
```

3. To generate Yocto images, run the following command:

```
$: bitbake imx-image-multimedia
```

After executing previous commands, the Yocto images are generated at <build directory>/tmp/deploy/images. You can now use the zstd and dd commands or UUU tool to flash the images to a microSD card.

Customization

7.1 Work with expansion boards

To work with certain expansion boards on FRMD-IMX93, the corresponding dtb file must be specified.

Table 9 shows the corresponding relationship.

Table 9. Corresponding relationship

Expansion board	Interface	dtb
7-inch Waveshare LCD	MIPI DSI	imx93-11×11-frdm-dsi.dtb
5-inch Tianma LCD	24 bit Parallel	imx93-11×11-frdm-tianma-wvga-panel.dtb
RPI-CAM-MIPI	MIPI CSI	imx93-11×11-frdm.dtb
RPI-CAM-INTB	40pins	imx93-11×11-frdm-mt9m114.dtb
MX93AUD-HAT	40pins	imx93-11×11-frdm-aud-hat.dtb
8MIC-RPI-MX8	40pins	imx93-11×11-frdm-8mic.dtb
2EL M.2 Module	M.2 Key E	imx93-11×11-frdm.dtb

The dtb file can be specified in U-Boot:

```
u-boot=> setenv fdtfile <dtb name>
```

```
u-boot=> saveenv
```

```
u-boot=> boot
```

Note: Bluetooth and Wi-Fi are supported on i.MX FRDM through on-board chip (MAYA-W27x with NXP IW612) or external NXP SDIO IW612 (tested with Murata LBES5PL2EL). By default the on-board chip is used. If external hardware is used, it must rework the board according to the FRDM-IMX93 Board User Manual.

7.2 How to build U-Boot and Kernel in a standalone environment

To build U-Boot and Kernel in a standalone environment, perform the following steps:

1. Generate an SDK that includes the necessary tools, toolchain, and a small rootfs to compile on the host machine.

To generate an SDK from the Yocto Project build environment, run the following command:

```
$ bitbake core-image-minimal -c populate_sdk
```

The populate_sdk generates a script file that sets up a standalone environment without Yocto Project.

2. To build on, copy the sh file from the build directory in tmp/deploy/sdk to the host machine and execute the script to install the SDK. The default location is in /opt, but it can be placed anywhere on the host machine.

3. On the host machine, to build U-Boot and Kernel, perform the following steps:

- a. For i.MX 9 builds on the host machine, set the environment with the following command before building:

```
$ source /opt/fsl-imx-xwayland/6.6-nanbiel/environment-setup-aarch64-poky-linux
```

```
$ export ARCH=arm64
```

U-Boot:

Download source by cloning as follows:

```
$ git clone https://github.com/nxp-imx/u-boot-imx -b lf_v2024.04
```

```
$ cd u-boot-imx
```

```
$ git checkout lf-6.6.36-2.1.0
```

#Apply patches for i.MX FRDM and “DIR” is the directory of this i.MX FRDM Software release.

```
$ git am DIR/meta-imx-frdm/meta-imx-bsp/recipes-bsp/u-boot/u-boot-imx/*.patch
```

- b. For i.MX 93 11x11 FRDM board, run the following command:**

```
$ make distclean
```

```
$ make imx93_11x11_frdm_defconfig
```

```
$ make
```

Kernel:

Download source by cloning as follows:

```
$ git clone https://github.com/nxp-imx/linux-imx -b lf-6.6.y
```

```
$ cd linux-imx
```

```
$ git checkout lf-6.6.36-2.1.0
```

#Apply patches for FRDM-IMX and “DIR” is the directory of this release.

```
$ git am DIR/meta-imx-frdm/meta-imx-bsp/recipes-kernel/linux/linux-imx/*.patch
```

- c. To build the Kernel in the standalone environment for i.MX 9, execute the following commands:**

```
$ make imx_v8_defconfig
```

```
$ make
```

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Revision history

Table 10 summarizes the revisions to this document.

Table 10.Revision history

Document ID	Release date	Description
UG10195 v.1.0	20 December 2024	Initial public release

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