

i.MX Linux Release Notes

Contents

1 Release Contents

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

Additionally, the following sections contain release contents and license information.

Supported HW SoC/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
- i.MX 6SoloX SABRE-SD Board
- i.MX 6SoloX SABRE-AI Board

NOTE

In this document the following notation is used:

- 6SABRE-SD means the i.MX 6Quad and i.MX 6DualLite SABRE-SD Platforms.

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Release Contents

- 6SABRE-AI means the i.MX 6Quad 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.

1.1 Contents

This release consists of the following package files:

- L3.10.53_1.1.0_IMX6SL_BUNDLE.tar.gz
- L3.10.53_1.1.0_IMX6QDLS_BUNDLE.tar.gz
- L3.10.53_1.1.0_IMX6SX_BUNDLE.tar.gz
- L3.10.53_1.1.0_AACP_CODECS.tar.gz
- fsl-yocto-L3.10.53_1.1.0.tar.gz

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

"<Kernel_version>": BSP Kernel version. (For example, "L3.10.53" indicates that this BSP release is based on the kernel version 3.10.53.)

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

The tables below list the contents included in each package:

Table 1. Release Contents

Components	Details
Linux™ Kernel and Device Trees	3.10.53
U-Boot Configurations	v2014.04
SD Card images	Images
Manufacturing Tools	Manufacturing tools support

In the table below, 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 sub-directory `conf/machine`.

Table 2. U-Boot Configurations

U-Boot Configurations for Boot Device	Description	Supported Machine Configurations
sd	This supports booting from the SD card. This is the default U-Boot configuration.	imx6qsabresd, imx6dlsabresd imx6qsabreauto, imx6dlsabreauto imx6slevk imx6sxsabresd imx6sxsabreauto
spi-nor	This supports booting from SPI-NOR	imx6qsabreauto, imx6dlsabreauto imx6slevk

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Table 2. U-Boot Configurations (continued)

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

The table below describes the kernel and device tree 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 3.10.53 kernel. This kernel is built with the imx_v7_defconfig.
Standard	Each reference board has a standard device tree as listed below. <ul style="list-style-type: none"> zImage-imx6q-sabresd.dtb zImage-imx6dl-sabresd.dtb zImage-imx6q-sabreauto.dtb zImage-imx6dl-sabreauto.dtb zImage-imx6sl-evk.dtb zImage-imx6sx-sdb.dtb zImage-imx6sx-sdb-reva.dtb zImage-imx6sx-sabreauto.dtb <p>Note: zImage-imx6sx-sdb.dtb is used for supporting the i.MX 6SoloX SABRE-SDB Rev. B board, and imx6sx-sdb-reva.dtb is used for supporting the legacy SABRE-SDB Rev. A board.</p>
GPMI and EIM_NOR	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. <ul style="list-style-type: none"> zImage-imx6dl-sabreauto-gpmi-weim.dtb zImage-imx6q-sabreauto-gpmi-weim.dtb
ldo	Enables 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. <ul style="list-style-type: none"> zImage-imx6q-sabresd-ldo.dtb, zImage-imx6dl-sabresd-ldo.dtb

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Table 3. Kernel and Device Tree Configurations (continued)

Kernel and Device Tree Configuration	Description
	<ul style="list-style-type: none"> • zImage-imx6sl-evk-ldo.dtb • zImage-imx6sx-sdb-ldo.dtb, zImage-imx6sx-sdb-reva-ldo.dtb
hdcp	<p>Enables HDMI-HDCP feature. This avoids the pin conflict between the I2C2 and HDCP-DDC pins.</p> <ul style="list-style-type: none"> • zImage-imx6q-sabresd-hdcp.dtb • zImage-imx6dl-sabresd-hdcp.dtb
ecspi	<p>Enables ecspi which is disabled by default.</p> <ul style="list-style-type: none"> • zImage-imx6dl-sabreauto-ecspi.dtb • zImage-imx6q-sabreauto-ecspi.dtb
flexcan1	<p>Enables flexcan1 which is disabled by default due to pin conflicts with fec.</p> <ul style="list-style-type: none"> • zImage-imx6q-sabreauto-flexcan1.dtb • zImage-imx6dl-sabreauto-flexcan1.dtb
csi	<p>Enables CSI support for v4l2.</p> <ul style="list-style-type: none"> • zImage-imx6sl-evk-csi.dtb
pf200	<p>Enables PMIC pf200 support.</p> <ul style="list-style-type: none"> • zImage-imx6sl-evk-pf200.dtb • zImage-imx6dl-sabresd-pf200.dtb
enetirq	<p>An example to demonstrate GPIO6 workaround for bug where only the ENET wake-up interrupt request can wake the system from Wait mode. Since the pad GPIO6 is used by I2C3 on the board, these device trees have I2C3 disabled to enable this workaround.</p> <ul style="list-style-type: none"> • zImage-imx6q-sabresd-enetirq.dtb zImage-imx6dl-sabresd-enetirq.dtb
uart	<p>Enables UART support on SABRE-SD boards to support bluetooth uart devices.</p> <ul style="list-style-type: none"> • zImage-imx6q-sabresd-uart.dtb • zImage-imx6sl-evk-uart.dtb
emmc	<p>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.</p> <ul style="list-style-type: none"> • zImage-imx6sx-sdb-emmc.dtb
M4	<p>M4 - Disables adc 1 & 2, flexcan 1 & 2, i2c3, uart2 and qspi2 when M4 is running.</p> <ul style="list-style-type: none"> • zImage-imx6sx-sdb-m4.dtb • zImage-imx6sx-sabreauto-m4.dtb

The release package contains some pre-built images. These are described below.

Table 4. Pre-built images

Package	Description
X11 SDCard	The following SD card images are provided in this release. These images are Qt5 with X11 backend. The imx6qdlsole image will work on all i.MX 6SABRE-SD and i.MX 6Sabre-AI with U-Boot and device tree changes. To change U-Boot and/or device tree, read the i.MX Linux (R) OS User's Guide for instructions. <ul style="list-style-type: none"> fsl-image-qt5-x11-imx6qdlsole.sdcard fsl-image-qt5-x11-imx6sxsabresd.sdcard fsl-image-gui-x11-imx6sxsabresd.sdcard fsl-image-gui-x11-imx6slevk.sdcard
DirectFB SDCard	The following SD card images are provided in this release for the DirectFB backend. <ul style="list-style-type: none"> fsl-image-gui-dfb-imx6qdlsole.ext3 fsl-image-gui-dfb-imx6slevk.ext3 fsl-image-gui-dfb-imx6sxsabresd.ext3
Frame Buffer SDCard	The following SD card images are provided in this release for the Frame Buffer backend. <ul style="list-style-type: none"> fsl-image-qt5-fb-imx6qdlsole.ext3 fsl-image-gui-fb-imx6qdlsole.ext3 fsl-image-qt5-fb-imx6sxsabresd.ext3 fsl-image-gui-fb-imx6sxsabresd.ext3 fsl-image-gui-fb-imx6slevk.ext3
Wayland SDCard	The following SD card images are provided in this release for the Wayland backend with Weston compositor. <ul style="list-style-type: none"> fsl-image-qt5-wayland-imx6qdlsole.ext3 fsl-image-gui-wayland-imx6qdlsole.ext3 fsl-image-gui-wayland-imx6sxsabresd.ext3 fsl-image-qt5-wayland-imx6sxsabresd.ext3 fsl-image-gui-wayland-imx6slevk.ext3
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 support with manufacturing tools kernel

Table 5. L3.10.53_1.1.0_IMX6QDLS_BUNDLE.tar.gz Content

File	Description
EULA	Freescale End User License Agreement
Freescale_Yocto_Project_Users_Guide.pdf	Freescale Yocto Project User's Guide
Freescale README	Freescale README for L3.10.53_1.1.0-GA
doc/i.MX6	i.MX 6 Linux BSP Release Notes, User's Guide, and Reference Manual

Table 6. Multimedia Standard Packages

File Name	Description	Comments
gst1.0-fsl-plugins-4.0.2.tar.gz	GStreamer plugins	Freescale GStreamer plugins
gst-fsl-plugins-4.0.2.tar.gz		

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Table 6. Multimedia Standard Packages (continued)

File Name	Description	Comments
libfslcodec-4.0.2.bin	Freescale codecs	Freescale optimized A/V core codec
libfslparser-4.0.2.bin	Freescale parser	Freescale optimized core parser
libfslvpuwrap-1.0.57.bin	Freescale VPU wrapper	Freescale VPU wrapper for VPU library

Table 7. Multimedia Controlled Access Packages

File Name	Description	Comments
libfslaacpcodec-4.0.2.bin	AACPlus Decoder	Freescale optimized AACplus decoder
libfslmscodec-4.0.2.bin	Microsoft codecs	Freescale optimized Microsoft codecs
libfslmspaser-4.0.2.bin	Microsoft parser	Freescale optimized Microsoft ASF parser
libfslac3codec-4.0.2.bin	AC3 decoder	Freescale optimized Dolby Audio AC3 decoder
libfslddpcodec-4.0.2.bin	DDplus decoder	Freescale optimized Dolby Audio DDplus decoder
libfslreal-4.0.2.bin	Real Networks codecs and parser	Freescale optimized Real Networks real audio decoder, real media parser and real video firmware

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 the Freescale license must be accepted to setup an i.MX build. This acceptance is recorded in the build configuration files so that the following proprietary binaries can be extracted during the build process.

- imx-gpu-viv
- imx-vpu
- fslqtapplications
- firmware-imx
- libfslcodec
- libfslparser
- libfslvpuwrap

1.3 Multimedia Licensing

Freescale multimedia packages can be found in two locations:

- Standard packages are provided on the Freescale mirror. They will be accessed automatically by the Yocto Project scripts as needed.
- Limited Access packages are provided on freescale.com with controlled access. Contact your marketing representative for access. They are listed in the table below. These include codecs to support WMA, WMV, RMVB, AAC+, AC3, DD + decoding, and WMA 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

1.4 References

The references below are included in the release and contain additional information.

- *i.MX Linux Release Notes (IMX6LXRN)* - 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 in the Yocto Project.
- *i.MX 6 Linux Reference Manual (IMX6LXRM)* - Contains the information on Linux drivers for i.MX.
- *i.MX 6 Graphics User's Guide* - Describes the graphics used.
- *i.MX 6 Linux High Assurance Boot (HAB) User's Guide (IMX6HABUG)* - Contains the information on using High Assurance Boot.
- *i.MX 6 BSP Porting Guide (IMX6XBSPPG)* - Contains the instructions on porting the BSP to a new board.
- *i.MX 6 VPU Application Programming Interface Linux Reference Manual (IMX6VPUAPI)* - 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.

- i.MX 6 information is at freescale.com/iMX6series
- i.MX 6 SABRE information is at freescale.com/imxSABRE
- i.MX 6SoloLite EVK information is at freescale.com/6SLEVK

2 What's New?

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

2.1 New Features

See the git log for the complete list of new features and enhancements since the last release.

A summary of the main new features is as follows:

New features added for all supported boards

- Yocto Project upgraded to version 1.6 Daisy
- Supports the GCC 4.8.2 toolchain with the hardware floating point build
- The Linux kernel upgraded to v3.10.53
- U-Boot upgraded to v2014.04
 - SPI-NOR supports DMA
- New Security Features:
 - CAAM driver is split into two drivers, CAAM and Job Ring.
 - Job Ring driver has been uncoupled from the CAAM controller driver.
- Freescale images updated to include Qt5
- New Graphics Features:
 - GPU driver upgraded to Vivante v5.0.11p4.1
 - Weston upgraded to 1.6.0
 - DirectFB upgraded to 1.7.4
 - Xserver upgraded to 1.16
 - Graphics 6SoloLite support added using Mesa for 3D software rendering on X11
 - Freescale GPU SDK upgraded to 2.0 with support for all backends
 - Qt5 support added for X11, Wayland, and Framebuffer backends
 - Graphics packaging consolidation and restructure.
 - OpenGL/ES 3.0 support added
 - Apitrace X11 tools added to trace OpenGL OpenGL ES, Direct3D and DirectDraw APIs
- New Multimedia Features:
 - Real Networks parser and codec
 - Qt5 i.MX Player
 - GStreamer 1.0
 - Supported RMVB playback
 - Added imxvideoconvert_g2d, imxvideoconvert_ipu plugin, which can do color space converting, resizing, rotation with GPU2D or IPU.
 - Enhanced Metadata supporting in MP4, MKV, AVI, ASF parser.
 - Supported dynamic resolution video playback.
 - Supported multiple video track stream playback.

Features on new i.MX 6SoloX

- i.MX 6 SoloX TO1.2 SOC support added
- ADC support added.
- U-Boot: GIS supported. Image input from rearview camera will be displayed within 1.5 seconds after power up.
- U-Boot: M4 boot supported.
- U-boot: auto set mmc index according to SD/MMC booting device.
- VADC support PAL and NTSC added.
- GC400T GPU support added

- MCC support added
- ENET AVB Qav feature support added

Features on new i.MX 6SoloX SD

- Support added for the i.MX 6SoloX SABRE-SD board
- i.MX 6 SoloX SABRE-SDB Rev. B support added
- i.MX 6 SoloX TO1.2 SOC support added
- SAI interface audio on WM8962 added.

Features on new i.MX 6SoloX Auto

- Support added for the i.MX 6SoloX SABRE-AI board
- MLB50 support for ctrl, async, isoc and sync mode added.

2.2 Power Management Supported Features

Supported power management features that are common.

- CPU/GPU frequency throttle
- GPU dynamic power management
- CPUIdle 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 .

- LDO bypass

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

- CPUFreq driver support: CPU frequency adjusted based on the CPU loading, Interactive governor
- VPU/GPU dynamic power management
- LDO bypass
- BUSFreq support
- SD3.0 dynamically 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	Details
Khronos GLES 3.0 API	<p>The 5.x driver fully supports the latest Khronos GLES 3.0 API (current 3.0.2 spec dated 8 April 2013) and compliant to Khronos GLES 3.0 conformance test. New functionality in the GLES 3.0 API includes:</p> <ul style="list-style-type: none"> • Rendering pipeline enhancements to enable acceleration of advanced visual effects including: occlusion queries, transform feedback, instanced rendering and support for four or more rendering targets. • High quality ETC2/EAC texture compression which eliminates the need for a different set of textures for each platform.

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Table 9. New Features (continued)

Feature	Details
	<ul style="list-style-type: none"> • Shading language enhancements which include full support for integer and 32-bit floating point operations. • Enhanced texturing functionality including guaranteed support for floating point, 3D, depth, vertex, NPOT, R/RG, immutable and 2D array textures, as well as for swizzles, LOD and mip level clamps, seamless cube maps and sampler objects. • Extensive set of required, explicitly sized texture and render-buffer formats, which reduces implementation variability and makes it much easier to write portable applications.
Compatible with 4.X Driver for OpenGL ES 2.0 API	<ul style="list-style-type: none"> • The 5.x driver is compatible with the 4.x driver. Applications developed using 4.X drivers can run on the 5.x driver without any changes. • Application's performance on the 5.x driver will be better than or equal to that with the 4.x driver.
2D	<p>New Features</p> <ul style="list-style-type: none"> • Use intermediate filters when vertical filter stretch on factor greater than 8 • Remove old 2d SetTarget() function use SetGenericTarget() instead. • Add support to not use input devices in FB mode to support FB+VDK multi-process testing. • Refine draw line function for GC320 2D core. • Add function for setting hardware manually in 2D driver to support changing the hardware mode in DFB driver. • Disable 2D output compression in HW when there is any filterblit in the frame. • Add check for filterblit with A8 format alphablend in 2D driver. • Add support for additional new 2D features. • Refine TPC compression. • Add OPF full table support. • Refine command buffer commit time when doing two-pass filterblit from planar YUV to another format. • Check Rect size in 2D driver to reduce stretch blit times and increase DFB fill span performance. • Refine 2D OPF block size setting when dual pipe is enabled. • Empty gco2D_Flush which has been done automatically. • Refine and prepare 2D compression code for addition of dec compression. • Add source settings for CLEAR operations when ROP implies using source. • Add flush command after 2D compression reset. • Add index1 format translation only to support CLEAR with source. • Fix src/dst check when set source for CLEAR. • Refinements for addition of source for CLEAR operations. • Refine 2D TPC compression enum definition. <p>Bug Fixes</p> <ul style="list-style-type: none"> • Set command->using2D correctly when gcdCMD_NO_2D_CONTEXT = 1. 2D Fixed one pixel line blt issue. • Fix the stretch factor in the brush stretchblit function. • Resolve 2D engine double free under DFB backend. • Fix bitblit and multi-srcblit rotation performance for GC420. placement calculation. • When srcRect is same as dstRect • Fix quad setting in 2d bitblit when output format is YUV422 with rotation. • Change stretchblit to bitblit when there is no source according to HW spec. • Fix block size setting for compressed tile source. • Refine check for hardware support for A8 feature. • Fix clear src rectangle settings.
3D	<p>New Features</p>

Table continues on the next page...

Table 9. New Features

Feature	Details
	<ul style="list-style-type: none"> • WClip refinements. • Refine direct texture support; • Add a return error if the surface of a texture is null in <code>gcoTEXTURE_GetFormatInfo</code>. • Add disable tile status before cpu upload texture if texture surface has it. • Add <code>gcvSHADER_FORCE_LINKING</code> to support -G option in VCompiler. • Enhance sin/cos SW simulation precision by using more precise coefficients. • More refinements for wclip. • More optimization for GFXBench30. • Utilize clamp lod with maxlevel HW support on new hardware. • Refine shader language extension support. • Reject HW resolve clear request if clear rectangle cannot meet the alignment limitation. • When propagating constants, don't optimize the store instruction. • Refine the vertex sampler setting for GC400T. • Check if backBuffer surface and context is NULL before <code>queueBuffer</code> in swap buffer. • Mark shadow dirty after upload texture. • Skip precision check for internal variable in compiler. • Check depth/stencil surface to set <code>depthOnly</code>; also handle vertex attrib stride out of boundary correctly while using FBO. • More shader compiler refinements <ul style="list-style-type: none"> • Support <code>gl_FragData</code> array; • -0.0 should be equal to 0.0; • Refinements for normal branch_any; • Support varying ≥ 16; • 1 load FS shader binary should fill correct location for <code>gcSL_COLOR</code>; • Skip immediate value check. • More refinements for <code>glTexDirectVIVMap()</code> support. • Refinements for precompiled shader support. • Refine tile status disable function. • More shader optimizations for 3DMark Taiji. • Refine HW fence implementation. • Refine objects query support. • Compiler refinements don't shift source swizzle and use right coord components for <code>texpcf</code>. • Adjust reflect vector calculation. • Add <code>glEnable/glDisable(GL_PROFILE_VIV)</code> support to start and stop profiler. • Refinements for MSAA surface resolve. • Performance optimization for Quadrant. • Add fast upload path for super-tile textures in some formats. • Performance optimizations for Android UI. • Export EGL extension string 'EGL_EXT_protected_surface'. • Optimization for BasemarkOS2II benchmark. • Add fast super-tiled texture uploading path(s) for same source destformat. • Refine instruction programming logic to fix some hangs that occur when mixing OGL and OCL applications. • Driver enhancements for new release ES30 CTS(20140530). • Return more detailed status when a shader link fails. • Omit MVP check on VIR because the temp register is remapped. • Refinements for GFXBench3.0.16. • Refine vertexID and instanceID support and add XFB support. • Refine direct texture support for <code>GL_RG8_EXT</code> format. • For vertex attribute array operations when the attribute index is -1 return <code>GL_INVALID_VALUE</code>.

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Table 9. New Features

Feature	Details
	<ul style="list-style-type: none"> • Support multi-layered split tiled textures. • For CUBE, 2DArray, or CUBE types, CopyPixels and CopyTexImg need to set srcSurf offset. • Move flush shader L1 cache from every draw to end of XFB. • Performance optimization for Android CTS texture_view. • Disable txIntFilter for X8R8G8B8 for ES3 CTS only because it expects X8R8G8B8 same as A2B10G10R10. • Enhance unified status settings for shader programming. • Invalidate VS or PS even in state mode. • Refine upload of super-tiled surface for RGB565 to ARGB. • Remove the initial cache mode programming as we always program shaderConfig first. • Refine shaderConfig programming always put it at the very beginning and program uniform select for PS to be what VS did. • Refine the render checks for FBO. • Enhancements in ES30 driver for new ES30 CTS(20140530). • Refine EGL image increase 3D arbitrary rotation/browser performance. • Add a copydirty flag to avoid glBindBuffer() recopy of the buffer. • Correct return value while querying the buffer parameter of GL_RENDERBUFFER_SAMPLES. • GenerateMipmap will now skip software path gcvSURF_A8L8in gcvSURF_Resample. • Add S8 only rendering support. <ul style="list-style-type: none"> • Adjust the event execution status updating; • Adjust the event reference counting implementation; • Adjust the worker thread mechanisms for event handling; • Allocate TX surface when buffer has no SW usage. • Disable implicit native buffer sync in some conditions. • Flush tile status cache even for older cores. • Make glReadPixels from R8 to RGBA/BGRA_EXT into gcoHARDWARE_CopyPixels fast path to improve performance. • Add some functions for unified constants. • Add uniform_decode_select programming for driver-side uniform uploading. • Enable unified constants. • Refinements for 2D-VG/Wayland support make sure the eglSwapbuffer resolves to the backBuffer.surface. • Add more prints of link errors. • Optimization for basemark2v2 performance. • Disable dual16 for GFXBench3xALU test to aid performance. • Disable dual16 for MM07 texture filtering test. • Fix assert and access CPU memory if defaultUBO has CPU cache. defaultUBO need to issue fence if it is used by the draw. • Adjust fragment const value for composition to correct image error in Electopia on GC4000. • Add more exported symbols for supporting XServer 1.15. • Flush HZFC buffer to the HZ buffer before HZ FC is disabled. • Resolve MaxDrawBuffers_vert and MaxDrawBuffers_frag failures in OES20 CTS on core v465_rc2c; the wrong maxdrawbuffer value was being queried. • Disable fast upload path for superTiled textures to avoid random hangs on WinCE. • Add a parameter in eglPostBuffer to send fencefd from HWC to EGL. • Refine the eglSwapbuffers API trace function and change the VIV_PROFILE environment variable check logic to include the case VIV_PROFILE=3.

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Table 9. New Features

Feature	Details
	<ul style="list-style-type: none"> • Refine OQ related code in command buffer for EA NFS performance. • Disable HZ test only if disableTileStatus needs decompression and do not set the dirty flag if hzDisabled was already TRUE. <p>Bug Fixes</p> <ul style="list-style-type: none"> • Resolve a dead loop issue in gcoHARDWARE_ProgramTexture() when using MAX_NUM texture. • Fix a vertex data corrupted issue found by game 'GTRacing 2' • Correct swap rectangle (EGL_VIV_swap_rectangle), correct Android native visual id, and fix invalid cancelBuffer function pointer. • Adjust shader source code signature settings. • Refine user pool planar surface placement (stride, align-width) calculations. • Fix tile alignment for fast clear fill feature. at most change XYZ components. • Resolve an Egypt rendering issue in GLBenchmark2.1.5 which was caused by a special optimization. • Refine the output pack in linker to use the output location not the index of outputs and to add the layout location to the IR dump. • Fix vsprintf buffer overflow problem. • Fix a 3D-VG image reference issue in a multi-context app. • Fix PA clipping issue. • Correct VS and PS sampler settings for GC400T(v464RC5). • Fix 3D-VG rendering issue in line strip primitives. • SFT bug fixes Fix draw error when the width and height of FBO attachments are not same. • Fix extensions check on compiler FE per GLES.SL spec the extension directives must occur before any non-preprocessor tokens. • Fix return value while querying the buffer parameter of GL_BUFFER_ACCESS_OES. • Fix texture format quality issue found by SFT30. • Fix Vellamo benchmark crash when run Aquarium Canvas item. • Fix FE initialization for an array without a specified size. • Call sema/stall before load state to texture samplers to isolate VS and PS texture update in secure driver. • Fix Android native fence sync. • Correct the return values when the internal format is one of the unsized base internal formats from GL_INVALID_VALUE to GL_INVALID_ENUM. • Add a workaround for an icache issue that results in a hang if the minimal register usage is set to 3. • Resolve a flush triangle issue which produced corrupted vertex data in GT Racing2. • Fix a memory leak issue found running YouTube; • Fix a glmark2 segmentation fault on GC400T/X11. • Enable color pipe if alpha test is enabled to avoid incorrect depth outputs that may occur if color pipe is disabled causing a bypass of alpha test. • Correct EGL Image sibling check. • Correct texture fenceID for cases where the draw command is called more than 2 times and there is only glFlush() between draw command. • Pause and resume TS when endOQ. • Move validation of shader resource after loading program down to under layers to make sure all shader states in the hardware object are updated when updating uniforms. • Add a check for indexbuffer data upload to avoid hangs on QQ browser draw with the indexbuffer. • Refine code for direct calls to glRenderbufferStorage without any RBO object. • Add check for integer attribute input support.

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Table 9. New Features (continued)

Feature	Details
	<ul style="list-style-type: none"> • Fix fence fd leaks for virtual displays. • Revert a fix for Vellamo benchmark. • Fix ES3-CTS.gtf.GL3Tests.copy_tex_image_conversions.copy_tex_image_conversions_required failure on GC2100 GC880 <ul style="list-style-type: none"> • All VS samplers to PS so app can query correct uniforms; • Skip recompile for PS in cases of out of sampler usage; • Force VS to always stream out compare pass; • Use format A2B12G12R12 to more accurately simulate SRGB8 render format; • Disable multi-layer format for temp linear bitmap; and 6) Add another BlitCPU patch for CopyTexImage. • For non-2D compression hardware correct the block size settings if source is tiled. • Detach drawable from driver context before updating it. • Prevent screen flash GFXBench3x during driver overhead test on GC400T. • Fix attributes conversion for ES31-CTS.vertex_attr_binding.basic-input1-case1. • Special patch for game to handle INF float correctly on some hardware when vertex has invalid data. • Correct variable name of the access flag to flush the CPU and GPU cache when unmapping a buffer object.
EGL	<p>New Features</p> <ul style="list-style-type: none"> • Add EGL surface content protected extension support. • Add some missed error set when EGL function call fails. • Update the srcSurface of eglImage when marking the shadow surface to dirty. • Update EGL makefile for Wayland. • Recycle EGL resources after eglReleaseThread / thread exits. • Do not disconnect Android native window when making current to another context. • Refine Android native window buffer usage and count settings. • Correct Android frame buffer check when querying render mode. • Refine Android native window buffer attribute settings. • Fix floating vg on QNX caused by Wayland porting code. <p>Bug Fixes</p> <ul style="list-style-type: none"> • Dereference EGL image from client. • Always assume EGL image source is dirty for other EGL image sources. • Fix Android CTS testOpenGLEsVersion failure on GC400T. • Correct EGLImage timestamp compare.
OES	<p>New Features</p> <ul style="list-style-type: none"> • OES: Add GL_OES_vertex_array_object extension API support. • OES11: Refine OES11 share context feature support. • OES2.0: Enable BGRA format for glReadPixel. • OES2.0: Enable MSAA support for glReadPixel. • OES3.0: Optimization for driver overhead test in GFXBench3.0. • OES3.0: Refine color mask settings for OES30. • OES3.0: Refinements for OES30 glClear(). • OES3.0: Add BGRA support for read buffer. <p>Bug Fixes</p> <ul style="list-style-type: none"> • OES11: Resolve an OES11 conformance texture combine failure in the compiler mad should not be generated if mul has SAT modifier.

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Table 9. New Features (continued)

Feature	Details
	<ul style="list-style-type: none"> • OES11/ES31: Fix ES11 glGetString and ES31 glGetString conflict issue in ES3 conformance test. • OES11: Fix frame buffer status query in OES11 driver. • OES11: When transforming the incoming normal to the eye space coordinates by using matrix palette • OES11: Don't call glFlush directly in OES11 driver. • OES30: Correct max surface count when FBO attachment is GL_TEXTURE_2D_ARRAY texture.
OGL	<p>New Features</p> <ul style="list-style-type: none"> • Improve the performance of GLBenchmark2.5 Egypte HD. • More refinements for Manhattan in GFXBench3.0; • Add more built-in attribute support in GL2 driver. • Set memory limit in kernel for DRI backend for WebGL with Chrome browser. • Add GL_EXT_packed_depth_stencil extension support in OGL. • Remove unnecessary gcmHEADER() and gcmFOOTER(). a) Improve event's wakeup implementation; • Add support for GLX1.3 WinPixmap. • Refine user memory map/unmapping for OpenGL on Yocto. • Fix a memory leak issue in the OpenGL driver.
VG	<p>New Features</p> <ul style="list-style-type: none"> • Add dump VG API time supporting for 355VG. • Resolve VGMark rendering issue on MOVG. • Added 2D VG support on Android. • Add more MOVG support. • Allow VG uses gcvPOOL_CONTIGUOUS as command buffer if this pool is available. • 2D: Refine Tessellation buffer size calculations. • 2D: Print memory is available only when 2D-VG is enabled. • 2D: Update path bounds during convert stroke. • 2D: For zero length paths path bounds do not need updating. • 2D: Fix changing tree depth value when GC355_PROFILER is enabled. <p>Bug Fixes</p> <ul style="list-style-type: none"> • 2D: Optimize mask image; create mask image only when necessary. • 2D: Allow negative or zero values for stride data for vglImageSubData and vglImageSubData. • 2D: Set kernel->timeOut correctly for VG. • 2D: 2D-VG driver needs to ignore thegcoHAL_QueryChipLimits() error check for non-355vg cores. • 2D: Add mask when selecting 2D/3D/VG core build mode to avoid memory increases. • 2D: Refine compiler Out of Memory warning. • Correct behavior of vglImageSubData.
VTK	<p>New Features</p> <ul style="list-style-type: none"> • Enable vprofiler for X and wayland.
Security	<p>New Features</p> <ul style="list-style-type: none"> • 2D: Implement 2D source buffer check in security driver. • 3D: Implement 2D source buffer check in security driver.
Android	<p>New Features</p> <ul style="list-style-type: none"> • More refinements in hwcomposer driver <ul style="list-style-type: none"> • Fix a crash issue when dumping bitmap;

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Table 9. New Features (continued)

Feature	Details
	<ul style="list-style-type: none"> • Refine debug log output; Check max supported number of displays; • Add multi-source blit with different source offsets support; • Refine 2D features check; • Support dynamic enable for hwcomposer debug option at runtime. • Refine Android native fence sync support. • Add an implicit sync point for Android native buffer. • 3D: Add supertiled mode setting in HWC. • 3D: Fix Android CTS test failure found by android_media_cts_presentationsync test. • Add protected content support for Android native window back buffer. • 2D: Fix multi-source blit with source offset and add multi-source blit v2 features to HWComposer. • 2D: HWComposer_v1 simulate mirror operation using source flip in fliterblit. • Prepare Android make file for platform specific configurations. • Remove an incorrect compile flag. • Add native OS fd to reference video memory node for gralloc buffers disabled by default. • Add debug print for fb target layer in HWC. • Add target tiling check in HWComposer prepare. • Add usage check when accessing the gralloc buffer. • Correct log print i-n gralloc. • Correct gralloc usage check for cacheable bitmaps. • Build Vivante gralloc allocator as a static library. • Add gralloc helper function to inform on buffer content changes. • Use C style ABI for gralloc functions. • Add a notify update- call in ION reference allocator. <p>Bug Fixes</p> <ul style="list-style-type: none"> • Fix hwcomposer composition for YV12/I420 source. • Fixed screenshot doesn't work issue. • Correct Android native window buffer tiled output. • Correct gralloc buffer allocation. • Implement GPU helper for Android gralloc
EXA	<p>New Features</p> <ul style="list-style-type: none"> • Refine EXA dr+B134iver for performance.
MOVG	<p>New Features</p> <ul style="list-style-type: none"> • 355VG Refine ts.cfg parsing. Where there are no illegal args but the count of args is less than 4, some args will be assigned 0. • Refinement for 355VG only mode driver (gcdDISABLE_CORES_2D3D). • Fix chip info dump for VG. • Set TS alignment to be always by 128. • Add 2D-VG memory footprint support. • Add 2D-VG profiler feature support. <p>Bug Fixes</p> <ul style="list-style-type: none"> • Change trigger condition for printing video memory statistics from gcdENABLE_VG to gcdMOVG.
OCL	<p>New Features</p> <ul style="list-style-type: none"> • Enable OpenCL ICD driver support. • Add optimization for ambient occlusion test in CLBenchmark(e4dc373e). • Report error when attempting to enable an unsupported extension. • Refine OpenCL context and command queue management.

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Table 9. New Features (continued)

Feature	Details
	<ul style="list-style-type: none"> • Refine the default OpenCL platform settings. • Improve OCL event mechanisms. • Add flush operation for OCL MapBuffer. • Fix built-in function modf in OCL compiler. • Add a missed GPU flush operation in OCL. • Refine multi-threading support in OCL driver. • Refine OCL command queue management. • A CL shader can use all constant resources. • More refinements for OCL command queue management. • Disable the release signal for deferred command release. • Change the minimum value of maxMemAllocSize to 128MB. • Implement use of flag gcvSURF_FORMAT_OCL to add 64bytes for cache overflow. <p>Bug Fixes</p> <ul style="list-style-type: none"> • Correct a max group size calculation in OCL.
Compiler	<p>New Features</p> <ul style="list-style-type: none"> • Shader compiler enhancement for GC2000 vffff5450. • Support GLSL 1.20.8. • Refine value for built-in constant maxFragTextureImageUnits. • Fix some potential problems reported by static analysis tool. • Mark all layer samplers as used in shader. • Refine ACOS/ASIN functions. • Correct function returns type check. <p>Bug Fixes</p> <ul style="list-style-type: none"> • Refine code generation for FLOOR. • Refine default UBO. • Resolve uniform issue found by OE30 CTS on security driver.
DirectFB	<p>New Features</p> <ul style="list-style-type: none"> • Change flush pending function usage to fix multi-process render issue. • Refine line check in DFB driver. • Add display API for DFB backend. <p>Bug Fixes</p> <ul style="list-style-type: none"> • Fix tiger render error on DFB backend. • Fix DFB double free issue.
Wayland	<p>New Features</p> <ul style="list-style-type: none"> • Refinements for Wayland support. <p>Bug Fixes</p> <ul style="list-style-type: none"> • Remove dedicate warning error to pass wayland build
General	<p>New Features</p> <ul style="list-style-type: none"> • Refine version information of the driver libraries. • MMU cache flush refinements. • Resolve a race condition in kernel event management. • Refine a library loading process in HAL to reduce loading time. • Add a skip of setting the registers shared by 2D/3D pipes when no corresponding feature bit. • Add platform porting layer.

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Table 9. New Features

Feature	Details
	<ul style="list-style-type: none"> • Remove pre-rotation support • More refinements in gralloc driver Correct y-invert flag for gralloc wrapped surfaces;Wrap user surface via GPU MMU if physical address is above 2G. • Add unified swap model support. • Resolve a varying packing issue found by vCompiler testing. • Specify usage when reserving command buffer for GC400T. • Use spin_lock_irqsave/spin_lock_irqrestore since _Print is called by ISR. • Resolve some build warnings found by codesonar/klocwork tools. • Enable GPU pending interrupts check. • Fix bytes per pixel calculation for first plane for some YUV formats. • Disable tile status buffer for 8bit format. • Refine compiler reference counting to fix a random crash issue in testing. • More optimizations for process detection. • SHM and ION allocator integration and EGL protected content extension refinements. • Used filterblit temp surface without syncing with GPU. • Enable gcvSURF_PROTECTED_CONTENT when constructing surface. • Remove duplicated data copies in context switch. • Call setPower() after setClock() in gckOS_SetGPUPower when turning off the power, Set PM state to gcvPOWER_OFF_BROADCAST at driver initialization. • Export more information by debugfs. • Fix build warnings found by Codesonar. • More refinements for video memory lock. • Check gcPLS.os object before using it. • Refine MMU mapped PIXMAP linear buffer rendering path. • Refine gcoHAL_QueryChipCount() for OS/HAL objects construction failure. • Add cache() platform interface for special implementation with GC5000-5434. • Move threadDefault out of VIVANTE_NO_3D. • Disable dump MMU state for AXI BUS ERROR. • Fix more build warnings found by Codesonar/klocwork • Refine GPU idle detection. • Refine GPU recovery function. • Refine 'reserved' memory allocation. • Add 2D/3D/355VG separate or combination build support. • Add gcvSURF_CONTIGUOUS to allocate contiguous surfaces. • Refine memory allocation from gcvPOOL_VIRTUAL and flag with gcvALLOC_FLAG_NON_CONTIGUOUS. • Add dynamic disable for power management. • Detect process name 'galTrigger2DHang' to force a 2D hardware hang. • Enable GPU lower memory killer function and fix issue that tasklist_lock is not available for module. • Add GID for ION lock. • Support to query virtual command buffer usage. • Support low or high memory usage query in debugfs. • Remove device->dataReadys since no one uses its value. • Add semaphore and stall after pipe switch in context buffer. • Added semaphore and stall after pipe selection for GC400T. • Dump whole process db. • Add hardware state recorder. • Make sure the GPU driver is loaded before display driver on WinCE (platform-specific issue). • Refine make files for Linux/Android. • Connect video memory node to a native OS fd. • Turn power management on/off according to vProfiler status at the beginning of a process.

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Table 9. New Features

Feature	Details
	<ul style="list-style-type: none"> • Additional refinements for Wayland support. • Update README for WINCE build/test. • Refine back buffer method in DFBVDK. • Add environment variable (FB_IGNORE_DISPLAY_SIZE) for X platform to control surface size changes which are determined by display device. • Change environment variable IGNORE_DISPLAY_SIZE name on different platforms (now DRI_IGNORE_DISPLAY_SIZE FB_IGNORE_DISPLAY_SIZE or X_IGNORE_DISPLAY_SIZE). • Add gcoOS_LockVideoMemory for video memory allocator (customer-specific). • Resolvemulti-thread write/read share info error on AXI bus. • Add iommu support. • Add missed gc_hal_kernel_iommu.c. • Remove out of memory error message from release driver for WCE. <p>Bug Fixes</p> <ul style="list-style-type: none"> • Correct wrong destination addresses when writing data to an ARGB8 buffer. • Fix surface stride • Fix incorrect creation of memory allocator struct. • Fix normalize issue per game. • Correct an event source error when flushing MMU. • Avoid unnecessary calling of release_mem_region() when removing galcore.ko. • Remove a duplicated unlocking call about Hardware->tempSurface. • Fix some build warnings. • Refinements when crossing 4K boundary. • Fix dynamic DMA mapping API usage. • Add more buffer handling checks in gralloc functions. • Exclude more 2D calls from 3D only driver. • Correct Kitkat SDK version number. • Fix version information in library binary. • Fix PM test when VIV_PROFILE=0. • Refinements for debug builds. • Fix kernel module build for old linux kernel version. • Modify queue worker thread polling • Support tool apitrace • Link failed for libEGL.so • Rewrite gralloc helper for browser mess issue • Enhanced gcoSURF_SetVideoBuffer • Fix FSL-GPU-SDK OpenVG 2D issue • Fix libGAL_egl.so debug build error • Fix GLX application resized by window manager • Sometimes no rendering when run multiple es2gears • Free imported video node correctly • Save video node for imported buffer • Fix Cannot play one H264Dec video by Gallery on 6sl_evk. • Fixed incorrect display stack linked list • Detect depth from the user created window • Fix glx application rendering upside down bug • Enable alpha and dim layer process by hwcomposer • Update test build script • Fix dependency and export table for libGAL restructuring • Memory leak in eglMakeCurrent • Add VG355 support to X11 desktop • Special mesa apps cause imx6dl-sabresd hang • Fix DRM memory leakage • Add tracing string into libGAL.so

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Table 9. New Features (continued)

Feature	Details
webGL	<p>New Features</p> <ul style="list-style-type: none"> Fixed issues found by WebGL conformance test. <p>Bug Fixes</p> <ul style="list-style-type: none"> Fix WebGL Oimo rendering issue.
GL2	<p>Bug Fixes</p> <ul style="list-style-type: none"> Fix memory leak caused by GLX context management. Avoid unnecessary flushes to improve the performance.

2.4 Defect Fixes

See the log of each git repo by using the command `git log`, for the list of the defects fixed in this release.

3 BSP Supported Features

Table below describes the features that are supported in this BSP release. In table below, if no board is explicitly stated then the feature is shared across all boards otherwise only the boards listed.

Table 10. Supported Features

Feature	Supported Boards	Comments
Kernel		
Kernel	All i.MX 6	Kernel version: 3.10.53
File System	All i.MX 6	<p>EXT2/EXT3/EXT4 are used as the file system in MMC/SD Hard Disk.</p> <p>On 6SABRE-AI,</p> <ul style="list-style-type: none"> UBIFS is used for NAND JFFS2/UBIFS is used for Parallel NOR.
Bootloader		
U-Boot	All i.MX 6	<p>U-Boot delivery is based on U-Boot version v2014.04.</p> <p>Clock, Anapop regulator, ENET, UART, MMC/SD, eMMC4.3/4.4</p> <p>High Assurance Boot, ROM Plug-in Mode.</p> <p>SPI-NOR, Parallel NOR, SATA, NAND, QuadSPI-NOR, USB Mass Storage.</p> <p>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.</p> <p>i.MX 6Quad/Dual Lite SABRE-SD and SABRE-AI support DDR3 528MHz@64bit.</p> <p>i.MX 6Dual Lite/Solo SABRE-SD and SABRE-AI support DDR3 400MHz@64bit.</p> <p>i.MX 6SoloX SABRE-SD and SABRE-AI support LDDR3 400MHz@32bit</p>

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Table 10. Supported Features (continued)

Feature	Supported Boards	Comments
		i.MX 6SoloLite EVK supports LPDDR2 400MHz@32bit and boot using L2Cache as OCRAM
Machine Specific Layer		
ARM® Core	All i.MX 6	Supports Cortex-A9®. Supports reboot and power-off.
Memory	All i.MX 6	The user/kernel space is split 2G/2G.
Interrupt	All i.MX 6	GIC
Clock	All i.MX 6	Controls system frequency and clock tree distribution.
Timer (GPT)	All i.MX 6	System timer tick support.
GPIO/EDIO	All i.MX 6	GPIO is initialized in earlier phase according to hardware design.
IOMUX	All i.MX 6	Provides the interfaces for I/O configuration. IOMUX-V3 version is used.
DMA Engine		
SDMA	All i.MX 6	Conforms to DMA engine framework.
APBH-Bridge-DMA	6SABRE-AI	Conforms to DMA engine framework. To use this feature requires a nand U-Boot.
Character Device Drivers		
MXC UART	All i.MX 6	i.MX 6SABRE-SD, and SoloLite EVK support console via internal Debug UART1. i.MX 6SoloX SABRE-SD and SABRE-AI support A9 Debug via UART1 and M4 Debug via UART2. i.MX 6SABRE-AI support console via internal Debug UART 4.
Power Management Drivers		
Anatop Regulator	All i.MX 6	Supports Anatop regulator management.
Lower Power mode	All i.MX 6	Supports standby mode and dormant (mem) mode.
CPUIdle	All i.MX 6	2 levels CPUIdle supported: purely WFI and WFI with wait mode enabled.
CPUFreq	All i.MX 6	CPUFreq can be used for CPU frequency adjustment. The Interactive governor is added and enabled by default.
BusFreq	All i.MX 6	Supports the system bus clock frequency scaling.
Battery charging	All i.MX 6	
Networking Drivers		
ENET	All i.MX 6	Supports AR8031 PHY. i.MX 6SoloX-SABRE-SD and SABRE-AI support AVB Features.
IEEE 1588	All i.MX 6	Supports IXXAT V1.05.03 stack. Supports Linuxptp stack. Features: <ul style="list-style-type: none"> • Supports IPv4, IPv6, IEEE 802.3 transport. • Supports E2E, P2P transparent clock. • Supports IEEE802.1AS-2011 in the role of end station. Note: IXXAT V1.05.03 stack is commercial authorization from IXXAT. Linuxptp stack is open source. Command instance:

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Table 10. Supported Features (continued)

Feature	Supported Boards	Comments
		ptp_main_1.05.03 -d -t -o -z -i 0:eth0 ptp41 -A -4 -H -m -i eth0
PCIe	All i.MX 6 except 6 SoloLite	
MediaLB	6SABRE-AI 6SoloX-AI	On i.MX 6SABRE-AI CPU1 supports MLB 150.and MLB 25/50. On i.MX 6SABRE-AI CPU2 supports MLB 25/50 only. On i.MX 6SoloX-AI supports MLB 25/50.
FlexCAN	6SABRE-AI 6SoloX-SD 6SoloX-AI	Supported one CAN with default device tree on i.MX 6SABRE-AI. Supported both CAN using flexcan device tree but has pin conflict with FEC. Supported with default device tree on i.MX 6SoloX-SD but has pin conflict with QSPI1.
Security Drivers		
CAAM	All i.MX 6 except 6 SoloLite	Security Drivers
SNVS	All i.MX 6	
Sound Drivers		
WM8962/SSI	6SABRE-SD 6SoloLite 6SoloX-SD	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	Supports sample rates conversion from 5KHz to 192KHz 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	6SoloX-SD	Supports 16 bit, 24 bit, and 32 bit PCM format. Supports sample rate from 8 KHz to 96 KHz for record and playback . Supports full duplex operations. Supports amixer alsamixer control from user space. Supports clock control.
HDMI Audio	6SABRE-SD 6SABRE-AI	Supported only on i.MX 6Dual/Quad and i.MX 6DualLite for SABRE-SD and SABRE-AI
Input Device Drivers		

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Table 10. Supported Features (continued)

Feature	Supported Boards	Comments
USB devices	All i.MX 6	Supports USB mouse and USB keypad via USB ports.
Touch panel	All i.MX 6	6SABRE-SD and 6SABRE-AI supports EGalaxy capacitive touch screen. 6SoloLite supports E Ink touch screen on DC2/DC3 add-on card. i.MX 6SoloX SABRE-SD and SABRE-AI support WVGA panel.
Keypad	6SoloLite	6SoloLite supports 4x4 keypads on DC2/DC3 add-on card.
MTD driver		
QuadSPI-NOR	6SoloX-SD 6SoloX-AI	i.MX 6SoloX SABRE-AI supports QSPI1. i.MX6 SoloX SABRE-SD supports QSPI2.
SPI-NOR	6SABRE-AI 6SoloLite	Supports M25P32 On i.MX 6SABRE-SD DualQuad/DualLite there is a pin conflict for supporting SPI-NOR
NAND	6SABRE-AI 6SoloX-AI	Normal NAND and ONFI NAND asynchronous mode with BCH40.
Parallel NOR	6SABRE-AI	Supports Parallel NOR by using the EIM interface.
SATA	6SABRE-SD 6SABRE-AI	Serial ATA 2.0 supports only i.MX 6 DualQuad SABRE-SD and SABRE-AI.
USB Drivers		
USB Host	6SABRE-AI 6SoloLite 6SoloX-SD 6SoloX-AI	Supports USB HOST1 and USB OTG host.
USB Device	All i.MX 6	Supports USBOTG device mode.
USB	All i.MX 6	Supports USB OTG2.0 and USB Host2.0 ports. USB Host mode: MSC, HID, UVC, USB audio. USB device mode: MSC, Ethernet, Serial. USB OTG pin detect support for HNP and SRP on OTG.
Graphics Drivers		
GPU	All i.MX 6	Graphics Chips Details GC2000, GC355 and GC320 on 6Dual/6Quad GC880, GC355 and GC320 on 6Solo/DualLite GC400T on 6SoloX The GPU on the chips listed above supports these features which include 2D and 3D hardware acceleration: <ul style="list-style-type: none"> • Supports EGL 1.4 for fbdev, X11, directFB, Wayland • Supports OpenGL ES1.1 • Supports OpenGL ES2.0 (WebGL 1.0.1 compatible on X11) • Supports OpenGL ES3.0 • Supports OpenVG1.1 • Supports OpenCL1.1 • Supports OpenGL2.1

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Table 10. Supported Features (continued)

Feature	Supported Boards	Comments
		GC355 and GC320 on 6SoloLite which include only 2D hardware acceleration <ul style="list-style-type: none"> • Supports EGL 1.4 for fbdev, X, directFB, Wayland • Supports OpenVG1.1
Frame Buffer Driver	All i.MX 6	MXC Frame buffer driver for IPU V3 on i.MX 6SABRE-SD and i.MX 6SABRE-AI. MXC Frame buffer driver for PXP on i.MX 6SoloLite and i.MX 6SoloX SABRE-SD and SABRE-AI.
VDOA	6SABRE-SD 6SABRE-AI	Supports Video Data Order Adapter.
LVDS	6SABRE-SD 6SABRE-AI 6SoloX-SD 6SoloX-AI	Supports HannStar LVDS panel. It's the default display if no other video option is setup. On the SABRE-AI there are 2 ports. Port 0 is the default.
HDMI	6SABRE-SD 6SABRE-AI 6SoloLite 6SoloX-AI	i.MX 6SABRE-SD and SABRE-AI support on-chip DesignWare HDMI hardware module. i.MX 6SoloLite and i.MX 6SoloX SABRE-AI support external HDMI.
HDCP	6SABRESA	Supports HDCP v1.2 specifications.
WVGA panel	All i.MX 6	Supports SEIKO WVGA panel.
PxP	6SABRE-SD 6SoloLite 6SoloX-SD 6SoloX-AI	On i.MX 6SABRE-SD, PXP is only supported on i.MX 6DualLite SABRE SD. Enables PXP Driver for EPDC on i.MX 6SoloLite and i.MX6DualLite SABRE-SD. Conforms to DMA engine framework.
MIPI Display	6SABRE-SD	Supports MIPI DSI driver through MIPI daughter card.
EPDC	6SABRE-SD 6SoloLite	Enable EPDC on i.MX6 Dual Lite SABRE SD and i.MX6 SoloLite EVK: 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.

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Table 10. Supported Features (continued)

Feature	Supported Boards	Comments
		Supports panning (y-direction only). Supports three EPDC driver display update schemes: Snapshot, Queue, and Queue and Merge. Supports user control of the delay between completing all updates and powering down the EPDC. Supports dithering.
Multimedia Drivers		
IPU V3 driver	6SABRE-SD 6SABRE-AI	On i.MX 6SABRE-SD and i.MX 6SABRE-AI provides interfaces to access IPU V3 modules.
V4L2 Output	All i.MX 6	On i.MX 6SABRE-SD and i.MX 6SABRE-AI uses the IPU post-processing functions for video output. On i.MX 6SoloLite and i.MX 6SoloX SABRE-SD and SABRE-AI, they use the PXP post-processing functions for video output.
V4L2 Capture	All i.MX 6	Supports dual camera on i.MX 6SABRE-SD and SABRE-AI. Supports single camera on i.MX 6SoloLite and i.MX 6SoloX SABRE-SD and SABRE-AI.
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	6SoloLite 6SoloX-SD 6SABRE-SD	Supports OV5640 camera sensor.
TV-IN	6SABRE-AI	Supports TV-IN via ADV7180 on the 6SABRE-AI. Supports bt656, NTSC, and PAL.
General drivers		
uSDHC	All i.MX 6	Supports SD2.0, SD3.0 and SDXC. Supports eMMC 1bit/4bit/8bit SDR/DDR mode. i.MX 6SABRE-SD is soldered, i.MX 6SABRE-AI uses the daughter card, i.MX 6SoloX-SD is not soldered. Supports eMMC4.5 on i.MX 6SoloLite and i.MX 6SoloX-SD.
Watchdog	All i.MX 6	Supports Watchdog reset.
I2C	All i.MX 6	Supports I2C master.
SPI	All i.MX 6	Supports SPI master mode.
PWM	All i.MX 6	Supports the backlight driver via PWM.
ADC	6SoloX-SD 6SoloX-AI	Supports ADC driver.
Temperature monitor	All i.MX 6	Pre-calibrated. See the "Thermal Driver" chapter in <i>i.MX 6 Linux Reference Manual</i> for more information.
Accelerometer	6SABRE-SD 6SoloLite 6SoloX-SD 6SoloX-AI	Supports MMA8451 sensor on i.MX 6SABRE-SD and i.MX 6SoloX-SABRE-SD and SABRE-AI. Supports MMA8450 sensor on i.MX 6SoloLite.

Table continues on the next page...

Table 10. Supported Features (continued)

Feature	Supported Boards	Comments
Wi-Fi	All i.MX 6	Supports AR6003 Wi-Fi.
Bluetooth	6SABRE-SD 6SoloLite 6SoloX-SD 6SoloX-AI	
MAX7310	6SABRE-SD 6SABRE-AI	Supports MAX7310 GPIO expander.
SNVS RTC	All i.MX 6	Low power section only.
Ambient Light Sensor	6SABRE-SD 6SABRE-AI 6SoloX-SD 6SoloX-AI	Supports ISL29023 sensor.
Magnetometer Sensor	6SABRE-SD 6SABRE-AI 6SoloX-SD 6SoloX-AI	Supports MAG3110 sensor.
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.

Table below describes the different boot parameters.

In order to force i.MX 6SABRE-AI board to disable SMP to remove overhead, add boot parameters "nosmp" by default. Disabling CONFIG_SMP configuration can remove further overhead for single core.

Table 11. Common Kernel Boot Parameters

Kernel Parameters	Description	Typical Values	Used When
console	Where to output kernel logging by printk.	console=ttymxc0,115200 For 6SABRE-AI, console=ttymxc3,115200 For 6SoloX-AI, console=ttymxc0,115200	All cases
ip	Tell kernel how or whether to get 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	The location of the NFS server/directory.	nfsroot=<ip_address>:<rootfs path>	Used in "boot from tftp/NFS" together with "root=/dev/nfs."

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Table 11. Common Kernel Boot Parameters (continued)

Kernel Parameters	Description	Typical Values	Used When
root	The location of the root file system.	root=/dev/nfs or root=/dev/mmcblk0p2	Used in "boot from tftp/NFS" (that is, root=/dev/nfs); Used in "boot from SD" (that is, root=/dev/mmcblk0p2). root is set by default by U-Boot to the SD/MMC slot that U-Boot is booting from.
rootfstype	Indicates the file system type of the root file system.	rootfstype=ext4	Used in "boot from SD" together with "root=/dev/mmcblk1p2."
rootwait	Wait (indefinitely) for root device to show up.	rootwait	Used when mounting SD root file system.
mem	Tell kernel how much memory can be used.	None or mem=864M	Note: MemTotal-<mem> - <gpu_memory> is reserved.
max17135	Configure Maxim17135 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 case. It is equivalent to "nosmp".
epdc	Enable EPDC	epdc video=mxcepdcfb:E060SCM,bpp=16	Add 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 kernel/driver which resolution/depth and refresh rate should be used for display port 0 or 1. See the parameter information under Documentation/fb/modedb.txt Tells the kernel/driver which IPU display interface format should be used.	<ol style="list-style-type: none"> 1. video=mxcfb0:dev=hdmi, 1920x1080M@60,if=RGB24 video=mxcfb1:dev=ldb,if=RGB666 2. video=mxcfb0:dev=ldb,if=RGB666 video=mxcfb1:dev=hdmi, 1920x1080M@60,if=RGB24 3. video=mxcfb0:dev=hdmi, 1920x1080M@60,if=RGB24 4. video=mxcfb0:dev=ldb,if=RGB666 5. video=mxcfb0:dev=lcd,CLAA-WVGA,if=RGB656 6. video=mxcfb0:dev=mipi_dsi,TRULY-WVGA,if=RGB24 	<ol style="list-style-type: none"> 1. Used when primarily displaying on HDMI with 1080P60 mode. Secondly displaying on LVDS with XGA mode. 2. Used when primarily displaying on LVDS with XGA mode. Secondly displaying on HDMI with 1080P60 mode. 3. Used when primary displaying on HDMI with 1080P60 mode. 4. Used when primary displaying on the HannStar LVDS1. 5. Used when primary displaying on the CLAA-WVGA dumb parallel LCD panel.

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Table 11. Common Kernel Boot Parameters (continued)

Kernel Parameters	Description	Typical Values	Used When
			<p>6. Used when primary displaying on the TRULY-WVGA MIPI DSI LCD panel.</p> <p>NOTE: GBR24/RGB565/YUV444 etc represents the display HW interface format. Typical values for certain different display devices are shown below:</p> <p>TVOUT: YUV444</p> <p>VGA: GBR24</p> <p>HDMI&DVI: RGB24</p> <p>CLAA WVGA LCD: RGB565</p> <p>Typical values for dev= are shown below:</p> <p>lcd: LCD interface</p> <p>ldb: LVDS</p> <p>hdmi: HDMI on chip or sii902x</p> <p>dvi: DVI port</p> <p>vga: VGA through TVE</p> <p>tve: TVOUT</p>
<p>video on 6SABRE-AI</p>	<p>Tells 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"> 1. video=mxcfb0:dev=hdmi, 1920x1080M@60,if=RGB24video=mxcfb1:dev=ldb,if=RGB666 2. video=mxcfb0:dev=ldb,if=RGB666video=mxcfb1:dev=hdmi, 1920x1080M@60,if=RGB24 3. video=mxcfb0:dev=hdmi, 1920x1080M@60,if=RGB24 4. video=mxcfb0:dev=ldb,if=RGB666 5. video=mxcfb0:dev=hdmi, 1920x1080M@60,if=RGB24 	<ol style="list-style-type: none"> 1. Used when primarily displaying on HDMI with 1080P60 mode. Secondly displaying on LVDS with XGA mode. 2. Used when primarily displaying on LVDS with XGA mode. Secondly displaying on HDMI with 1080P60 mode. 3. Used when primary displaying on HDMI with 1080P60 mode. 4. Used when primary displaying on the HannStar LVDS0. 5. Used when enabling HDMI 1080P60 mode and LVDS0. To enable second display, run "echo 0 > /sys/class/graphics/fb2/blank" <p>NOTE: GBR24/RGB565/YUV444 etc represents the display HW interface format. Typical values for certain different display devices are shown below:</p> <p>TVOUT: YUV444</p> <p>VGA: GBR24</p> <p>HDMI&DVI: RGB24</p> <p>CLAA WVGA LCD: RGB565</p>

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Table 11. Common Kernel Boot Parameters (continued)

Kernel Parameters	Description	Typical Values	Used When
			Typical values for dev= are shown below: lcd: LCD interface ldb: LVDS hdmi: HDMI on chip or sii902x dvi: DVI port vga: VGA through TVE tve: TVOUT
video on 6SoloLite	Tells EPDC FB driver which E Ink panel is in use and what bpp should be used for the Frame Buffer.	video=mxcepdcb:E060SCM,bpp=16	Used when enabling EPDC to select the correct E Ink panel parameters to use. bpp=16 selects RGB565 FB pix format bpp=8 selects Y8 FB pixel format
video on 6SoloLite	Tells ELCDIF FB driver which LCD panel is in use and which bpp should be used for the Frame Buffer.	video=mx_elcdif_fb:SEIKO-WVGA,bpp=16	Used when enabling LCDIF to select the correct panel parameters to use. bpp=16 selects RGB565 FB pix format Note: if only use EPDC FB, then turn off ELCDIF FB by "video=mx_elcdif_fb:off"
dmfc	Tells the kernel/driver how to set the IPU DMFC segment size.	None Or dmfc=3	"dmfc=1" means DMFC_HIGH_RESOLUTION_DC. "dmfc=2" means DMFC_HIGH_RESOLUTION_DP. "dmfc=3" means DMFC_HIGH_RESOLUTION_ONLY_DP. DMFC_HIGH_RESOLUTION_ONLY_DP can only be set by the command line. It is recommended to set this when no IPU connects the two panels. When it is set, each IPU can only connect one panel.
mtdparts on 6SABRE-AI	Tells the kernel mtd partition information.	mtdparts=gpmi-nand:16m(boot),16m(kernel),1024m(rootfs),-(user)	When to enable NAND. The partition: 16m(boot),16m(kernel),1024m(rootfs) is an example, you can change it according to your needs.
csi	Enable CSI driver	csi	Used when enabling CSI driver(needed by ov5640) Note: CSI and EPDC has pin conflicts. When csi is enabled, then EPDC cannot be used.
bluetooth	Choose which bluetooth module on board.	bluetooth=ar3001 or, bluetooth=sxsdman	Choose AR3001 on UART2, or choose SXSDMAN on UART4.

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Table 11. Common Kernel Boot Parameters (continued)

Kernel Parameters	Description	Typical Values	Used When
uart clock from osc for 6SoloX low power idle and scenario of Linux/MQX™ operating system running together.	Choose UART's clock parent.	uart_from_osc	This is necessary for low power idle and all use cases with the MQX RTOS running on ARM Cortex-M4. When setting this parameter, UART sources clock from OSC instead of PLL3_80M, then all PLLs can be off in low power idle.

5 Known Issues/Limitations

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

Table below lists some key known issues.

Table 12. Common Known Issues and Workarounds

Module	Source	Description	Workaround
Thermal	Hardware	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 <i>i.MX Linux Reference Manual</i>
GPU	Software	Driver recovery mechanism may not work properly sometimes.	None.
GPU	Software	2D blt performance may decrease by 10-30% in some cases.	None.
GPU	Software	Pixelmap performance for Frame Buffer backend dropped.	None.
GPU	Software	OpenVG library for GC355 core is not available in X backend.	None.
GPU	Software	ES11 conformance tests fails.	None.
GPU	Software	Xorg 1.15.0 GLX Pixmap causes Xorg server invalid state	Use Xorg 1.14.4.
GPU	Software	Run more than one DFB applications may cause "segmentation fault" .	None.
GPU	Software	glcontexts may cause segmentation fault.	None.
GPU	Software	glmark2 may cause segmentation fault .	None.
GPU	Software	glx pixmap failed to execute	None

Table 13. Known Issues and Workarounds for i.MX 6 SABRE-SD and i.MX 6 SABRE-AI

Module	Source	Description	Workaround
ARM	Software	smp_wmb performance is very low.	This is the common side-effect of SMP. No fix plan.
IPU	Software	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.
PCIe	Hardware/ Software	PCIe doesn't support Hot Plug and Power Management.	No.
Memory Management	Software	The system will report page allocation failure: order:9, mode:0xd0 when system has no big enough 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 cannot set to 1080p@60hz with kernel configuration settings.	Use the xrandr application to configure the HDMI resolution from user-space.
MMC	Software	Hynix eMMC: times out when the rootfs automatically mounts the RPMB partition on i.MX 6SABRE-SD.	Rootfs should not automatically mount the RPMB partition, since it is a secure partition.
GPU	Software	OpenCL output accuracy maybe not high enough.	None.
GPU	Software	WEBGL 1.0.1 conformance test fails.	None.

Table 14. Known Issues and Workarounds for i.MX 6 SABRE-SD

Module	Source	Description	Workaround
Feature	Category	Description	Resolution/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 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", since "-x 1" means enable for IPU library.

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Table 14. Known Issues and Workarounds for i.MX 6 SABRE-SD (continued)

Module	Source	Description	Workaround
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
Feature	Category	Description	Resolution/Workaround
SATA Boot	Hardware	The system can't boot from SATA on the RevB board.	Remove R7
Boot	Hardware	The system can't boot sometimes when it is first powered on the RevB board.	Add 2.2Mohm resistor to 24M OSC.
Suspend/Resume	Hardware/ Software	Suspend/Resume failure if board rework "Add 2.2Mohm resistor to 24M OSC".	Remove rework

Table 16. Known Issues and Workarounds Specifically for i.MX 6Solo/6DualLite SABRE-SD

Module	Source	Description	Workaround
Feature	Category	Description	Resolution/Workaround
PMIC	Hardware	i.MX 6DualLite SD board depopulates the resistor R30 takes away the ability of the processor to turn off the PMIC in hardware.	i.MX 6DualLite will use dumb mode by default.
EPDC	Hardware	The PINs of EPDC are in conflict with other modules.	To enable EPDC, add "epdc" command option into boot command line.
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	ENGR00178495 3 boards cannot boot with EPDC DC2 attached while they boot normally without DC2 daughter cards. 100%.	This occurs when the SW3 (KEYPAD_LOCK) switcher on EBOOK DC2 board was switched "ON" which affects the boot bin "EIM_DA7" (BT_CFG1_7). You need to set SW3 in DC2 board to "OFF."

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Table 16. Known Issues and Workarounds Specifically for i.MX 6Solo/6DualLite SABRE-SD (continued)

Module	Source	Description	Workaround
uSDHC	Hardware	SD3.0: U-Boot can't boot with SDR50 and SDR104. This is not an issue with i.MX 6Dual/6Quad.	Fixed in TO1.1.

Table 17. Known Issues and Workarounds for i.MX 6Dual/6Quad SABRE-AI

Module	Source	Description	Workaround
Feature	Category	Description	Resolution/Workaround
ARM	Software	CONFIG_SMP should be disabled for 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 will be provided with future Linux BSP release.
IPU	Hardware	Default 24bpp on second display used by HDMI. IPU keeps printing error for hardware bandwidth limitation as described in CR ENGR00293432.	No.
eCompass	Hardware	eCompass can't work after EIM-NOR or SPI-NOR are enabled on 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 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 6Solo/6DualLite SABRE-AI

Module	Source	Description	Workaround
Feature	Category	Description	Resolution/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, please check the board. .
CPU hotplug	Software	System hangs after conducting CPU hot plug many times during heavy interrupt.	Known ARM Linux limitation. No workaround as of yet.

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Table 18. Known Issues and Workarounds Specifically for i.MX 6Solo/6DualLite SABRE-AI (continued)

Module	Source	Description	Workaround
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", since "-x 1" means enable for IPU library.
uSDHC	Hardware	SD3.0: U-Boot can't boot with SDR50 and SDR104.	Fixed in TO1.1.

Table 19. Known Issues and Workarounds for i.MX 6SoloLite

Module	Source	Description	Workaround
Feature	Category	Description	Resolution/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.
GPU	Software	Driver recovery mechanism may not work properly sometimes.	No.
System	Hardware	Reboot may not work on 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 since these two modules share the same pins on the EVK board.	The board file in BSP will configure these pins for proper function via DTS. Use imx6sl-evk.dts for EPDC, and imx6sl-evk-csi.dts for CSI.
X-Acceleration	Hardware/ Software	Out of memory error during x11perf test.	It's a system limitation since the x11perf needs a lot of memory. No work-around on the EVK board (only with LPDDR2 memory of 512MB). 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 would be 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 20. Known Issues and Workarounds for i.MX 6SoloX

Module	Source	Description	Workaround
Video	Software	The video display have green line at bottom during gplay.	No workaround.
Security	Software	Security drivers are not provided in this release.	Provided in next release.
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 HW workaround is required. See the HW ticket ENGR00338067. It requires the SW patches to accommodate this HW rework. See the SW JIRA ticket MLK-9819.
PCIe	Hardware/ Software	When the extremely power save mode is enabled on i.MX 6SoloX PCIe., i.MX 6 SoloX PCIe phy/controller would be power off completely, all the TLPs on the PCIe link would be discarded, and link would be down in suspend. 6 SoloX PCIe and the PCIe link would be re-initialized again completely during resume operations. There is one know issue when pcie2usb device is used during suspend/resume, the dev node of the pcie2usb device maybe changed, since the pcie2usb device is reset during the i.MX 6SoloX PCIe 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, since it is a secure partition.
CSI/LCD	Hardware	Cannot be used simultaneously since these two modules share the same pins on i.MX 6SoloX SABRE-SD board.	No.
UART	Hardware	UART can not wake up with the RTS pin programmed with hard flow control enabled. And there is limitation of the framesize to about 16.	No.

6 Multimedia

This chapter contains information on the multimedia component of the BSP. GStreamer 1.0 is introduced in this release. Not all the features of GStreamer 0.10 are available yet in 1.0. GStreamer 0.10 is still provided with the same features as the previous release. Check the tables below to determine which features are available which version.

The versions of the Gstreamer releases are listed below:

Multimedia

GStreamer 0.10:

- gstreamer (version 0.10.36)
- gstreamer-plugins-base (version 0.10.36)
- gstreamer-plugins-good (version 0.10.31)

GStreamer 1.0:

- gstreamer (version 1.2.3)
- gstreamer-plugins-base (version 1.2.3)
- gstreamer-plugins-good (version 1.2.3)

6.1 Freescale GStreamer Plugins

Table 21. Freescale Gstreamer 0.10 plugins

Plugin	Features
Audio decoder	<ul style="list-style-type: none">• beepdec: unified audio decoder plugin Supports MP3, AAC, AAC+, WMA, AC3, Vorbis, DD+• mfw_amrdecoder: AMR audio decoder
Audio encoder	<ul style="list-style-type: none">• mfw_mp3encoder: MP3 audio encoder plugin• mfw_wma8encoder: WMA8 audio encoder plugin
Audio process	mfw_audio_ppaudio: audio equalizer
Video decoder	<ul style="list-style-type: none">• vpudec: VPU-based video decoder plugin (for SOC with VPU)
Video encoder	vpueuc: VPU-based video encoder plugin (for SOC with VPU)
Video process	mfw_ipucsc: IPU-based video converter
Demux	aiurdemux: aiur universal demuxer plugin supporting Supports AVI, MKV, MP4, MPEG2, ASF, OGG, FLV, WebM
Video render	<ul style="list-style-type: none">• imxv4l2sink: v4l2 video sink plugin• mfw_isink: IPU device based video sink plugin
Camera source	imxv4l2src: v4l2 based embedded camera SRC plugin
TV-In source	tvsrc: v4l2 based TV-In SRC plugin

NOTE

Gstreamer 0.10 notes:

- mfw_isink is unavailable with the SoCs with PXP.
- mfw_v4lsink does not support resizing and rotation in the SoCs with PXP.
- glimagesink is only available for those SoCs with GPU 3D.

Table 22. 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

Table continues on the next page...

Table 22. Freescale Gstreamer 1.0 plugins (continued)

Plugin	Features
Video decoder	<ul style="list-style-type: none"> • vpudec: VPU-based video decoder plugin • Software video decoder plugins: use gst-libav plugins
Video encoder	Vpuenc : VPU-base video encoder plugin
Demux	aiurdemux: aiur universal demuxer plugin supporting Supports AVI, MKV, MP4, MPEG2, ASF, OGG, FLV, WebM
Video render	<ul style="list-style-type: none"> • imxv4l2sink: v4l2 based video sink plugin • overlaysink : g2d based video sink plugin
Video source	imxv4l2src: v4l2 based camera /TVin source plugin
AVB streaming	<ul style="list-style-type: none"> • avbpcmsrc: AVB audio source, de-packetizes LPCM data from the AVTP package, following IEC 61883-6 • avbpcmsink: AVB audio sink, packetizes LPCM data into the AVTP package, following IEC 61883-6 • avbmpegtssrc: AVB video source, de-packetizes compressed video TS package from the AVTP package, following IEC 61883-4 • avbmpegtssink: AVB video sink, packetizes compressed video TS package into the AVTP package, following IEC 61883-4
Video convert	<ul style="list-style-type: none"> • imxvideoconvert_g2d: GPU2D based video convert plugin, to perform video color space conversion, resize, rotate • imxvideoconvert_ipu: IPU based video convert plugin, to perform video color space conversion, resize, rotate, deinterlacing.

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.

6.2 Multimedia Feature Matrix

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

6.2.1 Parser/Demuxer specifications

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

Table 23. 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	-

Table continues on the next page...

Table 23. Parser/Demuxer supported audio/video (continued)

	Demuxer feature	ASF	AVI	MP4	OGG	FLV	MPG2	MKV	RMVB
	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

6.2.2 Video Codec Specifications

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

Table 24. 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	-

Table continues on the next page...

Table 24. Video codec specification for hardware with VPU acceleration (continued)

-	Feature	Profile	Max. resolution	Min. resolution	Max. framerate	H/W or S/W	Bitrate	Comment
	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	-
Video encoder	MPEG4	SP	1280 * 720	64 * 64	30 fps	H/W	12 Mbps	-
	H.263	P3	1280 * 720	64 * 64	30 fps	H/W	8 Mbps	-
	H.264	BP	1920 * 1080	64 * 64	30 fps	H/W	14 Mbps	-
	MJPEG	-	1920 * 1080	64 * 64	30 fps	H/W	160 Mpixl	-

Table 25. Video codec specification for hardware without VPU acceleration

	Feature	Profile	Max. resolution	Min. resolution	Max. framerate	H/W or S/W	Comment
Video decoder	MPEG4	SP/ASP	D1	64 * 64	30 fps	S/W	Gstreamer 0.10 only
	H.264	BP/MP/HP	CIF	64 * 64	30 fps	S/W	-
	WMV9	SP/MP	D1	64 * 64	30 fps	S/W	Gstreamer 0.10 only

Gstreamer 1.x uses the gst-libav plugin which is available separately.

Gstreamer 0.10 uses the gst-ffmpeg plugin which is available separately.

6.2.3 Audio Codec Specification

Table 26. 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)	stereo/mono	<= 48	8 - 448	S/W	-
	MPEG-2 (Layer-1/ Layer-2/Layer-3)					
	MPEG-2.5 (Layer-3)					
AACLC	MPEG-2 AACLC	<= 5.1	8 - 96	8 - 256	S/W	-
	MPEG-4 AACLC					
HE-AAC	HE-AAC V1	stereo/mono	8 - 96	Mono: 8 - 384 stereo: 16 - 768	S/W	-
	HE-AAC V2					
WMA10 Std	L1 @ QL1	stereo/mono	44.1	64 - 161	S/W	-
	L2 @ QL1	stereo/mono	<= 48	<= 161	S/W	-

Table continues on the next page...

Table 26. Audio codec specification (continued)

Decoder	Feature/Profile	Channel	Sample rate (KHz)	Bit rate (kbps)	H/W or S/W	Comment
WMA10 Pro	L3 @ QL1	stereo/mono	<= 48	<= 385	S/W	-
	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	-
WMA 9 Lossless	M3 @ QL2	<= 7.1	<= 96	<= 1500	S/W	-
	N1	stereo/mono	<= 48	<= 3000	S/W	-
	N2	<=5.1	<= 96	<= 3000	S/W	-
AC-3	N3	<=7.1	<= 96	<= 3000	S/W	-
	-	<=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	-

Table 27. Audio encoder specification

Encoder	Feature/Profile	Channel	Rate (KHz)	Bit rate	H/W or S/W	Comment
MP3	MPEG-1/ Layer-3	Stereo/Mono	32, 44.1,48	See Note	S/W	-
WMA8	L1/L2/L3	Stereo/Mono	22.05, 32, 44.1, 48	See Note	S/W	Gstreamer 0.10 only

NOTE

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

6.2.4 Image codec specification

Table 28. 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

6.2.5 Speech codec specification

Table 29. 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

6.2.6 Streaming protocol specification

Table 30. Streaming protocol specification

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

6.2.7 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* for information on how to build and install it.

Table 31. 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

6.3 Known Issues and Limitations for Multimedia

Issues seen on both Gstreamer 1.x and Gstreamer 0.10:

- 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 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 968x968 when enabled deinterlacing due to a driver limitation.
- For long time video playback, system memory may be occupied by file cache as linux kernel policy, this may cause some driver allocate page failed then cause playback failed. To avoid this issue, please include below line in your /etc/rc.local :

```
echo 30000 > /proc/sys/vm/min_free_kbytes
```

Issues only seen on Gstreamer 1.x:

- Rewind may report an EOS when using libav for video decoding.

Issues only seen on Gstreamer 0.10:

- For video files which contain multiple audio tracks, the default selected audio track may be different for each playback due to the playbin2 implementation.
- In the dual-display use case, if the primary and secondary displays do not have the same resolution, the secondary display shows a color strip. To solve this issue, the imxv4l2sink property of the secondary display needs to be set with the actual width and height in the command line.
- Rotation is not supported for a display resolution larger than 1024x1024 due to a driver limitation.

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