

# 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 7Dual SABRE-SD Board (beta quality)
- 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.
- 7D-SABRE-SD means the i.MX 7Dual SABRE-SD Platform.
- 6UltraLite means the i.MX 6UltraLite EVK Platform.

## 1.1 Contents

This release consists of the following package files:

- L3.14.52\_1.1.0-ga\_images\_MX6QDLSOLO.tar.gz
- L3.14.52\_1.1.0-ga\_images\_MX6QPSABRESO.tar.gz
- L3.14.52\_1.1.0-ga\_images\_MX6SLEVK.tar.gz
- L3.14.52\_1.1.0-ga\_images\_MX6SXALL.tar.gz
- L3.14.52\_1.1.0-ga\_images\_MX6UL.tar.gz
- L3.14.52\_1.1.0-ga\_mfg-tools.tar.gz
- fsl-yocto-L3.14.52\_1.1.0-ga.tar.gz

The release version is named "L<Kernel\_version>\_<x.y.z>."

"<Kernel\_version>": BSP Kernel version. (For example, "L3.14.52" indicates that this BSP release is based on the kernel version 3.14.52.)

"<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 1. Release contents**

Component	Description
Linux® OS Kernel and Device Trees	3.14.52
U-Boot Configurations	v2015.04
SD Card images	Images
Manufacturing Tools	Manufacturing tools support

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, imx6dlsabresd imx6qsabreauto, imx6dlsabreauto, imx6slevk imx6xsabresd

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**Table 2. U-Boot configurations (continued)**

U-Boot configuration for Boot device	Description	Supported machine configuration
		imx6xsabreauto imx7dsabresd 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  imx6xsabreauto imx7dsabresd
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	imx6xsabresd
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.	imx6xsabreauto imx7dsabresd imx6ulevk
emmc	This supports booting from EMMC.	imx6xsabresd
m4fastup	This supports booting from ARM Cortex-M4 processor by disabling QSPI2 from using ARM Cortex-M4 processor.	imx6xsabresd

The following table describes the kernel and device trees supported 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 3.14.52 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"> <li>• zImage-imx6q-sabresd.dtb zImage-imx6qp-sabresd.dtb</li> <li>• zImage-imx6dl-sabresd.dtb</li> <li>• zImage-imx6q-sabreauto.dtb zImage-imx6qp-sabreauto.dtb</li> <li>• zImage-imx6dl-sabreauto.dtb</li> </ul>

*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"> <li>• zImage-imx6sl-evk.dtb</li> <li>• zImage-imx6sx-sdb.dtb zImage-imx6sx-sdb-reva.dtb</li> <li>• zImage-imx6sx-sabreauto.dtb</li> <li>• zImage-imx7d-sdb.dtb</li> <li>• zImage-imx6ul-14x14-evk.dtb</li> <li>• zImage-imx6ul-9x9-evk.dtb</li> </ul> <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"> <li>• zImage-imx6dl-sabreauto-gpmi-weim.dtb</li> <li>• zImage-imx6q-sabreauto-gpmi-weim.dtb</li> <li>• zImage-imx6qp-sabreauto-gpmi-weim.dtb</li> <li>• zImage-imx7d-sdb-gpmi-weim.dtb</li> </ul>
ldo	<p>Enables the LDO feature. By default, the LDO bypass is enabled. Use LDO devices trees on configurations with CPU@1.2GHZ, which does not support LDO bypass mode.</p> <ul style="list-style-type: none"> <li>• zImage-imx6q-sabresd-ldo.dtb, zImage-imx6dl-sabresd-ldo.dtb</li> <li>• zImage-imx6sl-evk-ldo.dtb</li> <li>• zImage-imx6sx-sdb-ldo.dtb, zImage-imx6sx-sdb-reva-ldo.dtb</li> </ul>
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"> <li>• zImage-imx6q-sabresd-hdcp.dtb</li> <li>• zImage-imx6dl-sabresd-hdcp.dtb</li> </ul>
ecspi	<p>Enables eCSPI, which is disabled by default.</p> <ul style="list-style-type: none"> <li>• zImage-imx6dl-sabreauto-ecspi.dtb</li> <li>• zImage-imx6q-sabreauto-ecspi.dtb</li> <li>• zImage-imx6qp-sabreauto-ecspi.dtb</li> </ul>
flexcan1	<p>Enables flexcan1, which is disabled by default due to pin conflicts with fec.</p> <ul style="list-style-type: none"> <li>• zImage-imx6q-sabreauto-flexcan1.dtb</li> <li>• zImage-imx6dl-sabreauto-flexcan1.dtb</li> <li>• zImage-imx6qp-sabreauto-flexcan1.dtb</li> </ul>
csi	<p>Enables CSI support for V4L2. On i.MX 6UltraLite EVK this device tree fixes the pin conflict between SIM and CSI.</p> <ul style="list-style-type: none"> <li>• zImage-imx6sl-evk-csi.dtb</li> <li>• zImage-imx6ul-14x14-evk-csi.dtb</li> </ul>
pf200	<p>Enables PMIC pf200 support.</p> <ul style="list-style-type: none"> <li>• zImage-imx6sl-evk-pf200.dtb</li> <li>• zImage-imx6dl-sabresd-pf200.dtb</li> </ul>
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"> <li>• zImage-imx6q-sabresd-enetirq.dtb zImage-imx6dl-sabresd-enetirq.dtb</li> </ul>

Table continues on the next page...

**Table 3. Kernel and device tree configurations (continued)**

Kernel and device tree configuration	Description
emmc	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. <ul style="list-style-type: none"> <li>zImage-imx6sx-sdb-emmc.dtb</li> </ul>
Cortex-M4	Disables ADC 1 & 2, flexcan 1 & 2, I2C3, UART 2 and QSPI 2 when ARM Cortex-M4 processor is running. <ul style="list-style-type: none"> <li>zImage-imx6sx-sdb-m4.dtb</li> <li>zImage-imx6sx-sabreauto-m4.dtb</li> <li>zImage-imx7d-sdb-m4.dtb</li> </ul>
enet	<ul style="list-style-type: none"> <li>zImage-imx7-sdb-enet.dtb</li> </ul>
epdc	Pin conflict between HDMI and EPDC, disable HDMI for EPDC. <ul style="list-style-type: none"> <li>zImage-imx7d-sdb-epdc.dtb</li> </ul>
qspi	Enable DDR quad mode for Macronix qspi chip mx25l51245g by setting Quad bit in status register. <ul style="list-style-type: none"> <li>zImage-imx7-sdb-qspi.dtb</li> </ul>
hdmi-audio	Wm8960 and HDMI cannot be used together for they use same SAI interface. <ul style="list-style-type: none"> <li>zImage-imx7-sdb-hdmi-audio.dtb</li> </ul>
wm89860	Wm8960 and HDMI cannot be used together for they use same SAI interface. <ul style="list-style-type: none"> <li>zImage-imx7-sdb-wm8960.dtb</li> </ul>
sim	Disable epdc, conflict with SIM1. <ul style="list-style-type: none"> <li>zImage-imx7-sdb-sim.dtb</li> </ul>
touch	Add tsc2046 touch screen controller support. Due to the pin PENIRQ of tsc2046 is conflict with the interrupt pin of HDMI, so disable the HDMI. <ul style="list-style-type: none"> <li>zImage-imx7-sdb-touch.dtb</li> </ul>
Bluetooth Wi-Fi	Enable Broadcom Bluetooth and Wi-Fi hardware. <ul style="list-style-type: none"> <li>zImage-imx6q-sabresd-btwifi.dtb</li> <li>zImage-imx6dl-sabresd-btwifi.dtb</li> <li>zImage-imx6l-evk-btwifi.dtb</li> <li>zImage-imx6sx-sabresd-btwifi.dtb</li> <li>zImage-imx6ul-14x14-evk-btwifi.dtb</li> <li>zImage-imx6ul-9x9-evk-btwifi.dtb</li> </ul>

The release package contains the following pre-built images.

**Table 4. Pre-built images**

Package	Description
X11 SDCard	This release provides the following SD card images. These images are GUI with X11 backend. The imx6qdlsole 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> . <ul style="list-style-type: none"> <li>fsl-image-gui-x11-imx6qdlsole.sdcard</li> <li>fsl-image-gui-x11-imx6qpsabresd.sdcard</li> </ul>

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**Table 4. Pre-built images (continued)**

Package	Description
	<ul style="list-style-type: none"> <li>fsl-image-gui-x11-imx6ul7d.sdcard</li> <li>fsl-image-gui-x11-imx6levk.sdcard</li> <li>fsl-image-gui-x11-imx6sx_all.sdcard</li> </ul>
Frame Buffer SDCard	<p>This release provides the following SD card images for the Frame Buffer backend.</p> <ul style="list-style-type: none"> <li>fsl-image-qt5-fb-imx6qdlisolos.tar.bz2</li> <li>fsl-image-gui-fb-imx6qdlisolos.tar.bz2</li> <li>fsl-image-qt5-fb-imx6sx_all.tar.bz2</li> <li>fsl-image-gui-fb-imx6sx_all.tar.bz2</li> <li>fsl-image-gui-fb-imx6slevk.tar.bz2</li> <li>fsl-image-qt5-fb-imx6slevk.tar.bz2</li> <li>fsl-image-gui-fb-imx6qpsabresd.tar.bz2</li> <li>fsl-image-qt5-fb-imx6qpsabresd.tar.bz2</li> </ul>
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"> <li>fsl-image-qt5-xwayland-imx6qdlisolos.tar.bz2 fsl-image-gui-xwayland-imx6qdlisolos.tar.bz2</li> <li>fsl-image-gui-xwayland-imx6sx_all.tar.bz2</li> <li>fsl-image-qt5-xwayland-imx6sx_all.tar.bz2</li> <li>fsl-image-gui-xwayland-imx6slevk.tar.bz2</li> <li>fsl-image-qt5-xwayland-imx6slevk.tar.bz2</li> <li>fsl-image-gui-xwayland-imx6qpsabresd.tar.bz2</li> <li>fsl-image-qt5-xwayland-imx6qpsabresd.tar.bz2</li> </ul>
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-L3.14.52\_1.1.0-ga.tar.gz content**

File name	Description
Freescall_Yocto_Project_Users_Guide.pdf	Freescall Yocto Project User's Guide
README	Freescall README for L3.14.52_1.1.0-ga
/doc	i.MX Linux® BSP Release Notes, User's Guide, and Reference Manual

**Table 6. Multimedia standard packages**

File name	Description	Comment
gst1.0-fsl-plugins-4.0.8.tar.gz	GStreamer plugins	Freescall GStreamer plugins
libfslcodec-4.0.8.bin	Freescall codecs	Freescall optimized A/V core codec
libfslparser-4.0.8.bin	Freescall parser	Freescall optimized core parser
libfslvpwrap-1.0.62.bin	Freescall VPU wrapper	Freescall VPU wrapper for VPU library
fslqtapplications-1.0.6.bin	Freescall Qt applications	Freescall Qt applications

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

**Table 7. Controlled access packages**

File name	Description	Comment
libfslaacpcodec-4.0.8.bin	AACplus decoder	Freescale optimized AACplus decoder
libfslmscodec-4.0.8.bin	Microsoft codecs	Freescale optimized Microsoft codecs
libfslmsparser-4.0.8.bin	Microsoft parser	Freescale optimized Microsoft ASF parser
libfslac3codec-4.0.8.bin	AC3 decoder	Freescale optimized Dolby audio AC3 decoder
libfslddpcodec-4.0.8.bin	DDplus decoder	Freescale optimized Dolby audio DDplus decoder
libfslreal-4.0.8.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 and Wi-Fi	Broadcom Firmware for Wi-Fi and Bluetooth.

## 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 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
- fslqtapplications
- firmware-imx
- libfslcodec
- libfslparser
- libfslvpuwrap

## 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 are provided on [freescale.com](http://freescale.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, WMA, Broadcom firmware and E Ink firmware. encoding. 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	libfslaacppcodec-[version].bin	Freescale AACplus core decoder
Microsoft Codec	libfslmscodec-[version].bin	Freescale optimized MS codec
Microsoft Parser	libfslmspartner-[version].bin	Freescale optimized ASF parser
AC3 Decoder	libfslac3codec-[version].bin	Freescale AC3 core decoder
DDplus Decoder	libfslddpcodec-[version].bin	Freescale DD-plus decoder
RMVB Decoders and Parser	libfslreal-[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

## 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.
- *Freescale 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 Freescale 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 [freescale.com](http://freescale.com).

- i.MX 6 information is at [freescale.com/iMX6series](http://freescale.com/iMX6series)
- i.MX 6 SABRE information is at [freescale.com/imxSABRE](http://freescale.com/imxSABRE)
- i.MX 6SoloLite EVK information is at [freescale.com/6SLEVK](http://freescale.com/6SLEVK)
- i.MX 7Dual information is at [freescale.com/webapp/sps/site/prod\\_summary.jsp?code=i.MX7D](http://freescale.com/webapp/sps/site/prod_summary.jsp?code=i.MX7D)
- i.MX 6UltraLite information is at [freescale.com/webapp/sps/site/prod\\_summary.jsp?code=i.MX6UL](http://freescale.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:

- Yocto Project upgraded to version 1.8 Fido.
- Supports the GCC 4.9.2 toolchain.
- The Linux kernel is upgraded to v3.14.52.
- The U-Boot is upgraded to 2015.04.
- New graphics features:
  - GPU driver upgraded to Vivante v5.0.11p7.4.
  - DirectFB support removed.
  - XWayland support added.
  - Last release to provide graphics software floating point binaries.
- New multimedia features and changes:
  - Qt 5.5 support integrated, which supports hardware accelerated QML video.
  - Qt 5 is not supported for SoC without hardware graphics. Qt 5 video is not supported on SoC without VPU.
  - Video compositing plugins based on PXP are supported.
  - GStreamer playback engine API is supported, providing high level APIs for media playback and operations.
  - Video overlay composition meta (meta:GstVideoOverlayComposition) is supported in i.MX video sinks, convert and compositor. This feature accelerates the text image (such as subtitle, timestamp) blending with video in these plugins with hardwares.
  - Supports the Broadcom/Murata BCM4339 Bluetooth/Wi-Fi module.

Features on new 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 with 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 7Dual:

- Multimedia: MPI-DSI, SAI, wm8960, and wm8958 32bit word length support
- Security: CAAM
- Connectivity: SIMv2, PCIe-RC, and PCIe-EP mode (validation board)
- Sensor through the I2C interface including: MPL3115A2, FXOS8700CQR1, FXAS21002CQR1
- Multi-core communication: RPMsg

Features on new i.MX 6QuadPlus:

- i.MX 6QuadPlus TO1.0 SOC support added.
- i.MX 6QuadPlus SABRE-AI and SD boards supported.
- PRE-Prefetch 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 SoC with GPU
- GPU dynamic power management for SoC 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 on 6SoloLite are supported:

- LDO bypass

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

- 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 spec 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"> <li>• 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.</li> <li>• High quality ETC2/EAC texture compression, which eliminates the need for a different set of textures for each platform.</li> <li>• Shading language enhancements, which include full support for integer and 32-bit floating point operations.</li> <li>• 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.</li> <li>• Extensive set of required, explicitly sized texture and render-buffer formats, which reduces implementation variability and makes it much easier to write portable applications.</li> </ul>
Compatible with 4.x Driver for OpenGLES 2.0 API	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Application performance on the 5.x driver is better than or equal to that with the 4.x driver.</li> </ul>
Incremental features	<ul style="list-style-type: none"> <li>• 2D: Add YUV layer support for multi-source blit in hwcomposer v1.</li> <li>• 2D-VG: Add GC355_PROFILER build option and rename GC355_PROFILER macro to gcdGC355_PROFILER in driver.</li> </ul>

*Table continues on the next page...*

**Table 9. New features (continued)**

Feature	Description
	<ul style="list-style-type: none"> <li>• 2D-VG: Refined 2D-VG memory footprints.</li> <li>• 2D-VG: Refine 2D-VG profiler function.</li> <li>• 2D-VG: Add A8 format RT support for 2D-VG.</li> <li>• 2D-VG: Optimization for 2D-VG matrix inversion, and add <code>vgLoadInverseMatrix()</code>.</li> <li>• 2D-VG: Enable A8 format RT support for 2D-VG only.</li> <li>• 2D-VG: Add <code>vgCreateImageConstVIV()</code> for constant image in 2D-VG.</li> <li>• 3D: Optimize to register access and refine UBO handling.</li> <li>• 3D: Enhance dump function for chip patch management.</li> <li>• 3D: Add share context support for OES11.</li> <li>• 3D: Add support for <code>EGL_EXT_image_dma_buf_import</code> extension.</li> <li>• 3D: Add fbdev external resolve feature.</li> <li>• 3D: Optimize wait native fence sync.</li> <li>• 3D: Optimize to the function <code>UploadSuperTiled()</code> for performance.</li> <li>• 3D: Support to disable no-resolve feature in Wayland by environment parameter <code>'GPU_VIV_EXT_RESOLVE'</code>.</li> <li>• 3D: Add YUV support in texture image copy and <code>glReadPixels()</code>.</li> <li>• 3D: More refinements for 'ctrl+C' issues.</li> <li>• Compiler: More refinements for LTC optimization.</li> <li>• Compiler: Refine instruction converting from MOV to LOAD, also increase max uniform mapping count.</li> <li>• Compiler: Refine LTC check for instructions.</li> <li>• EXA: Support to allocate video memory with cacheable attribute in EXA driver.</li> <li>• General: Refinements for process name detecting.</li> <li>• General: Support time statistic of each GPU state.</li> <li>• General: Reduce <code>recordArraySize</code> and allocate only one stable map for <code>gckCOMMAND</code> to cut off memory cost in driver.</li> <li>• General: Clarify parameter 'Physical' of <code>gcoSURF_SetBuffer</code>, also remove unnecessary physical range check when wrap user memory in <code>gralloc</code>.</li> <li>• General: Refine cache flush operations for WinCE.</li> <li>• General: Enhance debug function in the kernel driver.</li> <li>• General: Get vProfiler working on Android™ platform LP5.x.</li> <li>• General: Refinements for pipeline flush.</li> <li>• General: Add part of kernel fence support.</li> <li>• General: Add dump function when executing mmu configure function.</li> <li>• GLX MGS-918: <code>glXChooseFBConfig</code> does not match OpenGL documentation.</li> <li>• GL2: Add no light spin lock solution in GL2 driver.</li> <li>• GL2: Refinements for <code>DRM_CAS</code> macro for more platforms.</li> <li>• GL2: Enhancements in GL2 driver for MIPS and A8 format support.</li> <li>• OCL: MGS-1240 OCL conformance test failed because of the atomic check error.</li> <li>• OCL: MGS-883 Extend OCL compiler.</li> <li>• OCL: MGS-885 OpenCL Memory Leak on i.MX 6DualQuad.</li> <li>• OCL: MGS-1164 Disable atomic operation in OpenCL compiler.</li> <li>• OCL: Refinements for OCL command buffer dependency for performance.</li> <li>• Wayland 3D: Refinements for Wayland support in driver.</li> </ul>
Bug Fixes	<ul style="list-style-type: none"> <li>• 2D: MGS-1138 Add two G2D APIs to support query hardware type and feature.</li> <li>• 2D: MGS-1082 Remove build warning for G2D library.</li> <li>• 2D: Fix one pass filter blit feature check in 2D driver.</li> <li>• 2D: Fix tmp surface format in TPF when left and right of <code>srcRect</code> are not aligned to 2.</li> <li>• 2D: Fix block size setting for 2D compression support board.</li> <li>• 2D: Fix out of memory issue for DEC300 with TPC.</li> <li>• 2D: Fix flush setting issue for DEC300 with TPC.</li> <li>• 2D: Separate GC320 block size settings in 2D driver.</li> </ul>

*Table continues on the next page...*

**Table 9. New features**

Feature	Description
	<ul style="list-style-type: none"> <li>• 2D: Fix source tile status buffer setting for no compression source when enable DEC300 compression.</li> <li>• 2D: Make tmp surface to do blit twice when src and dst address overlap less than 64 bytes on some boards.</li> <li>• 2D: GC320-v5007 does not support monoblit feature;</li> <li>• 2D: Remove redundant CPU cache flush of the user memory in the GDI module.</li> <li>• 2D: Correct window connection for HWC.</li> <li>• 2D: Remove width/height alignment requirement and change check of physical address alignment for DEC300 driver.</li> <li>• 2D: Disable 2d output compression in HWC if there is any stretch blit.</li> <li>• 2D: Disable 2D compression for large tiled surface pixels.</li> <li>• 2D: Fix multisrcblit block size setting for GC320 when start y of rectangle is not aligned to 64 pixels.</li> <li>• 2D: Refine HWC driver for v1.2/v1.4, also improve HWC debug functions.</li> <li>• 2D: Disable src transparency for 2D line operation.</li> <li>• 2D: Allocate extra surface memory for 2D quad cache overflow.</li> <li>• 2D: Refine frame buffer handle caching for HWC.</li> <li>• 2D: Fix split 2D filterblit feature for GC320.</li> <li>• 2D: Fix a function parameter error in gco2D_Clear().</li> <li>• 2D: MGS-899 fix OpenVG bitmapFont freeze issue</li> <li>• 2D-VG: Update path bounds during convert stroke in 2D-VG.</li> <li>• 2D-VG: Fix a build issue that occurred when turning on static link in release package.</li> <li>• 2D-VG: Fix MMU mapping issue for 2D-VG.</li> <li>• 2D-VG: Disable FBDEV external resolve for 2D-VG.</li> <li>• 3D: MGS-1112 Fix float pipe mis-configuration.</li> <li>• 3D: Compiler: MGS-1024 Fix the infinte loop in glsl compiler.</li> <li>• 3D: MGS-923 mm06 NOAA performance drop.</li> <li>• 3D MGS-1033 Fix glsl shader compiler seg faults.</li> <li>• 3D: MA-7062 Fix the issue that Antutu v5.2 total score cannot display with 3D composition.</li> <li>• 3D: MGS-513 webgl conformance test met chrome abort.</li> <li>• 3D: Do not recompile sample mask if RT is not multi-sample.</li> <li>• 3D: Fix more build warnings found by Klocwork.</li> <li>• 3D: Refine computing clear value for surface with gcvSURF_R32i_1_A8R8G8B8 format.</li> <li>• 3D: Fix vProfiler for GC400T.</li> <li>• 3D: Don't evaluate vertexID if the chip does not reset vertexID when a new instance begin.</li> <li>• 3D: Remove redundant patch code.</li> <li>• 3D: Correct a check condition that the texture level should be less than maxLevels to avoid memory cross-border access.</li> <li>• 3D: Need to recompile keystate if RT is dirty.</li> <li>• 3D: Correct the offset of VST cache.</li> <li>• 3D: Close the handle of thread when the render thread is killed.</li> <li>• 3D: Enable destinationRead for MSAA surface if the surface does not have a tile status buffer, then colorCompression could be off.</li> <li>• 3D: Initialize the value of program-&gt;aLocPosition and program-&gt;aLocTexCoord in gcChipProgramCleanBindingInfo().</li> <li>• 3D: Get current bound index buffer object from named VAO if there is named VAO currently bound.</li> <li>• 3D: Fix status bar render issue caused missed content in no-resolve mode.</li> <li>• 3D: Correct shadowSurface check in EGLImage.</li> <li>• 3D: Fix binding EGL image texture to FBO.</li> </ul>

*Table continues on the next page...*

**Table 9. New features**

Feature	Description
	<ul style="list-style-type: none"> <li>• 3D: Correct EGL native object synchronization.</li> <li>• 3D: Add missed unlocks for multi-node surface.</li> <li>• 3D: Set gcvSHADER_ONCE_OPTIMIZER for gclinkShaders when program binary.</li> <li>• 3D: Add RGB565 format for image_dma_buf_import extension.</li> <li>• 3D: EGLsurf also need to consider chosen format and requested format.</li> <li>• 3D: Fix more build warnings found by static code analysis.</li> <li>• 3D: Reflush all uniforms if uniform base was changed when instance switch.</li> <li>• 3D: Allocate all constant variables at the very beginning of the STATEMENT_SET that those variables are declared.</li> <li>• 3D: Make use of glFinish as frame delimiter for vProfiler.</li> <li>• 3D: Generate the texture object and check for shadow if already bound to FBO.</li> <li>• 3D: Do not support cube map texture with anisotropic filtering.</li> <li>• 3D: Validate EGL image before accessing its contents avoid crash when EGL image is null.</li> <li>• 3D: Use a uniform to control how to flip the texture coord for yinter pointsprite.</li> <li>• 3D: For glTexDirectVIV, enable shadow path if the chip doesn't support the linear render target.</li> <li>• 3D: Add semaphore stall for split draw.</li> <li>• 3D: Disable TX clock gating for GC2000-v5108.</li> <li>• 3D: Correct window surface format setting for GC400T.</li> <li>• 3D: Add a patch for GoogleEarth® to allow '#define XXX;' in shader source.</li> <li>• 3D: Update chip info for new GC2000+-v5450.</li> <li>• 3D: Need to create the render mutex before create the render thread again.</li> <li>• 3D: Fix native fence fd leaks found in Android CTS.</li> <li>• 3D: Enable all EGL configurations with conformant attribute for ES30 CTS.</li> <li>• 3D: Update VTK driver build for Android platform 5.1 (ANDROID_SDK_VERSION =22).</li> <li>• 3D: Validate native Pixmap object on Android platform to fix a crash use case of eglCopyBuffers().</li> <li>• 3D: Fix ES3-CTS.gtf.GL3Tests.framebuffer_blit.* failures.</li> <li>• 3D: Fix ES3-CTS.gtf.GL3Tests.uniform_buffer_object.uniform_buffer_object_max_uniform_block_size failure.</li> <li>• 3D: Recover display settings and free display for fbdev on abnormal exit('ctrl +C').</li> <li>• 3D: Need to consider the tiling mode when calculating texture horizontal alignment.</li> <li>• 3D: Use medium precision for Leanback launcher.</li> <li>• 3D: Enable 3D compression and disable no-resolve for Leanback launcher for performance issue.</li> <li>• 3D: Refine Leanback launcher workaround.</li> <li>• 3D: Need shadow when the tiling mode of direct source and depth buffer are mismatched.</li> <li>• 3D: More optimizations for multiple Android games.</li> <li>• 3D: Fake D16 to D24 in CTS for hardware with compression v1 feature.</li> <li>• 3D: Remove useless variable of gcoVERTEXARRAY_IndexUpdate().</li> <li>• 3D: Fix EGL_KHR_lock surface.</li> <li>• 3D: Refine VST and PST cache flush.</li> <li>• 3D: Change the unrolling factor for shader from 8 to 10 to improve performance.</li> <li>• 3D: Add access mutex for EGL image to avoid multithread issue.</li> <li>• 3D: Refine computing of wLimit value.</li> <li>• 3D: Fix VG driver cannot run with multiple buffers.</li> <li>• 3D: Refine chip patch management.</li> <li>• 3D: Add check for GL_ETC1_RGB8_OES texture format GL_ETC1_RGB8_OES.</li> </ul>

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**Table 9. New features**

Feature	Description
	<ul style="list-style-type: none"> <li>• 3D: Refine acquisition of the size of a specified window object.</li> <li>• 3D: Add float format texture support and special workaround for WebGL tests.</li> <li>• 3D: Fix EGL image copy and overwrite magic and type of EGL image field in <code>_CreateImageFromVGParentImage</code>.</li> <li>• 3D: Fix vProfilier for GC2000+.</li> <li>• 3D: MGS-919-3 Fix ES3-CTS.shaders.negative.uniform_precision_matching failed</li> <li>• 3D: MGS-919-2 Fix ES3-CTS.shaders.negative.constant_sequence</li> <li>• 3D: MGS-919-1 Fix ES2-CTS.shaders.negative.initialize</li> <li>• 3D: EGL does not set bufferCount for FramebufferSurface for Android 2.0 platform and later.</li> <li>• 3D: MGS-828 Revert disabling <code>GL_EXTID_VIV_tex_direct</code>-extention for HTML5</li> <li>• 3D: MGS-376 fix 3d fence delay commit issue</li> <li>• VG2D: MGS-1177 Met application hang when running Openvg2D unit test app <code>cover_flow</code>.</li> <li>• VG2D: MGS-987 Fix 2D OpenVG freeze issue.</li> <li>• VG2D: MGS-877 Add support for <code>EGL_VG_PARENT_IMAGE_KHR</code> in <code>eglCreateImageKHR</code> for GC355.</li> <li>• Compiler: Create constantUBO before mov uniforms to defaultUBO to make sure that there is enough uniform resource for constant.</li> <li>• Compiler: Fix an issue when getting indexed register and indexed mode for LOAD instruction.</li> <li>• Compiler: Change unnecessary <code>gctSIZE_T</code> to <code>gctUINT32</code> to make the shader binary portable across 32/64 bit platform.</li> <li>• Compiler: Refine defaultUBO index check.</li> <li>• Compiler: Add a MAD pattern for SUB+MUL instruction.</li> <li>• Compiler: Identifiers support to use <code>'_'</code> per spec.</li> <li>• EXA: Remove a redundant check for GLX in EXA driver.</li> <li>• EXA: Remove X server module from GL client library.</li> <li>• General: Copy the updated record array only instead of always copying the whole record array.</li> <li>• General: MGS-1146 Fix CMA performance drop issue.</li> <li>• General: MGS-1099: GPU kernel driver build fix for 3.14.28 kernel.</li> <li>• General: MA-7138 Fix GPU driver build failure on Android platform 6.0 MashMallow.</li> <li>• General: MGS-1113 Enable Thermal notifier only when thermal kernel config available.</li> <li>• General: MA-7063 Enable record array size optimization on GC2000 R2.</li> <li>• General: MGS-990 VDK test have failed items.</li> <li>• General: MGS-1070 system freeze after long time monkey test.</li> <li>• General: MA-7040-1 correct alloc failure for recordArray to avoid kernel panic.</li> <li>• General: MGS-955-3 remove <code>IRQF_DISABLED</code>.</li> <li>• General: MGS-955-2 file_node struct change.</li> <li>• General: MGS-955-1 Add kernel version check for <code>CONFIG_PM_RUNTIME</code>.</li> <li>• General: MA-7040 Fix GPU driver kernel panic when out of vmalloc.</li> <li>• General: MGS-912 <code>vdksample10_es20</code> display abnormal on FB/Wld.</li> <li>• General: MA-6962 Fix browser crash issue in p7 driver.</li> <li>• General: MGS-981 Fix <code>vdksample3_es20</code> assert aborted issue.</li> <li>• General: MA-6985 GPU low memory killer should not kill itself.</li> <li>• General: MA-6953 fix simulate secondary display flicker issue.</li> <li>• General: MA-6726 fix Screen tremble when do zoom operation with magnification gesture enable.</li> <li>• General: MA-6912 fix wifi display rotation flicker issue.</li> <li>• General: Refine <code>gcoHARDWARE_Destroy()</code> to avoid a crash when a hardware construct fails.</li> </ul>

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**Table 9. New features**

Feature	Description
	<ul style="list-style-type: none"> <li>• General: Fix GPU idle cycles counter for vProfilier.</li> <li>• General: Add a missed error check for gckOS_AcquireMutex().</li> <li>• General: Correct frame buffer size calculation.</li> <li>• General: Fix a library dependency issue when building.</li> <li>• General: Fix out of memory issue about CMA allocator.</li> <li>• General: Fix the default stuckDump level.</li> <li>• General: Don't dump an invalid entry in link queue and fix dump message format.</li> <li>• General: Fix galcore_trace issues.</li> <li>• General: Remove redundant garbage releasing into user space, process db will handle all resource which is not released when an application quits.</li> <li>• General: Print platform code path in debugfs.</li> <li>• General: Dump PID and name of process in command buffer dump.</li> <li>• General: Fix GPU kernel crash with the new MMU on i.MX 6DualPlus/6QuadPlus.</li> <li>• General: Set AXI attribute for all iMX 6 chips.</li> <li>• General: Disable virtual command buffer when command buffer is allocated from reserved memory.</li> <li>• General: Correct tile status lock count.</li> <li>• General: Correct condition checks for allocating auxiliary buffer nodes.</li> <li>• General: Disable MMU exception in driver.</li> <li>• General: Fix link error because of unexported symbols.</li> <li>• General: MGS-925 fix GPU kernel crash with 2D OpenVG</li> <li>• General: MGS-888 SegFault found in video replay test. General: MGS-791 Unmaped virtual address cause MMU exception</li> <li>• G2D: MGS-871 enable external LFLAGS for g2d build</li> <li>• General: MGS-739 disable supertile not support log in libgal</li> <li>• General: MGS-821 fix base address alignment with hw-resolve</li> <li>• GL2: Sync with compile interface change</li> <li>• GL2: Fix the number of sampler units in GL2 driver.</li> <li>• GL2: Fix anti-aliasing line feature setting in GL2 driver.</li> <li>• GL2: MGS-896 Kernel panic when run mesa_copytex on 6qp board</li> <li>• GL2: Correct stride and type setting when uploading the texture to fix glMark2 rendering issue.</li> <li>• G2D: MGS-839 fixes the GPU hang issue with the overlay test sample</li> <li>• OCL: Fix memory issue found by runtime analysis tool.</li> <li>• EGL: MGS-832 Improve out of box experience with EXT-resolve+FBDEV+single buffer on i.MX 6QuadPlus</li> <li>• EGL: MGS-822 Limit the max multi-framebuffer number on FB.</li> <li>• EGL-FB: MGS-1040-2 Refine multi-buffer swap work flow on FB.</li> <li>• EGL: MA-6961 Fix 1080p video playback system hang up issue</li> <li>• EGL-FB: MGS-1169 Sync the framebuffer code with FB backend.</li> <li>• EGL-FB: MGS-1062 Display hang when using multibuffer.</li> <li>• EGL-FB MGS-1046 Avoid setting nonstand resolution.</li> <li>• EGL-FB MGS-1040 Refine multi-buffer swap work flow on FB.</li> <li>• EGL MGS-756 Add support for EGL_LOCK_SURFACE_BIT_KHR eglLockSurfaceKHR.</li> <li>• EGL-X MGS-942 Fix memory leak in x backend.</li> <li>• Wayland: MGS-1239 Wayland Testwindow Error: double free or corruption.</li> <li>• Wayland: MGS-1254 Fix wayland build failed with SDK.</li> <li>• Wayland: MGS-931 Segmentation fault found in glmark2 test.</li> <li>• Wayland: MGS-813 Add support for WL_create_wayland_buffer_from_image extension.</li> <li>• Wayland: MGS-1189 Ensure wayland queue does not have pending events before destroying.</li> </ul>

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**Table 9. New features (continued)**

Feature	Description
	<ul style="list-style-type: none"> <li>• Wayland MGS-958 test_wl_resizes crash in stess test.</li> <li>• Wayland MGS-986 fix wayland build broken with the incompatible rootfs.</li> <li>• Wayland MGS-938 Helloworldx crash in wayland backend.</li> <li>• Wayland 3D: Check the native window type in veglDisconnectWindow for Wayland.</li> <li>• Wayland 3D: Disable FB pre-fetch in Wayland compositor side.</li> <li>• Wayland: Add swap queue into Wayland.</li> <li>• Wayland: Fix EGL swap worker thread for Wayland.</li> <li>• Wayland: MGS-765 Add support for EGL_WAYLAND_Y_INVERTED_WL in eglQueryWaylandBufferWL</li> <li>• Wayland: MGS-754-3 Add support for configurable EGL back buffer count for Wayland-EGL.</li> <li>• Wayland:MGS-777 Wayland EGL resize corruption.Wayland MGS-852 Cannot show video again if repeat playback video.</li> </ul>
Conformance Tests	<ul style="list-style-type: none"> <li>• OpenGL ES 2.0/3.0 GPU Drivers are conformant to Khronos Conformance Test release version:20150622.</li> </ul>
GPU Tools	<ul style="list-style-type: none"> <li>• vCompiler: Add new GPU configuration file for i.MX 6QuadPlus GPU</li> <li>• vProfiler: Add environment variable "VP_USE_GLFINISH" to use glFinish() instead of eglSwapBuffers() as the frame delimiter</li> <li>• vTexture: Port ETC Package v274 to vTexture.</li> <li>• vTexture: Add PNG and BMP to input formats.</li> <li>• vTexture: Allow the user to preview compressed textures.</li> <li>• vTracer: Add support for 64 bit tracer on Windows OS platform.</li> <li>• vAnalyzer: Improve accuracy of display of bandwidth data for 128 bit boards.</li> <li>• vCompiler: Update help message and version number.</li> <li>• vCompiler: Do not expose the "-p" option in vCompiler, as it is an internal option.</li> <li>• vCompiler: Save pre-link shader as binary source to avoid a difference between the results on offline and online compiler.</li> <li>• vCompiler: Check if the shader is NULL before copying it.</li> <li>• vCompiler: Set hardware type to 3D because the default type 2D cannot support shader.</li> <li>• vEmulator: Update OpenGL version reporting in vEmulator.</li> <li>• vEmulator: Fix a build issue for OpenCL1.1 library.</li> <li>• vEmulator: Fix the build issue of the test case "cl_sample".</li> <li>• vEmulator: Refine OpenGL ES3.0 library name.</li> <li>• vEmulator: Refine VDK library name.</li> <li>• vEmulator: Refine vEmulator VC solution project dependence.</li> <li>• vEmulator: Fix rendering issue related to shader source.</li> <li>• vPlayer/vTracer: Sync up EGL/GL header files with new header files.</li> <li>• vPlayer: Fix use cases where the "--renderframelist" option does not work.</li> <li>• vPlayer: Resolve deleting window handle in eglDestroyWindowSurface.</li> <li>• vPlayer: Fix a replay issue with game "Dungeon_Hunter3".</li> <li>• vPlayer: Refine behavior in glFlushMappedBufferRange.</li> <li>• MGS-947 vplayer can't work on x11</li> <li>• vProfiler: Resolve incorrect hardware counters of PA and/or RA modules on GC400T and other hardware.vTexture: Fix incorrect ETC2 alpha channel.</li> </ul>
Known Issues	<ul style="list-style-type: none"> <li>• MGS-1088: Some Graphics applications may cause flickering or tearing while running with FB_MULTI_BUFFER=1 on i.MX6DualPlus/QuadPlus. This is due to the free running of applications in a performance mode, where the GPU and display are not synchronized. To ensure synchronization to the display refresh, please export the default setting "export FB_MULTI_BUFFER=3" in the target console.</li> <li>• MGS-1208 Offline Vivante shader compiler issues.</li> </ul>



### 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 only the boards listed.

**Table 10. Supported features**

Feature	Supported board	Comment
<b>Kernel</b>		
Kernel	All i.MX	Kernel version: 3.14.52
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"> <li>• UBIFS is used for NAND.</li> <li>• JFFS2/UBIFS is used for Parallel NOR, QSPI NOR.</li> </ul>
<b>Bootloader</b>		
U-Boot	All i.MX	U-Boot delivery is based on U-Boot version v2015.04. Clock, Anapop 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. 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 LDDR3 400 MHz @ 32 bit i.MX 6SoloLite EVK supports LPDDR2 400 MHz @ 32 bit and boot using L2Cache as OCRAM 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
<b>Machine-specific layer</b>		
ARM® Core	All i.MX	6SABRE-SD, 6SABRE-AI, 6SoloLite, 6SoloX-SD, and 6SoloX-AI support the ARM® Cortex®-A9 processor. 7D-SABRE-SD supports the ARM® Cortex®-A7 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.

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**Table 10. Supported features (continued)**

Feature	Supported board	Comment
IOMUX	All i.MX	Provides the interfaces for I/O configuration. IOMUX-V3 version is used.
<b>DMA engine</b>		
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.
<b>Character device drivers</b>		
MXC UART	All i.MX	<p>i.MX 6 SABRE-SD, and SoloLite EVK support console through internal Debug UART1.</p> <p>i.MX 6SoloX SABRE-SD and SABRE-AI support Cortex-A9 processor through UART1 and Cortex-M4 processor through UART2.</p> <p>i.MX 7Dual SABRE-SD Cortex-A7 processor through UART1 and Cortex-M4 processor through UART2.</p> <p>i.MX 6UltraLite EVK Cortex-A7 processor through UART1.</p> <p>i.MX 6 SABRE-AI supports console through internal Debug UART 4.</p>
<b>Power Management Drivers</b>		
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	-
<b>Networking drivers</b>		
ENET	All i.MX	<p>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.</p> <p>i.MX 6SoloX SABRE-SD, SABRE-AI, and i.MX 7Dual SABRE-SD support AVB Features.</p>
IEEE 1588	All i.MX	<p>Supports Linuxptp stack.</p> <p>Features:</p> <ul style="list-style-type: none"> <li>• Supports IPv4, IPv6, IEEE 802.3 transport.</li> <li>• Supports E2E, P2P transparent clock.</li> <li>• Supports IEEE802.1AS-2011 in the role of end station.</li> </ul> <p>Note:</p> <p>Linuxptp stack is open source.</p> <p>Command instance:</p> <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	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.

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**Table 10. Supported features (continued)**

Feature	Supported board	Comment
	i.MX 6SoloX-SD	<ul style="list-style-type: none"> <li>• EP can be initialized/enumerated by RC.</li> <li>• EP can access the memory of RC.</li> <li>• RC can access the memory of EP.</li> <li>• EP can trigger MSI, and the triggered MSI can be captured by RC.</li> </ul>
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 7D-SABRE-SD 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 the default device tree on i.MX 7Dual SABRE-SD. Supports with default device tree on i.MX 6UltraLite EVK.
<b>Security drivers</b>		
CAAM	All i.MX except 6SoloLite	Security drivers
SNVS	All i.MX	-
SIMv2	6UltraLite	Smart Card Interface
<b>Sound drivers</b>		
WM8962/SSI WM8960/SSI	6SABRE-SD 6SoloLite 6SoloX-SD 7D-SABRE-SD 6UltraLite EVK	Supports playback.
S/PDIF	6SABRE-SD 6SABRE-AI 6SoloX-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.
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 7D-SABRE-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.

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**Table 10. Supported features (continued)**

Feature	Supported board	Comment
		Supports clock control.
HDMI Audio	6SABRE-SD 6SABRE-AI 7D-SABRE-SD	Supported on i.MX 6Dual/Quad and i.MX 6DualLite for SABRE-SD and SABRE-AI Supported on i.MX 7Dual SABRE-SD board.
<b>Input device drivers</b>		
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. 7Dual SABRE-SD supports E Ink® touch screen with a separate package download. 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.
<b>MTD driver</b>		
QuadSPI-NOR	6SoloX-SD 6SoloX-AI 7D-SABRE-SD 6UltraLite EVK	i.MX 6SoloX SABRE-AI supports QSPI1. i.MX 6SoloX SABRE-SD supports QSPI2. i.MX 6UltraLite EVK supports QSPI1. i.MX 7Dual SABRE-SD 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 7D-SABRE-SD	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.
<b>USB drivers</b>		
USB Host	6SABRE-AI 6SoloLite 6SoloX-SD 6SoloX-AI 7D-SABRE-SD 6UltraLite EVK	Supports USB HOST1 and USB OTG host.
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.

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**Table 10. Supported features (continued)**

Feature	Supported board	Comment
<b>Graphics drivers</b>		
GPU	All i.MX 6 except 6UltraLite	<p>Graphics Chips Details</p> <p>GC2000, GC355 and GC320 on 6Dual/6Quad</p> <p>GC2000+, GC355, and GC320 on 6QuadPlus</p> <p>GC880 and GC320 on 6Solo/DualLite</p> <p>GC400T on 6SoloX</p> <p>The GPU on the chips listed above supports these features which include 2D and 3D hardware acceleration:</p> <ul style="list-style-type: none"> <li>• Supports EGL 1.4 for fbdev, X11, Wayland</li> <li>• Supports OpenGL ES1.1</li> <li>• Supports OpenGL ES2.0 (WebGL 1.0.1 compatible on X11)</li> <li>• Supports OpenGL ES3.0</li> <li>• Supports OpenVG1.1</li> <li>• Supports OpenCL1.1</li> <li>• Supports OpenGL2.1</li> </ul> <p>GC355 and GC320 on 6SoloLite, which includes only 2D hardware acceleration</p> <ul style="list-style-type: none"> <li>• Supports EGL 1.4 for fbdev, X, Wayland</li> <li>• Supports OpenVG1.1</li> </ul>
Frame Buffer Driver	All i.MX	<p>MXC Frame buffer driver for IPU V3 on i.MX 6SABRE-SD and i.MX 6SABRE-AI.</p> <p>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.</p>
VDOA	6SABRE-SD 6SABRE-AI	Supports Video Data Order Adapter.
LVDS	6SABRE-SD 6SABRE-AI 6SoloX-SD 6SoloX-AI	<p>Supports HannStar LVDS panel. It's the default display if no other video option is setup.</p> <p>On the SABRE-AI there are 2 ports. Port 0 is the default.</p>
HDMI	6SABRE-SD 6SABRE-AI 6SoloLite 6SoloX-AI 7D-SABRE-SD	<p>i.MX 6SABRE-SD and SABRE-AI support on-chip DesignWare HDMI hardware module.</p> <p>i.MX 7D-SABRE-SD supports on-chip DesignWare HDMI hardware module.</p> <p>i.MX 6SoloLite and i.MX 6SoloX SABRE-AI support external HDMI.</p>
HDCP	6SABRE-SD	Supports HDCP v1.2 specifications.
WVGA panel	All i.MX	<p>Supports SEIKO WVGA panel.</p> <p>For i.MX 6UltraLite, it supports Embest LCD8000-43T LCD panel.</p>
PxP	6DualLite-SD 6SoloLite 6SoloX-SD 6SoloX-AI 7D-SABRE-SD	<p>Enables PXP Driver for EPDC on i.MX 6SoloLite and i.MX 6DualLite SABRE-SD.</p> <p>Enables PXP driver for EPDC on i.MX 7Dual SABRE-SD.</p> <p>Conforms to DMA engine framework.</p>

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**Table 10. Supported features (continued)**

Feature	Supported board	Comment
	6UltraLite EVK	
MIPI Display	6SABRE-SD	Supports MIPI DSI driver through MIPI daughter card.
EPDC	6DualLite-SD 6SoloLite 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 <sup>®</sup> but requires a separate download. Contact Marketing representative.
<b>Multimedia Drivers</b>		
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. 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	Supports OV5640 camera sensor.

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**Table 10. Supported features (continued)**

Feature	Supported board	Comment
	6SoloLite 6SoloX-SD	
TV-IN	6SABRE-AI	Supports TV-IN via ADV7180 on the 6SABRE-AI. Supports bt656, NTSC, and PAL.
<b>General drivers</b>		
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. Supports eMMC5.0 on i.MX 7Dual SABRE-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 7D-SABRE-SD 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 7D-SABRE-SD 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. Supports FXOS8700CQR1 sensor on 7D-SABRE-SD.
Wi-Fi	All i.MX	Supports the Broadcom/Murata BCM4339 Bluetooth/Wi-Fi module.
Bluetooth	6SABRE-SD 6UltraLite EVK 7D-SABRE-SD	Bluetooth supported 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 7D-SABRE-SD	Supports MAX7310 GPIO expander on i.MX 6 SABRE-SD and SABRE-AI. Supports 74LV595 GPIO expander on i.MX 7Dual SABRE-SD.
SNVS RTC	All i.MX	Low power section only.
Ambient Light Sensor	6SABRE-SD 6SABRE-AI 6SoloX-SD 6SoloX-AI	Supports ISL29023 sensor on i.MX 6 boards.

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**Table 10. Supported features (continued)**

Feature	Supported board	Comment
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
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/mmcbk0p2	Used in "boot from tftp/NFS" (that is, root=/dev/nfs); Used in "boot from SD" (that is, root=/dev/mmcbk0p2). 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/mmcbkXpY" (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.

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

Kernel parameter	Description	Typical value	Used when
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"> <li>1. video=mxafb0:dev=hdmi, 1920x1080M@60,if=RGB24</li> <li>2. video=mxafb1:dev=ldb,if=RGB666</li> <li>3. video=mxafb0:dev=ldb,if=RGB666</li> <li>4. video=mxafb1:dev=hdmi, 1920x1080M@60,if=RGB24</li> <li>5. video=mxafb0:dev=hdmi, 1920x1080M@60,if=RGB24</li> <li>6. video=mxafb0:dev=ldb,if=RGB666</li> <li>7. video=mxafb0:dev=lcd,CLAA-WVGA,if=RGB656</li> <li>8. video=mxafb0:dev=mipi_dsi,TRULY-WVGA,if=RGB24</li> </ol>	<ol style="list-style-type: none"> <li>1. Used when primarily displaying on HDMI with 1080P60 mode. Secondly displaying on LVDS with XGA mode.</li> <li>2. Used when primarily displaying on LVDS with XGA mode. Secondly displaying on HDMI with 1080P60 mode.</li> <li>3. Used when primary displaying on HDMI with 1080P60 mode.</li> <li>4. Used when primary displaying on the HannStar LVDS1.</li> <li>5. Used when primary displaying on the CLAA-WVGA dumb parallel LCD panel.</li> <li>6. Used when primary displaying on the TRULY-WVGA MIPI DSI LCD panel.</li> </ol> <p>NOTE: GBR24/RGB565/YUV444 represents the display HW interface format. Typical values for certain different display devices are as follows:</p> <p>TVOUT: YUV444</p> <p>VGA: GBR24</p> <p>HDMI&amp;DVI: RGB24</p> <p>CLAA WVGA LCD: RGB565</p> <p>Typical values for dev= are shown as follows:</p>

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

Kernel parameter	Description	Typical value	Used when
			lcd: LCD interface ldb: LVDS hdmi: HDMI on chip or sii902x dvi: DVI port vga: VGA through TVE tve: TVOUT
video on 6SABRE-AI	<p>Tells the kernel/driver which resolution/depth and refresh rate should be used for display port 0 or 1.</p> <p>See the parameter information under Documentation/fb/modedb.txt</p> <p>Tells the kernel/driver which IPU display interface format should be used.</p>	<ol style="list-style-type: none"> <li>video=mxcfb0:dev=hdmi, 1920x1080M@60,if=RGB24video=mxcfb1:dev=ldb,if=RGB666</li> <li>video=mxcfb0:dev=ldb,if=RGB666video=mxcfb1:dev=hdmi, 1920x1080M@60,if=RGB24</li> <li>video=mxcfb0:dev=hdmi, 1920x1080M@60,if=RGB24</li> <li>video=mxcfb0:dev=ldb,if=RGB666</li> <li>video=mxcfb0:dev=hdmi, 1920x1080M@60,if=RGB24</li> </ol>	<ol style="list-style-type: none"> <li>Used when primarily displaying on HDMI with 1080P60 mode. Secondly displaying on LVDS with XGA mode.</li> <li>Used when primarily displaying on LVDS with XGA mode. Secondly displaying on HDMI with 1080P60 mode.</li> <li>Used when primary displaying on HDMI with 1080P60 mode.</li> <li>Used when primary displaying on the HannStar LVDS0.</li> <li>Used when enabling HDMI 1080P60 mode and LVDS0. To enable second display, run "echo 0 &gt; /sys/class/graphics/fb2/blank"</li> </ol> <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&amp;DVI: RGB24            CLAA WVGA LCD: RGB565</p> <p>Typical values for dev= are shown below:</p> <p>lcd: LCD interface            ldb: LVDS            hdmi: HDMI on chip or sii902x            dvi: DVI port            vga: VGA through TVE            tve: TVOUT</p>
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	<p>Used when enabling EPDC to select the correct E Ink panel parameters to use.</p> <p>bpp=16 selects RGB565 FB pix format            bpp=8 selects Y8 FB pixel format</p>

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

Kernel parameter	Description	Typical value	Used when
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=mxm_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=mxm_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.
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 3.5.7 kernel page reclaiming issue. One workaround for this: echo 1 > /proc/sys/vm/drop_caches before you run the application.
HDMI	Software	ENGR00290866 HDMI cannot be set to 1080p@60hz with kernel configuration settings.	Use the xrandr application to configure the HDMI resolution from user-space.
ASRC	Hardware	Two ASRC M2M instances and one P2P instance conversion	When there are three instances, the total MIPS consumption should not exceed the ASRC

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

Module	Source	Description	Workaround
		simultaneously meet serious noise on 176 K and 192 K sampling rates.	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 mxc_vpu_test.out, 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.
Boot	Hardware	The system cannot boot sometimes when it ist 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
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 &gt; /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.

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

Module	Source	Description	Workaround
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 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.	No.
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 7Dual SABRE-SD**

Module	Source	Description	Workaround
SD/MMC	Hardware/ Software	SD2.0 U-Boot overnight stress reset test fails at 3040 and 616 times.	Hardware issue. There are multi-pulses on PMIC_PWRON if WDOG_B reset signal is triggered. This abnormal signal may cause system reset failure.
EPDC	Software	EPDC does not function for REGAL/-D due to license issue.	Ask for FAE/AE support to get the proper waveform.
HDMI	Software	HDMI supports only one startup resolution mode 1280x720 when booting to X backend rootfs.	For i.MX 7Dual, it cannot port Vivante or Freescale EXA driver to it, because the EXA driver depends on Vivante's 2D library and there is no GPU hardware on i.MX 7Dual. Therefore, a default software version driver (FBDEV) is used for i.MX 7Dual. The FB video mode is changed by FB command, but the UI cannot get the video mode changed event, because i.MX 7Dual has no GPU hardware and still draws the UI to original video mode. No workaround.
HDMI	Software	After booting up, it connects to the HDMI cable. The X backend desktop cannot display.	i.MX 7Dual, it cannot port Vivante or Freescale EXA driver to it, because the EXA driver depends on Vivante's 2D library and there is no GPU hardware on i.MX 7Dual. Therefore, a

*Table continues on the next page...*

**Table 22. Known issues and workarounds for i.MX 7Dual SABRE-SD (continued)**

Module	Source	Description	Workaround
			default software version driver (FBDEV) is used for i.MX 7Dual. It is expected, because FB video mode is changed after the DHMI cable is plugged in, and the UI cannot handle the HDMI cable plugin event or change the UI to new video mode. No workaround.
Wi-Fi	Software	Wi-Fi does not support suspend/resume when doing IPERF.	BroadCom Wi-Fi is not supported.
USB	Hardware	On the i.MX 6UltraLite EVK board, the USB OTG port can be only used as device mode.	-

## 6 Multimedia

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

The versions of the GStreamer releases are listed below:

GStreamer 1.0:

- gstreamer (version 1.4.5)
- gstreamer-plugins-base (version 1.4.5)
- gstreamer-plugins-good (version 1.4.5)
- gstreamer-plugins-bad (version 1.4.5)
- gstreamer-libav (version 1.4.5)

### 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"> <li>• vpudec: VPU-based video decoder plugin</li> <li>• Software video decoder plugins: use gst-libav plugins</li> </ul>
Video encoder	<ul style="list-style-type: none"> <li>• vpuenc_h264: VPU-based AVC/H264 video encoder</li> <li>• vpuenc_h263: VPU-based H263 video encoder</li> <li>• vpuenc_mpeg4: VPU-based MPEG4 video encoder</li> <li>• vpuenc_jpeg: VPU-based JPEG video encoder</li> </ul>
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"> <li>• imxv4l2sink: V4L2 based video sink plugin</li> <li>• overlaysink : G2D based video sink plugin</li> </ul>

*Table continues on the next page...*

**Table 23. Freescale GStreamer 1.0 plugins (continued)**

Plugin	Features
Video source	imxv4l2src: V4L2 based camera/TVin source plugin
Video convert	<ul style="list-style-type: none"> <li>• imxvideoconvert_g2d: GPU2D based video convert plugin, to perform video color space conversion, resize, rotate</li> <li>• imxvideoconvert_ipu: IPU based video convert plugin, to perform video color space conversion, resize, rotate, deinterlacing</li> <li>• imxvideoconvert_pxp: PXP based video convert plugin, to perform video color space conversion, resizing, and rotation</li> </ul>
OpenGL (ES) Plugins	<ul style="list-style-type: none"> <li>• glimagesink: OpenGL (ES) based video sink plugin, supported in X11, Wayland, and FB backends</li> <li>• gleffects: GL Shading Language effects plugin</li> </ul>
Video compositor	<ul style="list-style-type: none"> <li>• imxcompositor_g2d: GPU2D based video compositor plugin</li> <li>• imxcompositor_ipu: IPU based video compositor plugin</li> <li>• 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</li> </ul>

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

*Table continues on the next page...*

**Table 24. Freescale playback engine API functions (continued)**

Function	Feature
Display Control	<ul style="list-style-type: none"> <li>• Resize</li> <li>• Rotate</li> </ul>

## 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 that have hardware video codec.

## 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 that have hardware video codec on the X11 platform.

## 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	-
	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.

## 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	-

*Table continues on the next page...*

Table 30. Audio codec specification (continued)

Decoder	Feature/Profile	Channel	Sample rate (KHz)	Bit rate (kbps)	H/W or S/W	Comment
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	stereo/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.

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