



Jetson TX2 NX Interface Comparison and Migration from Jetson TX2, Jetson Xavier NX, and Jetson Nano

Application Note

Document History

DA-10170-001_v1.0

Version	Date	Description of Change
1.0	February 24, 2021	Initial Release

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Introduction

The first section of this application note focuses on the migration path from NVIDIA® Jetson™ TX2 to Jetson TX2 NX.

The second section compares the features and supported interfaces for all Jetson modules with SODIMM connector (NVIDIA® Jetson TX2 NX, Jetson Xavier™ NX, and Jetson Nano™).

Jetson TX2 to Jetson TX2 NX Migration

Jetson TX2 NX and Jetson TX2 modules are not pin compatible but share many of the same features. This section describes the differences to allow users familiar with Jetson TX2 to design a similar carrier board for Jetson TX2 NX.

The following figures show the Jetson TX2 NX and Jetson TX2 block diagrams. The interfaces or blocks that are supported only by one of the modules are highlighted in red. The interface types that are supported on both modules but where the number of lanes/instances, voltage level, or access is different are highlighted in magenta.

Figure 1. Jetson TX2 NX Block Diagram

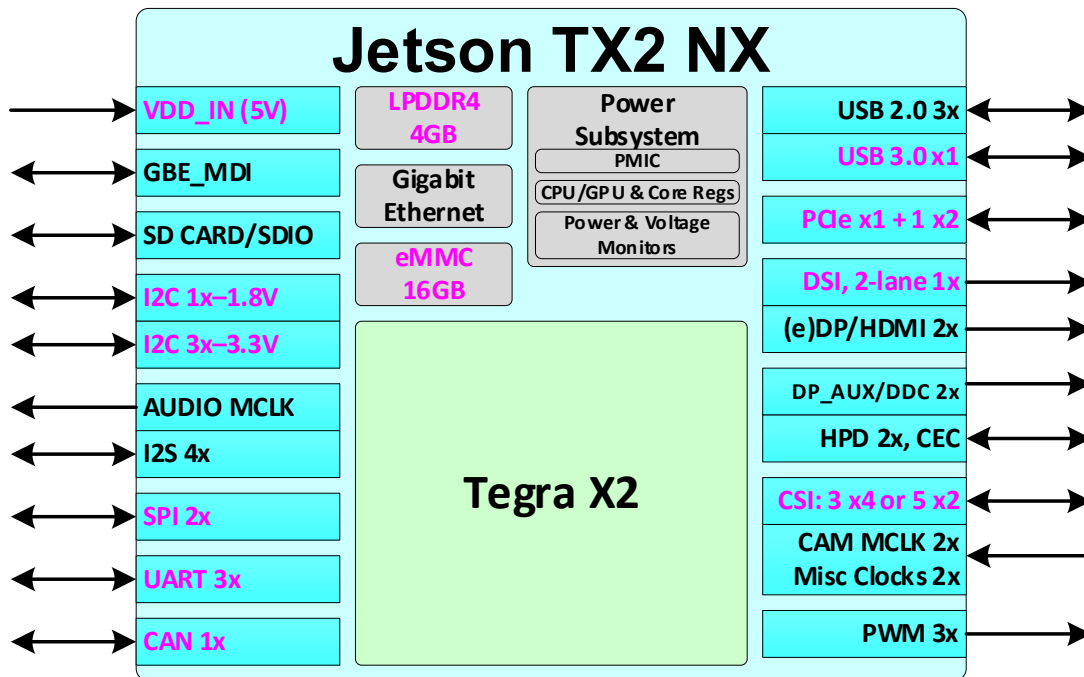
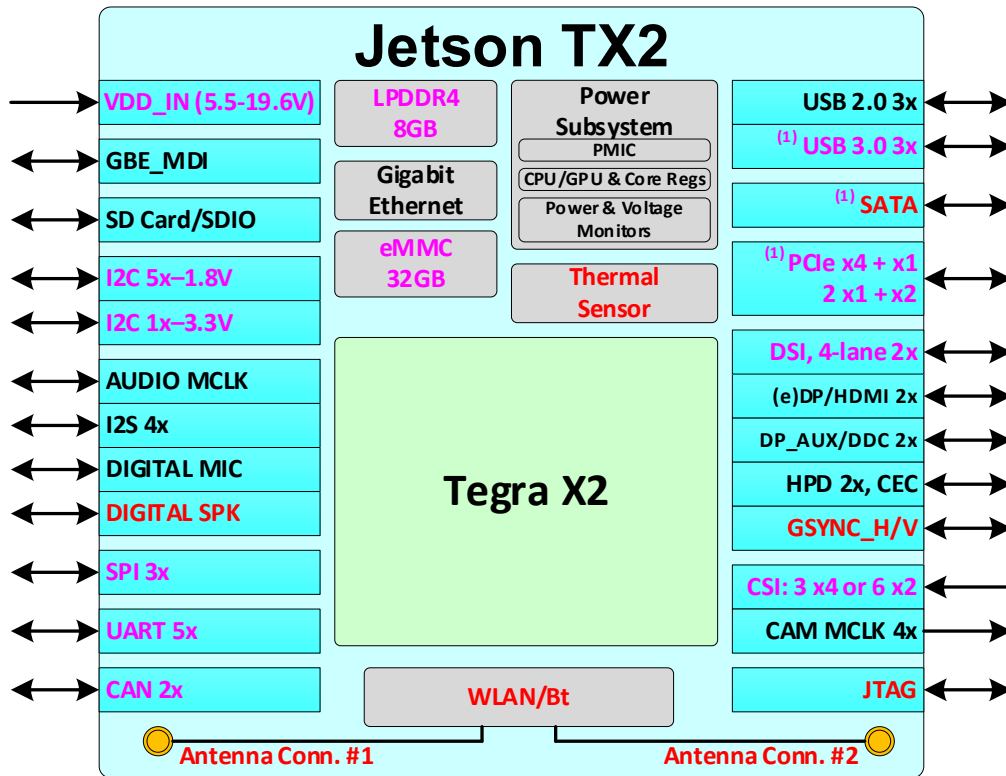


Figure 2. Jetson TX2 Block Diagram



Note:
¹USB 3.0, PCIe, and SATA share lanes. Not all instances shown in Figure 4 can be brought out together. See the *Jetson TX2 OEM Product Design Guide* for details.

Jetson TX2 NX and Jetson TX2 Interface Comparisons

Table 1 lists the interfaces that are supported on the Jetson TX2 NX and Jetson TX2 modules.

Table 1. Jetson TX2 NX and Jetson TX2 Device and Interface Comparison

Feature	Jetson TX2 NX	Jetson TX2
Devices on the Module		
Memory	4 GB 128-bit LPDDR4	8 GB 128-bit LPDDR4
Storage	16 GB eMMC 5.1	32 GB eMMC 5.1
Networking	10/100/1000 Base-T	

Feature	Jetson TX2 NX	Jetson TX2
Devices on the Module		
Camera	12 lanes (3x4 or 5x2) MIPI CSI-2 D-PHY 1.2 (2.5 Gb/s per pair)	12 lanes (3x4 or 6x2) MIPI CSI-2 D-PHY 1.2 (2.5 Gb/s per pair)
Wireless (WLAN/Bt)	Requires external solution	Included on-module
Interfaces		
USB 2.0	3x	
USB 3.x (See Note 1)	1x (3.0)	Up to 3x (3.0)
PCIe (See Note 1)	1 x1 + 1 x2 (Gen2), Root Port only.	1 x1 + 1 x4 or 1 x2 + 2 x1 (Gen2), Root Port only.
SATA (See Note 1)	Not supported	x1
Display	Two multi-mode DP 1.2a/eDP 1.4/HDMI 2.0a/b 1x2 DSI (1.5Gbps/lane)	Two multi-mode DP 1.2a/eDP 1.4/HDMI 2.0a/b Two 1x4 DS (1.5Gbps/lane)
Audio (I2S)	4x	
SDIO/SD Card	1x SD Card/SDIO	
Gigabit Ethernet	Supported	
I2C	4x	8x (see Note 2)
UART	3x	5x
SPI	2x	3x
JTAG	Not supported	Brought to module pins
Fan	PWM and Tach Input	
Notes:		
1. See the USB 3.0, PCIe, and SATA interface mapping comparison tables for details on lane sharing.		
2. Including DP_AUX pins used as I2C.		
3. Magenta text indicates differences between Jetson TX2 NX and Jetson TX2.		

Function and Interface Difference Details

This section describes the function and interface difference details.

Supported VDD_IN Voltage Range

Jetson TX2 NX requires a nominal input voltage on VDD_IN of 5V. Jetson TX2 supports a VDD_IN range from 5.5V (min) to 19.6V (max).

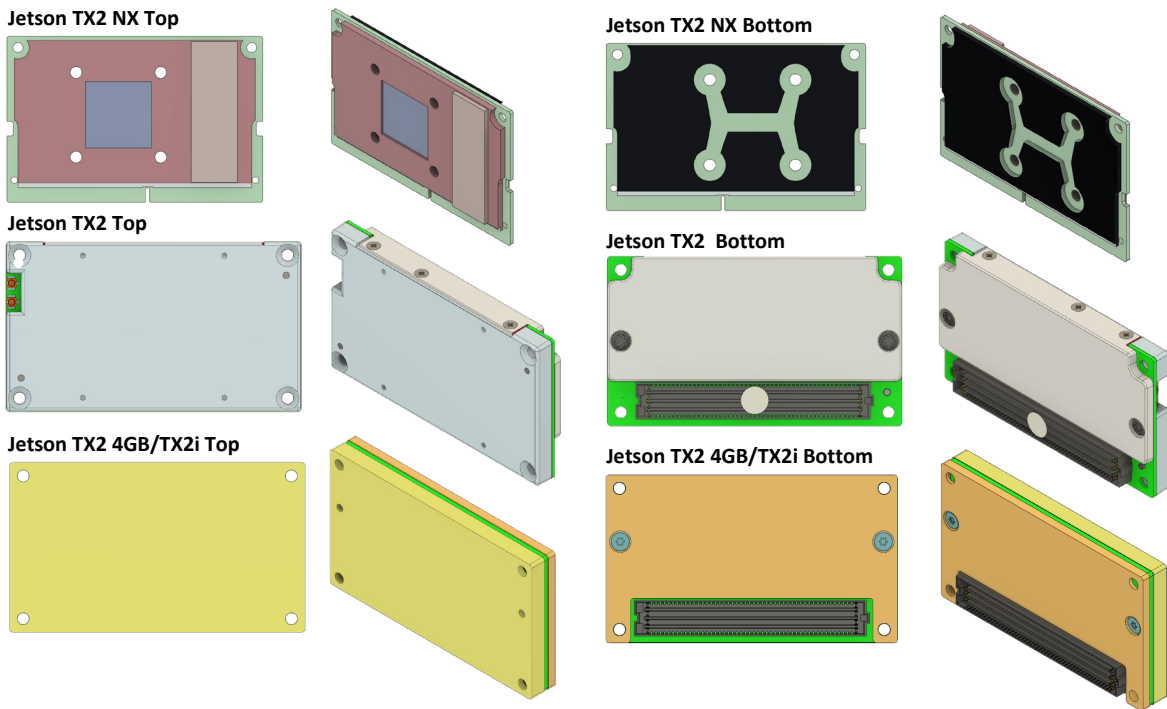
Mechanical Differences

Table 2 lists the mechanical differences.

Table 2. Mechanical Differences

Feature	Jetson TX2 NX	Jetson TX2
Size	69.9 mm x 45 mm	87 mm x 50 mm
Built-in Thermal Solution	None	Thermal Transfer Plate (TTP)
Thermal Solution Mounting	4 holes in PCB for screws to pass through thermal solution and Jetson TX2 NX board to connect to a metal bracket below module. Thermal solution contacts SoC (w/thermal material placed between).	Jetson TX2: 4 small threaded holes in the TTP or main mounting holes.

Figure 3. Jetson TX2 NX, Jetson TX2, and Jetson TX2 4GB/TX2i Module Top



Thermal Solution Mounting Differences

Jetson TX2 NX provides four holes just beyond the SoC corners that are used for mounting a thermal solution. Space is provided on the bottom of the module for a spring plate that screws that pass through the thermal solution attach to. Jetson TX2, Jetson TX2 4GB, and Jetson TX2i have thermal transfer plates (TTP). Jetson TX2 has four small threaded holes in a square pattern in the TTP that can be used to mount a thermal solution with. These are not available on Jetson TX2 4GB or Jetson TX2i. For a Jetson TX2 4GB and Jetson TX2i designs, the main mounting holes will need to be used for connecting a thermal solution to the TTP. This method can also be used for Jetson TX2.

Jetson TX2 to Jetson TX2 NX Interface Migration

Table 3 shows the mapping of interfaces between Jetson TX2 and Jetson TX2 NX.

Table 3. Jetson TX2 NX and Jetson TX2 Interface Migration

Interface Type	Tegra X2 Pin Name	Jetson TX2 Module Pin Name	Jetson TX2 NX Module Pin Name
USB 2.0 (Direct Mapping)	USB[2:0]	USB[2:0]	USB[2:0]
USB 3.0	PEX Lane 1 (Note 1) PEX Lane 2 (Note 2) PEX Lane 0 (Note 3)	PEX_RFU USB_SS1 USB_SS0 (PEX Lane 0) Note 3	USBSS No equivalent No equivalent
PCIe (Note 4)	Lane 0: PCIe x1, Ctl #2 Lane 1: PCIe x4 Ctl #0 lane 3 Lane 2: PCIe x2, Ctl #0 lane 1 Lane 3: PCIe x1 Ctl #0 Lane 2 PCIe x1 Ctl #1 Lane 4 PCIe x2, Ctl #0 lane 0	PEX1 PEX_RFU USB_SS1 PEX2 PEX2 PEX0	PCIE1 No equivalent (used for USB SS) PCIE0 Lane 1 No equivalent No equivalent PCIE0 Lane 0
Ethernet	NA	GBE_MDI[3:0] GBE_LINK_ACT GBE_LINK_100 GBE_LINK_1000	GBE_MDI[3:0] GBE_LED_ACT No equivalent GBE_LED_LINK
DSI	DSIA (CLK & 2 data lanes) DSI[D:B] (CLK & 2 data lanes each)	DSI0 (CLK & 2 data lanes) DSI[3:1] (CLK & 2 data lanes each)	DSI0 (CLK & 2 data lanes) No equivalent
HDMI/DP (Direct Mapping)	HDMI_DP[1:0]	DP[1:0]	DP[1:0]
CSI	CSI[D:A] CLK & Data [1:0]	CSI [3:0] CLK & Data [1:0]	CSI [3:0] CLK & Data [1:0]

Interface Type	Tegra X2 Pin Name	Jetson TX2 Module Pin Name	Jetson TX2 NX Module Pin Name
	CSI E CLK & Data [1:0] CSI F CLK CSI F Data [1:0]	CSI 4 CLK & Data [1:0] CSI 5 CLK CSI 5 Data [1:0]	CSI 4 CLK & Data [1:0] No equivalent CSI 4 Data [3:2]
SD/SDIO (Direct Mapping)	SDMMC1 SDMMC3	SDCARD_CLK/CMD/DAT[3:0] No equivalent	No equivalent SDMMC_CLK/CMD/DAT[3:0]
Audio	DAP4 DMIC[2:0] GEN[9:7]_I2C DAP1 DAP2	I2S3 I2S2 No equivalent I2S0 I2S1	No equivalent I2S1 I2S2 I2S0 I2S3
I2C	CAM_I2C GPIO_SEN[9:8] GEN1_I2C GEN7_I2C GEN9_I2C GEN8_I2C DP_AUX_CH[1:0]	I2C_CAM I2C_GP0 I2C_GP1 I2C_GP2 I2C_GP3 I2C_PM DP[1:0]_AUX	CAM_I2C I2C1 I2C0 No equivalent No equivalent I2C2 Not supported for I2C
SPI	GPIO_SEN[4:1] GPIO_CAM[7:4] GPIO_WAN[8:5]/MDM4	SPI0 SPI1 SPI2	SPI1 No equivalent SPI0
UART	UART1 UART3 UART2 UART4 (Note 5) UART7	UART0 UART1 UART2 UART3 RSVD D5/D8 (only TX/RX)	UART2 (only TX/RX) UART1 UART0 No equivalent No equivalent
CAN	CAN0 CAN1	CAN0 CAN1	CAN No equivalent

Notes:

1. On Jetson TX2, PEX_RFU (Tegra X2 Lane 1) also used for PCIe x4 (controller #0) interface Lane 3
2. On Jetson TX2, USB_SS1 (Tegra X2 Lane 2) also used for PCIe x4 (controller #0) interface Lane 1
3. On Jetson TX2, USB_SS0 muxed with PCIe x1 (controller #2) interface
4. Jetson TX2 USB/PCIe mappings are for Config #5 (see Jetson TX2 OEM DG)
5. UART3 on Jetson TX2 muxed with on-module WiFi / Bt
6. **Magenta** text indicates differences between Jetson TX2 NX and Jetson TX2.

Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX Comparison

The Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX are largely pin compatible. This section describes the differences between these three modules.

The following figures show the Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX block diagrams. The interfaces or blocks that are supported only by one of the modules are highlighted in red. The interface types that are supported on all three modules but where the number of lanes/instances, voltage level, or access is different are highlighted in magenta.

Figure 4. Jetson TX2 NX Block Diagram

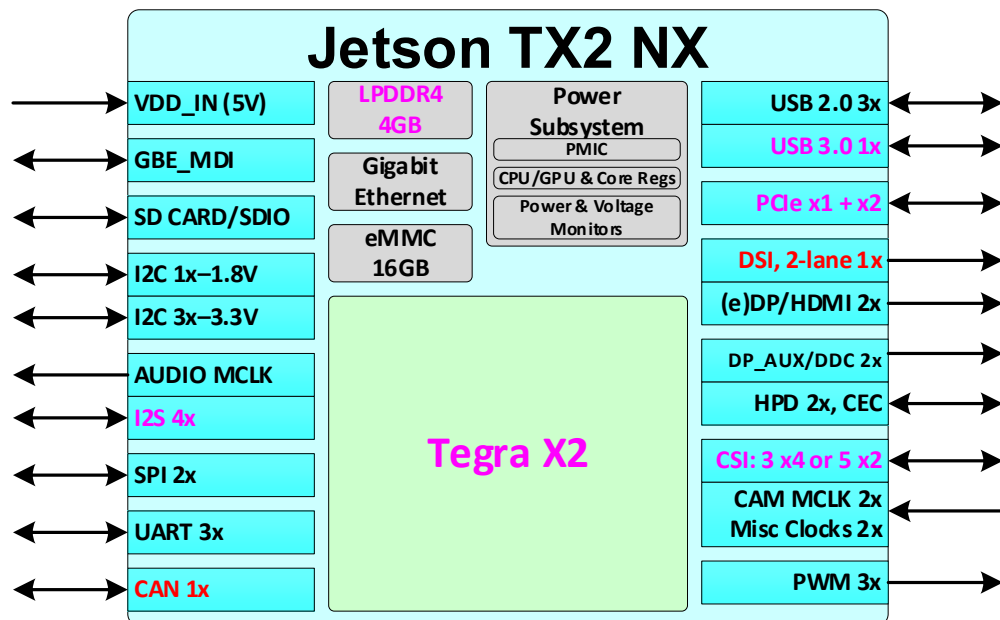


Figure 5. Jetson Nano Block Diagram

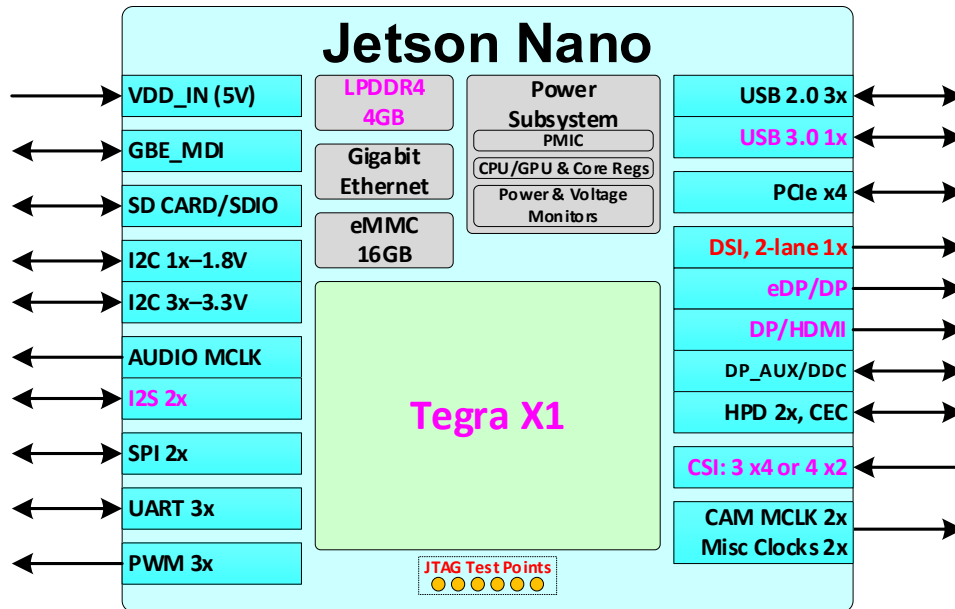
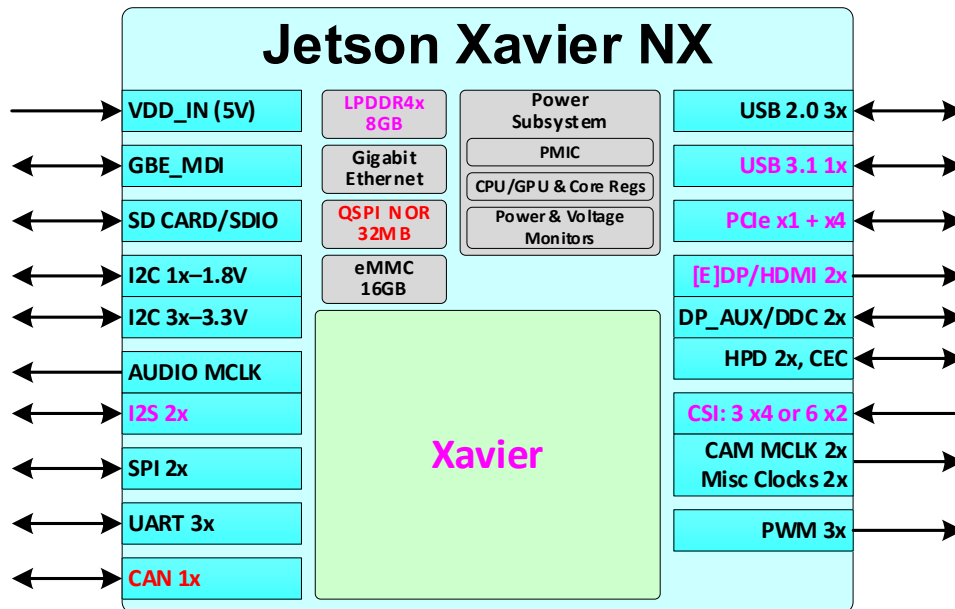


Figure 6. Jetson Xavier NX Block Diagram



Module Interface Comparisons

Table 4 lists the key system specifications, devices and interfaces that are supported on the Jetson TX2 NX, Jetson Nano, or the Jetson Xavier NX module.

Table 4. Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX Feature Comparison

Feature	Jetson TX2 NX	Jetson Nano	Jetson Xavier NX	
System Specifications and Device on the Module				
GPU	NVIDIA Pascal architecture with 256 NVIDIA® CUDA® cores	NVIDIA Maxwell™ architecture with 128 NVIDIA CUDA cores	NVIDIA Volta™ architecture with 384 NVIDIA CUDA cores and 48 Tensor cores	
CPU	Dual-core NVIDIA Denver 2 64-bit CPU and quad-core Arm® Cortex®-A57 MPCore processor complex	Quad-core Arm Cortex-A57 MPCore processor	6-core NVIDIA Carmel Armv8.2 64-bit CPU	
DL Accelerator	n/a	n/a	2x NVDLA Engines	
Vision Accelerator	n/a	n/a	7-Way VLIW Vision Processor	
Memory	4 GB 128-bit LPDDR4	4 GB 64-bit LPDDR4	8 GB 128-bit LPDDR4x	
Storage	16 GB eMMC			
Networking	10/100/1000 Base-T			
Video Encode	1x 4Kp60 3x 4Kp30 4x 1080p60 8x 1080p30 (H.265)	1x 4Kp60 3x 4Kp30 7x 1080p60 14x 1080p30 (H.264)	1x 4Kp30 2x 1080p60 4x 1080p30 4x 720p60 9x 720p30 (H.265 & H.264)	2x 4Kp30 6x 1080p60 14x 1080p30 (H.265 & H.264)
Video Decode	2x 4K60 4x 4K30 7x 1080p60 14x 1080p30 (H.265 & H.264)	1x 4K60 2x 4K30 4x 1080p60 8x 1080p30 9x 720p60 (H.265 & H.264)	2x 4K60 4x 4K30 12x 1080p60 32x 1080p30 (H.265)	2x 4K30 6x 1080p60 16x 1080p30 (H.264)
Camera	12 lanes (3x4 or 5x2) MIPI CSI-2 D-PHY 1.2 (2.5 Gb/s per pair)	12 lanes (3x4 or 4x2) MIPI CSI-2 D-PHY 1.1 (1.5 Gb/s per pair)	14 lanes (3x4 or 6x2) MIPI CSI-2 D-PHY 1.2 (2.5 Gb/s per pair)	
Wireless	Requires external solution	Requires external solution	Requires external solution	
Mechanical	69.6 mm x 45 mm 260-pin SO-DIMM edge connector			
Input Voltage	5V (nominal)			
Interfaces				
USB 2.0	3x			
USB 3.x (See Note 1)	1x (3.0 GEN1)	1x (3.0 GEN1)	1x (3.1 GEN2)	

Feature	Jetson TX2 NX	Jetson Nano	Jetson Xavier NX
PCIe (See Note 1)	1 x1 + 1 x2 (Gen2), Root Port only.	1 x4 (Gen2), Root Port only.	1 x1 (Gen3) + 1 x4 (Gen4). x1 is Root Port only. x4 has both Root Port and Endpoint support
Display	Two multi-mode DP 1.2a/eDP 1.4/HDMI 2.0a/b DSI (1 x2)		Two multi-mode (e)DP 1.4/HDMI™ 2.0a
Audio (I2S)	4x	2x	2x
SDIO/SD Card	1x SD/SDIO		
Gigabit Ethernet	Supported		
I2C	4x		
UART	3x		
SPI	2x		
CAN	1x	Not supported	1x
JTAG	Not supported	Brought to on-module test points only	Not supported
Fan	PWM and Tach Input		

Note: Magenta text indicates differences between Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX.

Mechanical, Function, and Interface Difference Details

This section describes the mechanical, function, and interface difference details.

Mechanical Differences

Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX have the same module outside dimensions. There are four holes in the PCB for screws to pass through the thermal solution and the module to a metal bracket below the module. The thermal solution contacts the SoC (w/thermal material placed between). The locations of the 4 holes is different for each module and shown in Figure 7.

Figure 7. Jetson TX2 NX, Jetson Nano, and Jetson TX2 Module Top

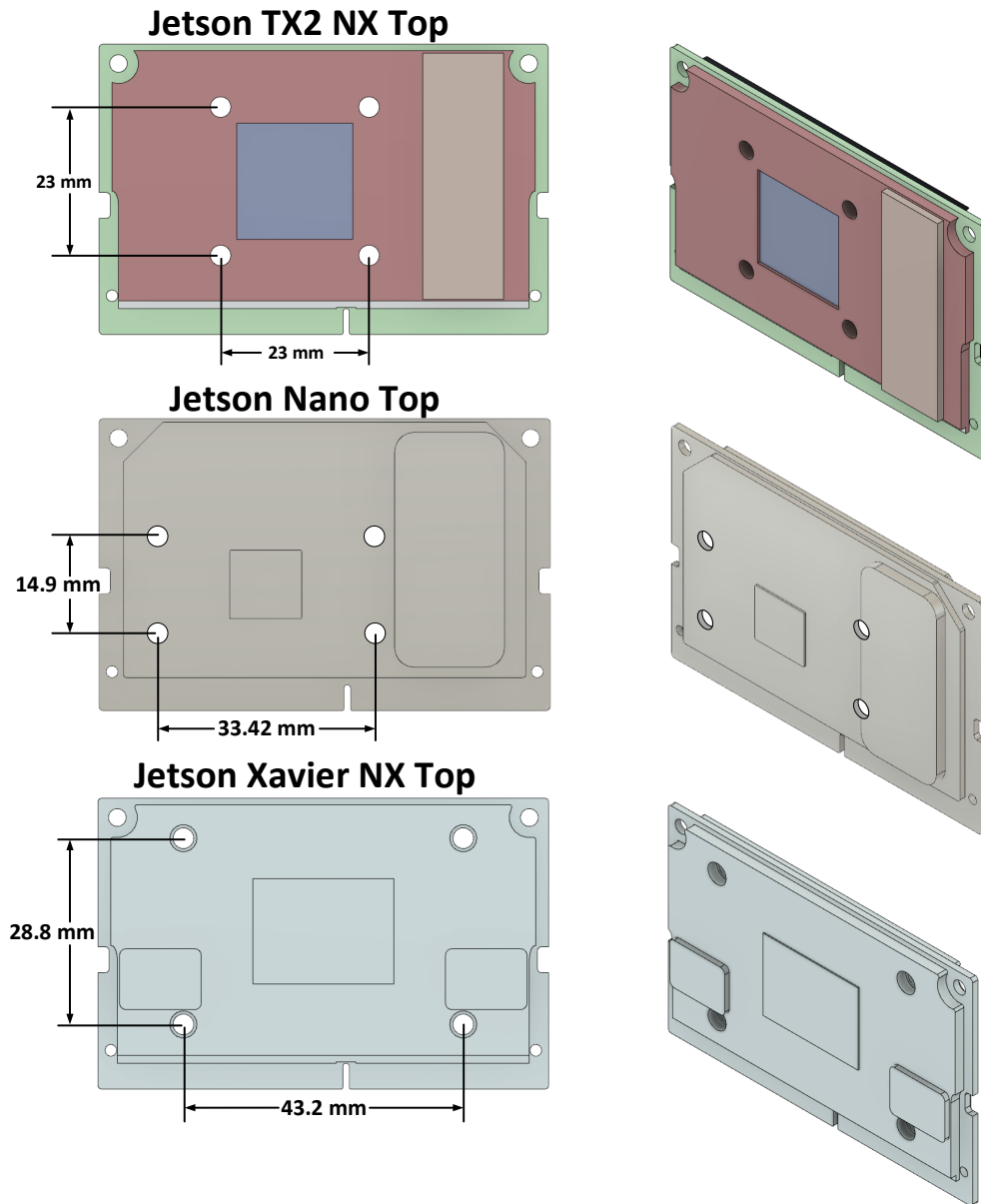
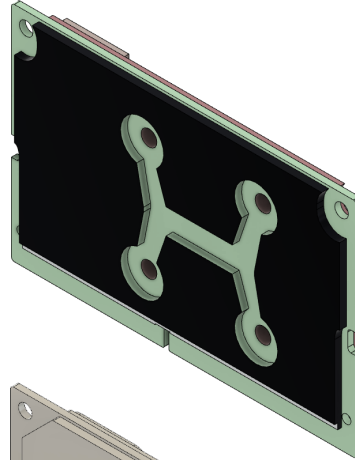
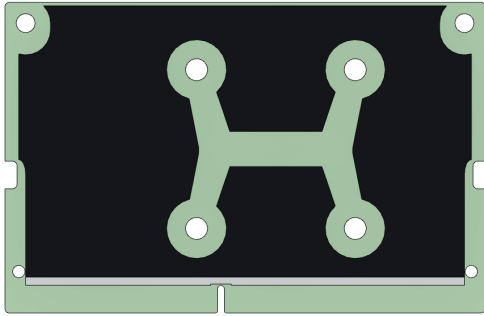
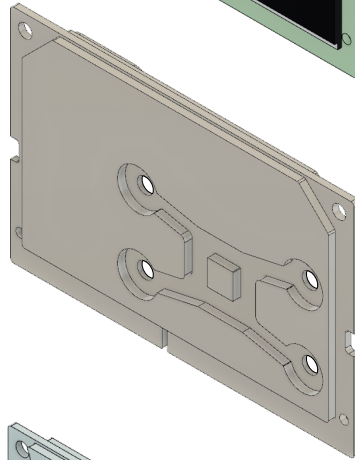
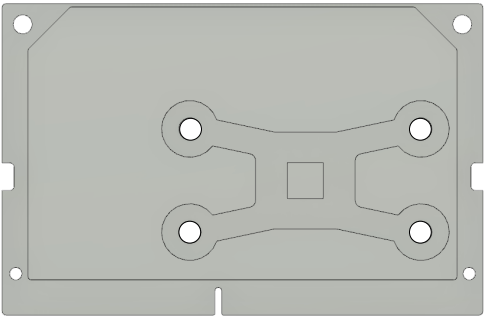


Figure 8. Jetson TX2 NX, Jetson Nano, and Jetson TX2 Module Bottom

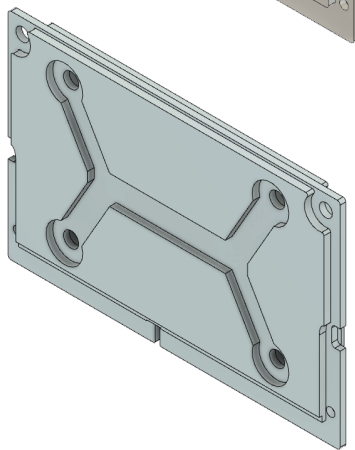
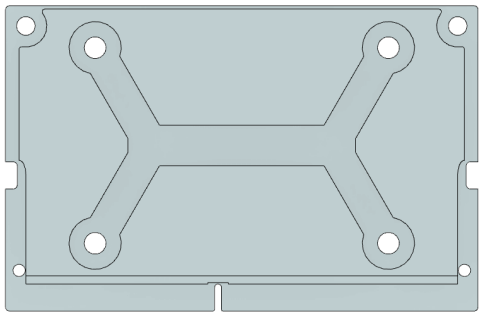
Jetson TX2 NX Bottom



Jetson Nano Bottom



Jetson Xavier NX Bottom



Note: The images in Figure 7 and Figure 8 are taken from the 3D CAD STEP models which show only the “envelope” view which provides the maximum component heights by region instead of the individual components. See the thermal design guides for more detailed images of the module.

USB 3.x, PCI Express, and SATA Mapping

The following tables show the different options for mapping USB 3.x and PCIe to the common set of interface pins.

Table 5. Jetson TX2 NX USB 3.0 and PCIe Lane Mapping

Jetson TX2 NX Function Names		na	PCIe2, Lane 0	PCIe#0, Lane 1	PCIe#0, Lane 0	PCIe#1, Lane 0	USBSS
Module Pin Names		PCIe#0, Lane 3	PCIe0, Lane 2	PCIe#0, Lane 1	PCIe#0, Lane 0	PCIe#1, Lane 0	USBSS
Tegra X2 Lanes		na	Lane 3	Lane 4	Lane 2	Lane 0	Lane 1
USB 3.1	PCIe						
1	1x1 + 1x2	na	na	PCIe #0_1	PCIe #0_0	PCIe#2_0	USB_SS Port #1
Usage when attached to Jetson Xavier NX devkit carrier board		Unused	Unused	Unused	M.2 Key E	PCIe x1	USB Hub

Table 6. Jetson Nano USB 3.0 and PCIe Lane Mapping

Module Pin Names		PCIe#0, Lane 3	PCIe0, Lane 2	PCIe#0, Lane 1	PCIe#0, Lane 0	PCIe#1, Lane 0	USBSS
Tegra X1 Lanes		Lane 1	Lane 2	Lane 3	Lane 4	Lane 0	Lane 6
USB 3.1	PCIe						
1	1x4	PCIe #0_3	PCIe #0_2	PCIe #0_1	PCIe #0_0	PCIe 1 lane 0 - Used on-module for Ethernet	USB_SS Port #0
Usage on Jetson Nano devkit		Unused	Unused	Unused	M.2 Key E	Ethernet	USB Hub

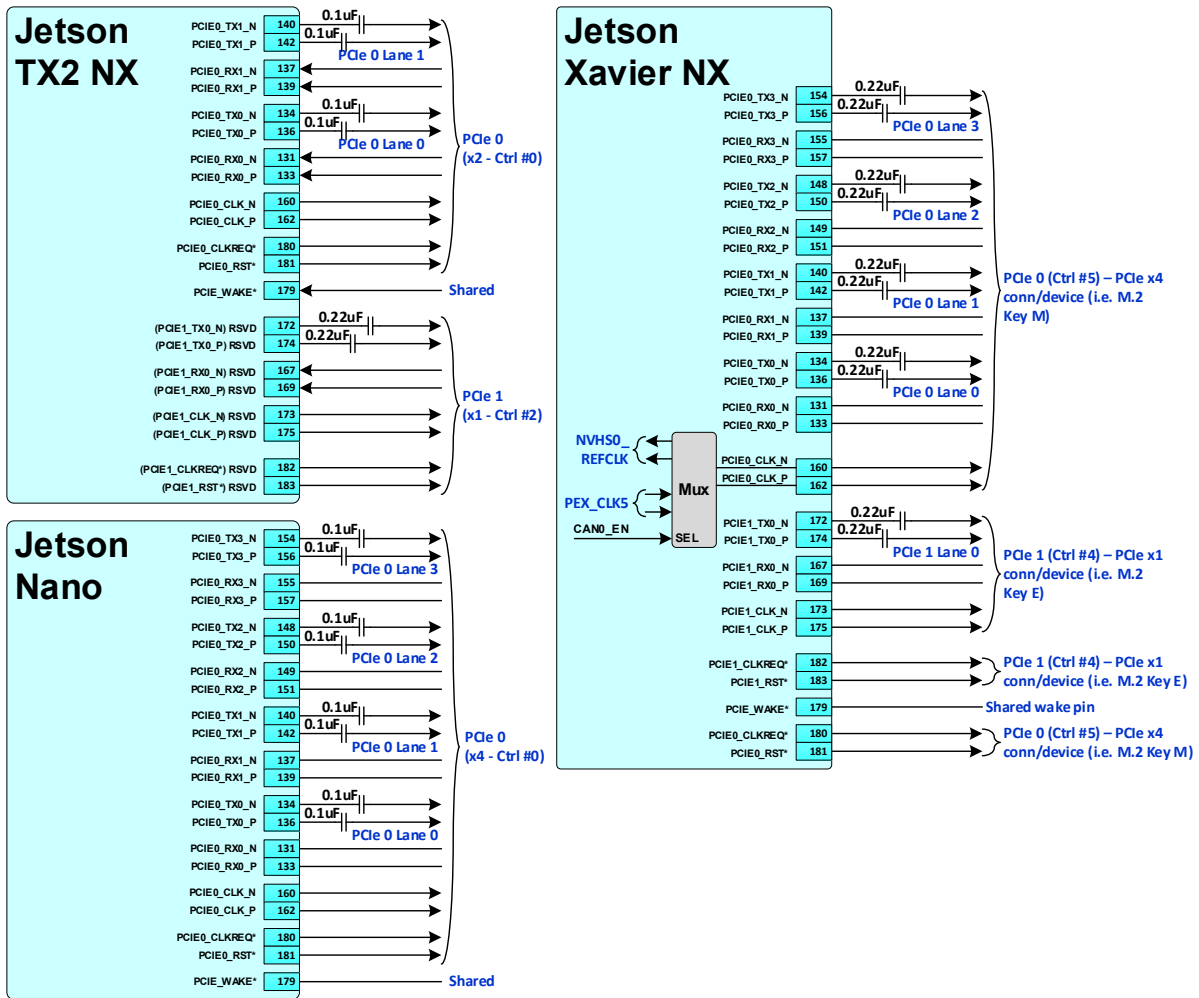
Table 7. Jetson Xavier USB 3.1 and PCIe Lane Mapping

Jetson Xavier NX Pin Names		PCIe0_RX3 PCIe0_TX3	PCIe0_RX2 PCIe0_TX2	PCIe0_RX1 PCIe0_TX1	PCIe0_RX0 PCIe0_TX0	PCIe1_RX0 PCIe1_TX0	USBSS_RX USBSS_TX	
Xavier Lanes		NVHS Lane 3	NVHS Lane 2	NVHS Lane 1	NVHS Lane 0	PCIe Lane 11	Lane 1	
USB 3.1	PCIe							
1	1x4 + 1x1	PCIe 0 lane 3 (Ctrl #5)	PCIe 0 lane 2 (Ctrl #5)	PCIe 0 lane 1 (Ctrl #5)	PCIe 0 lane 0 (Ctrl #5)	PCIe 1 lane 0 (Ctrl #4)	USB_SS Port #2	
Usage on Jetson Xavier NX devkit		PCIe x4 connector or device (i.e. M.2 Key M)				PCIe x1 conn. or device (i.e. M.2 Key E)		USB Hub

PCI Express

Jetson TX2 NX supports two PCIe Gen2 interfaces at the module pins: One x1 lane interface and one x2 lane interface. Jetson Nano supports a single x4 PCIe Gen2 interface. Jetson Xavier NX supports one x1 lane and one x4 lane interface.

Figure 9. Jetson TX2 NX, Jetson Nano, and Jetson TX2 PCIe Block Diagram



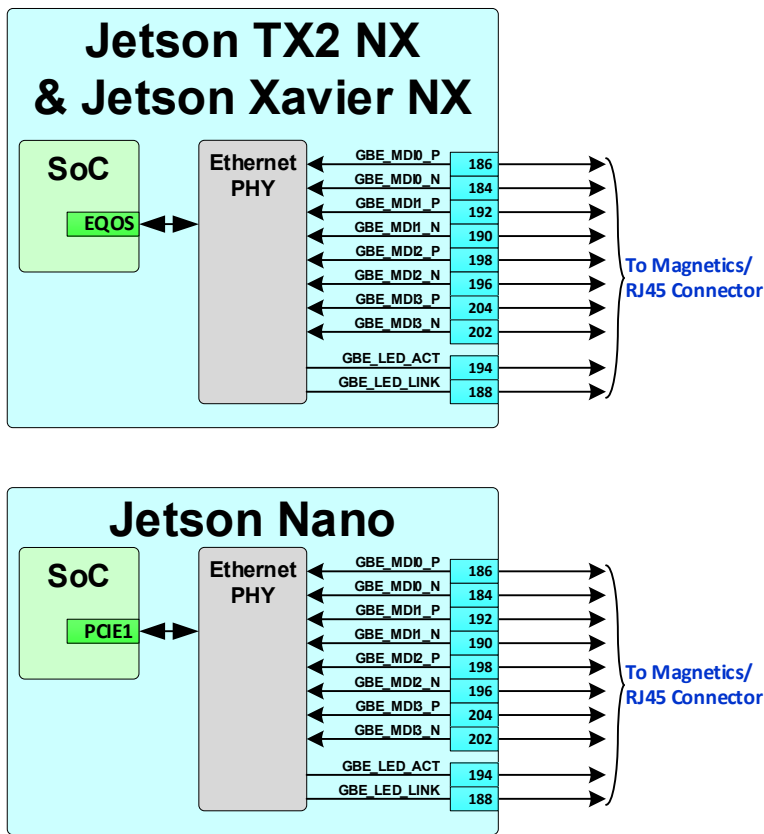
SATA

SATA is only supported on Jetson TX2, TX2i, and TX2 4GB modules. Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX do not support this feature.

Ethernet

Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX modules have Gigabit Ethernet PHYs on the module and output the MDI interface. Jetson TX2 NX and Jetson Xavier NX connect to the Ethernet PHY using the EQOS interface. Jetson Nano uses a PCIe x1 interface instead.

Figure 10. Jetson TX2 NX, Jetson Nano Jetson TX2 Ethernet Block Diagram



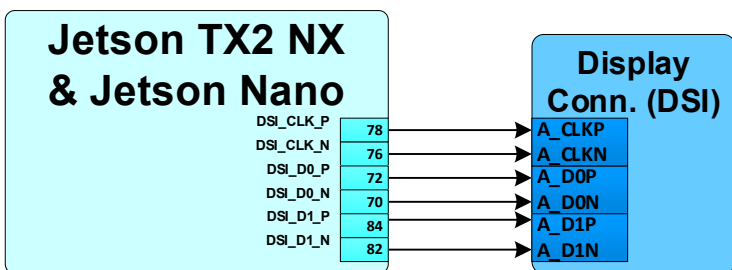
Display

Jetson TX2 NX and Jetson Nano support DSI. Jetson Xavier NX does not. All three modules support Vesa® DisplayPort™ (DP), embedded DisplayPort (eDP), and HDMI™ as described in this section.

DSI

Jetson TX2 NX and Jetson Nano each support a single two data lane DSI interface. Jetson Xavier NX does not support DSI.

Figure 11. Jetson TX2 NX and Jetson Nano DSI Block Diagram



eDP, DP, and HDMI

Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX support eDP, DP, and HDMI displays. Jetson TX2 NX and Jetson Xavier NX can support any of these displays on either of the two interfaces. Jetson Nano has one interface that supports only eDP (or DP - display only) while the other supports HDMI, eDP, or DP.

Table 8. eDP, DP, and HDMI Display Support

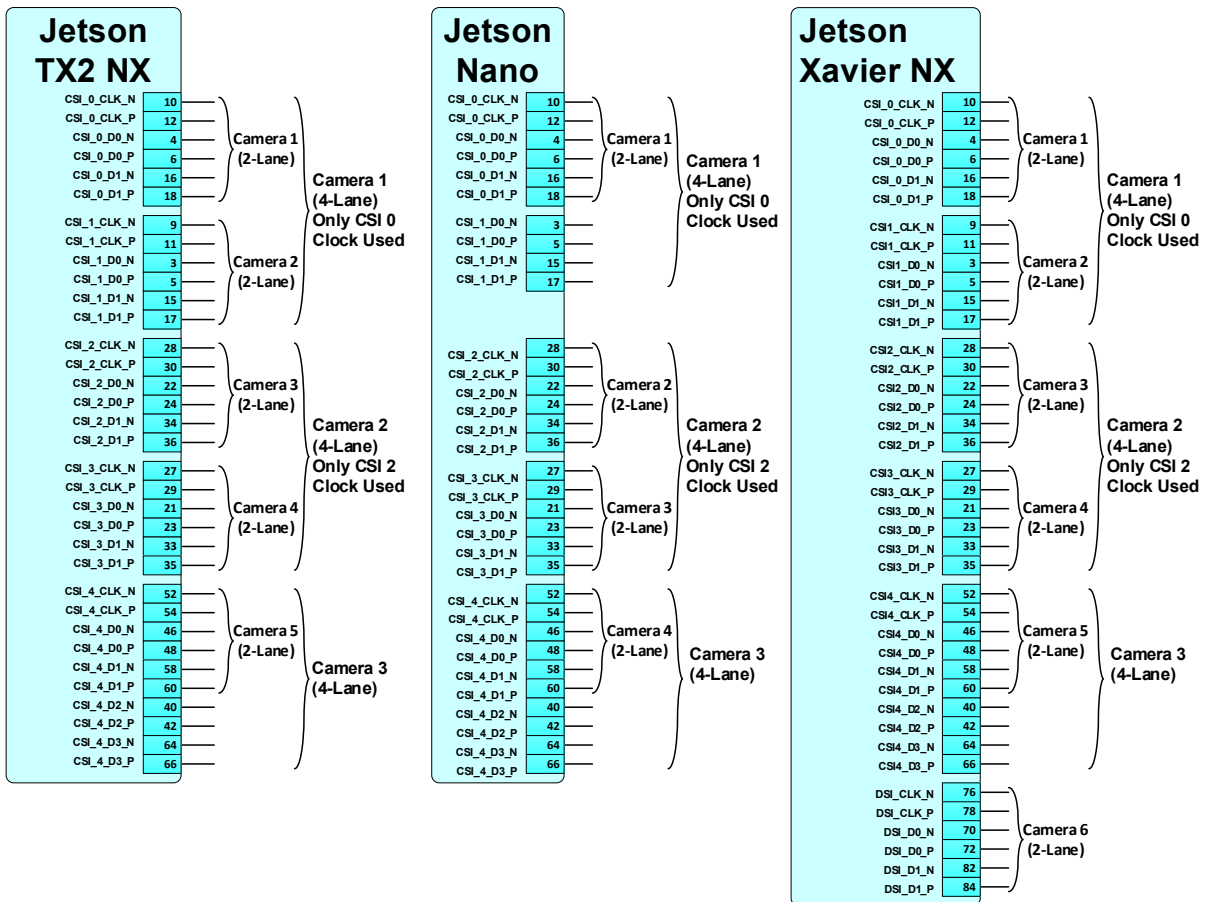
Feature	Jetson TX2 NX and Jetson Xavier NX	Jetson Nano
eDP/DP	DP[1:0]_TXD[3:0]_P/N, DP[1:0]_AUX_P/N, DP[1:0]_HPD	DP0_TXD[3:0]_P/N, DP0_AUX_P/N, DP0_HPD
HDMI/DP		DP1_TXD[3:0]_P/N, DP1_AUX_P/N, DP1_HPD, HDMI_CEC

Camera

Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX support CSI. Jetson TX2 NX and Jetson Nano each have 12 CSI data lanes, while Jetson Xavier NX has 14 lanes. The following configurations to cameras or serializers can be supported by the three modules as follows:

- ▶ Jetson TX2 NX
 - 3 x4, 2 x4 + 2 x2, 1 x4 + 4 x2, or 5 x2
- ▶ Jetson Nano
 - 3 x4, 2 x4 + 2 x2, 1 x4 + 3 x2, or 4 x2
- ▶ Jetson Xavier NX
 - 3 x4, 2 x4 + 2 x2, 1 x4 + 4 x2, or 6 x2

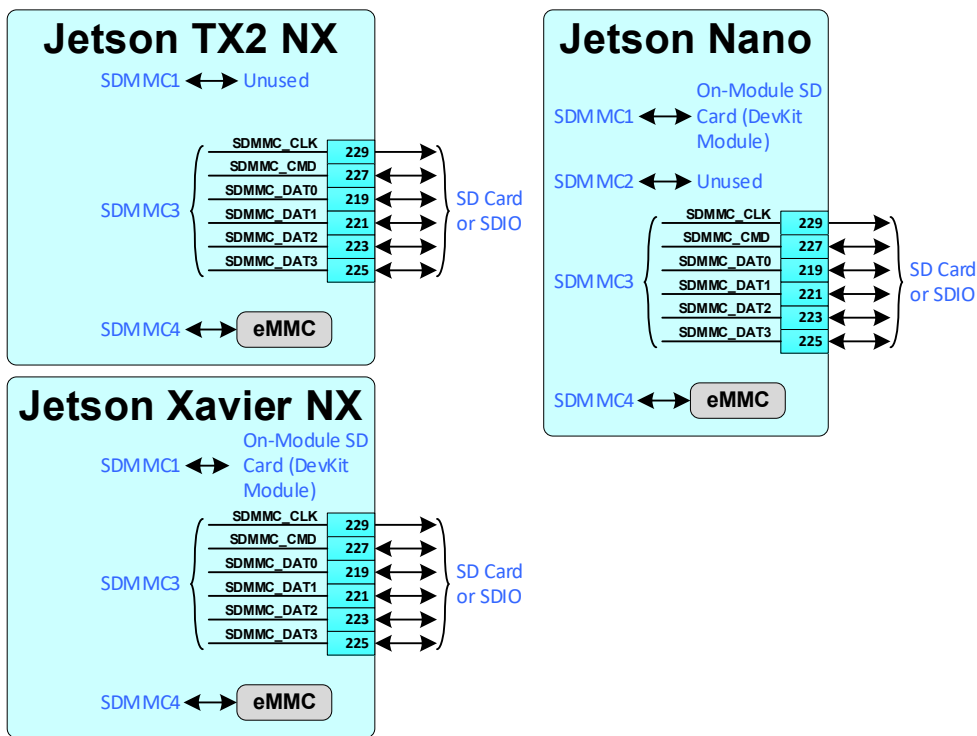
Figure 12. Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX CSI Block Diagram



SDIO and SD Card

Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX each bring one SDMMC interface to the module pins. This can be used for SD Card or SDIO. Of the remaining SDMMC interfaces, one is used for eMMC on the module. For Jetson Nano and Jetson Xavier NX, another SDMMC interface is used for the microSD Card socket on developer kit modules. (That SDMMC interface is unused on production modules, which include eMMC instead of microSD Card socket). Also, Jetson Nano has one additional SDMMC controller that is unused and not connected to the module pins.

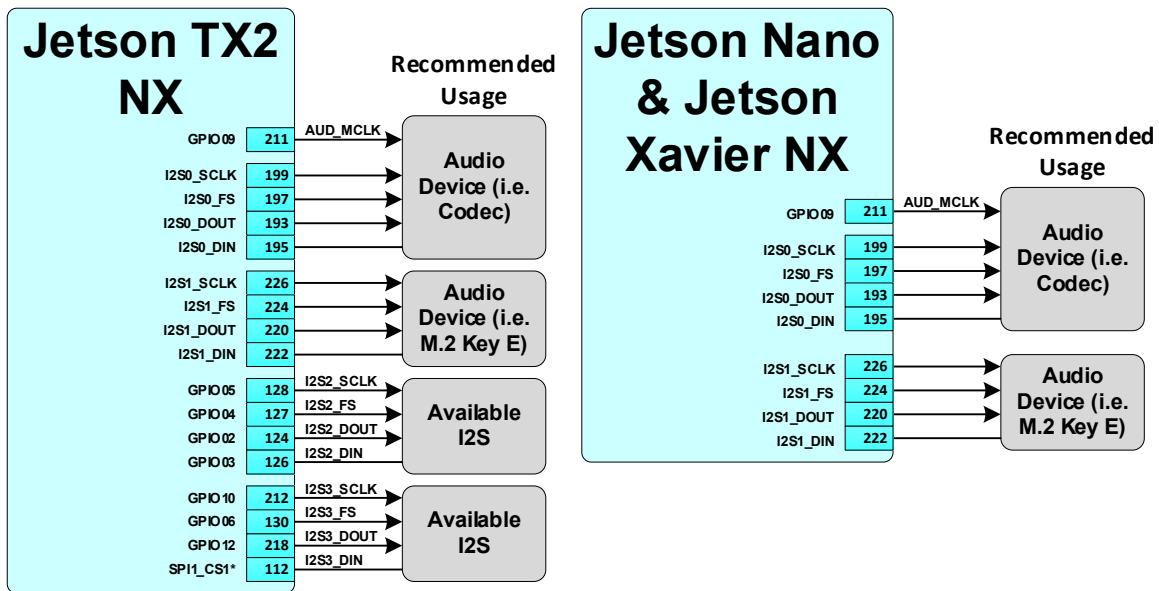
Figure 13. Jetson TX2 NX, Jetson Nano, Jetson Xavier NX SDIO/SD Card Block Diagrams



Audio

Jetson TX2 NX brings four I2S interfaces and a master audio MCLK to the module pins. Jetson Nano and Jetson Xavier NX brings two I2S and an audio MCLK to the module pins.

Figure 14. Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX Audio Block Diagram

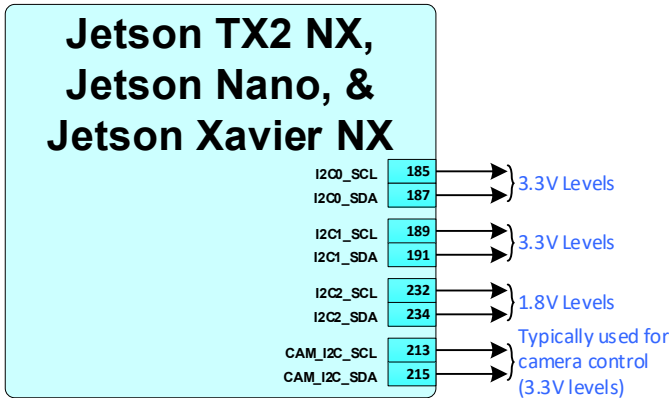


I2C

Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX all support up to four I2C interfaces at the module pins.

- ▶ All three modules have on-module pull-ups to 1.8V on I2C2 only (1.8V signal levels).
- ▶ The three modules have on-module pull-ups to 3.3V (3.3V signal levels) for I2C0, I2C1, and CAM_I2C.

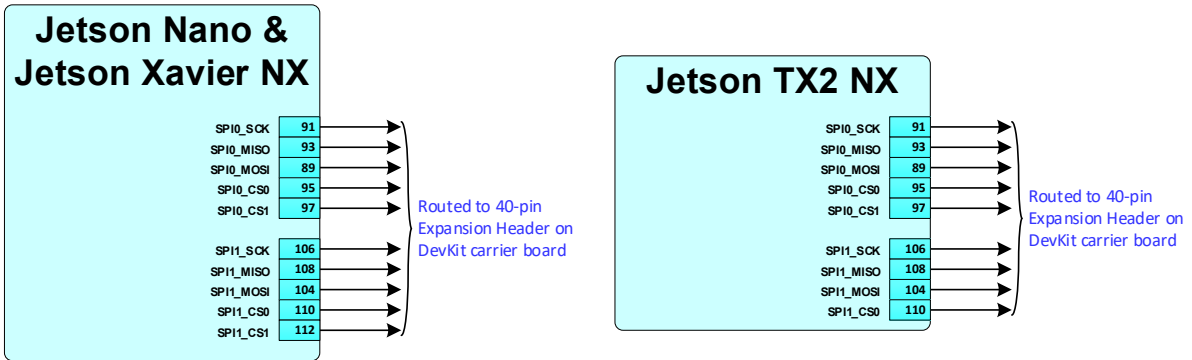
Figure 15. Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX I2C Block Diagram



SPI

Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX each have two SPI interfaces. Jetson TX2 NX has one less chip select on SPI1 than Jetson Nano or Jetson Xavier NX. On Jetson TX2 NX, the **SPI1_CS1** pin is used for one of the I2S interfaces.

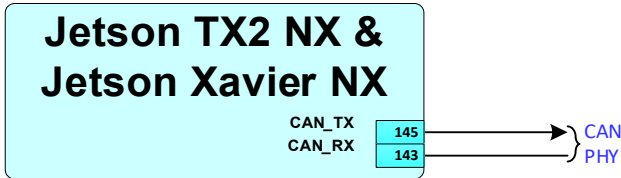
Figure 16. Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX SPI Block Diagram



CAN

Jetson TX2 NX and Jetson Xavier NX support a single CAN interface. Jetson Nano does not support CAN.

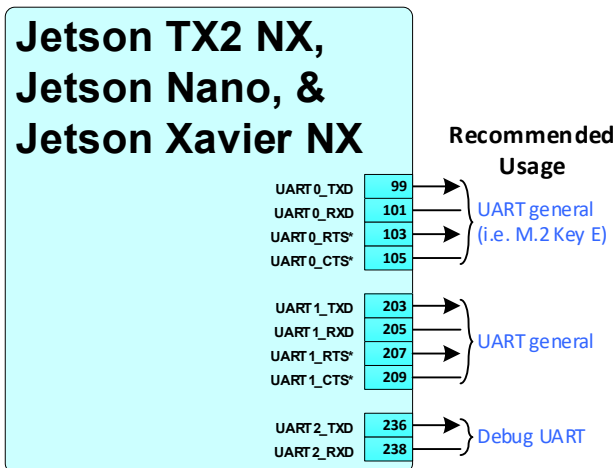
Figure 17. Jetson TX2 NX and Jetson Xavier NX CAN Block Diagram



UART

Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX all bring three UARTs to the module pins.

Figure 18. Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX UART Block Diagrams



Debug

Jetson TX2 NX, Jetson Nano, and Jetson Xavier NX all provide UART2 for debug purposes. JTAG support is not provided on Jetson TX2 NX and Jetson Xavier NX. Jetson Nano brings JTAG to test points only.

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