

i.MX Linux® Release Notes

1 Release Contents

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

Supported hardware SoC/board

- i.MX 6QuadPlus SABRE-SD Board and Platform
- i.MX 6QuadPlus SABRE-AI Board
- i.MX 6Quad SABRE-SD Board and Platform
- i.MX 6DualLite SABRE-SD Board
- i.MX 6Quad SABRE-AI Board
- i.MX 6DualLite SABRE-AI Board
- i.MX 6SoloLite EVK Board
- i.MX 6SoloX SABRE-SD Board
- i.MX 6SoloX SABRE-AI Board
- i.MX 6UltraLite EVK Board

NOTE

In this document, the following notation is used:

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Release Contents

- 6SABRE-SD means the i.MX 6Quad, i.MX 6QuadPlus, and i.MX 6DualLite SABRE-SD Platforms.
- 6SABRE-AI means the i.MX 6Quad, i.MX 6QuadPlus, and i.MX 6DualLite SABRE-AI Platforms.
- 6SoloLite means the i.MX 6SoloLite EVK
- 6SoloX-SD means the i.MX 6SoloX SABRE-SD Platform.
- 6SoloX-AI means the i.MX 6SoloX SABRE-AI Platform.
- 6UltraLite means the i.MX 6UltraLite EVK Platform.

1.1 Contents

This release consists of the following package files:

- L4.1.15_1.0.0-ga_images_MX6QDLSOLO.tar.gz
- L4.1.15_1.0.0-ga_images_MX6SLEVK.tar.gz
- L4.1.15_1.0.0-ga_images_MX6SXALL.tar.gz
- L4.1.15_1.0.0-ga_images_MX6ULEVK.tar.gz
- L4.1.15_1.0.0-ga_images_MX6QPSABRESO.tar.gz
- L4.1.15_1.0.0-ga_mfg-tools.tar.gz
- fsl-yocto-L4.1.15_1.0.0-ga.tar.gz

The release version is named "L<Kernel_version>_<x.y.z>."

"<Kernel_version>": BSP Kernel version. (For example, "L4.1.15" indicates that this BSP release is based on the kernel version 4.1.15.)

"<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 1. Release contents

| Component | Description |
|-----------------------------------|--|
| Linux® OS Kernel and Device Trees | 4.1.15. |
| U-Boot | v2015.04. |
| SD Card images | Pre-built images for download, and images files gathering a suggestion of packages and libraries needed for the common tests. |
| Manufacturing Tools | MFGtools is a program used to burn a production image into the board using a set of predefined parameters, such as the target memory to be used. |

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-fsl-arm and meta-fsl-bsp-release layers in the `conf/machine` sub-directory.

Table 2. U-Boot configurations

| U-Boot configuration for Boot device | Description | Supported machine configuration |
|--------------------------------------|---|--|
| sd | This supports booting from the SD card. This is the default U-Boot configuration. | imx6qsabresd, imx6qpsabresd, imx6dlsabresd imx6qsabreauto, imx6qpsabreauto, imx6dlsabreauto imx6slevk |

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Table 2. U-Boot configurations (continued)

| U-Boot configuration for Boot device | Description | Supported machine configuration |
|--------------------------------------|--|--|
| | | imx6sxsabresd imx6sxsabreauto imx6ulevk |
| spi-nor | This supports booting from SPI-NOR | imx6qsabreauto, imx6dlsabreauto imx6qpsabreauto imx6slevk |
| eim-nor | This supports booting from Parallel NOR. | imx6qsabreauto, imx6dlsabreauto, imx6solosabreauto imx6qpsabreauto |
| nand | This supports booting from NAND. | imx6qsabreauto, imx6dlsabreauto, imx6solosabreauto imx6qpsabreauto imx6sxsabreauto |
| sata | This supports booting from SATA. | imx6qsabresd, imx6qpsabresd imx6qsabreauto, imx6qpsabreauto |
| qspi2 | This supports booting from QSPI2. Booting from the ARM® Cortex®-M4 processor is supported through QSPI2. Use U-Boot command “bootaux” to boot ARM Cortex-M4 processor. The booting address is 0x78000000. | imx6sxsabresd |
| qspi1 | This supports booting from QSPI1. Booting from the ARM Cortex-M4 processor is supported through QSPI1. Use U-Boot command “bootaux” to boot ARM Cortex-M4 processor. The booting address is changed to 0x68000000. | imx6sxsabreauto imx6ulevk |
| emmc | This supports booting from EMMC. | imx6sxsabresd |
| m4fastup | This supports booting from ARM Cortex-M4 processor by disabling QSPI2 from using ARM Cortex-M4 processor. | imx6sxsabresd |

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

Table 3. Kernel and device tree configurations

| Kernel and device tree configuration | Description |
|--------------------------------------|---|
| zImage | Binary kernel image for the 4.1.15 kernel. This kernel is built with the imx_v7_defconfig for any i.MX 6 or i.MX 7 boards. |
| Standard | Each reference board has a standard device tree as follows: <ul style="list-style-type: none"> zImage-imx6q-sabresd.dtb zImage-imx6qp-sabresd.dtb zImage-imx6dl-sabresd.dtb zImage-imx6q-sabreauto.dtb zImage-imx6qp-sabreauto.dtb zImage-imx6dl-sabreauto.dtb zImage-imx6sl-evk.dtb |

Table continues on the next page...

Table 3. Kernel and device tree configurations (continued)

| Kernel and device tree configuration | Description |
|--------------------------------------|--|
| | <ul style="list-style-type: none"> • zImage-imx6sx-sdb.dtb zImage-imx6sx-sdb-reva.dtb • zImage-imx6sx-sabreauto.dtb • zImage-imx6ul-14x14-evk.dtb • zImage-imx6ul-9x9-evk.dtb <p>Note: zImage-imx6sx-sdb.dtb is used for supporting the i.MX 6SoloX SABRE-SDB Rev. B board, and imx6sx-sdb-reva.dtb is used for supporting the legacy SABRE-SDB Rev. A board.</p> |
| GPMI and EIM_NOR | <p>Enables the GPMI and EIM-NOR. Due to pin conflict, the GPMI and EIM-NOR are disabled by default. See the device tree file for more details:</p> <ul style="list-style-type: none"> • zImage-imx6dl-sabreauto-gpmi-weim.dtb • zImage-imx6q-sabreauto-gpmi-weim.dtb • zImage-imx6qp-sabreauto-gpmi-weim.dtb |
| ldo | <p>In standard DTB file, the LDO bypass is enabled. Therefore, to use LDO devices trees on configurations with CPU@1.2GHZ, which does not support LDO bypass mode, it is important to enable LDO. What is made in the following DTB files:</p> <ul style="list-style-type: none"> • zImage-imx6q-sabresd-ldo.dtb • zImage-imx6dl-sabresd-ldo.dtb • zImage-imx6sl-evk-ldo.dtb • zImage-imx6sx-sdb-ldo.dtb • zImage-imx6sx-sdb-reva-ldo.dtb |
| hdcp | <p>Enables the HDMI-HDCP feature. This avoids the pin conflict between the I2C2 and HDCP-DDC pins.</p> <ul style="list-style-type: none"> • zImage-imx6q-sabresd-hdcp.dtb • zImage-imx6dl-sabresd-hdcp.dtb |
| ecspi | <p>Enables eCSPI, which is disabled in the default DTB.</p> <ul style="list-style-type: none"> • zImage-imx6dl-sabreauto-ecspi.dtb • zImage-imx6q-sabreauto-ecspi.dtb • zImage-imx6qp-sabreauto-ecspi.dtb |
| flexcan1 | <p>Enables flexcan1, which is disabled by default in standard DTB file due to pin conflicts with FEC.</p> <ul style="list-style-type: none"> • zImage-imx6q-sabreauto-flexcan1.dtb • zImage-imx6dl-sabreauto-flexcan1.dtb • zImage-imx6qp-sabreauto-flexcan1.dtb |
| csi | <p>Enables CSI support for V4L2. On i.MX 6UltraLite EVK this device tree avoids the pin conflict between SIM and CSI.</p> <ul style="list-style-type: none"> • zImage-imx6sl-evk-csi.dtb • zImage-imx6ul-14x14-evk-csi.dtb |
| enetirq | <p>An example to demonstrate GPIO6 workaround for 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.</p> <ul style="list-style-type: none"> • zImage-imx6q-sabresd-enetirq.dtb • zImage-imx6dl-sabresd-enetirq.dtb |
| emmc | <p>The eMMC chip is DNP by default. This requires hardware modifications to burn the eMMC4.5 chip on the eMMC socket on uSDHC4 and connect eMMC signals as well as disconnect BOOT SD CARD slot signals.</p> |

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Table 3. Kernel and device tree configurations (continued)

| Kernel and device tree configuration | Description |
|--------------------------------------|---|
| | <ul style="list-style-type: none"> zImage-imx6sx-sdb-emmc.dtb |
| Cortex-M4 | <p>Disables ADC 1 & 2, flexcan 1 & 2, I2C3, UART 2 and QSPI 2 when ARM Cortex-M4 processor is running.</p> <ul style="list-style-type: none"> zImage-imx6sx-sdb-m4.dtb zImage-imx6sx-sabreauto-m4.dtb |
| epdc | <p>Pin conflict between HDMI and EPDC, disable HDMI for EPDC.</p> <ul style="list-style-type: none"> zImage-imx7d-sdb-epdc.dtb |
| Bluetooth® Wi-Fi | <p>Enable Broadcom Bluetooth and Wi-Fi hardware.</p> <ul style="list-style-type: none"> zImage-imx6q-sabresd-btwifi.dtb zImage-imx6qp-sabresd-btwifi.dtb zImage-imx6dl-sabresd-btwifi.dtb zImage-imx6l-evk-btwifi.dtb zImage-imx6sx-sabresd-btwifi.dtb zImage-imx6ul-14x14-evk-btwifi.dtb zImage-imx6ul-9x9-evk-btwifi.dtb |

The release package contains the following pre-built images.

Table 4. Pre-built images

| Package | Description |
|-----------------------------|---|
| X11 SDCard | <p>This release provides the following SD card images. These images include a GUI with X11 backend. The imx6qdsolo image works on all i.MX 6 SABRE-SD and i.MX 6 SABRE-AI SABRE-SD boards with U-Boot and device tree changes. To change U-Boot and the device tree, see the <i>i.MX Linux® User's Guide (IMXLUG)</i>.</p> <ul style="list-style-type: none"> fsl-image-gui-x11-imx6qdsolo.sdcard fsl-image-gui-x11-imx6ulevk.sdcard fsl-image-gui-x11-imx6slevk.sdcard fsl-image-gui-x11-imx6sx_all.sdcard |
| Frame Buffer SDCard | <p>This release provides the following SD card images for the Frame Buffer backend.</p> <ul style="list-style-type: none"> fsl-image-qt5-fb-imx6qdsolo.tar.bz2, fsl-image-gui-fb-imx6qdsolo.tar.bz2 fsl-image-qt5-fb-imx6sx_all.tar.bz2, fsl-image-gui-fb-imx6sx_all.tar.bz2 fsl-image-gui-fb-imx6slevk.tar.bz2, fsl-image-qt5-fb-imx6slevk.tar.bz2 |
| XWayland SDCard | <p>This release provides the following SD card images for the XWayland backend with the Weston compositor.</p> <ul style="list-style-type: none"> fsl-image-qt5-xwayland-imx6qdsolo.tar.bz2, fsl-image-gui-xwayland-imx6qdsolo.tar.bz2 fsl-image-gui-xwayland-imx6sx_all.tar.bz2, fsl-image-qt5-xwayland-imx6sx_all.tar.bz2 fsl-image-gui-xwayland-imx6slevk.tar.bz2, fsl-image-qt5-xwayland-imx6slevk.tar.bz2 |
| Kernel | Kernel and device trees as specified in Table 3. |
| U-Boot | U-Boot files as specified in Table 2. |
| mfgtools_with_rootfs.tar.gz | Manufacturing tools are supported with the manufacturing tools kernel. |

Table 5. fsl-yocto-L4.1.15_1.0.0-ga.tar.gz content

| File name | Description |
|---|---|
| Freescale_Yocto_Project_Users_Guide.pdf | Freescale Yocto Project User's Guide |
| README | Freescale README for L4.1.15_1.0.0-ga |
| /doc | i.MX Linux® BSP Release Notes, User's Guide, and Reference Manual |

Table 6. Multimedia standard packages

| File name | Description | Comment |
|---------------------------------|---------------------------|---------------------------------------|
| imx-gst1.0-plugins-4.0.9.tar.gz | GStreamer plugins | Freescale GStreamer plugins |
| imx-codec-4.0.9.bin | Freescale codecs | Freescale optimized A/V core codec |
| imx-parser-4.0.9.bin | Freescale parser | Freescale optimized core parser |
| imx-vpuwrap-1.0.65.bin | Freescale VPU wrapper | Freescale VPU wrapper for VPU library |
| imx-qtapplications-1.0.6.bin | Freescale Qt applications | Freescale Qt applications |

Contact marketing representative to get access to the following controlled packages.

Table 7. Controlled access packages

| File name | Description | Comment |
|----------------------------------|--|--|
| imx-aacpcodec-4.0.9.bin | AACplus decoder | Freescale optimized AACplus decoder |
| imx-mscodec-4.0.9.bin | Microsoft codecs | Freescale optimized Microsoft codecs |
| imx-lmsparser-4.0.9.bin | Microsoft parser | Freescale optimized Microsoft ASF parser |
| imx-ac3codec-4.0.9.bin | AC3 decoder | Freescale optimized Dolby audio AC3 decoder |
| imx-ddpcodec-4.0.9.bin | DDplus decoder | Freescale optimized Dolby audio DDplus decoder |
| imx-real-4.0.9.bin | Real Networks codecs and parser | Freescale optimized Real Networks real audio decoder, real media parser, and real video firmware |
| eink-waveform-firmware-1.0.1.bin | E Ink | E Ink REGAL/-D waveform for associated E Ink panels. |
| firmware-bcmdhd-1.0.2.bin | Broadcom Bluetooth firmware and Wi-Fi firmware | Broadcom Firmware for Wi-Fi and Bluetooth wireless technology. |

1.2 License

All source code files of the Board Support Package (BSP) are either GNU General Public License (GPL), GNU Lesser General Public License (LGPL), or another open source license.

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

The following components are released as binary files on the Yocto Project Mirror and have Freescale Proprietary Licenses. During the Yocto Project setup, to set up an i.MX build, the user needs to accept the Freescale license. This acceptance is recorded in the build configuration files so that the following proprietary binaries can be extracted during the build process. The Freescale proprietary packages contain a Software Content Register (SCR) file that lists information about the package

- imx-gpu-viv
- fsl-gpu-sdk
- imx-vpu
- imx-qtapplications
- firmware-imx
- imx-codec
- imx-parser
- imx-vpuwrap

1.3 Proprietary Licensing Packages

Freescale packages can be found in two locations:

- Standard packages are provided on the Freescale mirror. They are accessed automatically by the Yocto Project scripts as needed.
- Limited Access packages listed in the following table are provided on nxp.com with controlled access. Contact your sales representative for access. They are listed in the following table. These include codecs to support WMA, WMV, RMVB, AAC+, AC3, DD+ decoding, encoding, WMA, Broadcom firmware and E Ink firmware. Each package has its own README file with instructions on how to build, install, and run.

Table 8. Limited access packages for Yocto project releases

| Name | Package | Comment |
|---------------------------------|---|--|
| AACPlus Decoder | imx-aacpcodec-[version].bin | Freescale AACplus core decoder |
| Microsoft Codec | imx-mscodec-[version].bin | Freescale optimized MS codec |
| Microsoft Parser | imx-msparser-[version].bin | Freescale optimized ASF parser |
| AC3 Decoder | imx-ac3codec-[version].bin | Freescale AC3 core decoder |
| DDplus Decoder | imx-ddpcodec-[version].bin | Freescale DD-plus decoder |
| RMVB Decoders and Parser | imx-real-[version].bin | Freescale Real Networks |
| E Ink Waveform | firmware-eink-[version].bin | E Ink REGAL/-D waveform for i.MX 7D SABRE-SD |
| Broadcom Firmware | firmware-bcmd-[version].bin | Broadcom Bluetooth and Wi-Fi firmware |
| Broadcom Bluetooth Applications | BSA-ServerAndClientsApps-0107.00.16.bin | Broadcom Bluetooth applications |

1.4 References

This release includes the following references and additional information.

- *i.MX Linux® Release Notes (IMXLXRN)* - Provides the release information.
- *i.MX Linux® User's Guide (IMXLUG)* - Contains the information on installing U-Boot and Linux OS and using i.MX-specific features.

What's New?

- *Freescall Yocto Project User's Guide (IMXLXYOCTOUG)* - Contains the instructions for setting up and building Linux OS in the Yocto Project.
- *i.MX Linux® Reference Manual (IMXLXRM)* - Contains the information on Linux drivers for i.MX.
- *i.MX 6 Graphics User's Guide (IMX6GRAPHICUG)* - Describes the graphics used.
- *i.MX BSP Porting Guide (IMXXBSPPG)* - Contains the instructions on porting the BSP to a new board.
- *i.MX VPU Application Programming Interface Linux® Reference Manual (IMXVPUAPI)* - Provides the reference information on the VPU API.

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 \(IMX6QSDPQSG\)](#)
- [SABRE Board Quick Start Guide \(IMX6QSDBQSG\)](#)
- [SABRE Automotive Infotainment Quick Start Guide \(IMX6SABREINFOQSG\)](#)
- [i.MX 6SoloLite Evaluation Kit Quick Start Guide \(IMX6SLEVKQSG\)](#)

Documentation is available online at nxp.com.

- i.MX 6 information is at nxp.com/iMX6series
- i.MX 6 SABRE information is at nxp.com/imxSABRE
- i.MX 6SoloLite EVK information is at nxp.com/6SLEVK
- i.MX 7Dual information is at nxp.com/webapp/sps/site/prod_summary.jsp?code=i.MX7D
- i.MX 6UltraLite information is at nxp.com/webapp/sps/site/prod_summary.jsp?code=i.MX6UL.

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:

- Updated EULA to v13 March 2016.
- Yocto Project upgraded to version 2.0 Jethro.
- GStreamer is upgraded to 1.6.0.
- Supports the GCC 5.2.0 toolchain.
- The Linux kernel is upgraded to v4.1.15.
- Supports the Broadcom/Murata BCM4339 Bluetooth/Wi-Fi module.
- Supports BlueZ or Broadcom Bluetooth software.
- New graphics features:
 - GPU driver upgraded to Vivante v5.0.11p8.3.
 - Software floating point not supported.
- New multimedia features and changes:
 - Qt 5 is not supported for SoCs without hardware graphics. Qt 5 video is not supported on SoCs without a VPU.

Features on i.MX 6UltraLite:

- ARM Cortex-A7 revision r0p5 with 32K I/D L1 cache and 128K L2 cache
- MSL including CCM, IOMUX, GIC400, GPIO, OCOTP Fuse, SDMA, WDOG, system counter
- Connectivity including I2C, ECSPI, ENET, USB, CAN BUS, UART/BT, SIMv2, Touch screen, and ADC
- Storage including RawNAND, QSPI, and SD/MMC
- Multimedia including SAI, ASRC, MQS, SPDIF, CSI camera, LCDIF and PXP

- Security including CAAM, SNVS, Bus Encryption Engine, and HAB boot
- Sensor through the I2C interface including eCompass (MAG3110FCR2) and 3-Axis Accelerometer (fxls8471)

Features on i.MX 6QuadPlus:

- i.MX 6QuadPlus TO1.0 SOC support added.
- i.MX 6QuadPlus SABRE-AI and SD boards supported.
- Pre-fetch Resolve Engine - Prefetching of IPU data to improve overall memory access and larger on-chip RAM.
- NOC-based interconnect fabric with scheduler - Improves overall memory access efficiency.
- 3D GPU enhanced to GC2000+ supporting improved tile buffer handling.
- 2D GPU enhanced to GC320 supporting 8 overlays and improved tile buffer handling.

2.2 Power management supported features

The following common power management features are supported:

- CPU/GPU frequency throttle for SoCs with GPU
- GPU dynamic power management for SoCs with GPU
- CPU idle framework support with two working levels: pure WFI and WFI with wait mode enabled
- Low power mode support: standby and dormant (mem) mode
- Thermal temperature support

Power management features supported on 6SoloLite:

- LDO bypass

Power management features supported on 6SABRE-SD and 6SABRE-AI:

- CPUFreq driver support: CPU frequency adjusted based on the CPU loading and Interactive governor
- VPU/GPU dynamic power management for SoC with VPU and GPU
- LDO bypass
- Bus frequency support
- SD3.0 dynamic clock management
- USB remote wake-up and USB charger

2.3 Graphics

This section describes new features and bug fixes for the graphics provided in this release.

Table 9. New features

| Feature | Description |
|---------------------------|--|
| Khronos OpenGL ES 3.0 API | <p>The GPU 5.x driver fully supports the latest Khronos OpenGL ES 3.0 API (current 3.0.2 specification dated 8 April 2013) and compliant to Khronos OpenGL ES 3.0 conformance test. From the Khronos announcement, new functionality in the OpenGL ES 3.0 API includes:</p> <ul style="list-style-type: none"> • Rendering pipeline enhancements to enable acceleration of advanced visual effects, including occlusion queries, transform feedback, instanced rendering, and support for four or more rendering targets. • High-quality ETC2/EAC texture compression, which eliminates the need for a different set of textures for each platform. • Shading language enhancements, which include full support for integer and 32-bit floating point operations. |

Table continues on the next page...

Table 9. New features (continued)

| Feature | Description |
|--|---|
| | <ul style="list-style-type: none"> • Enhanced texturing functionality, including guaranteed support for floating point, 3D, depth, vertex, NPOT, R/RG, immutable, and 2D array textures, as well as for swizzles, LOD and mip level clamps, seamless cube maps, and sampler objects. • Extensive set of required, explicitly sized texture and render-buffer formats, which reduces implementation variability and makes it much easier to write portable applications. |
| Compatible with 4.x Driver for OpenGL ES 2.0 API | <ul style="list-style-type: none"> • The GPU 5.x driver is compatible with the the 4.x driver. Applications developed using 4.x drivers can run on the 5.x driver without any changes. • Application performance on the 5.x driver is better than or equal to that with the 4.x driver. |
| Incremental features | <ul style="list-style-type: none"> • 2D: Add 2D natural rotation support. • 2D-VG: Reduce 2D-VG MMU memory to 32KB and other refinements for 2D-VG. • 2D-VG: For MOVG, use rough bounds calculation based on control points. • 3D EGL: Refinements to support multiple EGL API implementations. • 3D: Refine chip patch management. • 3D: Optimization for GFXBench manhattan test. • 3D: Set right offset for gcoSURF_BlitCPU. • 3D: Refinements for glFramebufferTexure2D • Compiler: Optimization for chip patch management to reduce memory cost. • Compiler: Optimize compiler to reduce compile time and memory usage. • General: Refinements for fence support. • General: Optimization for Netflix application. • General: Refinements for GPU recovery. • General: Add gcvHAL_EVENT_COMMIT event support for vg kernel. • GL2: Refinements for selection and sorting of a subset of the supplied GL configurations based on the attributes. |
| Bug Fixes | <ul style="list-style-type: none"> • 2D: Set DRI FB address properly, otherwise X user can read/write it. • 2D: Fix compression2D and tile status hang issue in 2D driver. • 2D: Disable overlap setting in 2D driver and add support check for multi-dst rectangle in the case of address overlap. • 2D: Remove unnecessary cursor de-initialization. • 2D: Do 2D blit twice when src surface is same as dst surface. • 2D: Use stretch blit for yuv layer when HW supports it and filterStretch is enabled; stretch blit for yuv is supported when OPF feature exists. • 2D: Need full-screen 2D clear if there are no layers to compose. • 2D: Fix de-multiply issue of divided by zero in 2D driver. • 2D: Downscale multi-src blit v1 feature bit setting in 2D driver. • 2D-VG: Fix construct VG image issue. • 2D-VG: Add NAN argument detection for matrix operations (rotate, shear, scale, translate). • 3D: Fix a dead lock issue when accessing a shared resource. • 3D: Fix ES2-CTS.gtf.GL.read_format.read_format failure. • 3D: Correct a parameter of veglGetResObj() to resolve a crash issue. • 3D: Refine pointer to integer conversions. • 3D: Refine buffer usage check/settings. • 3D: Fix ES3-CTS.shaders.negative.uniform_precision_matching failure. • 3D: Remove layer sync wait for YouTube App. • 3D: Use surface width and height to get the aligned source origin. • 3D: Refinements for yInverted function. • 3D: Disable HZ correctly. • 3D: Fix dEQP-GLES3.functional.shaders.texture_functions.texturesize. Failures. |

Table continues on the next page...

Table 9. New features

| Feature | Description |
|---------|--|
| | <ul style="list-style-type: none"> • 3D: Fix dEQP-GLES3.functional.fbo.color.repeated_clear.sample.tex2d. Failures. • 3D: Fix dEQP-GLES3.functional.texture.mipmap.cube.base_level. failures. • 3D: Fix dEQP-GLES3.functional.lifetime.attach.deleted_output.buffer_transform_feedback failure. • 3D: Remove buffer object from current XFB object. For the non-bound XFB, the buffer object will be kept until the XFB object is destroyed. • 3D: Improve performance for texture downloads with PBO. • 3D: Fix swap behavior when nothing is drawn in the frame in direct rendering mode. • 3D: CL54116: Turn off 3D VG context support on Android platform to pass dEQP EGL must pass list. • 3D: Fix new dEQP-GLES3.functional. Failures in dEQP 6.0_r1. • 3D: Fix dEQP failures for i.MX 6 boards. • 3D: When a window resizes, copy the previous render target/depth contents to new render target/depth. • 3D: Fix dEQP-GLES3.functional.occlusion_query. Failures. • 3D-VG: Fix ARM64 build issue for VG driver. • Android platform: Correct libVDK library dependency for Android platform. • Android platform: Correct galcore module installation on Android platform. • Compiler: Refinements for the main packing function in compiler. • Compiler: Fix ES3-CTS.shaders.arrays.constructor.int3_vertex failure. • Compiler: Remove unused compiler code. • Compiler: Refine _FindAddressRegChannel() to fix Android platform game 'com.tencent.tmgp.mxm' crash issue. • Compiler: Fix ES2-CTS.shaders.negative.initialize failure. • Compiler: Fix ES3-CTS.shaders.negative.constant_sequence failure. • Compiler: Clean sIsNAME after create it, and check shared vector index only for a variable. • Compiler: Disable GL_EXT_shadow_samplers for OES2.0 in compiler. • Compiler: Fix compiler issue found by GLSL Sandbox shaders tests. • Compiler: Fix compiler built-in functions to resolve dEQP-GLES3.functional.shaders.texture_functions. Failures. • Compiler: Fix dEQP-GLES3.functional.shaders.fragdata.write_fragcolor_and_fragdata_simple failure. • Compiler: Fix dEQP-GLES3.functional.shaders.linkage.varying.rules.differing_interpolation_2 failure. • Compiler: Fix dEQP-GLES3.functional.shaders.constant_expressions.builtin_functions.common.clamp_Failures. • Compiler: Fix dEQP-GLES3.functional.shaders.uniform_block.invalid.reference_using_block_name_vertex failure. • Compiler: Fix dEQP-GLES3.functional.shaders.builtin_functions.precision.atan2. Failures. • Compiler: Fix issue found by offline shader compiler. • Compiler: Move ICache check after uniform check. • General: Fix kernel panic caused when page->ptl is null. • General: Add runtime environment USE_INPUT_DEVICE to override gcdUSE_INPUT_DEVICE. • General: Set the address properly to fix a performance issue. • General: Fixes for multiple buffers do not work on 1080p display. |

Table continues on the next page...

Table 9. New features

| Feature | Description |
|---------|---|
| | <ul style="list-style-type: none"> • General: Fix rendering issue found by 'duokantv-test' APK on Sabreauto_6QP board. • General: Fix an interrupt statistic issue when gckCOMMAND_Reserve() fails. • General: Fix GPU reset issue found by suspend/resume test on GC2000+. • General: Fix random kernel panic caused by insufficient memory allocation.75. • General: CL43199: Simplify GPU address allocation enabled by gcdMIRROR_PAGETABLE to always use map from MMU[0] to allocate GPU address. • General: Only output log message for debug driver. • General: Do not reference a page whose count is zero. • General: Add enum definition for v4 compression feature. • General: Add onekill,zeronoread for alphablend opt. • General: Surface main node of USER_POOL also needs to call _Unlock() in case it has tile status node attached. • General: Add missed gcvFEATURE_MMU query. • General: Disable unnecessary alpha blending and clear operations when composing layers. • General: Correct physical address query for each allocator. • General: Avoid calling kernel API when OS->memoryLock is held. • General: Fix condition check for multi-source blit v2 and don't use bitblit for small area for performance issue. • General: GPU low memory killer should check return status and not kill itself. • General: Cannot batch copy whole surface from temp to dst if their strides are different. • General: Avoid sleeping when OS->memoryLock is held. • General: Change unsigned to signed variable definition in TPF to fix out of boundary issue. • General: Add check for invalid kernel pointer before free memory • General: Refine implementation of debug file entry 'galcore_trace' to avoid code changes for different kernels. • General: Fix vmalloc failure caused by kernel panic in context update. • General: Pass cacheable flag to video memory allocator. • General: Program blend factors when half float pipe is available. • General: Sync the frame buffer code with FB backend. Also refine multi-buffer swap work flow on FB. • General: Fix VDK build when ANDROID_SDK_VERSION=23. • General: Fix typo of _gceOPTION. • GL2: Make sure the texture is bound to the sampler correctly to fix glmark2 terrain issue. • GL2: Remove unused environment variables. • HWComposer: Fix FD leaks in HWComposer driver. • HWComposer: Force disables no-resolve for Android platform compositor. • HWComposer: Fix blit error when clip rect out of dest rect in HWComposer. • HWComposer: Add invalid outbuf pointer check in HWComposer. • OCL: Fix an assertion in constant array indexing during loop unrolling found by ComputeBenchCL Gaussian buffer test. • OCL: Fix issue in mapping a constant array variable to a pointer and passed as argument to a function. • OCL: Fix issue in computing offset to a constant variable in the _CONSTANT address space. • OCL: Handle an array as a pointer in an arithmetic expression. • OCL: Add grace recovery for parsing error on variable in program space to be in constant address space. • OCL: Refine clScanLookAheadWithSkip() function to fix compiler syntax parsing error about "()". |

Table continues on the next page...

Table 9. New features (continued)

| Feature | Description |
|-----------------------------------|--|
| | <ul style="list-style-type: none"> • OCL: Refinements for OpenCL driver build. • VG: Need to flush VG pipe when destroying VG objects. • VG: Fix VG command buffer memory leak. |
| Bug Fixes on top of viv_5.0.11.p8 | <ul style="list-style-type: none"> • MGS-1593: Correct VG context buffer alignment to fix the video mapping failure. • MGS-664-1: VIV direct texture cannot work on the QP board. • MGS-1567: The FB worker number is limited by EGL_WORKER_COUNT. • MGS-1548: The vProfiler does not work well on the i.MX 6QuadPlus board. • MGS-1566: Fix eglReleaseThread problems. • MGS-1552-2: The GLSL compiler preprocessor fails to parse function-like macros with zero parameter. • MGS-1560: Fix the GPU kernel crash with the invalid pointer. • MGS-404: Make sure that pixmap rendering is complete before CPU operation. • MGS-404: Correct EGL error handling. • MGS-1391: Fix OpenVG Wayland show blank on display on i.MX 6SoloLite. • MGS-1414: GPU hung in the WebGL conformance test. • MGS-1536: Support GL_BGRA_EXT format in glCopyTexImage2D. • MGS-1535: Update 5.0.11.p8 driver copyright. • MA-7492: Fix DEQP gles2.0 CTS failure on Android platform 6.0. • MA-6208: Fix com.drawelements.deqp.gles3 cts failure. • MGS-1411: EGLCreateContext fails with error EGL_BAD_CONFIG when looping switching applications on Android platform. |
| Conformance Tests | <ul style="list-style-type: none"> • OpenGL ES 2.0/3.0: GPU Drivers are conformant to Khronos Conformance Test release version: 20150622. |

3 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 Supported Hardware in the Release contents section, otherwise, the feature is only supported on the boards listed.

Table 10. Supported features

| Feature | Supported board | Comment |
|-------------------|-----------------|--|
| Kernel | | |
| Kernel | All i.MX | Kernel version: 4.1.15 |
| File System | All i.MX | EXT2/EXT3/EXT4 are used as the file system in MMC/SD Hard Disk. On i.MX 6SABRE-AI and 7D-SABRE-SD, <ul style="list-style-type: none"> • UBIFS is used for NAND. • JFFS2/UBIFS is used for Parallel NOR, QSPI NOR. |
| Bootloader | | |
| U-Boot | All i.MX | U-Boot delivery is based on U-Boot version v2015.04. Clock, Anatop regulator, ENET, UART, MMC/SD, eMMC4.3/4.4. High Assurance Boot, ROM Plug-in Mode. SPI-NOR, Parallel NOR, SATA, NAND, QuadSPI-NOR, USB Mass Storage. |

Table continues on the next page...

Table 10. Supported features (continued)

| Feature | Supported board | Comment |
|---------------------------------|-----------------|---|
| | | Review Table 2 in Section 1.1 for U-Boot configurations supported on each board for SPI_NOR, NAND, Parallel NOR, QuadSPI-NOR, and SATA. These are not supported on all boards. i.MX 6QuadPlus/Quad/DualLite SABRE-SD and SABRE-AI support DDR3 528 MHz @ 64 bit. i.MX 6SoloX SABRE-SD and SABRE-AI support LPDDR3 400 MHz @ 32 bit i.MX 6SoloLite EVK supports LPDDR2 400 MHz @ 32 bit and boot using L2Cache as OGRAM i.MX 6UltraLite EVK supports DDR3 400 Mhz @ 16 bit |
| Machine-specific layer | | |
| ARM® Core | All i.MX | 6SABRE-SD, 6SABRE-AI, 6SoloLite, 6SoloX-SD, and 6SoloX-AI support the ARM Cortex-A9 processor. 6UltraLite EVK supports the ARM Cortex-A7 processor. Supports reboot and power-off. Supports reboot and power-off. |
| Memory | All i.MX | The user/kernel space is split 2G/2G. |
| Interrupt | All i.MX | GIC. |
| Clock | All i.MX | Controls the system frequency and clock tree distribution. |
| Timer (GPT) | All i.MX | System timer tick support. |
| 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. |
| DMA engine | | |
| SDMA | All i.MX | 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 | | |
| MXC UART | All i.MX | i.MX 6 SABRE-SD, and SoloLite EVK support console through internal Debug UART1. i.MX 6SoloX SABRE-SD and SABRE-AI support Cortex-A9 processor through UART1 and Cortex-M4 processor through UART2. i.MX 6UltraLite EVK Cortex-A7 processor through UART1. i.MX 6 SABRE-AI supports console through internal Debug UART 4. |
| Power Management Drivers | | |
| Anatop Regulator | All i.MX | Supports Anatop regulator management. |
| Lower Power mode | All i.MX | Supports standby mode and dormant (mem) mode. |
| CPUIidle | All i.MX | 2 levels CPUIidle supported: purely WFI and WFI with wait mode enabled. |
| CPUFreq | All i.MX | CPUFreq can be used for CPU frequency adjustment. The Interactive governor is added and enabled by default. |
| BusFreq | All i.MX | Supports the system bus clock frequency scaling. |
| Battery charging | All i.MX | - |
| Networking drivers | | |
| ENET | All i.MX | 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. |

Table continues on the next page...

Table 10. Supported features (continued)

| Feature | Supported board | Comment |
|------------------------------|---|--|
| | | i.MX 6SoloX SABRE-SD, SABRE-AI, and i.MX 7Dual SABRE-SD support AVB Features. |
| IEEE 1588 | All i.MX | Supports Linuxptp stack. Features: <ul style="list-style-type: none"> • Supports IPv4, IPv6, IEEE 802.3 transport. • Supports E2E, P2P transparent clock. • Supports IEEE802.1AS-2011 in the role of end station. Note: Linuxptp stack is open source. Command instance: <pre>ptp4l -A -4 -H -m -i eth0</pre> |
| PCIe | 6SABRE-SD 6SABRE-AI 6SoloX-SD 6SoloX-AI | - |
| PCIe EP/RC validation system | i.MX 6Quad SD i.MX 6SoloX-SD | Two of the same i.MX 6Quad SD boards, i.MX 7Dual SABRE-SD boards, or i.MX 6SoloX SDB boards. One is used as RC, and the other is used as EP. <ul style="list-style-type: none"> • EP can be initialized/enumerated by RC. • EP can access the memory of RC. • RC can access the memory of EP. • EP can trigger MSI, and the triggered MSI can be captured by RC. |
| MediaLB | 6SABRE-AI 6SoloX-AI | 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 supports MLB 25/50 only. On i.MX 6SoloX-AI, it supports MLB 25/50. |
| FlexCAN | 6SABRE-AI 6SoloX-SD 6SoloX-AI 6UltraLite EVK | 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 default device tree on i.MX 6SoloX-SD and i.MX 6SoloX-AI. Supports with default device tree on i.MX 6UltraLite EVK. |
| Security drivers | | |
| CAAM | All i.MX except 6SoloLite | Security drivers |
| SNVS | All i.MX | - |
| SIMv2 | 6UltraLite | Smart Card Interface |
| Sound drivers | | |
| WM8962/SSI WM8960/SSI | 6SABRE-SD 6SoloLite 6SoloX-SD 6UltraLite EVK | Supports playback. |
| S/PDIF | 6SABRE-SD 6SABRE-AI | 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 continues on the next page...

Table 10. Supported features (continued)

| Feature | Supported board | Comment |
|-----------------------------|--|---|
| | 6SoloX-AI | |
| ASRC | 6SABRE-AI 6SoloX-SD 6UltraLite EVK | 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 | 6SABRE-AI 6SoloX-AI | 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. |
| SAI/MQS | 6SoloX-SD 6UltraLite EVK | 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. |
| HDMI Audio | 6SABRE-SD 6SABRE-AI | Supported on i.MX 6Dual/Quad and i.MX 6DualLite for SABRE-SD and SABRE-AI |
| Input device drivers | | |
| USB devices | All i.MX | Supports USB mouse and USB keypad via USB ports. |
| Touch panel | All i.MX | 6SABRE-SD, 6SABRE-AI. Supports EGalaxy capacitive touch screen. 6SoloLite supports E Ink® touch screen on DC2/DC3 add-on card. 6SoloX SABRE-SD and SABRE-AI support LVDS panel. |
| Keypad | 6SoloLite | 6UltraLite EVK and 7D SABRE-SD support the resistive touch panel. 6SoloLite supports 4x4 keypads on DC2/DC3 add-on card. |
| MTD driver | | |
| QuadSPI-NOR | 6SoloX-SD 6SoloX-AI 6UltraLite EVK | i.MX 6SoloX SABRE-AI supports QSPI1. i.MX 6SoloX SABRE-SD supports QSPI2. i.MX 6UltraLite EVK supports QSPI1. |
| SPI-NOR | 6SABRE-AI 6SoloLite | Supports M25P32 On i.MX 6SABRE-SD DualQuad/DualLite there is a pin conflict for supporting SPI-NOR |
| NAND | 6SABRE-AI 6SoloX-AI | Normal NAND and ONFI NAND asynchronous mode with BCH40. |
| Parallel NOR | 6SABRE-AI | Supports Parallel NOR by using the EIM interface. |
| SATA | 6SABRE-SD 6SABRE-AI | Serial ATA 2.0 supports only i.MX 6DualQuad SABRE-SD and SABRE-AI and i.MX 6QuadPlus SABRE_SD and SABRE-AI. |
| USB drivers | | |
| USB Host | 6SABRE-AI 6SoloLite | Supports USB HOST1 and USB OTG host. |

Table continues on the next page...

Table 10. Supported features (continued)

| Feature | Supported board | Comment |
|-------------------------|--|--|
| | 6SoloX-SD 6SoloX-AI 6UltraLite EVK | |
| USB Device | All i.MX | Supports USBOTG device mode. |
| USB | All i.MX | Supports USB OTG2.0 and USB Host2.0 ports. USB Host mode: MSC, HID, UVC, USB audio. USB device mode: MSC, Ethernet, Serial. USB OTG pin detect support for HNP and SRP on OTG. |
| Graphics drivers | | |
| GPU | All i.MX 6 except 6UltraLite | Graphics Chips Details 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 which include 2D and 3D hardware acceleration: <ul style="list-style-type: none"> • Supports EGL 1.4 for fbdev, X11, Wayland • Supports OpenGL ES1.1 • Supports OpenGL ES2.0 (WebGL 1.0.1 compatible on X11) • Supports OpenGL ES3.0 • Supports OpenVG1.1 • Supports OpenCL1.1 • Supports OpenGL2.1 GC355 and GC320 on 6SoloLite, which includes only 2D hardware acceleration <ul style="list-style-type: none"> • Supports EGL 1.4 for fbdev, X, Wayland • Supports OpenVG1.1 |
| Frame Buffer Driver | All i.MX | 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 6SoloLite, i.MX 6SoloX SABRE-SD/SABRE-AI, i.MX 6UltraLite EVK and i.MX 7Dual SABRE-SD. |
| VDOA | 6SABRE-SD 6SABRE-AI | Supports Video Data Order Adapter. |
| LVDS | 6SABRE-SD 6SABRE-AI 6SoloX-SD 6SoloX-AI | Supports HannStar LVDS panel. It's the default display if no other video option is setup. On the SABRE-AI there are 2 ports. Port 0 is the default. |
| HDMI | 6SABRE-SD 6SABRE-AI 6SoloLite 6SoloX-AI | i.MX 6SABRE-SD and SABRE-AI support on-chip DesignWare HDMI hardware module. i.MX 6SoloLite and i.MX 6SoloX SABRE-AI support external HDMI. |
| HDCP | 6SABRE-SD | Supports HDCP v1.2 specifications. |

Table continues on the next page...

Table 10. Supported features (continued)

| Feature | Supported board | Comment |
|---------------------------|---|---|
| WVGA panel | All i.MX | Supports SEIKO WVGA panel. For i.MX 6UltraLite, it supports Embest LCD8000-43T LCD panel. |
| PxP | 6DualLite-SD 6SoloLite 6SoloX-SD 6SoloX-AI 6UltraLite EVK | Enables PXP Driver for EPDC on i.MX 6SoloLite and i.MX 6DualLite SABRE-SD. Conforms to DMA engine framework. |
| MIPI Display | 6SABRE-SD | Supports MIPI DSI driver through MIPI daughter card. |
| EPDC | 6DualLite-SD 6SoloLite | 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. |
| Multimedia Drivers | | |
| IPU V3 driver | 6SABRE-SD 6SABRE-AI | On i.MX 6SABRE-SD and i.MX 6SABRE-AI 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 | On i.MX 6SABRE-SD and i.MX 6SABRE-AI uses the IPU post-processing functions for video output. On i.MX 6SoloLite i.MX 6SoloX SABRE-SD and AI, i.MX 6UltraLite EVK and i.MX 7D SABRE-SD, they use the PXP post-processing functions for video output. |
| V4L2 Capture | All i.MX except 7D-SABRE-SD | Supports dual camera on i.MX 6SABRE-SD and SABRE-AI. |

Table continues on the next page...

Table 10. Supported features (continued)

| Feature | Supported board | Comment |
|-------------------------------|--|--|
| | | Supports single camera on i.MX 6SoloLite and i.MX 6SoloX SABRE-SD, SABRE-AI and i.MX 6UltraLite EVK. |
| VPU | 6SABRE-SD 6SABRE-AI | Encoder: MPEG-4, H.263, H.264(AVC/MVC), MJPEG Decoder: MPEG-4, H.263, H.264(AVC/MVC), VC-1, MPEG-2, MJPEG, AVS, VP8. |
| MIPI | 6SABRE-SD | Supports 2 lanes CSI and DSI. Supports OV5640 camera sensor |
| Parallel CSI | 6SABRE-SD 6SoloLite 6SoloX-SD | Supports OV5640 camera sensor. |
| TV-IN | 6SABRE-AI | Supports TV-IN via ADV7180 on the 6SABRE-AI. Supports bt656, NTSC, and PAL. |
| General drivers | | |
| uSDHC | All i.MX | Supports SD2.0, SD3.0 and SDXC. Supports eMMC 1bit/4bit/8bit SDR/DDR mode. i.MX 6SABRE-SD is soldered, i.MX 6SABRE-AI uses the daughter card, i.MX 6SoloX-SD is not soldered. Supports eMMC4.5 on i.MX 6SoloLite and i.MX 6SoloX-SD. |
| Watchdog | All i.MX | Supports Watchdog reset. |
| I2C | All i.MX | Supports I2C master. |
| SPI | All i.MX | Supports SPI master mode. |
| PWM | All i.MX | Supports the backlight driver via PWM. |
| ADC | 6SoloX-SD 6SoloX-AI 6UltraLite EVK | Supports ADC driver. |
| Temperature monitor | All i.MX | Pre-calibrated. See the "Thermal Driver" chapter in <i>i.MX 6 Linux[®] Reference Manual (IMXLXRM)</i> for more information. |
| Accelerometer | 6SABRE-SD 6SoloLite 6SoloX-SD 6SoloX-AI 6UltraLite EVK | Supports MMA8451 sensor on i.MX 6SABRE-SD. Supports MMA8451 sensor on i.MX 6SoloX-SABRE-SD and SABRE-AI. Supports MMA8450 sensor on i.MX 6SoloLite. Supports FXLS8471Q sensor on 6UltraLite EVK. |
| Wi-Fi | All i.MX | Supports the Broadcom/Murata BCM4339 Bluetooth/Wi-Fi module. |
| Bluetooth wireless technology | 6SABRE-SD 6UltraLite EVK 7D-SABRE-SD | Supports Broadcom BCM4339 Bluetooth module on i.MX 6 boards. The default Bluetooth software stack is BlueZ but Broadcom provides a Bluetooth stack that supports additional Bluetooth profiles if using Broadcom hardware. |
| GPIO Expander | 6SABRE-SD 6SABRE-AI | Supports MAX7310 GPIO expander on i.MX 6 SABRE-SD and SABRE-AI. |
| SNVS RTC | All i.MX | Low power section only. |
| Ambient Light Sensor | 6SABRE-SD 6SABRE-AI 6SoloX-SD | Supports ISL29023 sensor on i.MX 6 boards. |

Table continues on the next page...

Table 10. Supported features (continued)

| Feature | Supported board | Comment |
|---------------------|-----------------|--|
| | 6SoloX-AI | |
| Magnetometer Sensor | 6SABRE-SD | Supports MAG3110 sensor on i.MX 6 boards. |
| | 6SABRE-AI | Supports FXLS8471 sensor on i.MX 6UltraLite EVK board. |
| | 6SoloX-SD | Supports MPL3115A2, FXOS8700CQR1, and FXAS21002CQR1 sensors on the i.MX 7Dual SDB board. |
| | 6SoloX-AI | |
| | 6UltraLite EVK | |
| AM/FM module | 6SABRE-AI | Supports SI4763 AM/FM module. Supports FM by using the SSI interface. |

4 Kernel Boot Parameters

Depending on the booting/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. | console=ttymx0,115200 For 6SABRE-AI, console=ttymx3,115200 For 6SoloX-AI, console=ttymx0,115200 | All use cases |
| nosmp | A command-line option of 'nosmp' disables SMP activation entirely. | nosmp | CONFIG_SMP is defined. Any platform needs to remove SMP activation overhead for single core, for example, the i.MX 6Solo. Disabling the CONFIG_SMP can remove further overhead. |
| ip | Tell 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. |

Table continues on the next page...

Table 11. Common kernel boot parameters (continued)

| Kernel parameter | Description | Typical value | Used when |
|--------------------|--|--|--|
| 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.) |
| rootwait | Waits (indefinitely) for the root device to show up. | rootwait | Used when mounting SD root file system. |
| mem | Tell the kernel how much memory can be used. | None or mem=864M | Note: MemTotal-<mem> - <gpu_memory> is reserved. |
| max17135 | Configure the maximum of 17135 EPD PMIC pass number and VCOM voltage. | max17135:pass=[pass_num],vcom=[vcom_uV] | 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=mxcepdcb:E060SCM,bpp=16 | 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. | <ol style="list-style-type: none"> 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 | <ol style="list-style-type: none"> 1. Used when primarily displaying on HDMI with 1080P60 mode. Secondly displaying on LVDS with XGA mode. 2. Used when primarily displaying on LVDS with XGA mode. Secondly 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. <p>NOTE: GBR24/RGB565/YUV444 represents the display HW interface format. Typical values for certain different display devices are as follows: TVOUT: YUV444</p> |

Table continues on the next page...

Table 11. Common kernel boot parameters (continued)

| Kernel parameter | Description | Typical value | Used when |
|--------------------|--|---|--|
| | | | VGA: GBR24 HDMI&DVI: RGB24 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. | <ol style="list-style-type: none"> 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 | <ol style="list-style-type: none"> 1. Used when primarily displaying on HDMI with 1080P60 mode. Secondly displaying on LVDS with XGA mode. 2. Used when primarily displaying on LVDS with XGA mode. Secondly 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" <p>NOTE: GBR24/RGB565/YUV444 represents the display HW interface format. Typical values for certain different display devices are shown as follows:</p> <p>TVOUT: YUV444 VGA: GBR24 HDMI&DVI: RGB24 CLAA WVGA LCD: RGB565</p> <p>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</p> |

Table continues on the next page...

Table 11. Common kernel boot parameters (continued)

| Kernel parameter | Description | Typical value | Used when |
|--|---|--|---|
| | | | tve: TVOUT |
| video on 6SoloLite | Tells the EPDC FB driver which E Ink panel is in use and what bpp should be used for the Frame Buffer. | video=mxcepdcfb:E060SCM,bpp=16 | Used when enabling EPDC to select the correct E Ink panel parameters to use. bpp=16 selects RGB565 FB pix format bpp=8 selects Y8 FB pixel format |
| video on 6SoloLite | Tells the ELCDIF FB driver which LCD panel is in use and which bpp should be used for the Frame Buffer. | video=mx_elcdif_fb:SEIKO-WVGA,bpp=16 | Used when enabling LCDIF to select the correct panel parameters to use. bpp=16 selects RGB565 FB pix format Note: if only use EPDC FB, then turn off ELCDIF FB by "video=mx_elcdif_fb:off" |
| 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. |
| mtddparts on 6SABRE-AI | Tells the kernel mtd partition information. | mtddparts=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. |

5 Known Issues/Limitations

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

The following tables list some key known issues.

Table 12. Common known issues and workarounds

| Module | Source | Description | Workaround |
|---------|----------|---|--|
| Thermal | Hardware | The Temperature Monitor should only be enabled for chips that have undergone proper thermal sensor calibration. MC marked devices have undergone temperature calibration. | Ensure proper temperature calibration before using the temperature monitor. See the "Thermal Driver" Chapter in the <i>i.MX Linux® Reference Manual</i> (IMXLXRM). |

Table 13. Known issues and workarounds for i.MX 6 SABRE-SD and i.MX 6 SABRE-AI

| Module | Source | Description | Workaround |
|----------|-------------------|---|---|
| ARM core | Software | smp_wmb performance is very low. | This is the common side-effect of SMP. No fix plan. |
| IPU | Software | The framebuffer driver and v4l2 output driver share the same fb device. For example, /dev/video16 also uses the /dev/fb0 to do video playback. | Frame Buffer operations should be banned during video playback on the same FB device. |
| IPU | Hardware | Currently, only supports 4-stripe and 2-stripe split mode. When doing large ratio up-scaling from low resolution frames to high resolution frames, for example, 64x64 to 1920x1080, the requirement cannot be covered by the current split mode solution, that is, each stripe would exceed 1024 pixels for width. Therefore, the video cannot display a full screen. | No. |
| IPU | Hardware | CSI_SMFC_MEM capture channel cannot support 32 pixel IDMAC burst size for non-interleaved and partial-interleaved YUV pixel formats with non-16byte-aligned UV stride line. Little horizontal stripes can be seen on the capture frames. | The current workaround is to change 32 pixel burst size to 16 pixel burst size, which would bring considerable capture performance penalty. |
| PRE | Hardware | When the software write (hw_pre_ctrl_pio_write) and the hardware write (hw_pre_ctrl_enable_enable) are in the same clock cycle, the hardware write is ignored, because the software write has a higher priority. It causes the PRE to stop working unless the whole PRE+PRG + IPU corresponding channel is restarted. This issue is tracked by the PDM ticket TKT275991. The relevant framebuffer pan display or set par operations may cause the PRE to stop working due to accidentally triggering the hardware bug. | Currently no workaround. |
| PCIe | Hardware/Software | PCIe does not support Hot Plug and Power Management. | No. |

Table continues on the next page...

Table 13. Known issues and workarounds for i.MX 6 SABRE-SD and i.MX 6 SABRE-AI (continued)

| Module | Source | Description | Workaround |
|-------------------|----------|---|---|
| Memory Management | Software | The system reports page allocation failure: order:9, mode:0xd0 when the system does not have sufficient physical continuous memory to allocate. | This may be caused by the kernel page reclaiming issue. One workaround for this: <code>echo 1 > /proc/sys/vm/drop_caches</code> before you run the application. |
| HDMI | Software | ENGR00290866 HDMI cannot be set to 1080p@60hz with kernel configuration settings. | Use the <code>xrandr</code> application to configure the HDMI resolution from user-space. |
| ASRC | Hardware | Two ASRC M2M instances and one P2P instance conversion simultaneously meet serious noise on 176 K and 192 K sampling rates. | When there are three instances, the total MIPS consumption should not exceed the ASRC master clock (132 M). In this situation, the total MIPS consumption is more than 120 M, and it is close to the threshold (132 M) in theory. Therefore, this is a capability issue of ASRC, and the noise is expected. |

Table 14. Known issues and workarounds for i.MX 6 SABRE-SD

| Module | Source | Description | Workaround |
|--------------|----------|---|---|
| SPI NOR boot | Hardware | SPI NOR boot is not supported by the SABRE-SD board. | Current SD board uses KEY relative PINs as SPI interface. However, this set of PINs are not supported by ROM. Therefore, SPI NOR boot is not supported by the SABRE-SD board. |
| CPU hotplug | Software | System hangs after conducting CPU hot plug many times during heavy interrupt. | Known ARM Linux OS limitation. No workaround as of yet. |
| VPU | Software | Cannot support the "-x 1" option for unit test program <code>mxc_vpu_test.out</code> , because the IPU library is removed. | To avoid this issue, do not use "-x 1", since "-x 1" means enable for IPU library. |
| IPU | Hardware | Currently, only supports 4-stripe and 2-stripe split mode. When doing large ratio up-scaling from low resolution frames to high resolution frames, for example, 64x64 to 1920x1080, the requirement cannot be covered by the current split mode solution, that is, each stripe would exceed 1024 pixels for width. Therefore, the video cannot display a full screen. | No. |

Table 15. Known issues and workarounds specifically for i.MX 6Dual/6Quad SABRE-SD

| Module | Source | Description | Workaround |
|-----------|----------|--|------------|
| SATA Boot | Hardware | The system cannot boot from SATA on the Rev.B board. | Remove R7. |

Table continues on the next page...

Table 15. Known issues and workarounds specifically for i.MX 6Dual/6Quad SABRE-SD (continued)

| Module | Source | Description | Workaround |
|----------------|-----------------------|---|-----------------------------------|
| Boot | Hardware | The system cannot boot sometimes when it is powered on the Rev. B board for the first time. | Add 2.2M ohm resistor to 24M OSC. |
| Suspend/Resume | Hardware/ Software | Suspend/Resume failure if board rework "Add 2.2M ohm resistor to 24M OSC". | Remove rework. |

Table 16. Known issues and workarounds specifically for i.MX 6Solo/6DualLite SABRE-SD

| Module | Source | Description | Workaround |
|--------|----------|--|---|
| PMIC | Hardware | The i.MX 6DualLite SD board depopulates the resistor R30 and takes away the ability of the processor to turn off the PMIC in hardware. | i.MX 6DualLite uses dumb mode by default. |
| EPDC | Software | Enabling E Ink Auto-update mode (Device Drivers > Graphics Support > E Ink Auto-update Mode Support) causes E Ink panel updates to be distorted and flaky. | Disable the E Ink Auto-update Mode feature in the menuconfig. |
| EPDC | Hardware | The three boards cannot boot with EPDC DC2 attached while they boot normally without DC2 daughter cards. | This occurs when the SW3 (KEYPAD_LOCK) switch on the EBOOK DC2 board is switched "ON", which affects the boot bin "EIM_DA7" (BT_CFG1_7). You need to set the SW3 in DC2 board to "OFF." |

Table 17. Known issues and workarounds for i.MX 6Dual/6Quad SABRE-AI

| Module | Source | Description | Workaround |
|----------|----------|---|---|
| ARM core | Software | CONFIG_SMP should be disabled for the i.MX 6Solo chip. | To remove overhead caused by SMP for better performance, CONFIG_SMP is expected to be disabled for single core. Complete support with SMP disabled is provided with future Linux BSP release. |
| IPU | Hardware | Default 24bpp on the second display used by HDMI. IPU keeps printing error for hardware bandwidth limitation as described in CR ENGR00293432. | No. |
| eCompass | Hardware | eCompass cannot work after EIM-NOR or SPI-NOR are enabled on the kernel. | No. |
| USB | Software | USB OTG and USB host cannot work after EIM-NOR or SPI-NOR are enabled on kernel. | No. |
| TV-IN | Software | Error messages may be expected along with bad quality at first frames on the TV-IN interface. This may occur on a hot plug connection. | No. |
| U-Boot | Hardware | ENGR00236878: eMMC 4.4 fails to boot on SABRE-AI boards. | No. |
| MLB | Software | The SYNC mode cannot work stably in the test. | No |

Table continues on the next page...

Table 17. Known issues and workarounds for i.MX 6Dual/6Quad SABRE-AI (continued)

| Module | Source | Description | Workaround |
|---------|----------|--|------------|
| SDIO3.0 | Software | No available device to do the SDIO 3.0 test. | - |

Table 18. Known issues and workarounds specifically for i.MX 6QuadPlus

| Module | Source | Description | Workaround |
|--------|----------|---|--------------------------|
| PRE | Hardware | <p>When the software write(hw_pre_ctrl_pio_write) and the hardware write(hw_pre_ctrl_enable_enable) are in the same clock cycle, the hardware write is ignored, because the software write has a higher priority. It causes the PRE stop working unless the whole PRE+PRG + IPU corresponding channel is restarted.</p> <p>This issue is tracked by the PDM ticket TKT275991. The relevant framebuffer pan display or set par operations are likely to cause the PRE stop working due to accidentally triggering the hardware bug.</p> | Currently no workaround. |

Table 19. Known issues and workarounds specifically for i.MX 6Solo/6DualLite SABRE-AI

| Module | Source | Description | Workaround |
|----------------------|----------|--|--|
| Hardware manufacture | Hardware | HDMI, SD3 card detection, and eGalax touch screens are found to fail on some boards. | This is because some PINs are not soldered well. If any basic feature, which is announced to be supported, does not work on your board, check the board. |
| CPU hotplug | Software | System hangs after conducting CPU hot plug many times during heavy interrupt. | Known ARM Linux OS limitation. No workaround as of yet. |
| VPU | Software | Cannot support "-x 1" option for unit test program mxc_vpu_test.out, because IPU library is removed. | To avoid this issue, do not use "-x 1", because "-x 1" means enabled for IPU library. |

Table 20. Known issues and workarounds for i.MX 6SoloLite

| Module | Source | Description | Workaround |
|----------|----------|--|---|
| EPDC | Software | Enabling E Ink Auto-update mode (Device Drivers > Graphics Support > E Ink Auto-update Mode Support) causes E Ink panel updates to be distorted and flaky. | Disable the E Ink Auto-update Mode feature in the menuconfig. |
| System | Hardware | Reboot may not work on the EVK board. | Reboot function should be always okay if the hardware can trigger PMIC reset, which ensures RESET key and watchdog reset can control PMIC_ON_REQ pin. |
| CSI/EPDC | Hardware | Cannot be used simultaneously, because these two modules share the same pins on the EVK board. | The board file in BSP configures these pins for proper function through DTS. Use imx6sl-evk.dts for EPDC, and imx6sl-evk-csi.dts for CSI. |

Table continues on the next page...

Table 20. Known issues and workarounds for i.MX 6SoloLite (continued)

| Module | Source | Description | Workaround |
|----------------|-----------------------|---|--|
| X-Acceleration | Hardware/ Software | Out of memory error during the x11perf test. | It is a system limitation since the x11perf needs a lot of memory. No work-around on the EVK board (only with LPDDR2 memory of 512 MB). Users may use a larger memory to work around this issue. |
| Mfgtool2 | Software | Mfgtool2 may fail to execute the <code>frf</code> command if there is no <code>send</code> or <code>pipe</code> command executed prior to it. | Remove the <code>frf</code> command from <code>ucl2.xml</code> to fix this issue. |
| FUSE for RTC | Hardware | SEC_CONFIG[0] fuse bit is not burned, which leads the RTC not to be functional. | In U-Boot prompt, run the command "imxotp blow --force 4 0x2". |
| SDIO3.0 | Software | No available device to do the SDIO 3.0 test. | |
| HDMI | Software | ENGR00298771, i.MX 6SoloLite EVK: on some special resolutions, such as 1400x1050, the Yocto Project GUI display on HDMI is distorted. This is caused by <code>xrandr</code> and tries to expand the frame buffer size to 1408x1050 to align with 16 bytes. However, i.MX 6SoloLite ELCDIF does not support stride buffer and cannot crop 1400x1050 from the buffer 1408x1050, which then causes distortion. | No. Only found on 1400x1050 mode until now. |

Table 21. Known issues and workarounds for i.MX 6SoloX

| Module | Source | Description | Workaround |
|----------|-----------------------|--|--|
| Video | Software | The video display has a green line at bottom during <code>gplay</code> . | No workaround. |
| CAAM | Software | The system reboots after the CAAM RNG test is suspended and resumed. | There is hardware function conflict between the Mega/Fast mix off feature and CAAM. To use CAAM after kernel bootup, the user should enable the CAAM wakeup function to avoid Mega mix off in DSM. Workaround: <code>echo enabled > /sys/bus/platform/devices/2100000.aips-bus/2100000.caam/2101000.jr0/power/wakeup</code> |
| VADC | Software | Sometimes VADC cannot correctly detect the video standard. CSI works in NTSC mode but the VADC input is PAL. | The VADC auto standard detect function is not required. VADC input device does not change in product. Hard code VADC input standard in the VADC driver. |
| MLB | Software | SYNC mode is not stable. | No workaround. |
| QSPI-NOR | Hardware | PMIC needs to be reset to reset the QSPI-NOR flash on the board to the default 3 bytes mode. | The hardware workaround is required. |
| PCIe | Hardware/ Software | When the extremely power save mode is enabled on i.MX 6SoloX PCIe, the i.MX 6 SoloX PCIe phy/controller would be powered off completely, all the TLPs on the PCIe link would be discarded, and | No. |

Table continues on the next page...

Table 21. Known issues and workarounds for i.MX 6SoloX (continued)

| Module | Source | Description | Workaround |
|---------|----------|---|---|
| | | link would be down in suspend. The i.MX 6 SoloX PCIe and the PCIe link would be re-initialized completely during resume operations. There is one known issue when the pcie2usb device is used during suspend/resume. The development node of the pcie2usb device maybe changed, since the pcie2usb device is reset when the i.MX 6SoloX PCIe is re-initialized during resume. | |
| MMC | Software | Hynix eMMC times out when the rootfs automatically mounts the RPMB partition on i.MX 6SoloX SD. | Rootfs should not automatically mount the RPMB partition, because it is a secure partition. |
| CSI/LCD | Hardware | CSI and LCD cannot be used simultaneously since the two modules share the same pins on the i.MX 6SoloX SABRE-SD board. | No. |
| UART | Hardware | UART cannot wake up with the RTS pin programmed with hard flow control enabled. And there is limitation of the framesize to about 16. | No. |

Table 22. Known issues and workarounds for i.MX 6UltraLite EVK

| Module | Source | Description | Workaround |
|--------|----------|---|------------|
| USB | Hardware | On the i.MX 6UltraLite EVK board, the USB OTG port can be only used as device mode. | No. |

6 Multimedia

This chapter contains the information on the 4.0.9 multimedia component of the BSP.

The versions of the GStreamer releases are listed below:

GStreamer 1.0:

- gstreamer (version 1.6.0)
- gstreamer-plugins-base (version 1.6.0)
- gstreamer-plugins-good (version 1.6.0)
- gstreamer-plugins-bad (version 1.6.0)
- gstreamer-libav (version 1.6.0)

6.1 Freescale GStreamer plugins

Table 23. Freescale GStreamer 1.0 plugins

| Plugin | Features |
|---------------------|--|
| Audio decoder | beepdec: unified audio decoder plugin Supports MP3, AAC, AAC+, WMA, AC3, Vorbis, DD+, AMR, RA |
| Audio encoder | imxmp3enc: MP3 encoder plugin |
| Video decoder | <ul style="list-style-type: none"> vpudec: VPU-based video decoder plugin Software video decoder plugins: use gst-libav plugins |
| Video encoder | <ul style="list-style-type: none"> vpuenc_h264: VPU-based AVC/H264 video encoder vpuenc_h263: VPU-based H263 video encoder vpuenc_mpeg4: VPU-based MPEG4 video encoder vpuenc_jpeg: VPU-based JPEG video encoder |
| Demux | aiurdemux: aiur universal demuxer plugin supporting Supports AVI, MKV, MP4, MPEG2, ASF, OGG, FLV, WebM, RMVB |
| Video render | <ul style="list-style-type: none"> imxv4l2sink: V4L2-based video sink plugin overlaysink : G2D-based video sink plugin |
| Video source | imxv4l2src: V4L2 based camera/TVin source plugin |
| Video convert | <ul style="list-style-type: none"> imxvideoconvert_g2d: GPU2D-based video convert plugin, to perform video color space conversion, resize, rotate imxvideoconvert_ipu: IPU-based video convert plugin, to perform video color space conversion, resize, rotate, deinterlacing imxvideoconvert_pxp: PXP-based video convert plugin, to perform video color space conversion, resizing, and rotation |
| OpenGL (ES) Plugins | <ul style="list-style-type: none"> gimagesink: OpenGL (ES)-based video sink plugin, supported in X11, Wayland, and FB backends gleffects: GL Shading Language effects plugin |
| Video compositor | <ul style="list-style-type: none"> imxcompositor_g2d: GPU2D-based video compositor plugin imxcompositor_ipu: IPU-based video compositor plugin imxcompositor_pxp: PXP-based video compositor plugin 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 |

NOTE

- To support WMA, WMV, AAC+, AC3, DD+, rmvb decoding, and WMA encoding, you need to install special and excluded packages.
- vpudec plugins are only for SoCs with the VPU hardware.
- imxvideoconvert_g2d can only perform color space converting to RGB space.
- OpenGL (ES) plugins are from the gst-plugins-bad package, accelerated with Vivante private APIs.
- Video overlay composition meta (meta:GstVideoOverlayComposition) is supported in imx video sinks, convert and compositor. This feature accelerates the text image (such as subtitle, timestamp) blending with video in these plugins with hardwares.

6.2 Freescale playback engine API

Freescale provides a high-level API set for easier-making playback-related applications based on the GStreamer framework. This API set is based on playbin, it can be found from `gst1.0-fsl-plugin/tools/gplay/playengine.h`. This API set can provide the following functions.

Table 24. Freescale playback engine API functions

| Function | Feature |
|-----------------|--|
| Playback | <ul style="list-style-type: none"> • Play, Stop • Pause, Resume • Fast seek, Accurate seek • Playback rate control (fast forward, fast rewind, slow forward) |
| Media Info | <ul style="list-style-type: none"> • Media meta data (artist, year, etc.) • Video Thumbnail • Audio Album Art |
| Subtitle | Supports internal and external subtitle |
| Track Selection | <ul style="list-style-type: none"> • Audio Track Selection • Video Track Selection • Subtitle Selection |
| Display Control | <ul style="list-style-type: none"> • Resize • Rotate |

6.3 Freescale recording engine API

Freescale provides a high-level API set for easier-making 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 from `gst1.0-fsl-plugin/tools/grecorder/recorder_engine.h`.

This API set can provide the following functions.

Table 25. Recording engine functions

| Function | Feature |
|-------------------|--|
| Image capture | Captures images from the camera with different resolutions and saves them to JPEG files. |
| Video recording | Records audi and video into various file formats, supporting the following formats: (MP3) x (H264, MPEG4, H263, MJPEG) 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, specifies the total file segment count and each file's maximum size. It can record a file endlessly, saving to file segments in 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.

6.4 Freescale Qt Applications

Freescale provides the following applications based on Qt to demonstrate the multimedia features on the X11 backend.

Table 26. Qt applications

| Application | Feature |
|-------------|--|
| IMXPlayer | Based on the playback engine, it provides all the features supported in the playback engine. |
| IMXCamera | Based on the recording engine, it provides all the features supported in the recording engine. |

NOTE

The demo applications are only available in platforms with VPU and in an X11 environment.

6.5 Multimedia feature matrix

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

6.5.1 Parser/Demuxer specifications

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

Table 27. 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 | - |

Table continues on the next page...

Table 27. Parser/Demuxer supported audio/video (continued)

| | Demuxer feature | ASF | AVI | MP4 | OGG | FLV | MPG2 | MKV | RMVB |
|--|-----------------|-----|-----|-----|-----|-----|------|-----|------|
| | 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 |

6.5.2 Video codec specifications

The tables in this section show the video codec specs with and without VPU acceleration. Check Section [BSP Supported Features](#) to determine if your board supports VPU.

Table 28. Video codec specification for hardware with VPU acceleration

| - | Feature | Profile | Max. resolution | Min. resolution | Max. framerate | H/W or S/W | Bitrate | Comment |
|---------------|---------|---------|-----------------|-----------------|----------------|------------|-----------|----------------|
| Video decoder | MPEG2 | MP | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 50 Mbps | - |
| | MPEG4 | SP | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 40 Mbps | - |
| | MPEG4 | ASP | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 40 Mbps | - |
| | H.263 | P3 | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 20 Mbps | - |
| | H.264 | BP | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 50 Mbps | - |
| | H.264 | MP | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 50 Mbps | - |
| | H.264 | HP | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 50 Mbps | - |
| | VC-1 | SP | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 45 Mbps | - |
| | VC-1 | MP | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 45 Mbps | - |
| | VC-1 | AP | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 45 Mbps | - |
| | VP8 | - | 1280 * 720 | 64 * 64 | 30 fps | H/W | 20 Mbps | i.MX 6DualLite |
| | VP8 | - | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 20 Mbps | i.MX 6Quad |
| | MJPEG | - | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 120 Mpixl | - |
| | RV | 8/9/10 | 1920 * 1080 | 64 * 64 | 30 fps | H/W | 40 Mbps | - |

Table 29. Video codec specification for hardware without VPU acceleration

| | Feature | Profile | Max. resolution | Min. resolution | Max. framerate | H/W or S/W | Comment |
|---------------|---------|----------|-----------------|-----------------|----------------|------------|--------------------------|
| Video decoder | H.264 | BP/MP/HP | 720 * 480 | 64 * 64 | 30 fps | S/W | Supported with gst-libav |

GStreamer 1.x uses the gst-libav plugin, which is not included in the release image and needs to be build into the image separately. For how to include it, refer to the *i.MX Linux® User's Guide*.

6.5.3 Audio codec specification

Table 30. Audio codec specification

| Decoder | Feature/Profile | Channel | Sample rate (KHz) | Bit rate (kbps) | H/W or S/W | Comment |
|----------------|--|-------------|-------------------------------|-----------------------------------|------------|-----------------|
| 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 | S/W | - |
| AACLC | MPEG-2 AACLC MPEG-4 AACLC | <= 5.1 | 8 - 96 | 8 - 256 | S/W | - |
| HE-AAC | HE-AAC V1 HE-AAC V2 | stereo/mono | 8 - 96 | Mono: 8 - 384 stereo: 16 - 768 | S/W | - |
| WMA10 Std | L1 @ QL1 | stereo/mono | 44.1 | 64 - 161 | S/W | - |
| | L2 @ QL1 | stereo/mono | <= 48 | <= 161 | S/W | - |
| | L3 @ QL1 | stereo/mono | <= 48 | <= 385 | S/W | - |
| WMA10 Pro | M0a @ QL2 | stereo/mono | <= 48 | 48 - 192 | S/W | - |
| | M0b @ QL2 | stereo/mono | <= 48 | <= 192 | S/W | - |
| | M1 @ QL2 | <= 5.1 | <= 48 | <= 384 | S/W | - |
| | M2 @ QL2 | <= 5.1 | <= 96 | <= 768 | S/W | - |
| | M3 @ QL2 | <= 7.1 | <= 96 | <= 1500 | S/W | - |
| WMA 9 Lossless | N1 | stereo/mono | <= 48 | <= 3000 | S/W | - |
| | N2 | <=5.1 | <= 96 | <= 3000 | S/W | - |
| | N3 | <=7.1 | <= 96 | <= 3000 | S/W | - |
| AC-3 | - | <=5.1 | <= 48 | 32 - 640 | S/W | - |
| FLAC | - | <=7.1 | 8 - 192 | - | N/A | - |
| BSAC | - | <=5.1 | <= 48 | 64 per channel | N/A | Core codec only |
| Ogg Vorbis | q1 - q10 | Stereo | 8 - 192 | <= 500 | S/W | - |
| DD-plus | - | <=7.1 | 32, 44.1, 48 64, 88.2, 96 | <= 6.144 Mbps | S/W | - |
| RA | cook | stero/mono | 8k, 11.025k, 22.05k, 44.1k | - | S/W | - |

NOTE

- The bitrate (bps) supported for MP3 encoder: 32 k, 48 k, 56 k, 64 k, 80 k, 96 k, 112 k, 128 k, 160 k, 192 k, 224 k, 256 k, 320 k
- The sample and supported bitrate (bps) combinations for WMA8 encoder:
 - For mono output:
 - 22050 Hz: 20 k, 16 k, 22 k, 17.6 k
 - 32000 Hz: 20 k, 22 k
 - 44100 Hz: 32 k, 35.2 k, 48 k, 52.8 k
 - For Stereo output:
 - 22050 Hz: 35.2 k, 32 k, 22 k, 20 k
 - 32000 Hz: 52.8 k, 48 k, 44 k, 40 k, 35.2 k, 32 k
 - 44100 Hz: 211.2 k, 192 k, 176 k, 160 k, 140.8 k, 128 k, 105.6 k, 96 k, 88 k, 80 k, 70.4 k, 64 k
 - 48000 Hz: 211.2 k, 192 k, 176 k, 160 k, 140.8 k, 128 k

6.5.4 Image codec specification**Table 31. Image codec specification**

| | Feature | Profile | Max. resolution | H/W or S/W |
|---------------|---------|----------|-----------------|------------|
| Image decoder | JPEG | Baseline | Memory-related | S/W |
| | PNG | N/A | Memory-related | S/W |
| | GIF | N/A | Memory-related | S/W |
| | BMP | N/A | Memory-related | S/W |
| Image encoder | JPEG | Baseline | Memory-related | S/W |

6.5.5 Speech codec specification**Table 32. 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 |

6.5.6 Streaming protocol specification

Table 33. Streaming protocol specification

| Protocol | Feature |
|----------|----------------------------|
| HTTP | HTTP progressive streaming |
| RTSP | RTP, SDP |
| RTP/UDP | RTP/UDP MPEGTS streaming |

6.5.7 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 (IMXLUG)* for information on how to build and install it.

Table 34. 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 |

6.5.8 Subtitle specification

Table 35. Subtitle specification

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

6.6 Known issues and limitations for multimedia

- As the maximum buffer size of the playbin multi-queue is 2 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 (MPEG4(vpu) + AVI(avimux)) fails, because the AVIMUX mark MPEG4 video to DIVX is not supported.
- The accurate seek mode may have a longer time delay.
- Because the stream container does not have an index table, seek is not supported.
- Fast rewind of audio does not support audio-only streams.
- Pulseaudio is only available for the X11 backend.
- Rotation 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.

7 Revision History

This table provides the revision history.

Table 36. Revision History

| Revision number | Date | Substantive changes |
|------------------------|-------------|----------------------------|
| L4.1.15_1.0.0-ga | 03/2016 | Initial release |

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