RN00210

i.MX Linux Release Notes

Rev. LF6.6.52_2.2.0 — 6 January 2025 **Release notes**

Document information

Information	Content
Keywords	i.MX, Linux, LF6.6.52_2.2.0
Abstract	This document contains important information about the package contents, supported features, known issues and limitations in this release.

1 Overview

This document contains important information about the package contents, supported features, known issues and limitations in this release.

This release is a consolidated release for v6.6.52. Kernel upgrade and supports SoC in the i.MX 6, i.MX 7, i.MX 8 and i.MX 9 series boards that have been released before, and they have been full tested. They have been through automated testing to verify patches that were added after last GA release.

This document includes information for all previously released active i.MX SoCs and this can be used as context only for understanding this release. A future consolidated GA release will test and support all previously released GA i.MX SoCs listed below.

For information on changes in this release, see the manifest Readme at index: imx-manifest.git and the Change Logs at index: imx-manifest-ChangeLog.git.

i.MX reference boards

- i.MX 9 Series
  - i.MX 91 9x9 QSB Board (9x9 A0 silicon)
  - i.MX 91 EVK board (11x11 A0 silicon)
  - i.MX 93 EVK board (11x11 A1 silicon)
  - i.MX 93 PF09 EVK board (11X11 A1 silicon)
  - i.MX 93 9x9 QSB Board (9x9 A1 silicon)
  - i.MX 93 14x14 EVK Board (14x14 A1 silicon)
  - i.MX 95 19x19 EVK Board
  - i.MX 95 15x15 EVK Board
  - i.MX 95 19x19 Verdin Board
- i.MX 8 Series
  - i.MX 8ULP EVK Board (15x15 A2 CES and 9x9 A2 CES)
  - i.MX 8M Plus EVK Board
  - i.MX 8DualX MEK Board
  - i.MX 8DXL EVK Board (A1 silicon tested on LPDDR4 EVK, B0 silicon tested on LPDDR4 WEVK and DDR3L EVK)
  - i.MX 8QuadXPlus MEK Board (C0 silicon revision)
  - i.MX 8QuadMax MEK Board
  - i.MX 8M Quad EVK Board
  - i.MX 8M Quad WEVK Board
  - i.MX 8M Mini EVK Board
  - i.MX 8M Nano EVK Board
- i.MX 7 Series
  - i.MX 7Dual SABRE-SD Board
  - i.MX 7ULP EVKB Board
- i.MX 6 Series
  - i.MX 6QuadPlus SABRE-SD Boards
  - i.MX 6Quad SABRE-SD Boards
  - i.MX 6DualLite SDP SABRE-SD Boards
  - i.MX 6SoloX SABRE-SD Boards
  - i.MX 6UltraLite EVK Board
  - i.MX 6ULL EVK Board
  - i.MX 6ULZ EVK Board

– i.MX 6SLL EVK Board

Note:

In this document, the following notation is used:

- *6SABRE-SD stands for the i.MX 6Quad, i.MX 6QuadPlus, i.MX 6DualLite, and i.MX 6DualPlus SABRE-SD Platforms.*
- *6SoloLite stands for the i.MX 6SoloLite EVK*
- *6SoloX-SD stands for the i.MX 6SoloX SABRE-SD Platform.*
- *7D-SABRE-SD stands for the i.MX 7Dual SABRE-SD Platform.*
- *6UltraLite stands for the i.MX 6UltraLite EVK Platform.*
- *6ULL stands for the i.MX 6ULL EVK Platform.*
- *6ULZ stands for the i.MX 6ULZ EVK Platform.*
- *7ULP stands for the i.MX 7 Ultra Low Power Platform.*
- *8QuadMax stands for the i.MX 8QuadMax MEK Platform.*
- *8QuadXPlus stands for the i.MX 8QuadXPlus MEK Platform.*
- *8M Quad stands for the i.MX 8M Quad EVK and WEVK Platforms.*
- *8M Mini stands for the i.MX 8M Mini EVK Platform.*
- *8M Nano stands for the i.MX 8M Nano EVK Platform.*
- *8MP stands for the i.MX 8M Plus EVK Platform.*
- *8DXL stands for the i.MX 8DualXLite EVK Platform.*
- *8ULP stands for the i.MX 8ULP EVK Platform.*
- *i.MX 91 stands for the i.MX 91 11x11 EVK and i.MX 91 9x9 QSB Platforms.*
- *i.MX 93 stands for the i.MX 93 11x11 EVK, i.MX 93 11x11 PF09 EVK, i.MX 93 9x9 QSB, and i.MX 93 14x14 EVK Platforms.*
- *i.MX 95 stands for the i.MX 95 19x19 EVK, i.MX 95 15x15 EVK, and i.MX 95 19x19 Verdin Platforms.*

The following table lists the testing that was done for each SoC.

Table 1. Board validation and support scope

SoC	Test validation and support scope
i.MX 91 9x9	GA quality.
i.MX 91 11x11	GA quality.
i.MX 95 15x15 EVK	Beta quality.
i.MX 95 19x19 Verdin	Beta quality.
i.MX 95 19x19	Beta quality.
i.MX 93 11x11 PF09 EVK	GA quality.
i.MX 93 9x9, 11x11, 14x14	GA quality.
8ULP	GA quality.
8M Plus	GA quality.
8DXL OrangeBox	GA quality.
8DXL	GA quality.
8M Quad	GA quality.
8M Nano	GA quality.
8M Mini	GA quality.
8QuadMax	GA quality.

Table 1. Board validation and support scope*...continued*

SoC	Test validation and support scope
8QuadXPlus (C0 silicon)	GA quality.
7Dual/Solo	GA quality.
7ULP	GA quality.
6QuadPlus	GA quality.
6Quad	GA quality.
6DualLite	GA quality.
6SoloX	GA quality.
6UltraLite	GA quality.
6ULL	GA quality.
6SLL	GA quality.
6ULZ	GA quality.

1.1 References

i.MX has multiple families supported in software. The following are the listed families and SoCs per family. The i.MX Linux Release Notes describes which SoC is supported in the current release. Some previously released SoCs might be buildable in the current release but not validated if they are at the previous validated level.

- i.MX 6 Family: 6QuadPlus, 6Quad, 6DualLite, 6SoloX, 6SLL, 6UltraLite, 6ULL, 6ULZ
- i.MX 7 Family: 7Dual, 7ULP
- i.MX 8 Family: 8QuadMax, 8QuadPlus, 8ULP
- i.MX 8M Family: 8M Plus, 8M Quad, 8M Mini, 8M Nano
- i.MX 8X Family: 8QuadXPlus, 8DXL, 8DXL OrangeBox, 8DualX
- i.MX 9 Family: i.MX 91, i.MX 93, i.MX 95

This release includes the following references and additional information.

- *i.MX Linux Release Notes* (RN00210) - Provides the release information.
- *i.MX Linux User's Guide* (UG10163) - Provides the information on installing U-Boot and Linux OS and using i.MX-specific features.
- *i.MX Yocto Project User's Guide* (UG10164) - Describes the board support package for NXP development systems using Yocto Project to set up host, install tool chain, and build source code to create images.
- *i.MX Porting Guide* (UG10165) - Provides the instructions on porting the BSP to a new board.
- *i.MX Machine Learning User's Guide* (UG10166) - Provides the machine learning information.
- *i.MX DSP User's Guide* (UG10167) - Provides the information on the DSP for i.MX 8.
- *i.MX 8M Plus Camera and Display Guide* (UG10168) - Provides the information on the ISP Independent Sensor Interface API for the i.MX 8M Plus.
- *i.MX Digital Cockpit Hardware Partitioning Enablement for i.MX 8QuadMax* (UG10169) - Provides the i.MX Digital Cockpit hardware solution for i.MX 8QuadMax.
- *i.MX Graphics User's Guide* (UG10159) - Describes the graphics features.
- *Harpoon User's Guide* (HRPNUG_3.1) - Presents the Harpoon release for i.MX 8M device family.
- *i.MX Linux Reference Manual* (RM00293) - Provides the information on Linux drivers for i.MX.
- *i.MX VPU Application Programming Interface Linux Reference Manual* (RM00294) - Provides the reference information on the VPU API on i.MX 6 VPU.

- *EdgeLock Enclave Hardware Security Module API* (RM00284) - This document is a software reference description of the API provided by the i.MX 8ULP, i.MX 93, and i.MX 95 Hardware Security Module (HSM) solutions for the EdgeLock Enclave (ELE) Platform.

The quick start guides contain basic information on the board and setting it up. They are on the NXP website.

- SABRE Platform Quick Start Guide (IMX6QSDPQSG)
- i.MX 6UltraLite EVK Quick Start Guide (IMX6ULTRALITEQSG)
- i.MX 6ULL EVK Quick Start Guide (IMX6ULLQSG)
- i.MX 7Dual SABRE-SD Quick Start Guide (SABRESDBIMX7DUALQSG)
- i.MX 8M Quad Evaluation Kit Quick Start Guide (IMX8MQUADEVKQSG)
- i.MX 8M Mini Evaluation Kit Quick Start Guide (8MMINIEVKQSG)
- i.MX 8M Nano Evaluation Kit Quick Start Guide (8MNANOEVKQSG)
- i.MX 8QuadXPlus Multisensory Enablement Kit Quick Start Guide (IMX8QUADXPLUSQSG)
- i.MX 8QuadMax Multisensory Enablement Kit Quick Start Guide (IMX8QUADMAXQSG)
- i.MX 8M Plus Evaluation Kit Quick Start Guide (IMX8MPLUSQSG)
- i.MX 8ULP EVK Quick Start Guide (IMX8ULPQSG)
- i.MX 8ULP EVK9 Quick Start Guide (IMX8ULPEVK9QSG)
- i.MX 93 EVK Quick Start Guide (IMX93EVKQSG)
- i.MX 93 9x9 QSB Quick Start Guide (93QSBQSG)

Documentation is available online at nxp.com.

- i.MX 6 information is at nxp.com/iMX6series.
- i.MX SABRE information is at nxp.com/imxSABRE.
- i.MX 6UltraLite information is at nxp.com/iMX6UL.
- i.MX 6ULL information is at nxp.com/iMX6ULL.
- i.MX 7Dual information is at nxp.com/iMX7D.
- i.MX 7ULP information is at nxp.com/imx7ulp.
- i.MX 8 information is at nxp.com/imx8.
- i.MX 6ULZ information is at nxp.com/imx6ulz.
- i.MX 91 information is at nxp.com/imx91.
- i.MX 93 information is at nxp.com/imx93.
- i.MX 95 information is at nxp.com/imx95.

1.2 Release contents

This release consists of the following:

- Pre-built images
- Manufacturing tools (UUU)
- Documentation
- Git repo open source distributions on the GitHub
- Proprietary distributions on Yocto Project i.MX external mirror
- Limited access third-party distributions

The GA releases are named `L<Kernel_version>_<x.y.z>`.

`<Kernel_version>`: BSP Kernel version (For example, `L6.6.52` indicates that this BSP release is based on the kernel version 6.6.52).

`<x.y.z>`: Semantic versioning specification, where X is the major version, Y is the minor version, and Z is the patch version.

The following tables list the contents included in each package.

Table 2. Release contents

Component	Description
Linux OS Kernel and Device Trees	6.6.52
U-Boot	v2024.04
SD Card images	Prebuilt images used for testing to use on target i.MX reference boards
Manufacturing Tools (UUU)	Version: 1.5.182 Used to burn a production image into the board
i.MX Open Source repos	i.MX open source modifications or NXP original open source
NXP Component downloads	System Controller Porting kit and AACPlus Decoder downloadable on nxp.com
i.MX Proprietary on Yocto Project mirror	i.MX proprietary components for download Yocto Project mirror on nxp.com
i.MX Limited Access	i.MX 3rd-party packages requiring NXP marketing assistance

The release packages contain the following.

- Documentation.
- Prebuilt binaries:
  - SD Card prebuilt image for the release target SoC
  - Kernel and Device trees
  - Boot Images
  - Applicable Arm Cortex-M4 Demos if applicable to target SoC
- UUU default scripts that burn into eMMC. UUU example scripts are used as reference.

See the *i.MX Linux User's Guide* (UG10163) for information on how to use these release contents.

The following packages are available on the NXP Yocto Project mirror. Each package is pulled into builds directly when doing a Yocto Project build but can also be retrieved using the following command on the Linux OS.

```
wget https://www.nxp.com/lgfiles/NMG/MAD/YOCTO/<package file name>
```

Table 3. BSP and multimedia standard packages

File name	Description
`imx-codec-4.9.0.bin`	i.MX optimized Audio and Video core codec libraries
`imx-parser-4.9.2-828fcb7.bin`	i.MX optimized core parser
`imx-vpu-5.4.39.3.bin`	i.MX VPU library for i.MX 6 with VPU
`imx-vpu-hantro-1.35.0-98ff183.bin`	i.MX VPU Hantro libraries for i.MX 8M Quad, 8M Mini, and 8M Plus
`imx-vpu-hantro-daemon-1.4.0-75d9dd9.tar.gz`	i.MX VPU Hantro deamon binary for i.MX 8M Quad, 8M Mini, and 8M Plus
`imx-vpu-hantro-vc-1.10.1-c0244a1.bin`	i.MX VPU Hantro vc8000e Encoder libraries for i.MX 8M plus
`firmware-imx-8.26-d4c33ab.bin`	i.MX Firmware including firmware for VPU, DDR, EPDC, HDMI, DP (Display Port), and SDMA
`imx-seco-5.9.4.1-0333596.bin`	i.MX SECO firmware for i.MX 8QuadMax, 8QuadXPlus, and 8DXL reference boards

Table 3. BSP and multimedia standard packages...*continued*

File name	Description
imx-gpu-viv-6.4.11.p2.10-aarch32-accdd64.bin	i.MX Graphics libraries for i.MX 6 and 7 SoC with GPU
imx-gpu-viv-6.4.11.p2.10-aarch64-accdd64.bin	i.MX Graphics libraries for i.MX 8
imx-gpu-g2d-6.4.11.p2.10-arm-accdd64.bin	i.MX Graphics G2D libraries for i.MX 6 and 7 with GPU
imx-gpu-g2d-6.4.11.p2.10-arch64-accdd64.bin	i.MX Graphics G2D libraries for i.MX 8
imx-dpu-g2d-v1-2.2.2-e2dce80.bin	i.MX G2D library for i.MX 8 Auto SoCs with DPU blitter engine
imx-sc-firmware-1.17.0-83624b9.bin	i.MX System Controller Firmware for i.MX 8QuadMax, 8QuadXPlus, and 8DXL reference boards
isp-imx-4.2.2.24.4-8527c7b.bin	i.MX 8M Plus ISP SDK
imx7d-sabresd-m4-freertos-1.0.bin	i.MX 7D Cortex-M4 Demo
imx7ulp-m4-demo-2.16.000.bin	i.MX 7ULP Cortex-M4 Demo
imx8qm-m4-demo-2.9.0.bin	i.MX 8QuadMax Cortex-M4 Demo
imx8qx-m4-demo-2.9.0.bin	i.MX 8QuadXPlus Cortex-M4 Demo
imx8mq-m4-demo-2.16.000.bin	i.MX 8M Quad Cortex-M4 Demo
imx8mm-m4-demo-2.16.000.bin	i.MX 8M Mini Cortex-M4 Demo
imx8mn-m7-demo-2.16.000.bin	i.MX 8M Nano Cortex-M7 Demo
imx8dxl-m4-demos-2.9.0.bin	i.MX 8DXL Cortex-M4 Demo
imx8mp-m7-demo-2.16.000.bin	i.MX 8M Plus Cortex-M7 Demo
imx8ulp-m33-demo-2.16.000.bin	i.MX 8ULP Cortex-M33 Demo
imx93-m33-demo-2.16.000.bin	i.MX 93 Cortex-M33 Demo
imx95-m7-demo-24.12.00.bin	i.MX 95 Cortex-M7 Demo
firmware-ele-imx-1.3.0-17945fc.bin	i.MX 91, i.MX 93, i.MX 95, and i.MX 8ULP A0.1 and A1 ELE Firmware

Note:

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. For i.MX 95, download with the following links:

- *IMX95LPD5EVK-19*
- *IMX95LP4XEVK-15*
- *imx95verdinevk*

The following packages are available for download on nxp.com.

Table 4. NXP.com packages

File name	Description
imx-aacpcodec-4.9.0.bin	Coding Technologies AACplus decoder
imx-scfw-porting-kit-1.17.0.tar.gz	System Controller Firmware porting kit
imx-upower-porting-kit-1.3.1.tar.gz	uPower firmware porting kit

i.MX BSP also releases open source through repos on Github.com i.MX GitHub. The following table lists all the repos on GitHub.

Table 5. i.MX GitHub Distributions Repos

Repo	Description
imx-manifest	i.MX Yocto Project Linux BSP Manifest
linux-imx	i.MX Linux Kernel
uboot-imx	i.MX U-Boot
imx-atf	i.MX Arm Trusted Firmware for i.MX 8
imx-oei	DDR OEI
imx-sm	System Manager
imx-mkimage	i.MX Mkimage boot image tool
imx-lib	i.MX Libraries
imx-test	i.MX Driver unit test applications
imx-optee-os	i.MX OP-TEE OS
imx-optee-test	i.MX OP-TEE Test
imx-optee-client	i.MX OP-TEE Client
imx-gst1.0-plugin	i.MX Multimedia GStreamer Plugins
gst-plugins-base	i.MX Multimedia GStreamer Base
gst-plugins-bad	i.MX Multimedia GStreamer Bad
gst-plugins-good	i.MX Multimedia GStreamer Good
gstreamer	i.MX Multimedia GStreamer Core
imx-alsa-plugins	i.MX ALSA Plugins
libdrm-imx	i.MX Graphics DRM
opencv-imx	i.MX Graphics OpenCV
weston-imx	i.MX Graphics Weston
wayland-protocols-imx	i.MX Graphics Wayland Protocols
xf86-video-imx-vivante	i.MX Graphics X.org Vivante Driver
meta-imx	i.MX Yocto Project Release Layer
armnn-imx	i.MX ArmNN Fork
onnxruntime-imx	i.MX Onnxruntime Fork
nn-imx	i.MX NN Fork
mwifiex	NXP Wi-Fi kernel driver
gtec-demo-framework	i.MX Graphics Demo Framework
imx-firmware	i.MX Firmware for Cypress and NXP Wi-Fi and Bluetooth
imx-seco-libs	i.MX SECO libraries
imx-vpuwrap	i.MX VPU Wrapper
arm-computelibrary-imx	Arm compute library
pyarmnn-release	PyArmNN

Table 5. i.MX GitHub Distributions Repos*...continued*

Repo	Description
tensorflow-imx	TensorFlow
v2xseshm	V2XSE SHM library
vtest	V2X test application
sof	Sound Open Firmware
imx-xen	Xen Hypervisor for i.MX platforms
imx-qemu	Xen hypervisor virtio backend support
libcamera	Linux camera management framework
meta-nxp-connectivity	i.MX Matter components

An additional part of the release are Yocto Project demos that show additional use cases on different i.MX hardware. These demos are layers that work on top of a public BSP release. These are listed below and are updated within a month of each consolidated GA release. These demos are not fully tested but show how to integrate different stacks of software to use with i.MX reference boards and our BSP release.

- `meta-imx-orangebox`: Orangebox demos for i.MX Orangebox with i.MX 8DXL.
- `OTA`: Note no extra layer. Third parties support over the air solutions such as Mender or Foundries.io. Contact one of these third parties to integrate an OTA solution.

1.3 License

The Board Support Package (BSP) is composed of a set of packages and metadata (for Yocto Project Recipes) and each one has its own licensing. Verify the license of the target package before developing. The license can be found at the top of a recipe or a source file (such as `*.c` or `*.h`). For details, contact your NXP representative.

During the Yocto Project setup, to set up an i.MX build, accept the NXP license. This acceptance is recorded in the build configuration files so that the following proprietary binaries can be extracted during the build process. The NXP proprietary packages contain a Software Content Register (SCR) file that lists information about the package: `imx-gpu-viv`, `imx-codec`, and `imx-parser`.

1.4 Limited access proprietary packages

Limited access packages listed in the following table are provided on nxp.com with controlled access because they require additional licensing by a 3rd party. Contact your sales representative for access. Each package has its own Readme file with instructions on how to build, install, and run.

For the i.MX 95 platform, NXP can also provide Functional Safety deliverables (Alpha quality), but these are not available on nxp.com, as additional licensing terms are required. Please contact your sales representative for access.

Table 6. Limited access packages for Yocto project releases

Package	Description
`imx-mscodec-4.9.0.bin`	i.MX optimized Microsoft codec
`imx-msparser-4.9.2-828fcb7.bin`	i.MX optimized Microsoft ASF parser
`imx-real-4.9.2-be16e64.bi`	i.MX Real Networks RMVB Decoders and Parsers
`imx-dsp-2.1.9-a3074e2.bin`	DSP firmware
`imx-dsp-codec-2.1.8.bin`	DSP decoders (MP2, MP3, BSAC, DRM, DABPlus, SBC, AAC)

Table 6. Limited access packages for Yocto project releases*...continued*

Package	Description
imx-dsp-codec-ext-2.1.8.bin	DSP extra codecs
imx-dsp-codec-aacp-2.1.8.bin	DSP AACPlus decoder
imx-ap1302-1.0.0.tar.gz	Firmware Yocto recipe for Camera AP1302+AR0144.

1.5 Instructions to get the AP1302 firmware

Perform the following steps to get the AP1302 firmware from OnSemi GitHub:

1. Download ap1302_60fps_ar0144_27M_2Lane_awb_tuning.bin from OnSemi GitHub NXP_i.MX93_ap1302_firmware by following README.md.
2. Rename it as `ap1302.fw`.
   Note: *For i.MX 95, rename it as* `ap130x_ar0144_single_fw.bin`.
3. Copy it to the target board under `/lib/firmware/imx/camera`.
   Note: *For i.MX 95, copy it to the target board under* `/lib/firmware/`.

2 What's New?

This section describes the changes in this release, including new features and defect fixes.

2.1 New features

A summary of the main new features is as follows.

New features added for all supported boards:

- Upgraded the kernel to 6.6.52 with consolidated Linux Factory Kernel.
- Upgraded the U-Boot to v2024.04 with consolidated Linux Factory U-Boot.
- Updated EULA to v57 July 2024.
- Upgraded the Yocto Project to version 5.0 Scarthgap.
- Supports the GCC 13.3 toolchain.
- Supports Glitch Detection (GDET) on i.MX 93.
- Cortex-M33 update for 8ULP and i.MX 93, Cortex-M7 updates for i.MX 8M Nano, i.MX 8M Plus, and i.MX 95, and Cortex-M4 update for i.MX 7ULP, i.MX 8M Mini, and i.MX 8M Quad.
- Security
  - OP-TEE upgraded to 4.4.0.
- Multimedia updates:
  - Gstreamer upgraded to 1.24.7.
  - Supports ASRC plugin.
- Graphics updates:
  - GPU driver upgraded to 6.4.11.p2.10 with Vulkan enablement, bug fixes, and performance optimizations.
  - GPU SDK upgraded to 6.2.4.
  - Chromium upgraded to 117.0.5938.132.
    Note: *Support for i.MX 6 and i.MX 6 7 is deprecated in this release and will be removed in the next release.*
- Machine Learning updates:
  - OpenCV upgraded to 4.10.0.
  - TensorFlow Lite upgraded to 2.16.2 with GPU acceleration.

  - i.MX 93 Vela upgraded to 3.12.
- i.MX 8M Plus
  - Updates for ISP 4.2.2.24.4.
- i.MX 91
  - Introduction for i.MX 91 11x11 as GA quality.
  - Introduction for i.MX 91 9x9 as GA quality.
- Arm SystemReady-IR (SR-IR) certification
  - i.MX 8M Mini EVK board has passed the Arm SR-IR certification.
  - i.MX 8M Plus EVK board has passed the Arm SR-IR certification.
  - i.MX 8M Quad EVK board has passed the Arm SR-IR certification.
  - i.MX 8M Nano EVK board has passed the Arm SR-IR certification.
- Userspace Ethernet DPDK Driver
  - Supports DPDK-FPR application on i.MX 93.
  - Supports MTCP stack on i.MX 95.
- The following boards are not supported in this release:
  - i.MX 8QuadXPlus B0 MEK
  - i.MX 8DXL A1 DDR3L EVK
  - i.MX 6QuadPlus SABRE-AI
  - i.MX 6Quad/Dual SABRE-AI
  - i.MX 6DualLite SABRE-AI

3 SoC Feature Summary

The following table describes the SoC features summarized into groups.

Table 7. SoC hardware acceleration features

Feature	SoC
2D Graphics with GPU	i.MX 6 Family: 6Quad, 6DualLite, 6Solo, 6SoloX i.MX 7 Family: 7ULP i.MX 8 Family: 8ULP i.MX 8M Family: 8M Mini, 8M Plus
3D GPU	i.MX 6 Family: 6Quad, 6DualLite, 6Solo, 6SoloX i.MX 7 Family: 7ULP i.MX 8 Family: 8QuadMax, 8ULP i.MX 8X Family: 8QuadXPlus i.MX 8M Family: 8M Quad, 8M Mini, 8M Nano, 8M Plus i.MX 9 Family: i.MX 95
2D Graphics with DPU	i.MX 8 Family: 8QuadMax i.MX 8X Family: 8QuadXPlus i.MX 9 Family: i.MX 95
Vulkan GPU	i.MX 8 Family: 8QuadMax, 8ULP i.MX 8X Family: 8QuadXPlus i.MX 8M Family: 8M Plus, 8M Quad, 8M Nano i.MX 9 Family: i.MX 95
OpenVX	i.MX 8 Family: 8QuadMax, 8M Plus
VPU	i.MX 6 Family: 6Quad, 6DualLite, 6QuadPlus i.MX 8 Family: 8QuadMax

Table 7. SoC hardware acceleration features...*continued*

Feature	SoC
	i.MX 8X Family: 8QuadXPlus, 8DualX i.MX 8M Family: 8M Quad, 8M Mini, 8M Plus i.MX 9 Family: i.MX 95
EPDC	i.MX 6 Family: 6DualLite, 6SLL, 6ULL, 6ULZ i.MX 7 Family: 7Dual i.MX 8 Family: 8ULP
PXP	i.MX 6 Family: 6DualLite, 6SLL, 6UL, 6ULL, 6ULZ i.MX 7 Family: 7Dual i.MX 8 Family: 8ULP i.MX 9 Family: i.MX 93
Frame Buffer Display	i.MX 6 Family: 6Quad, 6DualLite, 6Solo, 6SoloX, 6SLL, 6UL, 6ULL, 6ULZ i.MX 7 Family: 7Dual, 7ULP
DRM Display	i.MX 8 Family: 8QuadMax, 8ULP i.MX 8X Family: 8QuadXPlus, 8DualX i.MX 8M Family: 8M Quad, 8M Mini, 8M Nano, 8M Plus i.MX 9 Family: i.MX 93, i.MX 95
Cortex-M Core	i.MX 6 Family: 6SoloX i.MX 7 Family: 7Dual, 7ULP i.MX 8 Family: 8QuadMax, 8ULP i.MX 8X Family: 8QuadXPlus, 8DX, 8DXL i.MX 8M Family: 8M Quad, 8M Mini, 8M Nano, 8M Plus i.MX 9 Family: i.MX 93, i.MX 95
HiFi4 DSP	i.MX 8 Family: 8QuadMax, 8ULP i.MX 8X Family: 8QuadXPlus, 8DualX i.MX 8M Family: 8M Plus
NXP eIQ Machine Learning	i.MX 8 Family: 8QuadMax, 8ULP i.MX 8X Family: 8QuadXPlus, 8DualX i.MX 8M Family: 8M Quad, 8M Mini, 8M Nano, 8M Plus i.MX 9 Family: i.MX 93, i.MX 95
V2X	i.MX 8DXL i.MX 9 Family: i.MX 95
NPU	i.MX 8 Family: 8M Plus i.MX 9 Family: i.MX 93, i.MX 95

4 BSP Supported Features

The following table describes the features that are supported in this BSP release. In this table, if no board is explicitly stated, the feature is shared across all boards listed in Section 1. Otherwise, the feature is only supported on the boards listed.

Table 8. Supported features

Feature	Supported board	Comment
Kernel		
Kernel	All i.MX	Kernel version: 6.6.52

Table 8. Supported features*...continued*

Feature	Supported board	Comment
File System	All i.MX	EXT2/EXT3/EXT4 are used as the file system in MMC/eMMC/SD card. On i.MX 6SABRE-AI and 7D-SABRE-SD, • UBIFS is used for NAND. • JFFS2/UBIFS is used for Parallel NOR, QSPI NOR.
Boot image		
U-Boot	All i.MX	U-Boot delivery is based on U-Boot version v2024.04. Clock, Anatop regulator, ENET, UART, MMC/SD, eMMC4.3/4.4/4.5/5.1. High-Assurance Boot, ROM Plug-in Mode. SPI-NOR, Parallel NOR, SATA, NAND, FlexSPI-NOR, USB Mass Storage. See Table 9 "U-Boot configurations" for the U-Boot configurations supported on each board for SPI_NOR, NAND, Parallel NOR, FlexSPI-NOR. These are not supported on all boards. i.MX 6QuadPlus/Quad/DualLite SABRE-SD support DDR3 528 MHz @ 64 bit. i.MX 6SoloX SABRE-SD support LDDR3 400 MHz @ 32 bit. i.MX 7Dual SABRE-SD supports DDR3 533 MHz @ 32 bit and boot using L2Cache as OCRAM. i.MX 6UltraLite EVK supports DDR3 400 MHz @ 16 bit. i.MX 6ULL supports DDR3 400 MHz @ 16 bit. i.MX 6ULZ supports DDR3 400 MHz @ 16 bit. i.MX 6SLL supports LPDDR3 400 MHz @ 32 bit. i.MX 7ULP supports Clock, UART, MMC/SD, eMMC4.3/4.4/4.5, High-Assurance Boot, ROM Plug-in Mode QuadSPI-NOR, USB Mass Storage I2C, and SPI. i.MX 8 and i.MX 9 use `imx-mkimage` to produce the `flash.bin` file that contains the i.MX 8 or i.MX 9 system controller firmware and U-Boot. The `flash.bin` file that can be flashed to the SD cards with the command: `dd if=<flash.bin> of=/dev/sd<x> seek=<x> bs=1k`. For 8M Mini, `seek=33`. For i.MX 8M Quad/Mini/Nano/Plus, U-Boot supports distro boot. For 8M mini EVK, U-Boot also supports EFI and is able to boot openSUSE and Fedora. For 8M Quad, 8QuadMax A0, and 8QuadXPlus A0, `seek=33`. For 8QuadMax B0, 8QuadXPlus B0 and C0, 8M Nano, 8M Plus, 8DXL, i.MX 93, and i.MX 95, `seek=32`.
Boot Firmware	All i.MX 8 i.MX 91 i.MX 93 i.MX 95	All i.MX 8 and i.MX 91 boards require Arm Trusted Firmware. i.MX 8QuadMax 8DXL and 8QuadXPlus require System Controller Firmware. i.MX 8QuadMax, 8DXL and 8QuadXPlus require SECO Firmware. i.MX 8QuadMax requires signed HDMI Firmware. i.MX 8ULP requires Secure Enclave and uPower Firmware. i.MX 91, i.MX 93, and i.MX 95 require Secure Enclave Firmware. i.MX 93 and i.MX95 require Secure Enclave Firmware. i.MX 95 requires System Manager and OEI Firmware.
OP-TEE	All i.MX	OP-TEE OS is required on the boot partition with the TEE file for OP-TEE enablement.
Jailhouse Hypervisor	All i.MX 8M 8ULP i.MX 93 i.MX 95	Jailhouse is a Type 1 hypervisor for i.MX 8. Look for related device trees for inmate and root device trees.
Machine-specific layer		

Table 8. Supported features*...continued*

Feature	Supported board	Comment
Arm Core	All i.MX	i.MX 6 SABRE-SD, 6SLL, and 6 SoloX-SD support the Arm Cortex-A9 processor. i.MX 7Dual SABRE-SD and 7ULP EVK support the Arm Cortex-A7 and Cortex-M processor. i.MX 6UltraLite EVK, 6ULL EVK, and 6ULZ EVK support the Arm Cortex-A7 processor. i.MX 8QuadXPlus processor consists of five cores: • Four Arm Cortex-A35 • One Arm Cortex-M4F i.MX 8QuadMax processor consists of eight cores: • Four Arm Cortex-A53 cores • Two Arm Cortex-A72 cores • Two Arm Cortex-M4F cores i.MX 8M Quad and i.MX 8M Mini support four Arm Cortex-A53 cores and one Arm Cortex-M4 core. i.MX 8M Nano supports four Arm Cortex-A53 cores and one Arm Cortex-M7F core. i.MX 8M Plus supports four Arm Cortex-A53 cores and one Arm Cortex-M7F core. i.MX 8ULP supports two Arm Cortex-A35 cores and one Arm Cortex-M33F core. i.MX 8DXL supports two Arm Cortex-A35 cores and one Arm Cortex-M4F core. i.MX 91 supports one Arm Cortex-A55 core. i.MX 93 supports two Arm Cortex-A55 cores and one Arm Cortex-M33 core. i.MX 95 supports six Arm Cortex-A55 cores, one Arm Cortex-M7 core, and one Arm Cortex-M33 core.
Memory	All i.MX	On i.MX 6 and i.MX 7 SoC, the user/kernel space is split 2G/2G. On i.MX 8 with 64-bit configuration, the memory is not split. i.MX 8QuadMax supports two 32-bit LPDDR4 channels @1600 MHz. i.MX 8QuadXPlus supports one 32-bit LPDDR4 channel @1200 MHz. i.MX 8DXL supports one 16-bit LPDDR4 channel @ 1200 MHz. i.MX 8M Quad supports one 32-bit LPDDR4 channel @ 1600 MHz and 50 MHz. i.MX 8M Mini supports one 32-bit LPDDR4 channel @ 1500 MHz and 50 MHz. i.MX 8M Nano supports one 16-bit LPDDR4 channel @ 750 MHz and 25 MHz. i.MX 8M Plus supports one 32-bit LPDDR4 channel @ 2000 MHz and 50 MHz. i.MX 8ULP supports Multi-port 32-bit LPDDR4, LPDDR4x, up-to 533 MHz clock. i.MX 91 supports Multi-port 16-bit LPDDR4, up to 2.4 gigabyte transfers per second. i.MX 93 11x11 EVK supports Multi-port 16-bit DDR LPDDR4, LPDDR4x, up to 3.733 gigabyte transfers per second. i.MX 93 14x14 EVK supports Multi-port 16-bit DDR LPDDR4, LPDDR4x, up to 3.733 gigabyte transfer per second. i.MX 93 9x9 QSB supports Multi-port 16-bit DDR LPDDR4, LPDDR4x, up to 3.2 gigabyte transfers per second. i.MX 95 19x19 EVK supports Multi-port 32-bit LPDDR5 up to 25.6 gigabyte transfers per second. i.MX 95 15x15 EVK supports Multi-port 32-bit LPDDR4x up to 16 gigabyte transfers per second.
Interrupt	All i.MX	GIC
Clock	All i.MX	Controls the system frequency and clock tree distribution.
Timer	All i.MX	System timer tick and broadcast timer support. GPT Timer used for i.MX 6 and i.MX 7.

Table 8. Supported features*...continued*

Feature	Supported board	Comment
		On i.MX 8M SoC and 8QuadXPlus, system counter timer instead of GPT. On i.MX 8 and i.MX 9, Arm Arch timer used instead of GPT. On i.MX 6 and i.MX 7 Enhanced Periodic Interrupt Timer (EPIT) available.
GPIO/EDIO	All i.MX	GPIO is initialized in earlier phase according to hardware design.
IOMUX	All i.MX	Provides the interfaces for I/O configuration. IOMUX-V3 version is used on i.MX 6, i.MX 7,and i.MX 8M boards. For i.MX 8QuadMax, i.MX 8DXL and 8QuadXPlus the system controller manages access to the IOMUX.
System Controller	8QuadMax 8QuadXPlus 8DXL	Provides abstraction to the hardware features and runs on Arm Cortex-M4 executing firmware.
System Manager	i.MX 95	Provides abstraction to the hardware features and runs on Arm Cortex-M33 executing firmware.
DMA engine		
SDMA	All i.MX 6 All i.MX 7 All i.MX 8M	Conforms to the DMA engine framework.
APBH-Bridge-DMA	6SABRE-AI	Conforms to the DMA engine framework. This feature requires a NAND U-Boot.
Character device drivers		
UART	All i.MX	i.MX 6 SABRE-SD supports console through internal Debug UART1. i.MX 6SoloX SABRE-SD supports Cortex-A9 processor through UART1 and Cortex-M4 processor through UART2. i.MX 7Dual SABRE-SD supports Cortex-A7 processor through UART1 and Cortex-M4 processor through UART2. i.MX 6UltraLite, 6ULL, and 6ULZ EVK boards support Cortex-A7 processor through UART1. i.MX 6 SABRE-AI supports console through internal Debug UART 4. i.MX 7ULP EVK supports through LPUART. There are two LPUARTs on the i.MX 7ULP EVK board. LPUART0 is connected to Arm Cortex-M4 domain and LPUART4 to Arm Cortex-A7 domain. i.MX 8M Mini EVK supports CA53 through UART2 and Cortex-M4 through UART4. i.MX 8M Quad supports Cortex-A53 processor through UART1 and Cortex-M4 processor through UART2. i.MX 8QuadMax, 8QuadXPlus, and 8DualX use LPUART. i.MX 8QuadMax and 8QuadXPlus support Cortex-A53 processor through UART0 and Cortex-M4 processor through UART2. i.MX 8M Nano supports Cortex-A53 through UART2 and Cortex-M7 through UART4. i.MX 8M Plus supports Cortex-A53 through UART2 and Cortex-M7 through UART4. i.MX 8DXL supports Cortex-A35 through UART0 and Cortex-M4 through M40_ UART0. i.MX 8ULP supports Cortex-A35 through LPUART5. i.MX 91, i.MX 93, and i.MX 95 support Cortex-A55 through LPUART1.
Power Management drivers		
Anatop Regulator	All i.MX 6 All i.MX 7	Supports Anatop regulator management.

Table 8. Supported features*...continued*

Feature	Supported board	Comment
Lower Power mode	All i.MX 6 All i.MX 7 All i.MX 8 All i.MX 9	Supports standby mode and dormant (mem) mode on i.MX 6, i.MX 7, i.MX 8, i.MX 91, i.MX 93, and i.MX 95 boards.
Low Drive mode	i.MX 93	The system runs at low drive mode frequency and voltage.
CPUIdle	All i.MX 6 All i.MX 7 All i.MX 8	2-level CPUIdle supported: purely WFI and WFI with wait mode enabled.
CPUFreq	All i.MX except for 8ULP, i.MX 91, i.MX 93, and i.MX 95	CPUFreq can be used for CPU frequency adjustment. The Interactive governor is added and enabled by default.
BusFreq	All i.MX 6 7D-SABRE-SD All i.MX 8M	Supports the system bus clock frequency scaling.
Battery charging	All i.MX 6 All i.MX 7 All i.MX 8M i.MX 8ULP	Supports battery charge type detection.
Networking drivers		
ENET	All i.MX 6 7D-SABRE-SD All i.MX 8 All i.MX 9	i.MX 6Quad/SoloX board supports AR8031 PHY, i.MX 6UltraLite EVK board supports KSZ8081 PHY, and i.MX 7Dual SABRE-SD board supports BCM54220 PHY. i.MX 6SoloX SABRE-SD, SABRE-AI, and i.MX 7Dual SABRE-SD support AVB features. i.MX 8 supports Atheros AR8031 PHY with 10/100/1000 bps mode, NXP automotive PHY TJA1100 PHY, and AVB features. For i.MX 8DXL, it has pin conflict with SD card. i.MX 93 supports TJA1103 SDBR RMII and SJA1105Q-EVB RGMII.
ENETC	i.MX 95	i.MX 95 supports RTL8211 PHY RGMII, AQR113C PHY 10GBASE-R, and TJA1103 SDBR RGMII and RMII. It also supports TSN features like 802.1 Qav, 802.1 Qbv, 802.1 Qci, and 802.1 Qbu.
EQOS_TSN	i.MX 8M Plus i.MX 8DXL All i.MX 9	i.MX 8DXL supports AR8031 PHY, i.MX 8M Plus supports RTL8211FDI. Supports Ethernet TSN features. For i.MX 8DXL, it has pin conflict with SD card.
IEEE 1588	All i.MX 6 All i.MX 7 All i.MX 8 All i.MX 9	Supports Linux PTP stack. Supports IPv4, IPv6, and IEEE 802.3 transport. Supports E2E, and P2P transparent clock. Supports IEEE802.1AS-2011 in the role of end station.
PCIe	All i.MX except for 6SLL, 6UL, 6ULL, 6ULZ, 8M Nano, i.MX 91, and i.MX 93	With the platform that supports PCIe module. For i.MX 6 and 7, the default kernel configuration does not enable PCIe. The i.MX 8 defconfig does enable PCIe. For EP/RC validation on i.MX 8, use a converter cable that converts from standard PCIe interface to M.2. • EP can be initialized/enumerated by RC. • EP can access the memory of RC.

Table 8. Supported features*...continued*

Feature	Supported board	Comment
		• RC can access the memory of EP. • EP can trigger MSI, and the triggered MSI can be captured by RC.
MediaLB	6SABRE-AI 8QuadXPlus	On i.MX 6SABRE-AI, CPU1 supports MLB 150 and MLB 25/50. On i.MX 6SABRE-AI, CPU2 and i.MX 6QuadPlus SABRE-AI support MLB 25/50 only.
FlexCAN	All i.MX 6 7D-SABRE-SD 8QuadMax 8QuadXPlus 8M Plus All i.MX 9	Supports one CAN with the default device tree on i.MX 6SABRE-AI. Supports both CANs using the FlexCAN device tree but has a pin conflict with FEC. Supports with the default device tree on i.MX 6SoloX-SD, 7Dual SABRE-SD, 6Ultre Lite EVK, and 6ULL EVK. With the platform that supports the FlexCAN module, FlexCAN supports CANFD mode.
Wi-Fi/Bluetooth wireless technology	All i.MX	Supports the NXP SDIO IW612 (tested with Murata LBES5PL2EL) on i.MX 91, i.MX 93, i.MX 95 15x15 EVK, i.MX 8M Nano LPDDR4 EVK, and i.MX 6ULL. Supports the NXP SDIO 88W8801 (tested with Murata LBWA0ZZ2DS with Murata M.2-to-usd adapter on i.MX 6ULL). Supports the NXP SDIO IW416 (tested with Murata LBEE5CJ1XK on i.MX 8ULP, and Murata LBEE5CJ1XK with Murata M.2-to-usd adapter on i.MX 6ULL). Supports the NXP SDIO 88W8997 (tested with Murata LBEE5XV1YM) on i.MX 8M Plus. Supports the NXP PCIe 88W9098 (tested with Murata LBEE5ZZ1XL) on i.MX 8M Plus, i.MX 8M Quad WEVK, i.MX 8QuadMax, i.MX 8QuadXPlus, and i.MX 8DXL, and (tested with U-Blox JODY-W3) on i.MX 95 19x19 EVK. Supports the NXP SDIO 88W9098 (tested with Murata LBEE5ZZ1XL) on i.MX 8M Plus. Supports the NXP PCIe 88W8997 Wi-Fi/Bluetooth SoC (tested with Murata LBEE5 XV1YM) on i.MX 8M Quad, and (tested with Azurewave AW-CM276MA-PUR) on i.MX 8M Plus. Supports the NXP SDIO 88W8987 Wi-Fi/Bluetooth SoC (tested with Murata LBEE5 QD1ZM) on i.MX 6, i.MX 7Dual, i.MX 7ULP, and (tested with Azurewave AW-CM358) on i.MX 8M Mini LPDDR4 EVK and i.MX 8M Nano LPDDR4 EVK. All the i.MX 6 boards require board modifications to support Bluetooth and to boot with the Wi-Fi/Bluetooth device tree.
DPDK	8M Mini 8M Plus 8DXL i.MX 91 i.MX 93 i.MX 95	Userspace Ethernet FEC, QOS, and ENETC drivers • DPDK version 22.11 • i.MX 8M Mini supports ENETFEC Ethernet interface. • i.MX 8DXL supports ENETQOS Ethernet interface. • i.MX 8M Plus, i.MX 93, and i.MX 91 support ENETFEC and ENETQOS Ethernet interfaces. • i.MX 95 supports ENETC ethernet interface. • `l2fwd`, `l3fwd`, and `testpmd` applications supported. • i.MX 93 and i.MX 95 support the DPDK-FPR application. • i.MX 95 supports the MTCP stack. For details on executing `l2fwd`, `l3fwd`, and `testpmd` applications, see the `dpdk/nxp/README` file. For more details, see Section "Data Plane Development Kit (DPDK)" in the *i.MX Linux Reference Manual* (RM00293).
Security drivers		
CAAM	All i.MX except for i.MX 6	Cryptographic Acceleration and Assurance Module.

Table 8. Supported features*...continued*

Feature	Supported board	Comment
	ULL/6ULZ/6 SLL/91/93/95	
SNVS	All i.MX 6 except for 6 ULL/6ULZ/6 SLL All i.MX 7 All i.MX 8M	Secure Non-Volatile Storage.
BBSM and BBNSM	All i.MX 9	Battery Backed Security Module for secure and non-secure storage.
SIMv2	6UltraLite 7D-SABRE-SD	Smart Card Interface.
EMVSIM	8QuadMax	Smart Card Interface.
Sound drivers and DSP		
DSP	8QuadXPlus 8QuadMax 8M Plus 8ULP	One HiFi 4 DSP
AK5558 AK4497 AK4458 AK5552	All i.MX 8M	Supported on Audio board but AK4497 and AK4458 on current audio board cannot work for i.MX 8M Nano and 8M Plus. AK5552 is only supported on 8M Plus.
WM8524 WM8960 SAI WM8962 SAI	All i.MX 8M	Supports playback.
WM8962/SSI WM8960/SSI	6SABRE-SD 6SoloX-SD 7D-SABRE-SD 6UltraLite 6ULL 6ULZ 6SLL 7ULP 8ULP	Supports playback.
SAI/MQS	8QuadMax i.MX 93	Supports playback.
S/PDIF	6SABRE-SD 6SABRE-AI 8QuadMax 8QuadXPlus 8ULP All i.MX 8M i.MX 91 i.MX 93	Supports 16 bit and 24 bit stereo playback from 32 kHz to 48 kHz sample rate. Supports 24 bit stereo record from 16 kHz to 96 kHz.

Table 8. Supported features*...continued*

Feature	Supported board	Comment
ASRC	6SABRE-AI 6SoloX-SD 6UltraLite 6ULL 6ULZ 8QuadMax 8QuadXPlus 8M Nano 8M Plus	Supports sample rates conversion from 5 kHz to 192 kHz and output sample rates from 32 kHz to 192 kHz. Supports ALSA plug-in library playback.
ESAI/CS42888/ CS42448	6SABRE-AI 8QuadMax 8QuadXPlus i.MX 91 i.MX 93 i.MX 95	Supports 16 bit, 24 bit PCM format, channel from 2 to 6, and sample rate from 8 kHz to 192 kHz for playback with ASRC P2P. Supports sample rate from 8 kHz to 96 kHz for record and playback without ASRC. Supports 4 channels input and 8 channels output. Supports full duplex operations. Supports amixer alsamixer control from user space. i.MX 91 and i.MX 93 support CS42448. i.MX 95 19x19 EVK supports CS42888.
SAI/MQS/WM8962	6SoloX-SD 7D-SABRE-SD 6UltraLite 6ULL 6ULZ 7ULP All i.MX 8M 8QuadMax 8QuadXPlus i.MX 91 i.MX 93	Supports 16 bit, 24 bit, and 32 bit PCM format. Supports sample rate from 8 kHz to 96 kHz for record and playback. Supports full duplex operations. Supports amixer alsamixer control from user space. Supports clock control. Supports MQS only on i.MX 6 and i.MX 7. Supports WM8962 on i.MX 8QuadMax and i.MX 8M Plus.
AMIX	8QuadMax 8QuadXPlus	Supports 16 bit, 18 bit, 20 bit, 24 bit, and 32 bit PCM format. Supports sample rate from 8 kHz to 96 kHz for record and playback. Supports amixer alsamixer control from user space.
HDMI Audio	6SABRE-SD 6SABRE-AI 7ULP 8QuadMax 8M Quad 8M Plus	For i.MX 8QuadMax, it is not supported on the reference board but is able to add to the custom board. i.MX 8M Quad supports audio playback through HDMI.
eARC	8M Plus	i.MX 8M Plus supports audio receive from eARC.
Audio HAT	i.MX 91 i.MX 93	Supports CS42448, SPDIF, PDM MIC.
8MIC-REVE	8M Nano 8M Mini 8M Plus i.MX 93	Supports PDM MIC recording.
Input device drivers		

Table 8. Supported features*...continued*

Feature	Supported board	Comment
USB devices	All i.MX	Supports USB mouse and USB keypad through USB ports.
Touch panel	All i.MX	6SABRE-SD and 6SABRE-AI support EGalaxy capacitive touch screen. 7Dual SABRE-SD supports E Ink touch screen with a separate package download. 6SoloX SABRE-SD supports LVDS panel. 7ULP EVK supports touch through DSI panel. All MIPI panels on i.MX 8M support Touch. i.MX 93 11x11 EVK supports MIPI Panel TS and LVDS panel TS. i.MX 93 14x14 EVK supports MIPI Panel TS. i.MX 95 19x19 EVK supports MIPI Panel TS. i.MX 95 15x15 EVK supports MIPI Panel TS. i.MX 95 19x19 Verdin supports MIPI Panel TS.
Keypad	6UltraLite 7D-SABRE-SD 7ULP	Supports the resistive touch panel.
Storage drivers		
FlexSPI-NOR	6SoloX-SD 6UltraLite 6ULL 6ULZ 7D-SABRE-SD All i.MX 8 i.MX 93 i.MX 95	i.MX 6SoloX SABRE-SD supports QSPI2. i.MX 6UltraLite EVK supports QSPI1. i.MX 7Dual SABRE-SD supports QSPI1. i.MX 8QuadXPlus, 8M Quad, 8M Mini, and 8M Plus support FlexSPI1. i.MX 8M Mini supports NOR Flash Boot. i.MX 93 11x11 EVK, 14x14 EVK, and 9x9 QSB support M.2 FlexSPI-NOR (MT25 QU512A) card. i.MX 95 19x19 EVK and 15x15 EVK support FlexSPI NOR.
SPI-NOR	6SABRE-AI	Supports M25P32. On i.MX 6SABRE-SD Dual/Quad/DualLite, there is a pin conflict for supporting SPI-NOR.
NAND	6SABRE-AI 7D-SABRE-SD 8QuadXPlus 8M Quad 8M Mini 8DXL DDR3L	Normal NAND and ONFI NAND asynchronous mode with BCH40/BCH62.
Parallel NOR	6SABRE-AI 8QuadMax	Supports Parallel NOR by using the EIM interface on i.MX 6 SABRE-AI.
SATA	6SABRE-SD 6SABRE-AI 8QuadMax	i.MX 6DualQuad SABRE-SD and SABRE-AI, i.MX 6 QuadPlus SABRE_SD and SABRE-AI support Serial ATA 2.0. i.MX 8QuadMax supports SATA III (6.0 GB/s).
USB drivers		
USB Host	All i.MX	Supports USB HOST1 and USB OTG host.
USB Device	All i.MX	Supports USB OTG device mode.
USB	All i.MX	Supports USB OTG 2.0, USB Host 2.0 for all i.MX except 8M Plus. All i.MX 8 and i.MX 7ULP EVK boards support Type-C ports. The boards that support USB 3.0 are i.MX 8QuadMax and 8QuadXPlus MEK boards, 8M Quad and 8M Plus EVK boards, and i.MX 95 EVK boards.

Table 8. Supported features*...continued*

Feature	Supported board	Comment
		USB Host mode: MSC, HID, UVC, and USB audio. USB device mode: MSC, Ethernet, and Serial. USB OTG pin detect support for Dual-role switch at USB2.
Graphics and Video drivers		
GPU	6SABRE-SD 6SABRE-AI 7ULP All i.MX 8M 8QuadXPlus 8QuadMax 8ULP i.MX 95 i.MX 93	Graphics Chips Details: See the *i.MX Graphics User's Guide* (UG10159) for more details. Mali G310 and DPU blitter on i.MX 95. PXP blitter on i.MX 93. One GC7000-Lite on 8M Quad. One GC7000-Ultra-Lite on 8M Nano. One GC7000-NanoUltra and GC320 on 8M Mini. One GC7000-Ultra-Lite and GC520l on 8M Plus. Two GC7000XSVX on 8QuadMax. One GC7000-Lite on 8QuadXPlus. One GC7000-NanoUltra and GC328 on 7ULP. GC2000, GC355, and GC320 on 6Dual/6Quad. GC2000+, GC355, and GC320 on 6QuadPlus. GC880 and GC320 on 6Solo/DualLite. GC400T on 6SoloX. The GPU on the chips listed above supports these features that include 2D and 3D hardware acceleration: • Supports EGL 1.5 for fbdev and XWayland. • Supports OpenGL ES1.1. • Supports OpenGL ES2.0 (WebGL 1.0.3 compatible). • Supports OpenGL ES3.0 on all except i.MX 6SoloX, 7ULP, and 8M Mini, which support 2.0 only. • Supports OpenGL ES3.1 i.MX 8QuadMax, 8QuadXPlus, 8DualX, 8M Plus, and 8M Quad. • Supports OpenGL ES3.2 on i.MX 8QuadMax and i.MX 95. • Supports Vulkan 1.3 on i.MX 8QuadMax, 8QuadXPlus, 8DualX, 8M Plus, 8M Quad, 8M Nano, 8ULP, and i.MX 95. • Supports OpenVX on i.MX 8QuadMax and 8M Plus. • Supports OpenVG1.1 on i.MX 6, i.MX 7, and i.MX 8. • Supports OpenCL1.1 on GC2000 on i.MX 6Quad. • Supports OpenCL1.2 on GC2000+ on i.MX 6Quad Plus. • Supports OpenCL3.0 on i.MX 8QuadMax, 8QuadXPlus, 8DualX, 8M Quad, 8M Quad, 8M Nano, 8ULP, and 8M Plus. • Supports OpenCL1.x 2.x 3.x on i.MX 95. • Supports G2D on all except for i.MX 8M Quad and i.MX 8M Nano. ***Note:*** *For i.MX 8,* `wl_shell` *has been removed by the community since Weston 11. The Wayland application needs to covert it to XDG-Shell.*
Frame Buffer Display	All i.MX 6 and 7	MXC Frame buffer driver for IPU V3 on i.MX 6SABRE-SD and i.MX 6SABRE-AI. MXC Frame buffer driver for PXP on i.MX 6SoloX SABRE-SD, i.MX 6UltraLite EVK, i.MX 6ULZ EVK i.MX 6ULL EVK, and i.MX 7Dual SABRE-SD.
Direct Rendering Manager (DRM) Display	All i.MX 8 i.MX 93 i.MX 95	DCSS is used for i.MX 8M Quad. DCNANO is used for i.MX 8ULP. LCDIF is used for all i.MX 8M and i.MX 93. i.MX DPU DRM is used for i.MX 8QuadMax, 8QuadXPlus, and i.MX 95.

Table 8. Supported features*...continued*

Feature	Supported board	Comment
Framebuffer compression	8M Quad	Supports graphic framebuffer compression with DEC400.
VDOA	6SABRE-SD 6SABRE-AI	Supports Video Data Order Adapter for tiling.
LVDS	6SABRE-SD 6SABRE-AI 6SoloX-SD 8QuadMax 8QuadXPlus 8M Plus i.MX 93 i.MX 95	Supports HannStar LVDS panel on i.MX 6. It is the default display if no other video option is set up. Uses the LDB controller. On the SABRE-AI there are two ports. Port 0 is the default. i.MX 8 supports the Mixel controller. i.MX 93 supports LVDS PHY designed by NXP. i.MX 95 supports the WUXGA and WXGA LVDS panels. i.MX 95 Verdin supports the LVDS panel 10 inch. i.MX 95 15x15 EVK supports the BOE-WXGA LVDS panel; i.MX 95 19x19 EVK supports the WUXGA LVDS panel.
HDMI Display	6SABRE-SD 6SABRE-AI 6SoloX-SD 7D-SABRE-SD 7ULP	i.MX 6SABRE-SD, 6SABRE-AI, and 7Dual support on-chip HDMI hardware. i.MX 6SoloX SABRE-SD supports external HDMI hardware. i.MX 7ULP EVK supports HDMI through the MIPI pins with external HDMI hardware.
HDMI/Display Port	8M Quad 8QuadMax 8M Plus	i.MX 8QuadMax supports HDMI/Display audio and on-chip HDMI hardware. i.MX 8M Quad supports HDMI/Display through DCSS. i.MX 8M Plus only supports HDMI.
LVDS to HDMI	8QuadMax 8M Plus 8QuadXPlus i.MX 93 i.MX 95	Uses ITE Driver IT6263. ***Note:*** *For i.MX 95, the Verdin board does not support LVDS-HDMI.*
MIPI to HDMI	All i.MX 8 7ULP i.MX 93 i.MX 95	Uses Advantec ADV7535. Supports 4K converter with Lontium LT9611UXC on i.MX 95.
HDCP	6SABRE-SD i.MX 8M 8QuadMax	Supports HDCP v1.2 specifications on specific HDCP parts. i.MX 8QuadMax can support HDCP v1.4 (for TX) and HDCP v2.2 (for RX and TX).
MIPI-DSI Display	6SABRE-SD All i.MX 7 i.MX 8 i.MX 93 i.MX 95	Supports 2 lanes through MIPI daughter card on i.MX 6 and i.MX 7-SABRE-SD. Supports 2 lanes MIPI DSI with direct connection on i.MX 7ULP. The default display for i.MX 7ULP EVK board is HDMI. MIPI DSI supports with hardware rework. Supports 4 lanes driven by DPU with up to 1080p60 on i.MX 8QuadMax and 8QuadXPlus. Supports 4 lanes driven by LCDIF with up to 720p60 on i.MX 8M Quad. Supports 4 lanes driven by LCDIF up to 1920x1200p60 on i.MX 8M Mini, 8M Nano, and 8M Plus. Supports 4 lanes driven by DCSS with up to 1080p60 on i.MX 8M Quad. Supports RM67191 OLED display panel through the MIPI DSI on i.MX 8. Supports RM67199 OLED display panel through the MIPI DSI on i.MX 8M Mini, 8M Nano, 8M Plus, 8M Quad, 8QuadMax, 8QuadXPlus, and i.MX 93. Supports RM68200 OLED display panel through the MIPI DSI on i.MX 8ULP.

Table 8. Supported features*...continued*

Feature	Supported board	Comment
		Supports RM692C9 OLED display panel through the MIPI DSI on i.MX 95. Supports MIPI Panel DSI 10 inch on the i.MX 95 Verdin board.
Parallel-LCD Display	All i.MX 6 All i.MX 7 i.MX 93	Supports SEIKO WVGA panel. For i.MX 6UltraLite, i.MX 6ULZ, i.MX 6ULL, and i.MX 7Dual SABRE-SD, it supports Embest LCD8000-43T LCD panel.
PxP	6DualLite-SD 6SLL 6SoloX-SD 7D-SABRE-SD 6UltraLite 6ULL 6ULZ i.MX 93	Enables PXP Driver for EPDC. Enables PXP Driver for G2D on i.MX 93. Conforms to DMA engine framework.
EPDC	6DualLite-SD 6SLL 6ULL 6ULZ 7D-SABRE-SD	Supports RGB565 frame buffer format. Supports Y8 frame buffer format. Supports full and partial EPD screen updates. Supports up to 256 panel-specific waveform modes. Supports automatic optimal waveform selection for a given update. Supports synchronization by waiting for a specific update request to complete. Supports screen updates from an alternate (overlay) buffer. Supports automated collision handling. Supports 64 simultaneous update regions. Supports pixel inversion in a Y8 frame buffer format. Supports posterization of the update contents (driving all pixels to either solid black or white). Supports use of a color map to remap Y8 frame buffer contents. Supports 90, 180, and 270 degree HW-accelerated frame buffer rotation. Supports panning (y-direction only). Supports three EPDC driver display update schemes: Snapshot, Queue, and Queue and Merge. Supports user control of the delay between completing all updates and powering down the EPDC. Supports dithering. i.MX 7Dual supports E Ink but requires a separate download. Contact Marketing representative.
VPU	6SABRE-SD 6SABRE-AI All i.MX 8 listed i.MX 9	i.MX 6 Encoder: MPEG-4, H.263, H.264 (AVC/MVC), MJPEG i.MX 8QuadMax and 8QuadXPlus Encoder: H.264 i.MX 6 Decoder: MPEG-4, H.263, H.264 (AVC/MVC), VC-1, MPEG-2, MJPEG, AVS, VP8 i.MX 8QuadMax and 8QuadXPlus Decoder: HEVC, H.264, MPEG4, MPEG2 i.MX 8M Quad Decoder: HEVC, VP9, H.264, VP8, RV9, AVS, MJPEG, H.263 i.MX 8M Mini Decoder: HEVC, VP9, H.264, VP8 i.MX 8M Mini Encoder: H.264, VP8 i.MX 8M Plus Encoder: 1080p60 HEVC, H.264 i.MX 8M Plus Decoder: 1080p60 HEVC, H.264, VP9, VP8 i.MX 95 Decoder: 4Kp60 HEVC/H264, MJPEG i.MX 95 Encoder: 4Kp60 HEVC/H264, MJPEG

Table 8. Supported features*...continued*

Feature	Supported board	Comment
LCDIFv3	8M Plus i.MX 93	Supports through DRM display framework.
DPU	8QuadMax 8QuadXPlus i.MX 95	Supports through DRM display framework and provides 2D Graphics processing. Supports DPR tiling.
DCSS	8M Quad	Supports display frame buffers in memory out to Ultra HD or HDTVs.
DCNANO	8ULP	Supports through DRM display framework.
IPU	6SABRE-SD 6SABRE-AI	On i.MX 6SABRE-SD and i.MX 6SABRE-AI, the IPU driver provides interfaces to access IPU V3 modules.
PRE/PRG driver	6QuadPlus-SD 6QuadPlus-AI	On i.MX 6QuadPlus provides interfaces to support prefetch linear frames or resolve tiled frames for display.
V4L2 Output	All i.MX 6 All i.MX 7	i.MX 6SABRE-SD and i.MX 6SABRE-AI use the IPU post-processing functions for video output. i.MX i.MX 6SoloX SABRE-SD, 6UltraLite, 6ULL, 6ULZ EVKs and i.MX 7D SABRE-SD use the PXP post-processing functions for video output. i.MX 7ULP EVK uses MIPI connection for V4L2 output.
Video Capture drivers		
V4L2 Capture	All i.MX	Supports 2 cameras on i.MX 6SABRE-SD and SABRE-AI. Supports 1 camera on i.MX 6SoloX SABRE-SD, 6UltraLite EVK, 6ULL EVK, 6ULZ EVK and 7D-SABRE-SD, and i.MX 8M Mini. Supports 2 cameras on i.MX 8M Quad and i.MX 8M Plus and 1 camera on i.MX 8M Mini, and 8M Nano. Supports 4 cameras on i.MX 8QuadXPlus and i.MX 95. Supports 8 cameras on i.MX 8QuadMax. Supports 1 parallel camera on i.MX 91. Supports 1 MIPI camera or 1 parallel camera on i.MX 93.
MIPI Camera CSI	6SABRE-SD 7D-SABRE-SD 7ULP All i.MX 8M 8QuadMax 8QuadXPlus i.MX 93 i.MX 95	Supports 2-lane CSI MIPI camera OV5640 with 720p30, 640x480@30, 320x240@30, 720x480@30, 1080p@30, 2592x1944@15, 176x144@30. Supports CSI MIPI camera OV10635 with 1280x800@30, ov10635 max supports 1280x800@30, and ISI does not support upscale, so 1080p, 2592x1944 cannot be supported on i.MX 8QuadMax and 8QuadXPlus. Supports 4-lane Basler CSI MIPI cameras AR0821 with 4K@30 with ISP on i.MX 8M Plus. Supports 4-lane CSI MIPI camera OS08A20 with 4K with ISP on i.MX 8M Plus and i.MX 95. Supports 2-lane CSI MIPI camera AP1302+AR0144 with 1080p@45, 1280x800@60, 720P@60 and 640x480@60 on i.MX 93. Supports 4-lane CSI MIPI camera AP1302+AR0144 with 1080p@60, 1280x800@60 on i.MX 95. Supports 4-lane CSI MIPI camera OX03C10 + MAX96717/MAX96724 GMSL2 SerDes (4 cameras) with ISP on i.MX 95.
Parallel CSI	6SABRE-SD 6SoloX-SD 6UltraLite 6ULL 6ULZ	Supports OV5640 camera sensor. i.MX 93 and i.MX 91 do not support OV5640 camera sensor. They support MT9M114 with 320x240@25, 640x480@25, 800x480@25, 1280x720@25.

Table 8. Supported features*...continued*

Feature	Supported board	Comment
	6SLL 8QuadXPlus i.MX 91 i.MX 93	
ISI	8QuadMax 8QuadXPlus 8M Nano 8M Plus i.MX 91 i.MX 93 i.MX 95	Supports capture through ISI controller. ISI Mem2Mem function is supported on i.MX 8M Plus and i.MX 95.
ISP	8M Plus i.MX 95	Supports capture through ISP controller on i.MX 8M Plus and i.MX 95. Supports stream configuration using Libcamera on i.MX 95. Supports image enhancing algorithms: • i.MX 8M Plus: AE/AF/AWB/DEWARP/LSC/CPROC, etc. • i.MX 95: AWB/AGC/AEC
IPU-CSI	6SabreSD	Supports capture through IPU CSI controller.
TV-IN	6SABRE-AI 8QuadMax	Supports TV-IN through ADV7180 on the 6SABRE-AI with bt656, NTSC, and PAL. Supports TV-IN through ADV7180 on the 8QuadMax with NTSC, and PAL.
General drivers		
uSDHC	All i.MX	Supports SD2.0 and SDXC. Supports SD3.0 on all i.MX except 6SABRE-SD. Supports eMMC 1bit/4bit/8bit SDR/DDR mode. i.MX 6SABRE-SD is soldered, i.MX 6SABRE-AI uses the daughter card, and i.MX 6SoloX-SD is not soldered. Supports eMMC4.5 on i.MX 6SoloX-SD. Supports eMMC5.0 on i.MX 7Dual SABRE-SD. Supports eMMC5.1 on i.MX 8, i.MX 8M, and i.MX 9.
Watchdog	All i.MX	Supports Watchdog reset.
I2C	All i.MX	Supports I2C master. Supports PCA9646 I2C switch on i.MX 8QuadXPlus.
SPI	All i.MX	Supports SPI master mode and slave mode. i.MX 95 does not support SPI slave mode.
I3C	8ULP i.MX 91 i.MX 93	Supports I3C master with SDR speed.
Pulse Width Modulator	All i.MX	Supports the backlight driver through PWM.
ADC	6SoloX-SD 7D-SABRE-SD 6UltraLite 6ULL 6ULZ 7ULP 8QuadMax	Supports the ADC driver.

Table 8. Supported features*...continued*

Feature	Supported board	Comment
	8QuadXPlus i.MX 95	
Temperature monitor	All i.MX	Pre-calibrated. See the "Thermal Driver" chapter in *i.MX Linux Reference Manual* (RM00293) for more information.
Accelerometer	6SABRE-SD 6SABRE-AI 6SoloX-SD 6UltraLite 6ULL 6ULZ 7D-SABRE-SD 7ULP 8QuadXPlus 8QuadMax	Supports the MMA8451 sensor on i.MX 6SABRE and i.MX 6SoloX. Supports the FXLS8471Q sensor on 6UltraLite EVK, 6ULZ and 6ULL EVK. Supports the FXOS8700 sensor on the i.MX 7. Supports the FXOS8700 sensor on the i.MX 8.
GPIO Expander	6SABRE-SD 6SABRE-AI 7D-SABRE-SD 8QuadMax 8QuadXPlus i.MX 93 i.MX 95	Supports the MAX7310 GPIO expander on i.MX 6 SABRE-SD and SABRE-AI. Supports the 74LV595 GPIO expander on i.MX 7Dual SABRE-SD. Supports PCA9557 and PCA6416 on i.MX 8. Supports ADP5585 and PCAL6524 on i.MX 93. Supports ADP5585/PCAL6408/PCAL6416/PCAL6524 on i.MX 95.
SNVS RTC	All i.MX 6 All i.MX 7 All i.MX 8	SNVS is a block that interfaces with CAAM and SRTC.
BBNSM RTC	All i.MX 9	-
Ambient Light Sensor	6SABRE-SD 6SABRE-AI 6SoloX-SD 8QuadMax 8QuadXPlus	Supports the ISL29023 sensor on i.MX 6 SABRE-SD, SABRE-AI, and 6 SoloX boards. Supports the ISL29023 sensor on i.MX 8QuadMax and i.MX 8QuadXPlus boards
Gyroscope Sensor	All i.MX 7 8ULP i.MX 93	Supports FXA2100 gyroscope sensor. Supports lsm6dso_gyro gyroscope sensor on i.MX 8ULP and i.MX 93.
Pressure Sensor	7D-SABRE-SD 8QuadMax 8QuadXPlus	Supports MPL3115 pressure sensor.
Magnetometer Sensor	i.MX 6	Supports MAG3110 magnetometer sensor on all i.MX 6 except 6SLL.
AM/FM module	6SABRE-AI	Supports the SI4763 AM/FM module. Supports FM by using the SSI interface.

5 U-Boot and Device Trees

This section describes the different U-Boots and device trees, as well as different kernel and boot parameters.

5.1 U-Boot configurations

In the following table, the U-Boot configurations are listed for each machine configuration. The machine configurations are provided through the Yocto Project layers in the `meta-freescale` and `meta-imx` layers in the `conf/machine` subdirectory.

Table 9. U-Boot configurations

U-Boot configuration for Boot device	Description	Supported machine configuration

`sd`	`sd` supports boot from an SD card. This is the default U-Boot configuration.
	For boards supporting eMMC, such as i.MX 6QuadPlus/Quad/DualLite, SD boot can be flashed in eMMC for boot from eMMC instead of an SD card.
		`imx6qsabresd`, `imx6qpsabresd`, `imx6dlsabresd`
		`imx6qsabreauto`, `imx6qpsabreauto`, `imx6dlsabreauto`
		`imx6sllevk`
		`imx6sxsabresd`
		`imx7dsabresd`
		`imx6ulevk`
		`imx6ull14x14evk`
		`imx6ullz4x14evk`
		`imx7ulpevk`
		`imx8qmmek`
		`imx8qxpmek`, `imx8qxpc0mek`
		`imx8mqevk`, `imx8mqwevk`
		`imx8mmevk`
		`imx8mnevk`
		`imx8mpevk`
		`imx8dxlevk`, `imx8dxlb0-ddr3l-evk`, `imx8dxlb0-lpddr4-evk`
		`imx8dxmek`, `imx8dxl-orangebox`
		`imx91-11x11-lpddr4-evk`, `imx91-9x9-lpddr4-qsb`, `imx93-11x11-lpddr4x-evk`, `imx93-14x14-lpddr4x-evk`, `imx93-9x9-lpddr4-qsb`
		`imx95-19x19-lpddr5-evk`, `imx95-15x15-lpddr4-evk`, `imx95-19x19-verdin-evk`

`spi-nor`	Supports booting from SPI-NOR.	`imx6qsabreauto`, `imx6dlsabreauto` `imx6qpsabreauto`
`eim-nor`	Supports booting from Parallel NOR.	`imx6qsabreauto`, `imx6dlsabreauto`, `imx6solosabreauto` `imx6qpsabreauto`

`nand`	Supports booting from NAND.	`imx6qsabreauto`, `imx6dlsabreauto`, `imx6solosabreauto` `imx6qpsabreauto`
		`imx7dsabresd`
		`imx6ull14x14evk`
		`imx8dxlb0-ddr3l-evk`

`sata`	Supports booting from SATA.	`imx6qsabresd`, `imx6qpsabresd` `imx6qsabreauto`, `imx6qpsabreauto`
`qspi`	Supports booting from QSPI. Booting from the Arm Cortex-M4 processor is supported through QSPI2 and QSPI1. Use U-Boot command `bootaux` to boot the Arm Cortex-M4 processor.	`imx6sxsabresd` with QSPI2 `imx7dsabresd` with QSPI1 `imx6ulevk` with QSPI1 `imx6ulz14x14evk` with QSPI1

Table 9. U-Boot configurations*...continued*

U-Boot configuration for Boot device	Description	Supported machine configuration
	The booting address for QSPI2 is 0x78000000. The booting address for QPIS1 is 0x68000000.	
emmc	Supports boot from eMMC. i.MX 8M Plus, i.MX 8M Mini, and i.MX have eMMC populated by default. Users need to populate it if needed. For other boards supporting eMMC such as i.MX 6QuadPlus/Quad/DualLite, SD boot is used.	imx6sxsabresd imx7dsabresd imx6ull14x14evk imx6ulz14x14evk imx7ulpevk imx8qmmek imx8qxpc0mek imx8dxlevk imx8mpevk imx8mmevk imx8ulpevk imx8dxlb0-lpddr4-evk imx8dxl-orangebox imx91-11x11-evk imx93-9x9-qsb imx93-11x11-lpddr4x-evk, imx93-14x14-lpddr4x-evk, imx93-9x9-lpddr4-qsb, imx93-11x11-lpddr4x-pf0900-evk imx95-19x19-evk, imx95-15x15-lpddr4-evk, imx95-19x19-verdin-evk
m4fastup	Supports booting from Arm Cortex-M4 processor by disabling QSPI2 from using Arm Cortex-M4 processor.	imx6sxsabresd
epdc	Supports EPDC splash screen in U-Boot.	imx7dsabresd
flexspi (fspi)	Supports FlexSPI boot.	imx8qmmek imx8qxpmek imx8qxpc0mek imx8dxlb0-lpddr4-evk, imx8dxla1-lpddr4-evk imx8mmevk imx8mnevk imx8mpevk imx8ulpevk imx93-14x14-lpddr4x-evk imx95-19x19-evk
ecc	Supports DDR ECC.	imx91-11x11-lpddr4-evk imx93-11x11-lpddr4x-evk, imx93-9x9-lpddr4-qsb, imx93-11x11-lpddr4x-pf0900-evk

5.2 Kernel device trees

The following table describes the kernel and device trees included in this release. A list of several device tree files is provided for each board to offer examples on how to handle different pin conflicts due to pin muxing.

Table 10. Kernel and device tree configurations

Kernel and device tree configuration	Description
Kernel Binary Image	i.MX 6 and i.MX 7 zImage kernel is built with the `imx_v7_defconfig` in `arch/arm/configs`. i.MX 8 and i.MX 9 Image kernel is built with `imx_v8_defconfig` in `arch/arm64/configs`.
DTB Descriptions	Each reference board has a standard device tree as follows: • `imx6q-sabresd.dtb`, `imx6qp-sabresd.dtb` • `imx6dl-sabresd.dtb` • `imx6q-sabreauto.dtb`, `imx6qp-sabreauto.dtb` • `imx6dl-sabreauto.dtb` • `imx6sx-sdb.dtb` supports the i.MX 6SoloX SABRE-SDB Rev. B board, and `imx6sx-sdb-reva.dtb` supports the SABRE-SDB Rev. A board. • `imx7d-sdb.dtb` supports the i.MX 7Dual SABRE-SDB Rev. C and Rev. D boards, and `imx7d-sdb-reva.dtb` supports the Rev. A board. • `imx6ul-14x14-evk.dtb`, `imx6ul-9x9-evk.dtb` • `imx6ulz-14x14-evk.dtb` • `imx6ull-14x14-evk.dtb` • `imx7ulp-evk.dtb` • `imx8mq-evk.dtb`: Supports both i.MX 8M Quad EVK board and i.MX 8M Quad WEVK board. • `imx8mm-evk.dtb`, `imx8mm-ddr4-evk` • `imx8mn-evk.dtb`, `imx8mn-ddr4-evk.dtb`, `imx8mn-ddr3l-evk.dtb` (for i.MX 8M NanoUltraLite) • `imx8mp-evk.dtb`: Supports single or multiple displays with HDMI, MIPI-DSI-HDMI, and LVDS-HDMI. • `imx8mp-evk-revb4.dtb`: Supports i.MX 8M Plus Rev. B4 board. • `imx8dxl-evk.dtb` • `imx8qm-mek.dtb`: Supports the LVDS-HDMI or MIPI-DSI-HDMI display with the LVDS-HDMI or MIPI-DSI-HDMI converts. The detection is on-the-fly by using the device-tree overlay technology. It is for non-partition boot that `flash.bin` does not include the Cortex-M4 image. • `imx8qm-mek-rpmsg.dtb`: Supports partition reset, and supports the LVDS-HDMI or MIPI-DSI-HDMI display with the LVDS-HDMI or MIPI-DSI-HDMI converts. This requires `flash.bin` to include the Cortex-M4 image. • `imx8qm-mek-revd-rpmsg.dtb` • `imx8qm-mek-revd-ca53.dtb` • `imx8qm-mek-revd-ca72.dtb` • `imx8qm-mek-revd-dsi-rm67191.dtb` • `imx8qm-mek-revd-dsi-rm67199.dtb` • `imx8qm-mek-revd-enet2-tja1100.dtb` • `imx8qm-mek-revd-hdmi-rx-ov5640.dtb` • `imx8qm-mek-revd-hdmi-rx.dtb` • `imx8qm-mek-revd-hdmi.dtb` • `imx8qm-mek-revd-jdi-wuxga-lvds1-panel-rpmsg.dtb` • `imx8qm-mek-revd-jdi-wuxga-lvds1-panel.dtb` • `imx8qm-mek-revd-ov5640.dtb` • `imx8qm-mek-revd-pcie-ep.dtb`

Table 10. Kernel and device tree configurations*...continued*

Kernel and device tree configuration	Description
	• imx8qm-mek-revd-root.dtb • imx8qm-mek-revd-sof-cs42888.dtb • imx8qm-mek-revd-sof-wm8962.dtb • imx8qm-mek-revd-usd-wifi.dtb • imx8qm-mek-revd-usdhc3-m2.dtb • imx8qm-mek-revd.dtb • imx8qxp-mek.dtb: Supports one LVDS-HDMI through the LVDS0-CH0 on the LVDS-HDMI daughter card. It is for non-partition boot that flash.bin does not include the Cortex-M4 image. • imx8qxp-mek-rpmsg.dtb • imx8ulpevk.dtb • imx8ulp-9x9-evk.dtb • imx8dxl-orangebox.dtb • imx8dxl-orangebox-sd.dtb • imx91-11x11-evk.dtb • imx91-9x9-qsb.dt • imx93-11x11-evk.dtb • imx93-11x11-evk-pmic-pf0900.dtb • imx93-9x9-qsb.dtb • imx93-14x14-evk.dtb • imx95-15x15-evk.dtb • imx95-19x19-verdin.dtb • imx95-19x19-evk.dtb: Not the default dtb; supports Bluetooth/Wi-Fi card; does not support any display/camera.
Audio	Enables various audio device trees. • imx8ulp-evk-sof-btsco.dtb: Sound open firmware • imx8mp-ab2.dtb: audio board • imx8mp-evk-sof-wm8960.dtb: Sound open firmware for WM8960 audio • imx8mp-evk-rpmsg.dtb: Supports low-power audio playback. • imx8mp-evk-rpmsg-lpv.dtb Supports low-power voice. • imx8mp-evk-revb4.dtb: Supports WM8962 codec. • imx8mq-evk-ak4497.dtb: Audio board ak4497 codec • imx8mq-evk-pdm.dtb: PDM microphone • imx8mq-evk-audio-tdm.dtb: Audio board TDM • imx8mm-evk-ak4497.dtb: Audio board ak4497 codec • imx8mm-evk-ak5558.dtb: Audio board ak5558 codec • imx8mm-evk-audio-tdm.dtb: Audio board TDM • imx8mn-dd4-evk-ak5558.dtb: Audio board TDM • imx7ulp-evk-wm8960.dtb: Enables WM8960 audio as the default one and disables HDMI audio • imx7d-sdb-reva-hdmi-audio.dtb: Enables HDMI audio as the default one and disables WM8960 audio • imx8mp-evk-revA3-8mic-revE.dtb: For 8MIC audio used on the SCH-46370 REV A3/B new reversions • imx93-14x14-evk-aud-hat.dtb • imx93-11x11-evk-aud-hat.dtb • imx93-11x11-evk-mqs.dtb • imx93-11x11-evk-rpmsg.dtb • imx93-11x11-evk-rpmsg-lpv.dtb

Table 10. Kernel and device tree configurations*...continued*

Kernel and device tree configuration	Description
	• imx93-11x11-evk-pmic-pf0900-aud-hat.dtb • imx93-11x11-evk-pmic-pf0900--mqs.dtb • imx93-11x11-evk-pmic-pf0900--rpmsg.dtb • imx93-11x11-evk-pmic-pf0900--rpmsg-lpv.dtb • imx93-9x9-qsb-aud-hat.dtb • imx93-9x9-qsb-rpmsg-lpv.dtb • imx93-9x9-qsb-rpmsg.dtb • imx93-9x9-qsb-aud-hat.dtb • imx95-19x19-evk-cs42888.dtb • imx95-19x19-evk-rpmsg.dts: Low Power Audio • imx95-19x19-evk-rpmsg-lpv.dts: Low Power Voice • imx95-19x19-evk-sof-wm8962.dts: Sound Open Firmware on the Cortex-M core • imx95-15x15-evk-aud-hat.dts: Audio Hat board. • imx95-15x15-ab2.dts: Audio Board 2 • imx95-15x15-evk-mqs.dts: MQS output • imx95-15x15-evk-rpmsg.dts: Low Power Audio • imx95-15x15-evk-rpmsg-lpv.dts: Low Power Voice • imx91-11x11-evk-aud-hat.dts: Audio Hat Board • imx91-11x11-evk-mqs.dts: MQS output • imx91-9x9-qsb-aud-hat.dts: Audio Hat board
Bluetooth wireless technology Wi-Fi	Enables the Bluetooth wireless technology and Wi-Fi hardware. The followings support NXP PCIe 88W8997 chip inside: • imx8mq-evk-pcie1-m2.dtb • imx8mp-evk.dtb The followings support NXP SDIO 88W8987 chip inside: • imx6q-sabresd-btwifi.dtb • imx6qp-sabresd-btwifi.dtb • imx6dl-sabresd-btwifi.dtb • imx6sll-evk-btwifi.dtb • imx6sx-sabresd-btwifi.dtb • imx6ul-14x14-evk-btwifi.dtb • imx6ull-14x14-evk-btwifi.dtb • imx6ulz-14x14-evk-btwifi.dtb • imx7ulp-evkb.dtb • imx7d-sdb-usd-wifi.dtb • imx8mm-evk.dtb • imx8mn-evk.dtb The following supports NXP SDIO 88w8997 chip inside: • imx8mp-evk-usdhc1-m2.dtb The followings support NXP PCIe 88w9098 chip inside: • imx8mq-evk.dtb (for i.MX 8M Quad WEVK board) • imx8mp-evk.dtb • imx8qm-mek-rpmsg.dtb • imx8qxp-mek-rpmsg.dtb • imx8dxl-evk-rpmsg.dtb • imx95-19x19-evk.dtb The followings support NXP SDIO 88w9098 chip inside: • imx8mp-evk-usdhc1-m2.dtb

Table 10. Kernel and device tree configurations*...continued*

Kernel and device tree configuration	Description
	The followings support NXP SDIO IW416 chip inside: • `imx8ulp-evk.dtb` • `imx6ull-14x14-evk-btwifi.dtb` The followings support NXP SDIO 88w8801 chip inside: • `imx6ull-14x14-evk-btwifi.dtb` The followings support NXP SDIO IW612 chip inside: • `imx8mn-evk-usd-wifi.dtb` • `imx6ull-14x14-evk-btwifi.dtb` • `imx91-11x11-evk.dtb` • `imx91-9x9-qsb.dtb` • `imx93-11x11-evk.dtb` • `imx93-11x11-evk-pmic-pf0900.dtb` • `imx93-9x9-qsb.dtb` • `imx95-15x15-evk.dtb` • `imx95-19x19-verdin.dtb` The following supports NXP SDIO AW611 chip inside: • `imx93-14x14-evk.dtb` The following supports U-Blox M2-JODY-W3 PCIe M.2 9098 chip inside: • `imx95-19x19-evk.dtb`
Video Capture	• `imx8qxp-mek-ov5640.dtb`: Supports one MIPI OV5640 and one parallel OV5640, which indicates to support two cameras. Tested with non-M4 `flash.bin`. • `imx8qm-mek-ov5640.dtb`: Supports one or two OV5640 sensors at the same time. • `imx8qm-mek-hdmi-rx.dtb`: Supports capture from HDMI RX port. `hdprx_enable` must be set to "yes" in U-Boot environment to enable the HDMIRX firmware load. • `imx8mq-evk-mipi-csi2.dtb`: MIPI-CSI2. • `imx8mp-evk-basler.dtb`: one Basler ISP camera (AR0821), reaches up to 4K30. • `imx8mp-evk-dual-basler.dtb`: Dual Basler ISP cameras (AR0821), reaches up to 1080 P60. • `imx8mp-evk-basler-ov5640.dtb`: Dual camera Basler ISP + OV5640. • `imx8mp-evk-os08a20.dtb`: Initial support for one ISP camera - OS08A20. • `imx8mp-evk-dual-os08a20.dtb`: Initial support for dual ISP cameras - OS08A20. • `imx8mp-evk-os08a20-ov5640.dtb`: Initial support for dual cameras OS08A20 + OV5640. • `imx6ul-14x14-evk-csi.dtb`: Avoids the pin conflict between SIM and CSI and enables CSI support for V4L2. • `imx6ul-9x9-evk-csi.dtb`: Avoids the pin conflict between SIM and CSI and enables CSI support for V4L2. • `imx8qxp-mek-rpmsg.dtb`: Supports capture from 4 sensors OV10635 • `imx8qm-mek-rpmsg.dtb`: Supports capture from up to 8 sensors OV10635 • `imx93-11x11-evk.dtb`, `imx93-11x11-evk-pmic-pf0900.dtb`: Support AP1302. • `imx91-11x11-evk-mt9m114.dtb`, `imx91-9x9-qsb-mt9m114.dtb`, `imx93-11x11-evk-mt9m114.dtb`, `imx93-9x9-qsb-mt9m114.dtb`: Support parallel MT9M114 camera. • `imx95-19x19-evk-ap1302.dtb`, `imx95-15x15-evk-ap1302.dtb`: Support AP1302 with miniSAS interface. • `imx95-15x15-evk-ap1302_rpi.dtb`: Supports AP1302 with RPI interface. • `imx95-15x15-evk-ox03c10-isp-adv7535.dtb`, `imx95-19x19-evk-ox03c10-isp-it6263-lvds0.dtb`, `imx95-19x19-verdin-ox03c10-isp-lt8912.dtb`: support OX03C10 with ISP.

Table 10. Kernel and device tree configurations*...continued*

Kernel and device tree configuration	Description
	• imx95-15x15-evk-os08a20-isp-adv7535.dtb, imx95-19x19-evk-os08a20-isp-it6263-lvds0.dtb, imx95-19x19-verdin-os08a20-isp-lt8912.dtb: support camera OS08A20 with ISP and the default display. • imx95-15x15-evk-ox03c10-isp-adv7535.dtb, imx95-19x19-evk-ox03c10-isp-it6263-lvds0.dtb, imx95-19x19-verdin-ox03c10-isp-lt8912.dtb: support camera OX03C10 + MAX96717/MAX96724 GMSL2 SerDes (4 cameras) with ISP and the default display. • imx95-15x15-evk-ox05b1s-isp-adv7535.dtb, imx95-19x19-evk-ox05b1s-isp-it6263-lvds0.dtb, imx95-19x19-verdin-ox05b1s-isp-lt8912.dtb: support 5MP RGBIR camera OX05B1S with ISP and the default display.
Video Display	• imx7d-sdb-epdc.dtb: Pin conflict between HDMI and EPDC. Disable HDMI for EPDC. • imx7d-sdb-reva-epdc.dtb: Pin conflict between HDMI and EPDC. Disable HDMI for EPDC. • imx7d-sdb-mipi-dsi.dtb: Enable MIPI-DSI. • imx7ulp-evk-mipi.dtb: Enable MIPI-DSI. • imx8ulp-evk-epdc.dtb: parallel EPDC panel. • imx8ulp-evk-rk055hdmipi4m.dtb: MIPI DSI panel. • imx8mp-evk-it6263-lvds-dual-channel.dtb: Dual-channel LVDS to HDMI converter. • imx8mp-evk-rm67191.dtb: MIPI MX8-DSI-OLED1 panel. • imx8mp-evk-rm67199.dtb: MIPI MX8-DSI-OLED1A panel. • imx8mp-evk-jdi-wuxga-lvds-panel.dtb: LVDS panel. • imx8qxp-mek-dsi-rm67191.dtb: Supports RM67191 MIPI MX8-DSI-OLED1 display panel. Tested with non-M4 flash.bin. • imx8qxp-mek-dsi-rm67191-rpmsg.dtb: Supports RM67191 MIPI MX8-DSI-OLED1 display panel. Tested with M4 flash.bin. • imx8qxp-mek-dsi-rm67199.dtb: Supports RM67199 MIPI MX8-DSI-OLED1 display panel. Tested with non-M4 flash.bin. • imx8qxp-mek-dsi-rm67199-rpmsg.dtb: Supports RM67199 MIPI MX8-DSI-OLED1 display panel. Tested with M4 flash.bin. • imx8qxp-mek-it6263-lvds0-dual-channel.dtb: Supports the LVDS-HDMI display with LVDS0 dual-channel feature. Tested with non-M4 flash.bin. • imx8qxp-mek-it6263-lvds1-dual-channel: Supports the LVDS-HDMI display with LVDS1 dual-channel feature. Tested with non-M4 flash.bin. • imx8qxp-mek-jdi-wuxga-lvds1-panel.dtb: Supports the dual-channel LVDS panel, connecting the two mini-SAS ports with the LVDS1 CH0 and LVDS1 CH1. Tested with non-M4 flash.bin. • imx8qxp-mek-jdi-wuxga-lvds0-panel.dtb: Supports the dual-channel LVDS panel, connecting the two mini-SAS ports with the LVDS0 CH0 and LVDS0 CH1. Tested with non-M4 flash.bin. • imx8qm-mek.dtb: Supports the LVDS-HDMI or MIPI-DSI-HDMI display with the LVDS-HDMI or MIPI-DSI-HDMI converts. The detection is on-the-fly by using the device-tree overlay technology. • imx8qm-mek-hdmi.dtb: Supports native HDMI TX interface on the CPU board. • imx8qm-mek-jdi-wuxga-lvds1-panel.dtb: Supports the dual-channel LVDS panel, connecting the two mini-SAS ports with the LVDS1 CH0 and LVDS1 CH1. • imx8qm-mek-dsi-rm67191.dtb: Supports RM67191 MIPI MX8-DSI-OLED1 display panel. • imx8qm-mek-dsi-rm67199.dtb: Supports RM67199 MIPI MX8-DSI-OLED1 display panel. • imx8mq-evk-lcdif-adv7535.dts: LCDIF + MIPI-DSI + HDMI adapter.

Table 10. Kernel and device tree configurations*...continued*

Kernel and device tree configuration	Description
	• `imx8mq-evk-dcss-adv7535.dtb`: DCSS + MIPI-DSI + HDMI adapter. • `imx8mq-evk-dcss-rm67191.dtb`: DCSS + MIPI-DSI + RM67191 MX8-DSI-OLED1 panel . • `imx8mq-evk-dcss-rm67199.dtb`: DCSS+MIPI-DSI+ RM67199 MX8-DSI-OLED1A panel. • `imx8mq-evk-lcdif-rm67191.dtb`: LCDIF+MIPI-DSI+ RM67191 MX8-DSI-OLED1 panel. • `imx8mq-evk-lcdif-rm67199.dtb`: LCDIF+MIPI-DSI+ RM67199 MX8-DSI-OLED1A panel. • `imx8mq-evk-dual-display.dtb`: Dual-display-to-HDMI and MIPI-to-HDMI adapter. • `imx8mq-evk-dp.dtb`: Display Port support (Set `video_off=y` in U-Boot with onboard DP connector). • `imx8mq-evk-epd.dtb`: Embedded Display Port support. • `imx8dxl-evk-lcdif.dtb`: Supports the LCDIF panel. • `imx8dx-mek-dsi-rm67191.dtb`: Supports RM67191 MIPI MX8-DSI-OLED1 display panel. Tested with non-M4 `flash.bin`. • `imx8dx-mek-dsi-rm67191-rpmsg.dtb`: Supports RM67191 MIPI MX8-DSI-OLED1 display panel. Tested with M4 `flash.bin`. • `imx8dx-mek-jdi-wuxga-lvds0-panel.dtb`: Supports the dual-channel LVDS panel, connecting the two mini-SAS ports with the LVDS0 CH0 and LVDS0 CH1. Tested with non-M4 `flash.bin`. • `imx8dx-mek-jdi-wuxga-lvds0-panel-rpmsg.dtb`: Supports the dual-channel LVDS panel, connecting the two mini-SAS ports with the LVDS0 CH0 and LVDS0 CH1. Tested with M4 `flash.bin`. • `imx8dx-mek-jdi-wuxga-lvds1-panel.dtb`: Supports the dual-channel LVDS panel, connecting the two mini-SAS ports with the LVDS1 CH0 and LVDS1 CH1. Tested with non-M4 `flash.bin`. • `imx8dx-mek-jdi-wuxga-lvds1-panel-rpmsg.dtb`: Supports the dual-channel LVDS panel, connecting the two mini-SAS ports with the LVDS1 CH0 and LVDS1 CH1. Tested with M4 `flash.bin`.
Video Display	• `imx8mm-evk-rm67191.dtb`: RM67191 MX8-DSI-OLED1 panel. • `imx8mm-evk-rm67199.dtb`: RM67199 MX8-DSI-OLED1A panel. • `imx8mm-ddr4-evk-rm67191.dtb`: DDR4 EVK with RM67191 MX8-DSI-OLED1 panel. • `imx8mn-ddr4-evk-rm67191.dtb`: DDR4 EVK with RM67191 MX8-DSI-OLED1 panel. • `imx8mm-ddr4-evk-rm67199.dtb`: DDR4 EVK with RM67199 MX8-DSI-OLED1A panel. • `imx8mn-evk-rm67191.dtb`: LPDDR4 EVK with RM67191 MX8-DSI-OLED1 panel. • `imx8mn-ddr4-evk-rm67199.dtb`: DDR4 EVK with RM67199 MX8-DSI-OLED1A panel. • `imx8mn-evk-rm67199.dtb`: LPDDR4 EVK with RM67199 MX8-DSI-OLED1A panel. • `imx91-11x11-evk-tianma-wvga-panel.dtb`, `imx91-9x9-qsb-tianma-wvga-panel.dtb`: Supports Tianma TM050RDH03 5.0" WVGA TFT LCD panel. • `imx93-14x14-evk-lvds-it6263.dtb`: Single-channel LVDS-to-HDMI converter. • `imx93-14x14-evk-rm67199.dtb`: MIPI MX8-DSI-OLED1A panel. • `imx93-11x11-evk-rm67199.dtb`, `imx93-11x11-evk-pmic-pf0900-rm67199.dtb`: Support RM67199 MIPI MX8-DSI-OLED1 display panel. • `imx93-11x11-evk-boe-wxga-lvds-panel.dtb`, `imx93-11x11-evk-pmic-pf0900-boe-wxga-lvds-panel.dtb`: Support BOE EV121WXM-N10-1850 LVDS Panel. • `imx93-9x9-qsb-ontat-wvga-panel.dtb`: Supports On Tat Industrial Company 5" WVGA DPI TFT LCD panel. • `imx95-19x19-evk-rm692c9.dtb`, `imx95-15x15-evk-rm692c9.dtb`, `imx95-19x19-verdin-rm692c9.dtb`: Raydium RM692C9 1080x1920 DSI panel. • `imx95-19x19-evk-jdi-wuxga-lvds-panel.dtb`: Dual-channel JDI WUXGA LVDS panel. • `imx95-19x19-evk-it6263-lvds1.dtb`: Single-channel LVDS-to-HDMI converter.

Table 10. Kernel and device tree configurations*...continued*

Kernel and device tree configuration	Description
	• `imx95-19x19-evk-it6263-lvds0.dtb`: Single-channel LVDS-to-HDMI converter. • `imx95-19x19-evk-it6263-lvds-two-disp.dtb`: Two single-channel LVDS-to-HDMI converter. • `imx95-19x19-evk-adv7535.dtb`: DSI-to-HDMI converter. • `imx95-15x15-evk-adv7535.dtb`: Supports DSI to HDMI adapter. • `imx95-15x15-evk-boe-wxga-lvds0-panel.dtb`: Supports BOE WXGA LVDS panel. • `imx95-15x15-evk-boe-wxga-lvds1-panel.dtb`: Supports BOE WXGA LVDS panel. • `imx95-15x15-evk-boe-wxga-lvds-two-panels.dtb`: Supports two BOE WXGA LVDS panel. • `imx95-15x15-evk-lt9611uxc.dtb`: Supports 4K DSI to HDMI adapter. • `imx95-15x15-evk-rm692c9.dtb`: Supports RM692C9 1080x1920 DSI panel • `imx95-19x19-verdin-adv7535.dtb`: Supports DSI-to-HDMI adapter. • `imx95-19x19-verdin-lt8912.dtb`: Supports DSI to HDMI adapter. • `imx95-19x19-verdin-lt9611uxc.dtb`: Supports 4K DSI to HDMI adapter. • `imx95-19x19-verdin-panel-cap-touch-10inch-dsi.dtb`: Supports Torardex 10" capacitive touch DSI panel. • `imx95-19x19-verdin-panel-cap-touch-10inch-lvds.dtb`: Supports Torardex 10" LVDS panel. • `imx95-19x19-verdin-rm692c9.dtb`: Supports RM692C9 1080x1920 DSI panel
eCSPI	Enables eCSPI, which is disabled in the default DTB. • `imx6dl-sabreauto-ecspi.dtb` • `imx6q-sabreauto-ecspi.dtb` • `imx6qp-sabreauto-ecspi.dtb`
LPSPI	Enables LPSPI or LPSPI slave mode, which is disabled in the default DTB. • `imx7ulp-evkb-spi-slave.dtb` • `imx8dxl-evk-lpspi-slave.dtb` • `imx8ulp-evk-lpspi-slave.dtb` • `imx91-11x11-evk-i2c-spi-slave.dtb` • `imx91-9x9-qsb-i2c-spi-slave.dtb` • `imx93-11x11-evk-i2c-spi-slave.dtb` • `imx93-9x9-qsb-lpspi-slave.dtb` • `imx93-9x9-qsb-lpspi.dtb` • `imx93-11x11-evk-pmic-pf0900-lpspi.dtb` • `imx93-11x11-evk-pmic-pf0900-lpspi-slave.dtb`
eMMC	The eMMC chip is DNP by default. This requires hardware modifications to burn the eMMC4.5 chip on the eMMC socket on uSDHC0 and connect eMMC signals as well as disconnect BOOT SD CARD slot signals. • `imx6sx-sdb-emmc.dtb` • `imx7ulp-evk-emmc.dtb` • `imx6ulz-14x14-evk-emmc.dtb`
ENET2	A second ENET port is supported with these device trees. Also the TJA1100 daughter cord enabled a 2nd Ethernet port enabled with TJA device trees listed below: • `imx8qxp-mek-enet2.dtb`: Supports ENET port on base boards. • `imx8qxp-mek-enet2-tja1100.dtb`: ENET2 uses TJA1100 Ethernet PHY. • `imx8qm-mek-enet2-tja1100.dtb`: ENET2 uses TJA1100 Ethernet PHY. • `imx8dxl-evk-enet0.dtb`: Used for Atheros 8031 PHY by connecting IMXAI2ETH-ATH on the ENET0 port. Pin conflict with the SD card.

Table 10. Kernel and device tree configurations*...continued*

Kernel and device tree configuration	Description
ENETC	• `imx95-19x19-evk-tja1103-tja1120.dtb`, `imx95-19x19-evk-tja1103-rmii.dtb`: Support i.MX 95 19x19 EVK ENETC 1 port connecting to the TJA1103-SDBR board. The first DTB is for RGMII mode, and the second DTB is for RMII mode. • `imx95-19x19-evk-netc-rpmsg.dtb`: Supports i.MX 95 19x19 EVK ENETC 2 port shared with Cortex-A and Cortex-M cores. The ENETC 2 PF is owned by Cortex-M, and the two VFs of ENETC 2 is owned by Cortex-A. Must use the custom `flash.bin` file: `imx-boot-variant-netc-imx95-19x19-lpddr5-evk-sd.bin-flash_netc`.
Enetirq	An example to demonstrate GPIO6 workaround for the bug where only the ENET wake-up interrupt request can wake the system from Wait mode. Since the pad GPIO6 is used by I2C3 on the board, these device trees have I2C3 disabled to enable this workaround. • `imx6q-sabresd-enetirq.dtb` • `imx6dl-sabresd-enetirq.dtb` • `imx6dl-sabreauto-enetirq.dtb` • `imx6q-sabreauto-enetirq.dtb`
Flexcan1	Enables flexcan1, which is disabled by default in standard DTB file due to pin conflicts with FEC. • `imx6q-sabreauto-flexcan1.dtb` • `imx6dl-sabreauto-flexcan1.dtb` • `imx6qp-sabreauto-flexcan1.dtb` • `imx93-9x9-qsb-can1.dtb`
Flexcan2	Enables flexcan2 which is disabled by default in standard DTB. • `imx8mp-evk-flexcan2.dtb`
GPMI and EIM_NOR	Enables the GPMI and EIM-NOR. Due to pin conflicts, the GPMI and EIM-NOR are disabled by default. See the device tree file for more details: • `imx6dl-sabreauto-gpmi-weim.dtb` • `imx6q-sabreauto-gpmi-weim.dtb` • `imx6qp-sabreauto-gpmi-weim.dtb` • `imx7d-sdb-gpmi-weim.dtb`, `imx7d-sdb-reva-gpmi-weim.dtb` • `imx6ulz-14x14-evk-gpmi-weim.dtb`
HDCP	Enables the HDMI-HDCP feature. This avoids the pin conflict between the I2C2 and HDCP-DDC pins. • `imx6q-sabresd-hdcp.dtb` • `imx6dl-sabresd-hdcp.dtb` • `imx6qp-sabresd-hdcp.dtb`
Hypervisor Jailhouse	Enables the Jailhouse Hypervisor device trees. • `imx8mq-evk-root.dtb`: DTB for root-cell • `imx8mq-evk-inmate.dtb`: DTB for the inmate cell • `imx8mm-evk-root.dtb`: DTB for root-cell • `imx8mm-evk-inmate.dtb`: DTB for the inmate cell • `imx8mq-evk-root.dtb`: Supports Jailhouse hypervisor • `imx8mm-evk-root.dtb`: Supports Jailhouse hypervisor • `imx8mn-evk-root.dtb`: Supports Jailhouse hypervisor • `imx8mn-evk-inmate.dtb`: DTB for the inmate cell • `imx8mp-evk-inmate.dtb`: DTB for the inmate cell • `imx8mp-evk-root.dtb`: DTB for root-cell • `imx93-11x11-evk-root.dtb`, `imx93-11x11-evk-pmic-pf0900-root.dtb`: DTB for root-cell

Table 10. Kernel and device tree configurations*...continued*

Kernel and device tree configuration	Description
	• imx93-11x11-evk-inmate.dtb, imx93-11x11-evk-pmic-pf0900-inmate.dtb: DTB for inmate-cell • imx95-19x19-evk-inmate • imx95-19x19-evk-root
LDO	In standard DTB file, the LDO bypass is enabled. Therefore, to use LDO device trees on configurations with CPU@1.2GHz, which does not support LDO bypass mode, it is important to enable LDO. The LDO is enabled in the following DTB files: • imx6q-sabresd-ldo.dtb • imx6qp-sabresd-ldo.dtb • imx6ul-9x9-evk-ldo.dtb • imx6dl-sabresd-ldo.dtb • imx6sx-sdb-ldo.dtb • imx6sx-sdb-reva-ldo.dtb
LP UART	Enables LPUART. • imx7ulp-evk-lpuart.dtb • imx91-11x11-evk-lpuart.dts • imx93-11x11-evk-lpuart.dtb • imx93-11x11-evk-pmic-pf0900-lpuart.dtb
Multi-Core, M-Core, and RPMSG	Enables the M-Core and RPMSG • imx8mp-evk-rpmsg.dtb: RPMSG. • imx8dxl-evk-rpmsg: RPMSG. • imx8dx-mek-rpmsg.dtb, imx8dx-mek-it6263-lvds1-dual-channel-rpmsg.dtb, imx8dx-mek-it6263-lvds0-dual-channel-rpmsg.dtb, imx8dx-mek-jdi-wuxga-lvds0-panel-rpmsg.dtb, imx8dx-mek-jdi-wuxga-lvds1-panel-rpmsg.dtb, imx8dx-mek-ov5640-rpmsg.dtb: RPMSG. • imx8qxpc0-mek-rpmsg and imx8qxp-mek-rpmsg with RPMSG. • imx8qxp-mek-rpmsg.dtb: Supports partition reset, RPMSG audio codec on Cortex-M4, and supports the LVDS-HDMI or MIPI-DSI-HDMI display with the LVDS-HDMI or MIPI-DSI-HDMI converts. This requires the flash.bin to include the Cortex-M4 image. • imx8qm-mek-rpmsg.dtb: Supports partition reset, and supports the LVDS-HDMI or MIPI-DSI-HDMI display with the LVDS-HDMI or MIPI-DSI-HDMI converts. This requires flash.bin to include the Cortex-M4 image. • imx8qm-mek_ca53.dtb: Supports four CortexA53 cores only. • imx8qm-mek_ca72.dtb: Supports two Cortex-A72 cores only. You need to build the special boot image through the imx-mkimage tools, and select the flash_ca72 build target. • imx8qm-mek-enet2-tja1100.dtb: Supports the tja1100 ENET daughter card. • imx8mq-evk-rpmsg.dtb: RPMSG. • imx8mm-evk-rpmsg.dtb: RPMSG. • imx8mn-evk-rpmsg.dtb and imx8mn-ddr4-evk-rpmsg.dtb: RPMSG. • imx8dx-mek-rpmsg.dtb • imx6sx-sdb-m4.dtb: Disables the access of ADC 1 and 2, FlexCAN 1 and 2, I2C3, UART 2 and QSPI 2 from Cortex-A processor when Arm Cortex-M4 processor is running. • imx6sx-sabreauto-m4.dtb: Disables the access of ADC 1 and 2, FlexCAN 1 and 2, I2C3, UART 2 and QSPI 2 from Cortex-A processor when Arm Cortex-M4 processor is running. • imx7d-sdb-m4.dtb: Disables the access of ADC 1 and 2, FlexCAN 1 and 2, I2C3, UART 2, and QSPI 2 from Cortex-A processor when Arm Cortex-M4 processor is running. • imx8qxp-mek-sof-wm8960.dtb, imx8qm-mek-sof-wm8960.dtb: Enables playback/record using Sound Open Firmware for HiFi4 DSP with WM8960 codec.

Table 10. Kernel and device tree configurations*...continued*

Kernel and device tree configuration	Description
	• `imx8qm-mek-sof-cs42888.dtb`, `imx8qm-mek-sof-cs42888.dtb`: Enables playback/record using Sound Open Firmware for HiFi4 DSP with CS42888 codec. ***Note:*** *On i.MX 8QuadMax and 8QuadXPlus, multiple partitions are supported. Due to the board design,* `flash.bin` *and the DTB need to be matched. If* `flash.bin` *includes the Cortex-M4 partition, use* `x-rpmsg.dtb`*.* • `imx93-11x11-evk-rpmsg.dtb`, `imx93-9x9-qsb-rpmsg.dtb`, `imx93-11x11-evk-pmic-pf0900-rpmsg-lpv.dtb`, `imx93-11x11-evk-pmic-pf0900-rpmsg.dtb`: RPMSG.
QSPI	Enables DDR Quad mode for Macronix QSPI chip mx25l51245g by setting Quad bit in status register. • `imx7-sdb-qspi.dtb`, `imx7-sdb-reva-qspi.dtb` • `imx7ulp-evk-qspi.dtb`
SD1	Enables sd1 on uSDHC1 on the base board. • `imx7ulp-sd1.dtb`
Touch	Adds tsc2046 touch screen controller support. Because the pin PENIRQ of tsc2046 conflicts with the interrupt pin of HDMI, this disables the HDMI. • `imx7-sdb-reva-touch.dtb`
USB	Enables USB certification for i.MX 6UltraLite. • `imx6ul-14x14-evk-usb-certi.dtb`
DPDK	• `imx8mm-evk-dpdk.dtb`, `imx8mp-evk-dpdk.dtb`: DTB file to export the FEC and QOS Ethernet ports to the Userspace DPDK `enetfec` driver and `enetqos` driver. • i.MX 8M Mini supports only the FEC interface. • i.MX 8M Plus supports both FEC and QOS interfaces.
I3C	Enables I3C, which is not used in the default DTB. • `imx8ulp-evk-i3c.dtb` • `imx8ulp-9x9-evk-i3c.dtb` • `imx91-11x11-evk-i3c.dtb` • `imx91-9x9-qsb-i3c.dtb` • `imx93-11x11-evk-i3c.dtb` • `imx93-9x9-qsb-i3c.dtb` • `imx93-11x11-evk-pmic-pf0900-i3c.dtb`
FlexIO	Enables FlexIO I2C master, which is not used in the default DTB. • `imx8ulp-evk-flexio-i2c.dtb` • `imx93-11x11-evk-flexio-i2c.dtb` • `imx93-11x11-evk-pmic-pf0900-flexio-i2c.dtb` ***Note:*** *FlexIO has exact timing requirement. Using FlexIO on non real-time ROS might cause timing issues. It is not recommended to use it on non real-time ROS.*
FlexSPI NOR	Supports FlexSPI NOR through the M.2 interface. • `imx91-11x11-evk-flexspi-m2.dtb` • `imx91-9x9-qsb-flexspi-m2.dtb` • `imx93-11x11-evk-flexspi-m2.dtb` • `imx93-11x11-evk-pmic-pf0900-flexspi-m2.dtb` • `imx93-9x9-qsb-flexspi-m2.dtb` • `imx93-14x14-evk-flexspi-m2.dtb`
FlexSPI NAND	Supports FlexSPI NAND through the M.2 interface on 11x11 EVK, while no M.2 interface on 9x9 QSB (soldered).

Table 10. Kernel and device tree configurations*...continued*

Kernel and device tree configuration	Description
	• imx91-11x11-evk-flexspi-nand-m2.dtb • imx91-9x9-qsb-flexspi-nand.dtb
LD	Supports the system to be switched to Low Drive (LD) mode. • imx93-11x11-evk-ld.dtb • imx93-11x11-evk-pmic-pf0900-ld.dtb • imx93-9x9-qsb-ld.dtb

5.3 Kernel boot parameters

Depending on the booting or usage scenario, you may need different kernel boot parameters.

The following table describes different boot parameters.

To force the i.MX 6SABRE-AI board to disable SMP to remove overhead, add boot parameters `nosmp`. Disabling CONFIG_SMP configuration can remove further overhead for single core.

Table 11. Common kernel boot parameters

Kernel parameter	Description	Typical value	Used when
`console`	Where to output the kernel logging by printk.	For i.MX 6 SABRE-SD, `console=ttymxc0, 115200` For i.MX 6 SABRE-AI, `console=ttymxc3, 115200` For i.MX 7ULP, `console=ttyLP0, 115200` For i.MX 8QuadMax and i.MX 93 EVK, `console=ttyLP0, 115200 earlycon`	All use cases
`nosmp`	A command-line option of `nosmp` disables SMP activation entirely.	`nosmp`	`CONFIG_SMP` is defined. Use this to disable SMP activation. SMP is activated by default through the CONFIG_SMP configuration.

`ip`	Tells the kernel how or whether to get an IP address.	`ip=none`
		`ip=dhcp`
		`ip=static_ip_address`
			`ip=dhcp` or `ip=static_ip_address` is mandatory in `boot from TFTP/NFS`.

`nfsroot`	Location of the NFS server/directory.	`nfsroot=<ip_address>:<rootfs path>`	Used in "boot from tftp/NFS" together with `root=/dev/nfs`.

`root`	Location of the root file system.	`root=/dev/nfs`
		or
		`root=/dev/mmcblk0p2`
			Used in "boot from tftp/NFS" (that is, `root=/dev/nfs`);
			Used in "boot from SD" (that is, `root=/dev/mmcblk0p2`).
			`root` is set by default by U-Boot to the SD/MMC slot that U-Boot is booting from.

`rootfstype`	Indicates the file system type of the root file system.	`rootfstype=ext4`	Used in "boot from SD" together with "`root=/dev/mmcblkXpY`" (X is the MMC device number while Y is the rootfs partition number.)

Table 11. Common kernel boot parameters*...continued*

Kernel parameter	Description	Typical value	Used when
`rootwait`	Waits (indefinitely) for the root device to show up.	`rootwait`	Used when mounting SD root file system.
`mem`	Tells the kernel how much memory can be used.	None or `mem=864M`	Note: `MemTotal-<mem> - <gpu_ memory>` is reserved.
`max17135`	Configures the maximum of 17135 EPD PMIC pass number and VCOM voltage.	`max17135:pass=[pass_num], vcom=[vcom_uV]` For 7D-SABRE-SD (EPDC panel upgrade to DC4): `max17135:pass=2, vcom=-2370000`	Used when enabling EPDC. pass_num should equal 2 for all IMXEBOOKDC2 cards. vcom_uV, in microvolts, should be equal to the value printed on the cable connector that is attached the E Ink panel being used.
`fec.macaddr`	Tells the Ethernet MAC address.	`fec.macaddr=0x00, 0x04, 0x9f, 0x01, 0x30, 0x05`	Changes the FEC MAC address.
`maxcpus`	[SMP] Maximum number of processors that SMP kernel should use.	`maxcpus=1`	`maxcpus=n : n >= 0` limits the kernel to using 'n' processors. `n=0` is a special situation. It is equivalent to `nosmp`.
`epdc`	Enables EPDC.	`video=mxcepdcfb:E060SCM, bpp=16` For 7D-SABRE-SD (EPDC panel upgrade to DC4): `video=mxcepdcfb:ED060XC8`	Adds to kernel options only if E Ink is the primary display panel. If other display panel is primary, this option may result in a pixel clock conflict and improper display function.
video on 6SABRE-SD	Tells the kernel/driver which resolution/ depth and refresh rate should be used for display port 0 or 1. See the parameter information under `Documentation/ fb/modedb.txt`. Tells the kernel/driver which IPU display interface format should be used.	1. `video=mxcfb0:dev=hdmi, 1920x1080M@60, if=RGB24 video=mxcfb1:dev=ldb, if=RGB666` 2. `video=mxcfb0:dev=ldb, if=RGB666 video=mxcfb1:dev=hdmi, 1920x1080M@60, if=RGB24` 3. `video=mxcfb0:dev=hdmi, 1920x1080M@60, if=RGB24` 4. `video=mxcfb0:dev=ldb, if=RGB666` 5. `video=mxcfb0:dev=lcd, CLAA-WVGA, if=RGB656` 6. `video=mxcfb0:dev=mipi_dsi, TRULY-WVGA, if=RGB24`	1. Used when primarily displaying on HDMI with 1080P60 mode. Secondarily displaying on LVDS with XGA mode. 2. Used when primarily displaying on LVDS with XGA mode. Secondarily displaying on HDMI with 1080P60 mode. 3. Used when primary displaying on HDMI with 1080P60 mode. 4. Used when primary displaying on the HannStar LVDS1. 5. Used when primary displaying on the CLAA-WVGA dumb parallel LCD panel. 6. Used when primary displaying on the TRULY-WVGA MIPI DSI LCD panel. NOTE: GBR24/RGB565/YUV444 represents the display HW interface format. Typical values for certain different display devices are as follows: `TVOUT`: YUV444 `VGA`: GBR24 `HDMI&DVI`: RGB24

Table 11. Common kernel boot parameters*...continued*

Kernel parameter	Description	Typical value	Used when
			`CLAA WVGA LCD`: RGB565 Typical values for `dev=` are shown as follows: `lcd`: LCD interface `ldb`: LVDS `hdmi`: HDMI on-chip or sii902x `dvi`: DVI port `vga`: VGA through TVE `tve`: TVOUT
video on 6SABRE-AI	Tells the kernel/driver which resolution/ depth and refresh rate should be used for display port 0 or 1. See the parameter information under `Documentation/fb/modedb.txt`. Tells the kernel/driver which IPU display interface format should be used.	1. `video=mxcfb0:dev=hdmi, 1920x1080M@60, if=RGB24video=mxcfb1:dev=ldb, if=RGB666` 2. `video=mxcfb0:dev=ldb, if=RGB666video=mxcfb1:dev=hdmi, 1920x1080M@60, if=RGB24` 3. `video=mxcfb0:dev=hdmi, 1920x1080M@60, if=RGB24` 4. `video=mxcfb0:dev=ldb, if=RGB666` 5. `video=mxcfb0:dev=hdmi, 1920x1080M@60, if=RGB24`	1. Used when primarily displaying on HDMI with 1080P60 mode. Secondarily displaying on LVDS with XGA mode. 2. Used when primarily displaying on LVDS with XGA mode. Secondarily displaying on HDMI with 1080P60 mode. 3. Used when primary displaying on HDMI with 1080P60 mode. 4. Used when primary displaying on the HannStar LVDS0. 5. Used when enabling HDMI 1080P60 mode and LVDS0. To enable second display, run `echo 0 > /sys/class/graphics/fb2/blank`. NOTE: GBR24/RGB565/YUV444 represents the display HW interface format. Typical values for certain different display devices are shown as follows: `TVOUT`: YUV444 `VGA`: GBR24 `HDMI&DVI`: RGB24 `CLAA WVGA LCD`: RGB565 Typical values for `dev=` are shown below: `lcd`: LCD interface `ldb`: LVDS `hdmi`: HDMI on-chip or sii902x `dvi`: DVI port `vga`: VGA through TVE `tve`: TVOUT
video on 7D SABRE-SD	Tells the ELCDIF FB driver which LCD panel is in use and which bpp should be used for the Frame Buffer.	`video=mxcfb0:dev=mipi_dsi,TRULY-WVGA,if=RGB24`	Used when primary displaying on the TRULY-WVGA MIPI DSI LCD panel.

Table 11. Common kernel boot parameters*...continued*

Kernel parameter	Description	Typical value	Used when
`dmfc`	Tells the kernel/driver how to set the IPU DMFC segment size.	None Or `dmfc=3`	`dmfc=1` means DMFC_HIGH_RESOLUTION_DC. `dmfc=2` means DMFC_HIGH_RESOLUTION_DP. `dmfc=3` means DMFC_HIGH_RESOLUTION_ONLY_DP. DMFC_HIGH_RESOLUTION_ONLY_DP can only be set by the command line. It is recommended to set this when no IPU connects the two panels. When it is set, each IPU can only connect one panel.
`mtdparts` on 6SABRE-AI	Tells the kernel MTD partition information.	`mtdparts=gpmi-nand:16m(boot), 16m(kernel), 1024m(rootfs), -(user)`	When to enable NAND. The partition: 16m (boot), 16m (kernel), 1024m (rootfs) is an example. You can change it according to your needs.
UART clock from OSC for 6SoloX low power idle and scenario of Linux OS and FreeRTOS running together	Chooses the UART's clock parent.	`uart_from_osc`	This is necessary for low power idle and all use cases with the FreeRTOS running on Arm Cortex-M4 processor. When setting this parameter, UART sources clock from OSC instead of PLL3_80M, and then all PLLs can be off in low power idle.
`transparent_hugepage`	Controls the default behavior of the system with respect to transparent hugepages. See `Documentation/admin-guide/kernel-parameters.txt` for details.	`always`, `madvise`, `never`	THP has big impact for the CMA allocation that cannot be isolated from the CMA region, which leads to CMA allocation failure under some conditions. Users can disable the THP by this kernel command line by setting it to `never` or `madvise` according to system requirement.
`clk-imxXX.mcore_booted snd_pcm.max_alloc_per_card`	Enables clock for Cortex-M core and enlarges the audio buffer for low power audio case.	For i.MX 8ULP: `snd_pcm.max_alloc_per_card=134217728` For i.MX 8M Mini: `clk-imx8mm.mcore_booted snd_pcm.max_alloc_per_card=134217728` For i.MX 8M Nano: `clk-imx8mn.mcore_booted snd_pcm.max_alloc_per_card=134217728` For i.MX 8M Plus: `clk-imx8mp.mcore_booted snd_pcm.max_alloc_per_card=134217728` For i.MX 93: `clk-imx93.mcore_booted snd_pcm.max_alloc_per_card=134217728`	Low Power Audio (LPA) and Low Power Voice (LPV).

Note:

For full command line list, see kernel source tree `Documentation/Kernel-parameter.txt`.

6 Known Issues/Limitations

Read through all hardware-related reference material and ensure that the necessary hardware modifications are made before using the software.

The following tables list some key known issues.

Table 12. Known issues and workarounds for i.MX 6 Family SoC

SoC	Module	Source	Description	Workaround
All	Kernel/BSP	Software	After getting the IP address for WLAN 0, the Ethernet is down and loses IP address with the SD card image.	Use connmanctl to set up WLAN 0 instead of directly calling UDHCPC. See https://wiki.archlinux.org/index.php/ConnMan#Wi-Fi.
All	Bluetooth	Software	Bluetooth cannot work anymore if unloading the Bluetooth NXP UART driver when the HCI0 interface is down.	Run `hciconfig hci0 up`, `hciconfig hci0 reset`, or `bluetootctl power on` before unloading the Bluetooth NXP UART driver.
All	Bluetooth	Hardware	If only the Bluetooth driver is loaded without the Wi-Fi driver, Bluetooth cannot work anymore after resuming, because the whole Wi-Fi/Bluetooth module is powered down by the SDIO bus.	For the SDIO Wi-Fi/Bluetooth module, load the Wi-Fi driver first, and then load the Bluetooth driver.

Table 13. Known issues and workarounds for i.MX 7 Family SoC

SoC	Module	Source	Description	Workaround
i.MX 7 family and i.MX 8 family	Kernel/BSP	Software	After getting IP address for WLAN 0, the Ethernet is down and loses IP address with the SD card image.	Use connmanctl to set up WLAN 0 instead of directly calling UDHCPC. See https://wiki.archlinux.org/index.php/ConnMan#Wi-Fi.

Table 14. Known issues and workarounds for i.MX 8 Family SoC

SoC	Module	Source	Description	Workaround
i.MX 8DXL OrangeBox	Kernel/BSP	Software	The software is unable to write or boot on/from the SD card.	It will be fixed in next release.
i.MX 8QuadMax	Kernel/BSP	Software	RTC Kernel hangs during the suspend resume stress test.	Use a longer wake-up time.
i.MX 8M Plus	PCIe	Software	When PCIe is supported, there is no EP (end point) device connected on the PCIe port.	Add `pcie_cz_enabled=yes` to the kernel command line. The PCIe clocks and power supplies should be kept on. Refer to the workaround of one erratum (Erratum ERR051128).

Table 14. Known issues and workarounds for i.MX 8 Family SoC*...continued*

SoC	Module	Source	Description	Workaround
i.MX 8ULP	Bootloader	Software	The eMMC fastboot does not support warm reboot. eMMC fastboot only supports 4-bit SDR setting.	No issue on A1 part (i.MX 8ULP EVK), but existing on A0.1 part (i.MX 8ULP 9x9 EVK).
i.MX 8ULP	SOF	Software	SOF only supports an 8K Sample rate.	It is a limitation.
i.MX 8ULP	Kernel/BSP	Software	In Linux OS, data cannot be transmitted by FlexIO 100% correctly.	It is a limitation.
i.MX 8ULP	Kernel/BSP	Software	In linux OS, sometimes Ethernet fails to probe when booting up using DTB of FlexIO I2C.	It is a limitation.
i.MX 8DXL DL3	SEC	V2X FW	ECB cipher test fails on V2X_ SHE.	No workaround.
i.MX 8M Mini, 8M Nano, 8M Plus	Low-power audio playback with Cortex-M core	Software	As the LPA needs a large buffer size, which exceeds the default size in ALSA, the LPA sound card probe fails with the default boot command.	Add the parameter `snd_pcm.max_alloc_per_card=134217728` in boot command when booting with `*-rpmsg.dtb` on these platforms.
i.MX 8M Plus	8MIC-REVE board	Software	8MIC-REVE board pin conflicts with UART3 for REVA3, REVB, and higher revision EVK board.	Disable UART3 node in DTS when the 8MIC-REVE board is used with REVA3/REVB or higher.
i.MX 8M, i.MX 8ULP, i.MX 93	ATF	Software	bl31 version uses the Android tag.	Ignore the Android tag, using the Git hash ID in the version strings.
i.MX 8M Quad EVK	Yocto	Software	There is no prebuild `.wic` image for i.MX 8M Quad EVK board.	Burn the `.wic` image for i.MX 8M Quad EVK board, and then update the boot image with `imx-boot-imx8mq-evk-sd.bin-flash_evk`.

Table 15. Known issues and workarounds for i.MX 9 Family SoC

SoC	Module	Source	Description	Workaround
i.MX 93	Headphone detection	Hardware	Headphone detection does not work on the first batch of the REV. B board.	Do hardware rework: Remove R1203, R1204. Jump wire between R1203.2 and R1204.2. Jump wire between R1204.1 and R132.1.
i.MX 93	Audio Hat CS42448	Hardware	CS42448: The playback has an issue with channel swap.	For old SCH-50567, REV A reversion: add an audio cable and swap the L/R channel from the cable. For a new board, reversion already has this rework by default.
i.MX 93	LVDS Touchscreen	Hardware	On SCH-51961 B1 and earlier versions, LVDS touchscreen	Do hardware rework: remove R131, and install R181 with 0Ω/0402.

Table 15. Known issues and workarounds for i.MX 9 Family SoC*...continued*

SoC	Module	Source	Description	Workaround
			cannot report events after touching for several times.	
i.MX 93	TypeC PTN5110 and GPIO expander PCAL65240	Hardware	Keep PTN5110 connected to the PC, and power off and on the board. In some low rate, PTN5110 causes the I2C bus stuck and Linux dump (IRQ storm).	Use the i.MX GPIO for PTN5110 alert# and do not share the GPIO with other modules.
i.MX 93	QT/Yocto	Software	Qt applications are showing graphics issues like flickering and dragging images on i.MX 93 after Qt is upgraded to 6.5.0.	Revert these three commits of the PR (https://github.com/nxp-imx/meta-imx/pull/4/commits).
i.MX 93	Parallel Display	Hardware	Parallel panel: The display is abnormal after it is resumed from suspending and has an obvious flicker after several times of suspending resuming.	This issue is fixed in the i.MX 93 9X9 QSB Rev. A2 board.
i.MX 93	Audio	Hardware	ALSA DAC: The right channel (2nd channel) has voice while playing 1 channel audio file.	This issue is fixed in the EVK V2 board.
i.MX 93 9x9 QSB	Audio	Hardware	CS42448: 192k playback no voice.	Exists on SCH-54852 Rev. A1. Do hardware rework: change R745 from 1 Kohm to 33 ohm.
i.MX 93 9X9 QSB	USB	Hardware	USB DC wake-up test resulted in a board damage.	Exists on SCH-54852 Rev. A1. Do hardware rework: change R314 and C308 to 0 ohm 1206 or short directly.
i.MX 93/i.MX 91	I2C	Hardware	The VBUS of PTN5110 for USB1 and USB2 is kept when powering off the board and connecting the type C cable to the PC, which makes the I2C bus stuck by the PTN5110 in low rate. In such case, devices like audio, camera on I2C, cannot work.	This is a board design issue, and there is no workaround currently. To avoid the impact, when powering off the board, disconnect the USB cable from the USB ports.
i.MX 95	Video	Hardware	The MXC JPEG driver reports the encode timeout issue when running certain CMDs.	This issue will be fixed in next tapeout revision.
i.MX 95	SEC	Software	"Error: wait_for_completion timed out." and "fsl-se-fw v2x-fw0: Failed to start ele rng" occur after system suspend and reboot.	This issue will be fixed in next release.
i.MX 95	SEC	Hardware	System reset occurs during the SMW test.	This issue will be fixed in next tapeout revision.

7 Multimedia

This chapter provides the information on the 4.9.2 multimedia component of the BSP.

The GStreamer version in this release is 1.24.7.

7.1 i.MX GStreamer plugins

Table 16. i.MX GStreamer 1.0 plugins

Plugin	Features
Demux	`aiurdemux`: AIUR universal demuxer plugin support Supports AVI, MKV, MP4, MPEG2, ASF, OGG, FLV, WebM, RMVB `spdifdemux`: Parses IEC937 data into compress audio. Parses IEC958 data into PCM audio or compress audio.
Audio decoder	`beepdec`: unified audio decoder plugin Supports MP3, AAC, AAC+, WMA, AC3, Vorbis, DD+, AMR, RA
Audio encoder	`lamemp3enc`: MP3 encoder plugin
Video decoder	i.MX 6 family: • `vpudec`: VPU-based video decoder plugin i.MX 8QuadXPlus or 8QuadMax: • `v4l2h263dec`: V4L2 H.263 Decoder • `v4l2h265dec`: V4L2 H.265 Decoder • `v4l2h264dec`: V4L2 H.264 Decoder • `v4l2mpeg4dec`: V4L2 MPEG4 Decoder • `v4l2xviddec`: V4L2 XVID Decoder • `v4l2mpeg2dec`: V4L2 MPEG2 Decoder • `v4l2vc1dec`: V4L2 VC1 Decoder • `v4l2h263dec`: V4L2 H.263 Decoder • `v4l2vp8dec`: V4L2 VP8 Decoder • `v4l2jpegdec`: V4L2 JPEG Decode • `v4l2rvdec`: V4L2 RealVideo Decoder • `v4l2spkdec`: V4L2 SPK Decoder i.MX 8M Mini and i.MX 8M Plus: • `v4l2h265dec`: V4L2 H.265 Decoder • `v4l2h264dec`: V4L2 H.264 Decoder • `v4l2vp8dec`: V4L2 VP8 Decoder • `v4l2vp9dec`: V4L2 VP9 Decoder i.MX 8M Quad: • `v4l2h263dec`: V4L2 H.263 Decoder • `v4l2h264dec`: V4L2 H.264 Decoder • `v4l2h265dec`: V4L2 H.265 Decoder • `v4l2mpeg4dec`: V4L2 MPEG4 Decoder • `v4l2mpeg2dec`: V4L2 MPEG2 Decoder • `v4l2jpegdec`: V4L2 JPEG Decode • `v4l2avsdec`: V4L2 AVS Decode • `v4l2vp8dec`: V4L2 VP8 Decoder • `v4l2vp9dec`: V4L2 VP9 Decoder • `v4l2rvdec`: V4L2 RMVB Decoder • `v4l2vc1dec`: V4L2 VC1 Decoder • `v4l2xviddec`: V4L2 XVID Decoder i.MX 95: • `v4l2h264dec`: V4L2 H.264 Decoder • `v4l2h265dec`: V4L2 H.265 Decoder • `v4l2jpegdec`: V4L2 JPEG Decode

Table 16. i.MX GStreamer 1.0 plugins*...continued*

Plugin	Features
	i.MX all: • Software video decoder plugins: uses `gst-libav` plugins
Video encoder	i.MX 6 family: • `vpuenc_h264`: VPU-based AVC/H.264 video encoder • `vpuenc_h263`: VPU-based H.263 video encoder • `vpuenc_mpeg4`: VPU-based MPEG4 video encoder • `vpuenc_jpeg`: VPU-based JPEG video encoder i.MX 8QuadXPlus or 8QuadMax: • `v4l2h264enc`: V4L2 H.264 encoder • `v4l2jpegenc`: V4L2 JPEG Encoder i.MX 8M Mini: • `v4l2h264enc`: VPU-based AVC/H.264 video encoder • `v4l2vp8enc`: VPU-based VP8 video encoder i.MX 8M Plus: • `v4l2h264enc`: VPU-based AVC/H264 video encoder • `v4l2h265enc`: VPU-based HEVC video encoder i.MX 95: • `v4l2h264enc`: VPU-based AVC/H.264 video encoder • `v4l2h265enc`: VPU-based HEVC video encoder • `v4l2jpegenc`: V4L2 JPEG encoder

Audio Source	`pulsesrc`: PulseAudio Audio Source
	Note:
	The PulseAudio server has been replaced by the PipeWire since the L6.6.3_1.0.0 release. Users need to start the PipeWire by running `systemctl --user --now enable pipewire wireplumber pipewire-pulse` for the first time after the bootup.
	The default audio source may not be the expected one. You can set the desired default one:
	`wpctl status`
	`wpctl set-default {ID}`

Audio convert	`imxasrc`: ASRC audio rample rate converter. ***Note:*** *Only supports this plugin on i.MX 8M Plus currently.*

Audio Render	`pulsesink`: PulseAudio Audio Sink
	Note:
	The PulseAudio server has been replaced by the PipeWire since the L6.6.3_1.0.0 release. Users need to start the PipeWire by running `systemctl --user --now enable pipewire wireplumber pipewire-pulse` for the first time after the bootup.
	The default audio sink may not be the expected one. You can set the desired default one:
	`wpctl status`
	`wpctl set-default {ID}`

Video render	i.MX 8 family, i.MX 93, and i.MX 95: • `waylandsink`: video sink based on Wayland interfaces i.MX 8M: • `kmssink`: video sink based on the DCSS KMS driver, only for the second display in dual-display case

Table 16. i.MX GStreamer 1.0 plugins*...continued*

Plugin	Features
	i.MX 6 family: • `overlaysink`: G2D-based video sink plugin • `imxv4l2sink`: V4L2-based video sink plugin i.MX with GPU3D: • `glimagesink`: video sink based on EGL
Video source	i.MX 95: • `libcamerasrc`: libcamera-based video capture source plugin i.MX 8 family and i.MX 9 family: • `v4l2src`: V4L2-based camera source plugin i.MX 6 family: • `imxv4l2src`: V4L2-based camera source plugin
Video convert	i.MX hardware based video convert plugins to perform video color space conversion, resize, rotate, and so on. • `imxvideoconvert_g2d`: GPU2D-based video convert plugin. • `imxvideoconvert_ipu`: IPU-based video convert plugin. • `imxvideoconvert_pxp`: PXP-based video convert plugin. • `imxvideoconvert_ocl`: OpenCL-based video convert plugin. • `autovideoconvert`: select the i.MX hardware based video convert plugins or other video convert plugins according to the input and output format. ***Note:*** *For `imxvideoconvert_ocl`, rotation is not supported currently. CSC, deinterlace, downscale, dewarp, and color range convertion are supported.*
Video compositor	i.MX 2D hardware based video compositor plugins can compose multiple videos into one, support color space conversion, resize, rotate, alpha, z-order, and keep aspect ratio feature at the same time while composition. • `imxcompositor_g2d`: GPU2D-based video compositor plugin • `imxcompositor_ipu`: IPU-based video compositor plugin • `imxcompositor_pxp`: PXP-based video compositor plugin
OpenGL (ES) Plugins	• `gleffects`: GL Shading Language effects plugin • `gldeinterlace`: video deinterlacing based on shaders • `glvideomixer`: compositing multiple videos together • `glcolorconvert`: video color space convert based on shaders • `glcolorbalance`: adjusting brightness, contrast, hue, and saturation on a video stream

Note:

- *To support WMA, AAC+, and RA decoding, install separate packages.*
- *On i.MX 8M Quad, enable video framebuffer compression (DTRC) by using: `kmssink force-hantrotile=true` or `waylandsink enable-tile=true`.*

7.2 i.MX playback example

i.MX provides an example gplay-1.0 application based on GStreamer's high-level API GstPlayer. The example provides the following functions.

Table 17. i.MX playback engine example

Function	Feature
Playback	• Play, Stop • Pause, Resume

Table 17. i.MX playback engine example*...continued*

Function	Feature
	• Fast seek, Accurate seek • Playback rate control (fast forward, fast rewind, slow forward)
Media Info	• Media metadata (artist, year, etc.) • Video Thumbnail • Audio Album Art
Subtitle	• Supports internal and external subtitle
Track Selection	• Audio Track Selection • Video Track Selection • Subtitle Selection
Display Control	• Resize • Rotate [0, 90, 180, 270] (flipping is not supported.)

7.3 i.MX recording engine API

i.MX provides a high-level API set for camera-related applications based on the GStreamer framework. This API set is based on the camerabin, which is from the `gst-plugins-bad` package.

This API can be found at `gst1.0-fsl-plugin/tools/grecorder/recorder_engine.h`.

This API is supported on the i.MX 6, i.MX 8, and i.MX 9 platforms, which have a VPU hardware encoder.

This API set can provide the following functions.

Table 18. Recording engine functions

Function	Feature
Image capture	Captures images from the camera with different resolutions and saves them to JPEG files.
Video recording	Records audio and video into various file formats, supporting (MP3) x (H.264, MPEG4, H.263, MJPEG, HEVC, VP8) x (MP4, MKV, AVI, FLV, TS).
Meta data	Adds the time and date information to the captured image or recorded video.
Endless recording	Records to multiple file segments and specifies the total file segment count and each file's maximum size. It can record a file endlessly, saving to file segments in a loop. This function can only work with the TS file format.
Web camera	Records audio and video, and sends them out through RTP. This function can only work with the TS file format.
Graphic effect	Supports adding the graphic effect in the video and record into the file.
Device selection	Supports selecting different camera and audio sources.

Note:

This recording engine is only available in platforms with VPU.

7.4 Multimedia feature matrix

This section provides feature matrix details of various codecs used for playback.

7.4.1 Parser/Demuxer specifications

The demuxer support of a particular audio or video type requires the availability of the codec.

Table 19. Parser/Demuxer supported audio/video

	Demuxer feature	ASF	AVI	MP4	OGG	FLV	MPG2	MKV	RMVB
Video	H264	-	Y	Y	-	Y	Y	Y	-
	MPEG2	-	Y	-	-	-	Y	Y	-
	MPEG4	Y	Y	Y	-	-	-	Y	-
	H263	-	Y	Y	-	Y	-	Y	-
	MJPEG	-	Y	Y	-	-	-	Y	-
	VC1	Y	Y	-	-	-	-	Y	-
	DivX	Y	Y	Y	-	-	-	Y	-
	Xvid	-	Y	-	-	-	-	Y	-
	VP8	-	-	-	-	-	-	Y	-
	VP6	-	-	-	-	Y	-	Y	-
	Theora	-	-	-	Y	-	-	-	-
	RV	-	-	-	-	-	-	Y	Y
Audio	AAC	-	Y	Y	-	Y	Y	Y	Y
	MP3	Y	Y	Y	-	Y	Y	Y	-
	WMA	Y	Y	-	-	-	-	Y	-
	AC3	-	Y	Y	-	-	Y	Y	-
	PCM/ADPCM	Y	Y	Y	-	Y	Y	Y	-
	AMR	-	-	Y	-	-	-	Y	-
	Vorbis	-	Y	Y	Y	-	-	Y	-
	SPEEX	-	-	-	Y	Y	-	Y	-
	DTS	-	-	-	-	-	Y	Y	-
	FLAC	-	-	-	Y	-	-	Y	-
	DD+	Y	-	Y	-	-	Y	Y	-
	RA	-	-	-	-	-	-	-	Y

7.4.2 Video codec specifications

The tables in this section show the video codec specifications with and without VPU acceleration. Check Section 4 to determine if your board supports VPU.

Table 20. Video codec specification for hardware with VPU acceleration

	Format	Platform	Profile	Min. resolution	Max. resolution	Frame rate	Bitrate	Comment
Video Decoder	HEVC	i.MX 8M Quad	main/main 10	144 x 144	4096 x 2304	60 fps	160 Mbps	-
		i.MX 8M Plus i.MX 8M Mini	main/main 10	144 x 144	1920 x 1080	60 fps	100 Mbps	-
		i.MX 8Quad XPlus	main	144 x 144	4096 x 2160	30 fps	100 Mbps	-

Table 20. Video codec specification for hardware with VPU acceleration...*continued*

	Format	Platform	Profile	Min. resolution	Max. resolution	Frame rate	Bitrate	Comment
		i.MX 8Quad Max	main	144 x 144	4096 x 2160	60 fps	100 Mbps	-
		i.MX 95	main	64 x 64	4096 x 2304	60 fps	100 Mbps	-
	H.264	i.MX 8M Quad	HP/MP/BP	48 x 48	4096 x 2304	30 fps	60 Mbps	-
		i.MX 8M Plus i.MX 8M Mini	HP/MP/BP	48 x 48	1920 x 1080	60 fps	60 Mbps	-
		i.MX 8Quad XPlus	HP/MP/BP	64 x 64	4096 x 2160	30 fps	50 Mbps	-
		i.MX 8Quad Max	HP/MP/BP	64 x 64	4096 x 2160	30 fps	50 Mbps	-
		i.MX 6	HP/MP/BP	64 x 64	1920 x 1080	60 fps	50 Mbps	-
		i.MX 95	HP/MP/BP	64 x 64	4096 x 2304	60 fps	50 Mbps	-
	VP9	i.MX 8M Quad	profile 0, 2	144 x 144	4096 x 2304	60 fps	100 Mbps	-
		i.MX 8M Plus i.MX 8M Mini	profile 0, 2	144 x 144	1920 x 1080	60 fps	100 Mbps	-
	VP8	i.MX 8M Quad	-	48 x 48	1920 x 1080	60 fps	60 Mbps	-
		i.MX 8M Plus i.MX 8M Mini	-	48 x 48	1920 x 1080	60 fps	60 Mbps	
		i.MX 8Quad XPlus	-	64 x 64	1920 x 1080	60 fps	60 Mbps	-
		i.MX 8Quad Max		64 x 64	1920 x 1080	60 fps	60 Mbps	-
		i.MX 6Quad	-	64 x 64	1920 x 1080	30 fps	20 Mbps	-
		i.MX 6DualLite	-	64 x 64	1280 x 720	30 fps	20 Mbps	-
	MPEG4/ XVID	i.MX 8M Quad	SP/ASP	48 x 48	1920 x 1080	60 fps	-	-
		i.MX 8Quad XPlus	SP/ASP	64 x 64	1920 x 1080	60 fps	-	-
		i.MX 8Quad Max	SP/ASP	64 x 64	1920 x 1080	60 fps	-	-
		i.MX 6	SP/ASP	64 x 64	1920 x 1080	30 fps	40 Mbps	-
	MPEG2	i.MX 8M Quad	MP	48 x 48	1920 x 1080	60 fps	-	-
		i.MX 8Quad XPlus	MP	64 x 64	1920 x 1080	60 fps	-	-
		i.MX 8Quad Max	MP	64 x 64	1920 x 1080	60 fps	-	-
		i.MX 6	MP	64 x 64	1920 x 1080	30 fps	50 Mbps	-
	H.263	i.MX 8M Quad	P3	48 x 48	1920 x 1080	60 fps	-	-
		i.MX 8Quad XPlus	P0/P3	64 x 64	1920 x 1080	60 fps	-	-

Table 20. Video codec specification for hardware with VPU acceleration...*continued*

	Format	Platform	Profile	Min. resolution	Max. resolution	Frame rate	Bitrate	Comment
		i.MX 8Quad Max	P0/P3	64 x 64	1920 x 1080	60 fps	-	-
		i.MX 6	P3	64 x 64	1920 x 1080	30 fps	20 Mbps	-
	VC1	i.MX 8M Quad	AP/MP/SP	48 x 48	1920 x 1080	60 fps	-	-
		i.MX 8Quad XPlus	AP/MP/SP	64 x 64	1920 x 1080	60 fps	-	-
		i.MX 8Quad Max	AP/MP/SP	64 x 64	1920 x 1080	60 fps	-	-
		i.MX 6	AP/MP/SP	64 x 64	1920 x 1080	30 fps	45 Mbps	-
	MJPEG	i.MX 8M Quad	-	48 x 48	1920 x 1080	60 fps	180 Mpixl	-
		i.MX 8Quad XPlus	-	64 x 64	1920 x 1080	60 fps	-	-
		i.MX 8Quad Max	-	64 x 64	1920 x 1080	60 fps	-	-
		i.MX 6	-	64 x 64	1920 x 1080	30 fps	120 Mpixl	-
		i.MX 95	-	64 x 64	4096 x 2160	30 fps	-	400 MSample/s The maximum resolution for a JPEG image is 8192 x 8192.
	RV	i.MX 8M Quad	9	48 x 48	1920 x 1080	60 fps	-	-
		i.MX 8QuadXPlus/i.MX 8QuadMax	8/9/10	64 x 64	1920 x 1080	60 fps		-
		i.MX 6	8/9/10	64 x 64	1920 x 1080	30 fps	40 Mbps	-
	Sorenson Spark	i.MX 8Quad XPlus i.MX 8Quad Max	-	64 x 64	1920 x 1080	60 fps	-	-
Video Encoder	H.264	i.MX 8M Plus	HP/MP/BP	144 x 144	1920 x 1080	60 fps	40 Mbps	-
		i.MX 8M Mini	HP/MP/BP	144 x 96	1920 x 1080	60 fps	40 Mbps	
		i.MX 8Quad XPlus	HP/MP/BP	64 x 64	1920 x 1080	30 fps	-	-
		i.MX 8Quad Max	HP/MP/BP	64 x 64	1920 x 1080	30 fps	-	-
		i.MX 6	BP	64 x 64	1920 x 1080	30 fps	20 Mbps	-
		i.MX 95	HP/MP/BP	256 x 128	4096 x 2304	60 fps	20 Mbps	-
	H.265	i.MX 8M Plus	main/main 10	136 x 136	1920 x 1080	60 fps	-	-
		i.MX 95	main	256 x 128	4096 x 2304	60 fps	-	-

Table 20. Video codec specification for hardware with VPU acceleration...*continued*

	Format	Platform	Profile	Min. resolution	Max. resolution	Frame rate	Bitrate	Comment
	MJPEG	i.MX 95	-	64 x 64	4096 x 2160	15 fps	-	The maximum resolution for a JPEG image is 8192 x 8192.
	VP8	i.MX 8M Mini	-	144 x 96	1920 x 1080	30 fps	60 Mbps	-
Software Video Decoder	-	i.MX All	-	-	According to system performance	According to system performance	According to system performance	Supported with FFmpeg

7.4.3 Audio codec specification

Table 21. Audio codec specification

	Platform	Feature/ Profile	Feature/ Profile	Channel	Sample rate (kHz)	Bit rate (kbps)	Comment
DSP Audio Decoder	i.MX 8M Plus i.MX Quad XPlus i.MX 8Quad Max i.MX 8ULP	MP3	MPEG-1 (Layer-1/ Layer-2/ Layer-3)	stereo/mono	<= 48	32-448	-
			MPEG-2 (Layer-1/ Layer-2/ Layer-3)		<= 24	8-256	-
			MPEG-2.5 (Layer-3)		<= 12	8-160	-
	i.MX 8M Plus i.MX Quad XPlus i.MX 8Quad Max i.MX 8ULP	AACLC	MPEG-2 AACLC MPEG-4 AACLC	i.MX 8ULP: stereo/mono others: <=5.1	8-96	-	Bit rate depends on both the sample rate and the number of channels
	i.MX 8M Plus i.MX Quad XPlus i.MX 8Quad Max	Ogg Vorbis	q1 - q10	Stereo	8-192	<= 500	-
	i.MX 8M Plus i.MX Quad XPlus i.MX 8Quad Max	WMA STD	L1 @ QL1	stereo/mono	44.1	64-161	-
			L2 @ QL1		<= 48	<= 161	-
			L3 @ QL1		<= 48	<= 385	-
	i.MX 8M Plus i.MX Quad XPlus i.MX 8Quad Max	WMA Pro	M0a @ QL2	stereo/mono	<= 48	48-192	-
			M0b @ QL2	stereo/mono	<= 48	<= 192	-
			M1 @ QL2	<= 5.1	<= 48	<= 384	-
			M2 @ QL2	<= 5.1	<= 96	<= 768	-

Table 21. Audio codec specification*...continued*

	Platform	Feature/ Profile	Feature/ Profile	Channel	Sample rate (kHz)	Bit rate (kbps)	Comment
			M3 @ QL2	<= 7.1	<= 96	<= 1500	-
	i.MX 8M Plus i.MX Quad XPlus i.MX 8Quad Max	WMA Lossless	N1	stereo/mono	<= 48	<= 3000	-
			N2	<=5.1	<= 96	<= 3000	-
			N3	<= 7.1	<= 96	<= 3000	-
	i.MX 8M Plus i.MX Quad XPlus i.MX 8Quad Max	AMR_NB	-	-	8	12.2, 10.2, 7.9, 7.4, 6.7, 5.9, 5.15, 4.75	-
		AMR_WB	-	-	16	23.85, 23.05, 19.85, 18.25, 15.85, 14.25, 12.65, 8.85, 6.6	-
Software Audio Decoder	i.MX All	MP3	MPEG-1 (Layer-1/ Layer-2/ Layer-3) MPEG-2 (Layer-1/ Layer-2/ Layer-3) MPEG-2.5 (Layer-3)	stereo/mono	<=48	8-448	-
		AACLC	MPEG-2 AACLC MPEG-4 AACLC	<=5.1	8-96	8-368	-
		HE-AAC	HE-AAC V1 HE-AAC V2	stereo/mono	8-96	Mono: 8-384 stereo: 16-768	-
		Ogg Vorbis	q1-q10	stereo	8-192	<= 500	-
		WMA STD	L1 @ QL1	stereo/mono	44.1	64-161	-
			L2 @ QL1		<= 48	<= 161	-
			L3 @ QL1		<= 48	<= 385	-
		WMA Pro	M0a @ QL2	stereo/mono	<= 48	48-192	-
			M0b @ QL2	stereo/mono	<= 48	<= 192	-
			M1 @ QL2	<= 5.1	<= 48	<= 384	-
			M2 @ QL2	<= 5.1	<= 96	<= 768	-
			WMA Pro	<= 7.1	<= 96	<= 1500	-
		WMA Lossless	N1	stereo/mono	<= 48	<= 3000	-
			N2	<=5.1	<= 96	<= 3000	-
			N3	<=7.1	<= 96	<= 3000	-

Table 21. Audio codec specification...*continued*

	Platform	Feature/ Profile	Feature/ Profile	Channel	Sample rate (kHz)	Bit rate (kbps)	Comment
		RA	cook	stereo/mono	8, 11.025, 22.05, 44.1	-	-
		AMR_NB	-	-	8	12.2, 10.2, 7.9, 7.4, 6.7, 5.9, 5.15, 4.75	-
		AMR_WB	-	-	16	23.85, 23.05, 19.85, 18.25, 15.85, 14.25, 12.65, 8.85, 6.6	-
		BSAC	-	<=5.1	<=48	64 per channel	Core codec only

7.4.4 Speech codec specification

Table 22. Speech codec specification

	Feature	Sample rate	Bit rate (kbps)	H/W or S/W
Speech codec	G.711	8 kHz	64	S/W
	G.723.1	8 kHz	5.3, 6.3	S/W
	G.726	8 kHz	16, 24, 32, 40	S/W
	G.729ab	8 kHz	8	S/W
	AMR_NB	8 kHz	12.2, 10.2, 7.9, 7.4, 6.7, 5.9, 5.15, 4.75	S/W
	AMR_WB	16 kHz	23.85, 23.05, 19.85, 18.25, 15.85, 14.25, 12.65, 8.85, 6.6	S/W

7.4.5 Streaming protocol specification

Table 23. Streaming protocol specification

Protocol	Feature
HTTP/HTTPS	HTTP/HTTPS progressive streaming
RTSP	RTP, SDP
RTP/UDP	RTP/UDP MPEGTS streaming
HLS	HTTP live streaming
MPEG-DASH	MPEG Dynamic Adaptive Streaming over HTTP

7.4.6 RTSP streaming server specification

To support the RTSP server, the gst-rtsp-server open source package needs to be installed. See Section “RTSP Streaming Server” in the *i.MX Linux User’s Guide* (UG10163) for information on how to build and install it.

Table 24. RTSP streaming server specification

Demux feature		AVI	MP4	FLV	MKV	MP3	AAC
Video	H264	Y	Y	Y	Y	-	-
	MPEG4	Y	Y	-	Y	-	-
Audio	MP3	Y	Y	Y	Y	Y	-
	AAC	Y	Y	Y	Y	-	Y

7.4.7 Subtitle specification

Table 25. Subtitle specification

Internal/External	Subtitle format
Internal	SRT, SSA, ASS
External	SRT

7.4.8 Sound Open Firmware

Sound Open Firmware was updated to v2.8.0 and contains the following new features:

- Support for i.MX 8ULP platform
- Equalizer support based on IIR and FIR filters
- Dynamic Range Compress support

7.4.9 Chromium

Chromium is updated to 117.0.5938.132 and VPU is integrated with V4L2VDA to accelerate Chromium video decoding on the i.MX 8 series platforms and the i.MX 95 platform with VPU hardware.

Table 26. Chromium supported hardware video codec

Chromium video codec	MP4		WEBM	
	HEVC	H.264	VP8	VP9
i.MX 8M Mini	Y	Y	Y	Y
i.MX 8M Plus	Y	Y	Y	Y
i.MX 8M Quad	Y	Y	Y	Y
i.MX 8QuadXPlus	Y	Y	Y	-
i.MX 8Quad Max	Y	Y	Y	-
i.MX 95	Y	Y	-	-

7.5 Known issues and limitations for multimedia

Issues seen on GStreamer 1.x:

- As the maximum buffer size of the playbin multiqueue is 10 MB, problems may be seen with some long audio or video interleaved streams. You can enlarge this buffer size to support these special use cases.
- AAC decoder: The ADIF format does not support seek mode nor FF/FB.
- Playing recorded AVI file on i.MX with VPU (MPEG4 (vpu) + AVI (avimux)) fails because the AVIMUX mark MPEG4 video to DIVX is not supported.

- Rotation on i.MX 6 with VPU is not supported for interlaced streams whose width or height is larger than 968 x 968 when enabled deinterlacing due to a driver limitation.
- Rewind may report an EOS when using libav for video decoding.
- Accurate seek mode may take a longer time delay.
- For clips with no index table in containers (or video with only very few key frames), seeking is not supported.
- Audio-only clips do not support FB.
- Playback may fail to start for some fuzz stream when using playbin3 as the playback backend. playbin3 has different error bitstream handling compared with playbin2. It reports error rather than continue to play.

Issues seen on Chromium:

- As Chromium disables auto spawning of the PulseAudio, users need to manually start PulseAudio with `systemctl --user --now enable pipewire wireplumber pipewire-pulse` before running Chromium command if needed.
- Since the L6.1.55_2.2.0 release, PipeWire has been supported. Users can also start pulse on PipeWire as audio backend of Chromium.
- Streams with out-of-order frames like H.264 with b-frames have video flicker.
- Switching between streams multiple times without exiting the process may cause CMA allocation failure and related kernel dump. This is limited by community design and the issue is recorded in https://issuetracker.google.com/issues/41496457.

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9 Revision History

This table provides the revision history.

Revision history

Document ID	Release date	Description
RN00210 v.LF6.6.52_2.2.0	6 January 2025	Updated the GPU features in Table 8.

Revision history...*continued*

Document ID	Release date	Description
RN00210 v.LF6.6.52_2.2.0	16 December 2024	Upgraded to the 6.6.52 kernel.
RN00210 v.LF6.6.36_2.1.0	30 September 2024	Upgraded to the 6.6.36 kernel.
IMXLXRN_6.6.23_2.0.0	28 June 2024	Upgraded to the 6.6.23 kernel, U-Boot v2024.04, TF-A v2.10, OP-TEE 4.2.0, Yocto 5.0 Scarthgap, and added the i.MX 91 as Alpha quality, i.MX 95 as Beta quality.
IMXLXRN v.LF6.6.3_1.0.0	29 March 2024	Upgraded to the 6.6.3 kernel, removed the i.MX 91P, and added the i.MX 95 as Alpha Quality.
IMXLXRN v.LF6.1.55_2.2.0	30 January 2024	Updated the i.MX 91P validation quality to 11x11 EVK as Alpha quality and 9x9 QSB as GA quality.
IMXLXRN v.LF6.1.55_2.2.0	12/2023	Updated Table 3 "BSP and multimedia standard packages".
IMXLXRN v.LF6.1.55_2.2.0	12/2023	Upgraded to the 6.1.55 kernel.
IMXLXRN v.LF6.1.36_2.1.0	10/2023	Updated the Security features in Section 2.1.
IMXLXRN v.LF6.1.36_2.1.0	09/2023	Upgraded to the 6.1.36 kernel and added the i.MX 91P.
IMXLXRN v.LF6.1.22_2.0.0	08/2023	Updated Table 3 "BSP and multimedia standard packages".
IMXLXRN v.LF6.1.22_2.0.0	06/2023	Upgraded to the 6.1.22 kernel.
IMXLXRN v.LF6.1.1_1.0.1	05/2023	Patch release for LF6.1.1_1.0.1.
IMXLXRN v.LF6.1.1_1.0.0	04/2023	Updated the Known issues for the i.MX 93.
IMXLXRN v.LF6.1.1_1.0.00	03/2023	Upgraded to the 6.1.1 kernel.
IMXLXRN v.LF5.15.71_2.2.0	12/2022	Upgraded to the 5.15.71 kernel.
IMXLXRN v.LF5.15.52_2.1.0	09/2022	Upgraded to the 5.15.52 kernel, and added the i.MX 93.
IMXLXRN v.LF5.15.32_2.0.0	06/2022	Upgraded to the 5.15.32 kernel, U-Boot 2022.04, and Kirkstone Yocto.
IMXLXRN v.LF5.15.5_1.0.0	03/2022	Upgraded to the 5.15.5 kernel, Honister Yocto, and Qt6.
IMXLXRN v.LF5.10.72_2.2.0	12/2021	Upgraded the kernel to 5.10.72 and updated the BSP.
IMXLXRN v.LF5.10.52_2.1.0	11/2021	Updated Table 3 "BSP and multimedia standard packages".
IMXLXRN v.LF5.10.52_2.1.0	09/2021	Updated for i.MX 8ULP Alpha and the kernel upgraded to 5.10.52.
IMXLXRN v.LF5.10.35_2.0.0	06/2021	Upgraded Yocto Project to Hardknott and the kernel upgraded to 5.10.35.
IMXLXRN v.LF5.10.9_1.0.0	03/2021	Upgraded Yocto Project to Gatesgarth and the kernel upgraded to 5.10.9.
IMXLXRN v.L5.4.70_2.3.0	01/2021	Updated the command lines in Section "Running the Arm Cortex-M4 image".
IMXLXRN v.L5.4.70_2.3.0	12/2020	i.MX 5.4 consolidated GA for release i.MX boards including i.MX 8M Plus and i.MX 8DXL.
IMXLXRN v.L5.4.47_2.2.0	09/2020	i.MX 5.4 Beta2 release for i.MX 8M Plus, Beta for 8DXL, and consolidated GA for released i.MX boards.
IMXLXRN v.L5.4.24_2.1.0	06/2020	i.MX 5.4 Beta release for i.MX 8M Plus, Alpha2 for 8DXL, and consolidated GA for released i.MX boards.

Revision history...*continued*

Document ID	Release date	Description
IMXLXRN v.L5.4.3_2.0.0	04/2020	i.MX 5.4 Alpha release for i.MX 8M Plus and 8DXL EVK boards.
IMXLXRN v.LF5.4.3_1.0.0	03/2020	i.MX 5.4 Kernel and Yocto Project Upgrades.
IMXLXRN v.L4.19.35_1.1.0	10/2019	i.MX 4.19 Kernel and Yocto Project Upgrades.
IMXLXRN v.L4.19.35_1.0.0	07/2019	i.MX 4.19 Beta Kernel and Yocto Project Upgrades.
IMXLXRN v.L4.14.98_2.0.0_ga	04/2019	i.MX 4.14 Kernel upgrade and board updates.
IMXLXRN v.L4.14.78_1.0.0_ga	01/2019	i.MX 6, i.MX 7, i.MX 8 family GA release.
IMXLXRN v.L4.14.62_1.0.0_beta	11/2018	i.MX 4.14 Kernel Upgrade, Yocto Project Sumo upgrade.
IMXLXRN v.L4.9.123_2.3.0_8mm	09/2018	i.MX 8M Mini GA release.
IMXLXRN v.L4.9.88_2.2.0_8qxp-beta2	07/2018	i.MX 8QuadXPlus Beta2 release.
IMXLXRN v.L4.9.88_2.1.0_8mm-alpha	06/2018	i.MX 8M Mini Alpha release.
IMXLXRN v.L4.9.88_2.0.0-ga	05/2018	i.MX 7ULP and i.MX 8M Quad GA release.
IMXLXRN v.L4.9.51_imx8mq-ga	03/2018	Added i.MX 8M Quad GA.
IMXLXRN v.L4.9.51_8qm-beta2/8qxp-IMXLXRN v.beta	02/2018	Added i.MX 8QuadMax Beta2 and i.MX 8QuadXPlus Beta.
IMXLXRN v.L4.9.51_imx8mq-beta	12/2017	Added i.MX 8M Quad.
IMXLXRN v.L4.9.51_imx8qm-beta1	12/2017	Added i.MX 8QuadMax.
IMXLXRN v.L4.9.51_imx8qxp-alpha	11/2017	Initial release.

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