

Software Features

NVIDIA® Tegra® Linux Driver Package (L4T) supports the following software features, which provide users a complete package to bring up Linux on targeted NVIDIA® Tegra® X2 devices.

This release supports the NVIDIA® Jetson™ TX2 developer kit and module.

Note: Check the *Release Notes* for constraints related to these features.

Boot Loaders

Boot Loader	Feature	Notes
nvtboot-bmp	Execution CPU	BPMP
	Storage location	Cold boot: eMMC
		RCM boot: Downloaded over USB recovery port
	Next stage storage location	Cold boot: eMMC
		RCM boot: Downloaded over USB recovery port
	Next stage	cboot
	Storage device support	eMMC
	Partition table support	GPT (with protective MBR)
	Filesystem support	None
	I/O bus support	I2C
Console UART		
cboot	Execution CPU	CCPLEX
	Storage location	Cold boot: eMMC
		RCM boot: Downloaded over USB recovery port
	Next stage storage location	Cold boot: eMMC
RCM boot: Downloaded over USB recovery port		

Software Features

	Next stage	U-boot or Linux kernel
	Storage device support	eMMC
	Partition table support	GPT (with protective MBR)
	Filesystem support	None
	I/O bus support	I2C
	Console	UART
U-Boot	Execution CPU	CCPLEX
	Storage location	Cold boot: eMMC
	Next stage storage location	Cold boot: eMMC
	Next stage	Linux kernel
	Storage device support	eMMC, SD card
	Partition table support	GPT (with protective MBR), DOS MBR
	Filesystem support	ext2/3/4. FAT
	I/O bus support	I2C, PCIe

Toolchain

Feature	Tool Chains	Notes
Aarch64	gcc-4.8.2-glibc-2.17	For 64-bit Kernel, Userspace, and U-Boot For more information see Building the Kernel .

Kernel

Interface	Feature	Notes
DSI	DSI Display Support	DSI0, DSI1
	DSI Ganged Mode	DSI1
	PWM Backlight	DSI0, DSI1
	DC Continuous Mode	DSI0
	DC Driven Command Mode	-
	Host Write	-
	DSI One-Shot Mode	-
	Dual Display	-
	Run Time Power Management	DSI0, DSI1
HDMI	EDID Support	Yes
	Hot-Plug Detection Mechanism	Yes
	HDMI 1.4	480p, 720p, 1080p, RGB 444 4K @ 30 Hz
	Driver Suspend/Resume for Low Power	Yes

Software Features

	HDMI as Primary Display	Yes	
	Multi Display	Yes for Mirror/Extended Mode	
	HDMI: 1.4b compliance	Yes	
	HDMI: 2.0 compliance	Yes	
	Audio Support	Yes	
	HDMI 2.0 support	4K @ 60 HZ	
Audio	ADSP Audio		
Display	DP2 support	Yes	
	Driver Suspend/Resume for low power	Yes	
	Support eDP as Primary Display		
	3-head Display		
Display DPO	DSI Host Read	DSI0	
	DSI Host Read	DSI1	
	DSI Secondary Data during v_blank	DSI0	
	DSI Secondary Data during v_blank	DSI1	
	DC Driven Command Mode	DSI0	
	DC Driven Command Mode	DSI1	
	Host Write	DSI0	
	Host Write	DSI1	
	DSI One-Shot Mode	DSI0	
	DSI One-Shot Mode	DSI1	
	DP Support		
	Audio Support		
	PWM	PWM Operations	PWM registration to framework
		Prod Setting	Tegra specific controller configuration
Clock accuracy calculation		Clock calculation	
I2C	DMA Mode	I2C Gen1	
	Bus Clear Support	I2C Gen1	
	Multi Master Support	I2C Gen1	
	Normal/Byte Mode	N/A	
	General Support	I2S0	
JTAG	JTAG Attach	Debugging capability	
	JTAG Halt/Step/Go	Debugging capability	
PCIe	Physical Port: PCI-E 0	General Support	
	Physical Port: CPI-E 1	General Support	
	Physical Port: CPI-E 2	General Support	
	Host Controller Features	Lanes Xbar config (X4_X0_X1, X2_X1_X1, X1_X1_X1) Hot-plug (using GPIO)	
	PCI Features	Message Signalled Interrupts	
	PCIe Link Capabilities	ASPM Support (L0s and L1)	
		L1 Clock Power Management	ASPM Support (L1.1 and L1.2)
	Root Control	PME Interrupt Enable	
	Extended Capabilities	Advanced Error Reporting (AER)	
	Miscellaneous Features	Dynamic Voltage Frequency (DVFS)	

Software Features

		Tegra Low Power Mode (LP0) Runtime PM
	L1 PM Substates	Rest All Capabilities
Bluetooth	Bluetooth 4.0	BCM4354
	BLE 4.0	No BCM4354 (BlueZ limitation)
Camera support (CSI input support)	V4L2 Media-Controller (V4L2 API bypasses ISP)	CSI0, CSI1, CSI2, CSI3, CSI4, CSI5 Note: The media-controller driver model is adopted in the 24.1 release. the Soc_camera driver is provided, but deprecated. doublecheck with Sean or Shantanu
Peripheral devices	INA support	Current monitoring for: CPU/GPU/VDD_IN
Platform support	P3310-B00 C03	
WiFi	Multi-Region support	Region Support: <ul style="list-style-type: none"> • US - 0x010000 • Tiawan - 0x020000 • Europe - 0x040000 • Japan - 0x080000 • Korea - 0x100000 • Canada - 0x200000 • Israel - 0x400000 • default (lowest-common-denominator)
	Dual-band 2.4 GHz/5 GHz	BCM 4354
	STA Mode	BCM 4354
	HostAP Mode	BCM 4354
	P2P Mode	BCM 4354 (but WEP-only security)
	WPA2 Security	BCM 4354

I/O

I/O Type	Feature	Notes
SPI	Physical Port: SPI1	Maximum bus speed: 65 MHz
	Physical Port: SPI2	Maximum bus speed: 65 MHz
	Physical Port: SPI 0/3	Maximum bus speed: N/A
	Packed/Unpacked	SPI4
	Full Duplex Mode	SPI4
	Both Enable Bit	SPI4
	Both Enable Byte	SPI4
	Bi-directional	SPI4
	Least Significant Bit	SPI4
	Least Significant Byte First	SPI4
	Software or Hardware	SPI4

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	Chip Select Polarity Section		
	Supported Modes 1/2/3/4	SPI4	
	Dual SPI	SPI MISO/MOSI can act as Rx and Tx	
	Multiple transfer request	Multiple SPI transfer request from single call	
SDMMC	I/O Speeds (Clock speed)	SDMMC1 (SD card): 204 MHz	
	Hot Plug Support	SDMMC1 (SD card)	
	SD High Speed Mode	SDMMC1 (SD card)	
	SDR50	SDMMC1 (SD card)	
	SDR104	SDMMC1 (SD card)	
	HS533	SDMMC4 (eMMC)	
	HS400	-	
	HS200	-	
	DDR Mode	SDMMC1 (SD card)	
	Voltage Switching	SDMMC1 (SD card)	
	Frequency Tuning	SDMMC1 (SD card)	
	Packed Commands	SDMMC4 (eMMC)	
	Cache Control	SDMMC4 (eMMC)	
	Discard	SDMMC4 (eMMC)	
	Sanitize	SDMMC4 (eMMC)	
	RPMB	SDMMC4 (eMMC)	
	HPI	SDMMC4 (eMMC)	
	BKOPS	SDMMC4 (eMMC)	
	Power Off Notification	SDMMC4 (eMMC)	
	Sleep	SDMMC4 (eMMC)	
	Field Firmware Upgrade	SDMMC4 (eMMC)	
		Device Life Estimation Type A	SDMMC4 (eMMC)
		Device Life Estimation Type B	SDMMC4 (eMMC)
	PRE EOL Information	SDMMC4 (eMMC)	
	Power Management	SDMMC4 (eMMC)	
SATA	Speed	GEN1	
		GEN2	
	AHCI Mode	1.3.1	
	SATA Specification	3.1	
	HIPM	Yes	
	NCQ	Yes	
	Port Multiplier Support	CBS	
	Link Power Management States	Partial	
		Slumber	
Device Power Management States	D0		
	D1		
	D2		

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	Runtime Time Power Management	Yes	
	S.M.A.R.T	Self-Monitoring Analysis and Reporting Technology	
	Dev sleep support	-	
USB 3.0	Speeds	USB0: HS/480 Mbps	
	Lanes	USB 0: N/A	
	USB 3.0 Support	USB0: Yes	
	Connector	USB0: Micro AB	
	USB 2.0 Support	USB 0: Yes	
	Remote Wakeup Support	USB0: USB 2.0	
	Host - Auto Suspend Support	USB 0: Yes	
	XOTG Support	USB 0: Yes	
	XUSB SS/HS/FS/LS Host Mode	USB 0: Yes	
	XUSB SS/HS/FS/LS Device Mode	USB 0: Yes	
	XUSB Device Port U1/U2/U3 Transition	USB 0: Yes	
	XUSB Host Port U1/U2/U3 Transition	USB 0: Yes	
	XUSB Device ELPG	USB 0: Yes	
	XUSB Host ELPG	USB 0: Yes	
	Class Support	Mass storage	USB 0: Yes
		USB video class	USB 0: Yes
		HID	USB 0: Yes
		USB video class	USB 0: Yes
		MTP	USB 0: Yes
		Ethernet	USB 0: Yes
Thumb/Hard Drive		USB 0: Yes	
Mouse		USB 0: Yes	
CDC - NCM/ECM	USB 0: Yes		
EQOS	Ping		
	Speed		
	LP_IDDQ Mode Support		
	Suspend Resume over NFS Support		
	NFS Boot		
RTC	Alarm		
	Wakeup from SC7		
Watchdog	Tegra Watchdog	Watchdog reboot from hang	
	Tegra Watchdog	Watchdog kick	
	PMIC Watchdog	Watchdog reboot from hang	
	PMIC Watchdog	Watchdog kick	
GPIO	System Programable GPIO Support	-	
	System Programable Pinmux Support	-	
	Wakeable GPIO Timestamping GPIO	-	
UART	Speed	UART0 (Debug): 115200	
	Hardware Flow Control	UART0: No	

Software Features

	for Debug	
	PIO Mode	UART0: Yes
	DMA Mode	UART0: Yes
	FIFO Mode	UART0: Yes
System	UCM1 4/4/16	
	UCM2 24x7	
	Reboot Support	
	Shutdown Support	
	SC7	
	Wake from Idle	
	Wake from Sleep	
	cpuidle	
	cpufreq	
	DVFS	
	Dual USB 3.0 A Port	
	Dual PCIE Port	
	CPU Hotplug	
	EMC Scaling	
	initrd Support	
	CPU Load Behavior	
System Boot with ATF as Secure Monitor		
Secure boot with ATF		
GPU	GPU @ POR Frequency	

Note:

PCIe: Tegra TX1 does not have any path from AHB-DMA or APB-DMA engines to PCIe IP as PCIe is connected directly to MSELECT and AHB-DMA and APB DMA engines only interact with IPs connected to respective AHB and APB buses. So it is not possible to use either AHB or APB engines for PCIe.

CUDA

Feature	Version
CUDA	Version 8.0.64

Graphics

Graphics APIs	Notes
OpenGL	4.5
OpenGL-ES	3.2
Vulkan	1.0.1
EGL	1.4
GLX	
GLVnd Version of EGL	Vendor neutral functionality

NVDC - Direct Rendering Manager (DRM)	Compatibility with DRM 2.0
EGL Stream	
X11 ABI-20	Legacy from 24.2 using Ubuntu 16.04
API Support	Notes
GL + EGL	
EGL without X11	Content display without X11 usage

EGL and OpenGL ES Support

EGL is an interface between Khronos rendering APIs, such as OpenGL ES, and the underlying native platform window system. It handles graphics context management, surface/buffer binding, and rendering synchronization. EGL enables high-performance, accelerated, mixed-mode 2D and 3D rendering using other Khronos APIs.

L4T supports the EGL 1.4 specification, [Khronos Native Platform Graphics Interface \(EGL 1.4 Specification\)](#).

The OpenGL ES driver in this release supports the following OpenGL ES specifications:

- [OpenGL ES Common Profile Specification 2.0](#)
- OpenGL 4.5

For more information on OpenGL ES, see the [Khronos OpenGL ES API Registry](#).

Video Decoders

Video Decode	Output Formats	Sampling Frequency and Bit rate/Frame rate	Notes
H.264	NV12, NVMM:NV12	3840 x 2160 at 60 fps Up to 120 Mbps	Full-frame, Disable-DPB, Skip-Frames
H.265	NV12, NVMM:NV12	3840 x 2160 at 60 fps Up to 160 Mbps	Decode Support in Gstreamer 1.4.5 and later
JPEG	I420, NVMM:I420	600 MP/sec	-
VP8	NV12, NVMM:NV12	3840 x 2160 at 60 fps	-

		Up to 140 Mbps	
VP9	NV12, NVMM:NV12	3840 x 2160 at 60 fps Up to 120 Mbps	-

Video Encoders

Video Encode	Input Formats	Sampling Frequency and Bit rate/Frame rate	Notes
H.264	I420, NV12, NVMM:I420, NVMM:NV12	3840 x 2160 at 30 fps Up to 120 Mbps	Supported features: control-rate, Bitrate, Iframeinterval, Quality- Level, Low-Latency, SliceIntrarefreshEnable, Sliceintrarefreshinterval , Bit-Packetization, VBV- Size, temporal-tradeoff, Insert-SPS-PPS, Slice- Header-Spacing, Profile, num-B-Frames, Force- IDR
JPEG	I420, NVMM:I420	600 MP/sec	-
H.265	I420, NVMM:I420, NVMM:NV12	3840 x 2160 at 30 fps Up to 100 Mbps	Supported features: control-rate, Bitrate, Iframeinterval, Quality- Level, SliceIntrarefreshEnable, Sliceintrarefreshinterval , Bit-Packetization, VBV- Size, temporal-tradeoff, Insert-SPS-PPS, Force- IDR
VP8	I420, NV12, NVMM:I420, NVMM:NV12	3840 x 2160 at 30 fps Up to 120 Mbps	Supported features: control-rate, Bitrate, Iframeinterval, Quality- Level, Force-IDR

Note: Use the `gst-inspect-1.0` utility to understand feature details. For example, the `gst-inspect-1.0 omxh264enc` command provides feature details of the H.264 encoder.

Display Outputs

nveglglessink	nvoverlaysink
X11 Window	Panel Overlay
-	Overlay
-	Overlay-Depth
-	Overlay-X
-	Overlay-Y
-	Overlay-W
-	Overlay-H

Conversion, Scaling, and Rotation Formats

Input Formats	Output Formats	Notes
I420	I420	Flip-Method
UYVY	UYVY	Flip-Method
NV12	NV12	Flip-Method
GRAY8	GRAY8	Flip-Method
NVMM:I420	NVMM:I420	Flip-Method
NVMM:NV12	NVMM:NV12	Flip-Method

CSI and USB Camera Formats

Output Format	Options	Notes
Gst-nvcamerasrc	NVMM: I420, NV12	
	Whitebalance Mode	
	Color effect	
	Auto-exposure	
	Flicker	
	Contrast	
	Saturation	

Software Features

	TNR strength	
	TNR Mode	
	Edge Enhancement	
	Intent	Still/Video/Video snapshot/Preview
	sensor-id	
	aeRegion	
	wbRegion	
	fpsRange	
	exposure-time	
	wbManualMode	
	wbGains	
	Sensor Orientation	
	Embedded Metadata	
	EGL Producer	
	Simultaneous multi- camera	
nveglstreamsrc	NVMM: I420, NV12	Input formats
nvvideosink	NVMM: I420, NV12	Output formats
nvegltransform	NVMM: I420, NV12	Input formats
		Output formats
videocuda	EGL Image	Input formats
		Output formats
nveglglessink	Output: X11 window	
nvoverlaysink	Output: Panel Overlay	Overlay index
		Overlay-depth
		Overlay-x
		Overlay-y
		Overlay-w
		Overlay-h

Software Features

nvhdmioverlaysink	Output: HDMI Overlay	Overlay Index
		Overlay Depth
		Overlay-x
		Overlay-y
		Overlay-w
		Overlay-h
nvvidconv	Input Formats	I420 UYVY NV12 GRAY8 NVMM: I420 NVMM: NV12
	Output Formats	I420 UYVY NV12 GRAY8 BGRx, RGBA NVMM: I420 NVMM: NV12 NVMM:RGBA
nvvidconv	Video Flip Methods	Counterclockwise Rotate Counter-clockwise 90 degrees
		Rotate-180 Rotate 180 degrees
		Clockwise Rotate clockwise 90 degrees
		Horizontal-flip Flip horizontally
		Upper-right-diagonal - Flip across
	Interpolation Methods	Nearest Linear Smart Bilinear
	Video Crop	Crop coordinates
Temporal Noise Reduction	-	