



Jetson Orin Nano Series, Jetson Nano, and Jetson TX2 NX Interface Comparison and Migration

Application Note

Document History

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Version	Date	Description of Change
0.1	August 26, 2022	Preliminary release – Advance information (Subject to change)
1.0	April 17, 2023	<ul style="list-style-type: none">• Updated Figure 1: Highlighted PWM count to magenta text color.• Figure 2 and Figure 3: Updated PWM count to 4x and highlighted text color to Magenta. Updated Table 1: <ul style="list-style-type: none">> Jetson Nano col Video Decode row> Storage and SDIO/SD Card rows for Jetson Orin Nano 4GB and 8GB from Not applicable to Not Supported> Storage row for Jetson Orin Nano 4GB and 8GB columns> Video Decode row for Jetson Nano> CAN row Jetson Nano col from Not applicable to Not Supported> Added PWM> Updated row Power for Jetson Orin Nano 4GB columns> Updated row Input Voltage for Jetson Orin Nano 4GB and 8GB columns <ul style="list-style-type: none">• Updated Table 2 and Table 3.• Table 4: Updated VDD_IN.• Added Section: UPHY Mapping and tables under Section: Interface Migration.• Added Note to Section: PCIe Mapping Options.
1.1	January 31, 2024	<ul style="list-style-type: none">• Updated Table 1: Jetson Orin Nano Series, Jetson Nano, and Jetson TX2 NX Feature Comparison<ul style="list-style-type: none">> Added RTC accuracy row.> Updated MIPI standard in Camera row.• Updated Section: Audio including Table 11; removed DMIC support for Orin Nano.• Added virtual channel support in Section: CSI.

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Introduction

This application note compares the features and interfaces supported on the NVIDIA® Jetson Orin Nano™ series, NVIDIA® Jetson Nano™, and NVIDIA® Jetson TX2 NX modules. This application note also describes the migration path for designers familiar with either Jetson Nano™ or Jetson TX2 NX to design a carrier board for the Jetson Orin Nano series. This will support the features available on Jetson Orin Nano series modules.



Note: References to Jetson Orin Nano apply to Jetson Orin Nano 8GB and Jetson Orin Nano 4GB except where explicitly noted.

Jetson Orin Nano Series vs. Jetson Nano and Jetson TX2 NX

Jetson Orin Nano series and both Jetson Nano and Jetson TX2 NX series are largely pin compatible. This section describes the differences between these modules.

Figure 1 and Figure 2 show the Jetson Orin Nano series, Jetson Nano, and Jetson TX2 NX series block diagrams. The interfaces or blocks that are supported only by one of the modules is highlighted in red. The interface types that are supported on both modules but where the number of lanes and instances, voltage level, or access is different are highlighted in magenta.

Figure 1. Jetson Nano Block Diagram

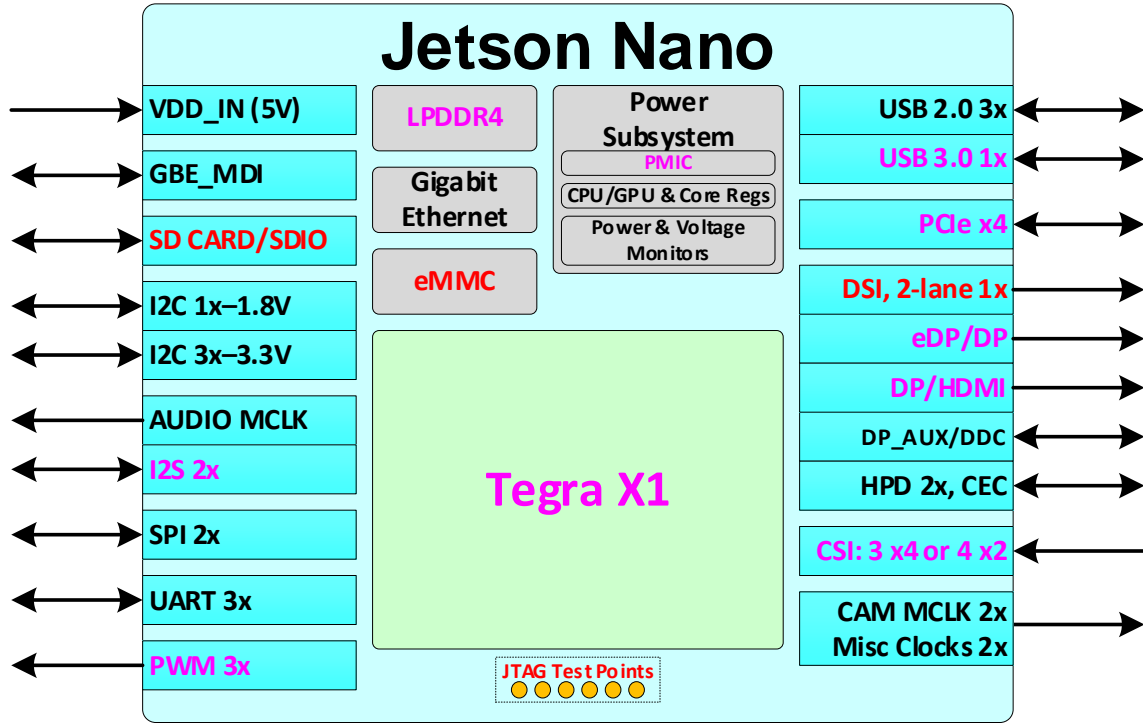


Figure 2. Jetson TX2 NX Block Diagram

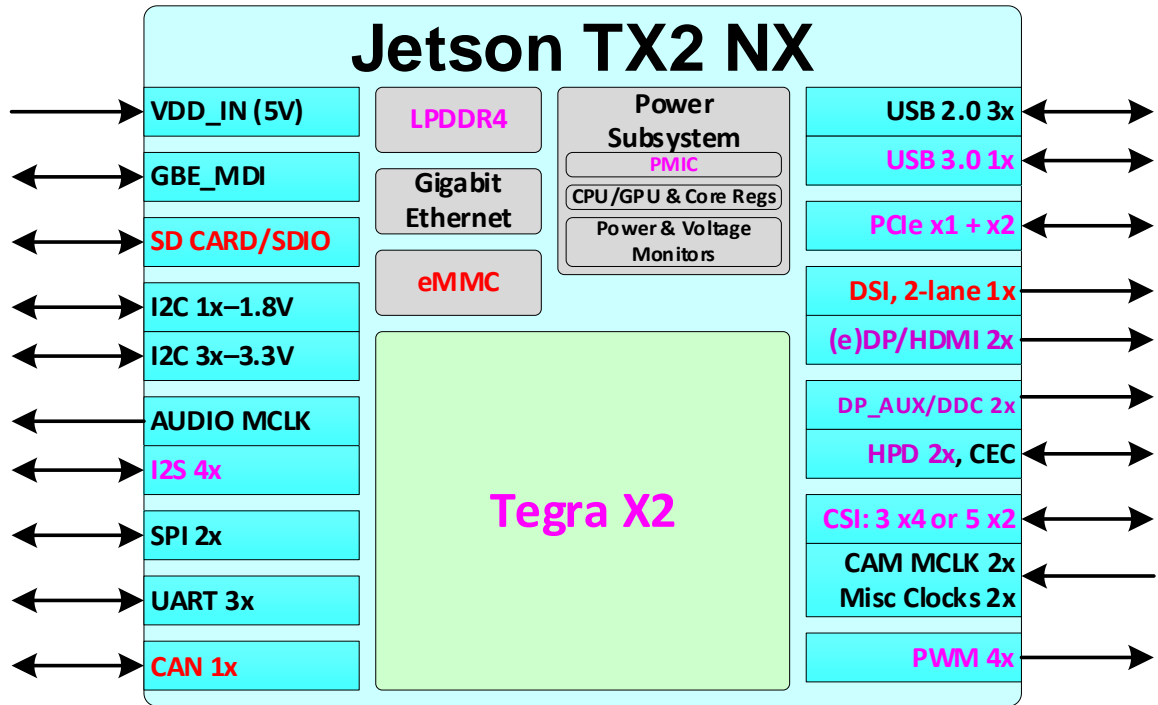
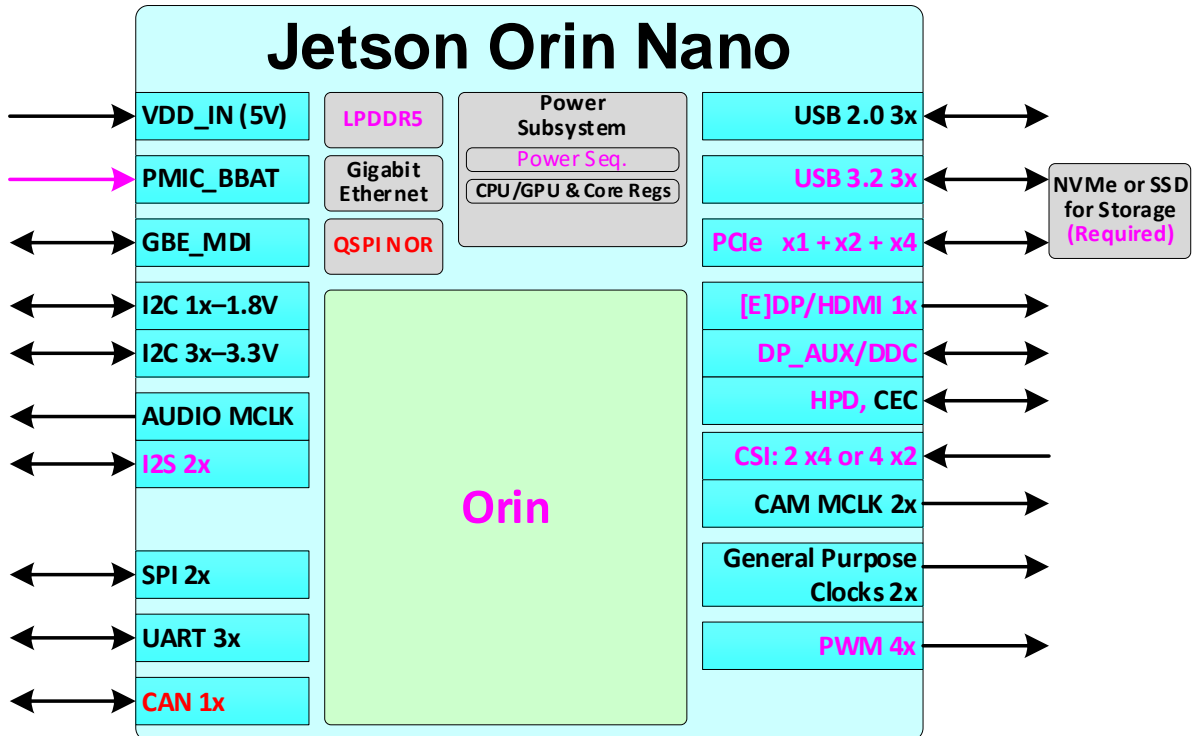


Figure 3. Jetson Orin Nano Series Block Diagram



Module Interface Comparisons

Table 1 lists the key system specifications, devices, and interfaces that are supported on the Jetson Orin Nano series, Jetson TX2 NX, and Jetson Nano modules.

Table 1. Jetson Orin Nano Series, Jetson Nano, and Jetson TX2 NX Feature Comparison

Feature	Jetson Nano	Jetson TX2 NX	Jetson Orin Nano 4GB	Jetson Orin Nano 8GB
System Specifications and Device on the Module				
AI Performance	0.5 TFLOPS (Dense)	1.3 TFLOPS (Dense)	20 TOPS (Sparse) 10 TOPS (Dense)	40 TOPS (Sparse) 20 TOPS (Dense)
GPU	Maxwell, 128 CUDA Cores, 921 MHz	Pascal, 256 CUDA Cores, 1300 MHz	Ampere, 512 CUDA Cores, 16 Tensor Cores, 625 MHz	Ampere, 1024 CUDA Cores, 48 Tensor Cores, 625 MHz
CPU SPEC int 2k6 SPEC int rage	4X A57, 1.5 GHz 9 16	4X A57 + 2X D15, 2.0 GHz 14 27	6X A78, 1.5 GHz 25 106	
Memory	4GB, 25 GB/s	4GB, 51 GB/s	4GB, 34 GB/s	8GB, 68 GB/s
Storage	16 GB eMMC		External, NVMe using PCIe or SSD on USB 3.2	
Networking	10/100/1000 Mbit			
Video Decode	H.265/H.264 1x4K60 2x4K30 4x1080p60 8x1080p30	H.265/H.264 2x4K60 4x4K30 7x1080p60 14x1080p30	H.265 1x4K60 2x4K30 5x1080p60 11x1080p30 H.264 1x4K30 3x1080p60 7x1080p30	AV1 1x4K60 2x4K30 5x1080p60 10x1080p30 VP9 10x1080p30

Feature	Jetson Nano	Jetson TX2 NX	Jetson Orin Nano 4GB	Jetson Orin Nano 8GB		
Video Encode	H.265/H.264 1x4K30 2x1080p60 4x1080p30	H.265 1x4K60 3x4K30 4x1080p60 8x1080p30 H.264 1x4K60 3x4K30 7x1080p60 14x1080p30	No NVENC. Video Encode supported by CPU			
Interfaces						
USB 2.0	3					
USB 3.x	1x USB 3.1		3x USB 3.2			
PCIe	1, x4 Gen2	1 x1 Gen2, 1 x2 Gen2	3 x1 Gen3, 1 x4 Gen3			
Display	2x 4K30	2x 4K60	1 multi-mode (4K30,2x1080p60), DP1.2 + MST, HDMI1.4, eDP 1.4			
Camera	12 lanes MIPI CSI-2 v3.0, D-PHY v1.1, (18 Gbps)	12 lanes MIPI CSI-2 v2.0, D-PHY v1.2, (30 Gbps)	8 lanes, MIPI CSI-2 v1.1, D-PHY v1.2, (20 Gbps), use GMSL for 8x cameras			
Audio (I2S)	2	4	2			
SDIO/SD Card	1x SD Card/SDIO		Not Supported			
Gigabit Ethernet	1x GbE					
I2C	4					
UART	3					
SPI	2					
CAN	Not Supported	1				
Fan	PWM and Tach					
PWM	3	4				
Miscellaneous						
RTC Back-up (PMIC_BBAT)	Input/Output, Supports rechargeable and non-rechargeable cells/super caps.		Input Only, Supports only non-rechargeable cells.			
RTC accuracy	± 2 sec /day		-11 ~ +20 sec /day			
Mechanical	70x45 mm, 260 pins					
Power	5 W 10 W	7 W 15 W	7 W 10 W	7 W 15 W		
Input Voltage	5V					

Function and Interface Difference Details

Module Power

Table 2 and Table 3 list the module power requirement for the Jetson Nano, Jetson TX2 NX, and the Jetson Orin Nano series modules.

Table 2. Jetson Nano vs. Jetson Orin Nano 4GB Module Power Requirements

Description	Jetson Nano	Jetson Orin Nano 4GB
Thermal design power	5 W	7 W
	10 W	10 W

Table 3. Jetson TX2 NX vs. Jetson Orin Nano Module Power Requirements

Description	Jetson TX2 NX	Jetson Orin Nano 8GB
Thermal design power	7 W	7 W
	15 W	15 W

Input Voltage Rails

Jetson Nano, Jetson TX2 NX, and Jetson Orin Nano series modules all have a single main input supply (VDD_IN) plus a real-time clock (RTC) battery back-up supply input option (PMIC_BBAT).

Table 4. Input Voltage Rails

Power Rail	Jetson Nano	Jetson TX2 NX	Jetson Orin Nano Series
VDD_IN	5V nominal		
RTC Back-up (PMIC_BBAT)	1.65V to 5.5V Input. 2.5 to 3.5V output for charging. Supports input for RTC back-up when system is off and output to charge a super capacitor or rechargeable cell. Output can be disabled to support non-rechargeable cells.		1.8V to 5.5V. Input only. Supports only non-rechargeable cells.

Mechanical Differences

Jetson Nano, Jetson TX2 NX, and Jetson Orin Nano series modules have the same X/Y dimensions as can be seen in Table 5. 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 (with thermal material placed between). The locations of the four holes are different for the Jetson Nano, Jetson TX2 NX, and Jetson Orin Nano series modules.

Table 5. Mechanical Differences

Feature	Jetson Nano	Jetson TX2 NX	Jetson Orin Nano Series
Size	69.5 mm × 45 mm		
Built-in thermal solution	None		
Thermal solution mounting (See the following figures for different mounting hole location dimensions).	Four holes in PCB for mounting thermal solution to module.	Same as Jetson Nano but mounting hole locations are different.	Same as Jetson Nano but mounting hole locations are different.

Figure 4. Module 3D Envelope Top Views with Thermal Mounting Hole Dimensions

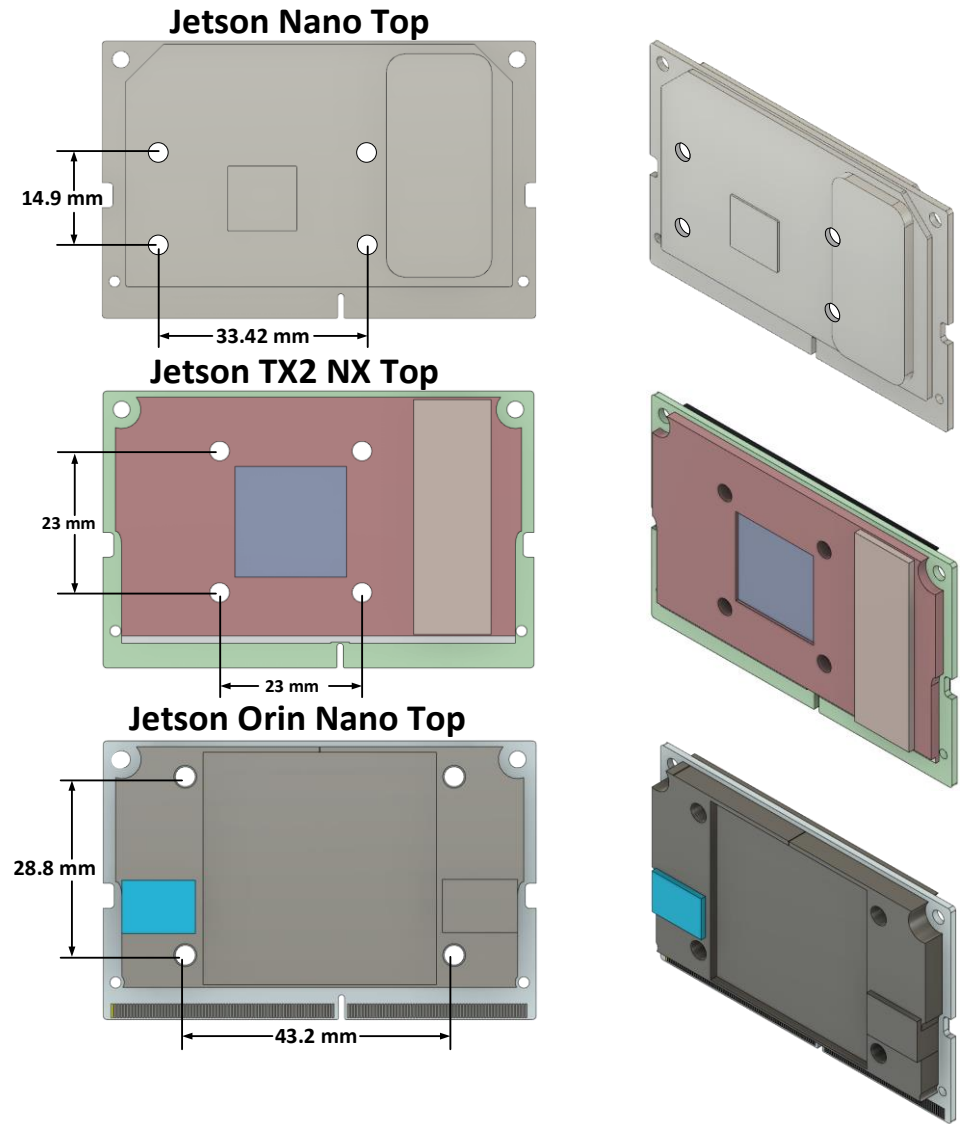
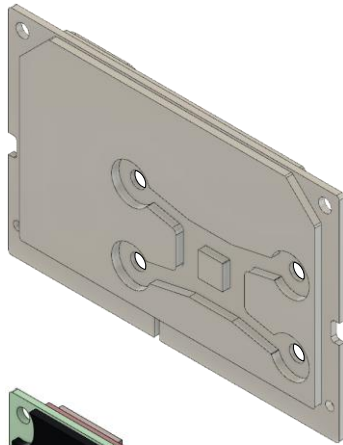
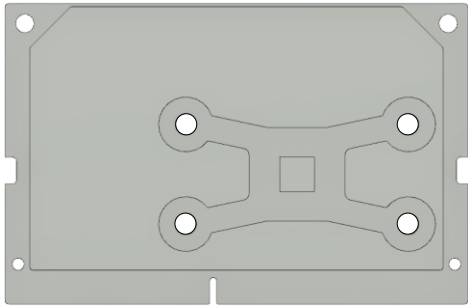
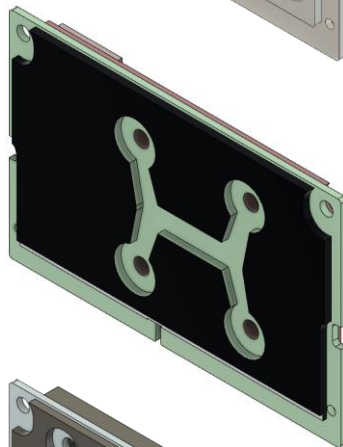
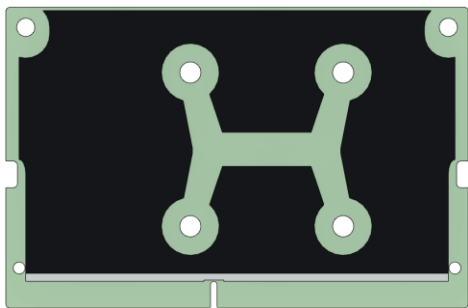


Figure 5. Module 3D Envelope Bottom Views

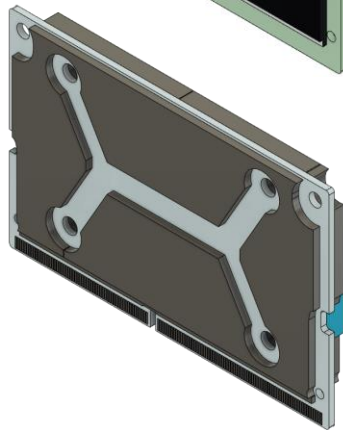
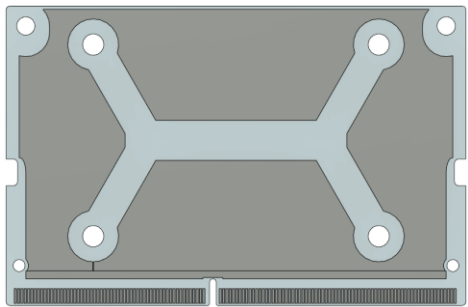
Jetson Nano Bottom



Jetson TX2 NX Bottom



Jetson Orin Nano Bottom



Interface Migration

Table 6 and Table 7 show the functional pin-mapping options for Jetson Nano, Jetson TX2 NX, and Jetson Orin Nano series and how they align and differ.

UPHY Mapping

Table 6. UPHY0 Mapping Options (USB 3.2 and PCIe)

Orin Module Pin Names	Orin Module Functions	UPHY0 Lanes	Nano Configs	TX2 NX Configs	Orin Nano Configs		
					Option #1	Option #2	Option #3
USBSS_RX/TX	USB 3.2 #1	Lane 0	USB 3.2 (P0)	USB 3.2 (P1)	USB 3.2 (P0)	USB 3.2 (P0)	USB 3.2 (P0)
DP0_TXD[1:0]_N/P	USB 3.2 #2	Lane 1	DP/HDMI	DP/HDMI	USB 3.2 (P1)	USB 3.2 (P1)	USB 3.2 (P1)
DP0_TXD[3:2]_N/P	USB 3.2 #3	Lane 2	DP/HDMI	DP/HDMI	USB 3.2 (P2)	USB 3.2 (P2)	Unused
PCIE1_RX0/TX0	PCIe #1 Lane 0	Lane 3	Used on module for Ethernet	PCIe x1 (C2), RP	PCIe x1 (C1), RP	PCIe x1 (C1), RP. Limited to Gen2	PCIe x1 (C1), RP
PCIE0_RX0/TX0	PCIe #1 Lane 0	Lane 4	PCIe x4 (C0), RP	PCIe x4 (C0), RP	PCIe x4 (C4), RP	PCIe x4 (C4), EP	PCIe x4 (C4), EP
PCIE0_RX1/TX1	USB 3.2 #1	Lane 5		Unused			
PCIE0_RX2/TX2	USB 3.2 #2	Lane 6					
PCIE0_RX3/TX3	USB 3.2 #3	Lane 7					

Table 7. UPHY2 Mapping Options (PCIe)

Orin Module Pin Names	Orin Module Functions	UPHY0 Lanes	Nano Configurations	TX2 NX Configurations	Orin Nano Configurations	
					Option #1	Option #2
CSI4_D[0:2]_RX0/TX0	PCIe #2 Lane 0	Lane 0	CSI	CSI	PCIe x2 (C7), RP	PCIe x1 (C7), RP
CSI4_D[1:3]_RX1/TX1	PCIe #2 Lane 1	Lane 1	CSI	CSI		PCIe x1 (C9), RP

USB 3.x Mapping Options

Table 8 shows how the USB 3.2 ports on Jetson Orin Nano map with the USB 3.1 port or other functions on Jetson TX2 NX or the USB 3.0 port on Jetson Nano.

Table 8. USB 3.x Mapping Options

Connector Pin Names	Jetson Nano Functions	Jetson TX2 NX Functions	Jetson Orin Nano Series Functions
USBSS_TX/RX	USB 3.0 (5 Gbps) Port #0	USB 3.1 (5/10 Gbps) Port #0	USB 3.2 (5/10 Gbps) Port #0
DP0_TXD[1:0]_P/N	HDMI/DP	HDMI/DP	USB 3.2 (5/10 Gbps) Port #1
DP0_TXD[3:2]_P/N	HDMI/DP	HDMI/DP	USB 3.2 (5/10 Gbps) Port #2

PCIe Mapping Options

Jetson Orin Nano series supports up to four PCIe interfaces:

- ▶ PCIe0: x4 lane interface (#C4), Gen3, Root Port or Endpoint
- ▶ PCIe1: x1 lane interface (#C1), Gen3, Root Port only
- ▶ PCIe2: x2 lane interface (#C7), Gen3, Root Port only or
- ▶ PCIe2 + PCIe3: x1 lane interface (#C7) plus x1 lane interface (#C9), both Gen3, Root Port only



Note: If PCIe0 (x4, #C4) on Orin Nano is used as Endpoint, either USB 3.2 Port #2 is not supported, or PCIe1 (x1, #C1) is limited to Gen2.

Jetson TX2 NX supports two PCIe interfaces:

- ▶ PCIe0: x2 lane interface (#C0), Gen2, Root Port only
- ▶ PCIe1: x1 lane interface (#C2), Gen2, Root Port only

Jetson Nano supports a single PCIe interface: PCIe0: x4 lane interface (#C0), Gen2, Root Port only.

Table 9 shows how the PCIe interface options on Jetson Orin Nano series map to the PCIe interface options on Jetson Nano and Jetson TX2 NX.

Table 9. PCIe Mapping Options

Jetson Module Connector Pin Names	Jetson Nano Functions	Jetson TX2 NX Functions	Jetson Orin Nano Series Function
PCIe0_RX0/TX0_P/N	PCIe	PCIe	PCIe
PCIe0_RX1/TX1_P/N	PCIe	PCIe	PCIe
PCIe0_RX2/TX2_P/N	PCIe	Reserved	PCIe
PCIe0_RX3/TX3_P/N	PCIe	Reserved	PCIe
PCIe0_CLK_P/N_P/N	PCIe	PCIe	PCIe

Jetson Module Connector Pin Names	Jetson Nano Functions	Jetson TX2 NX Functions	Jetson Orin Nano Series Function
PCIE0_RST*	PCIe	PCIe	PCIe
PCIE0_CLKREQ*	PCIe	PCIe	PCIe
PCIE1_RX0/TX0_P/N	Reserved	PCIe	PCIe
PCIE1_CLK_P/N	Reserved	PCIe	PCIe
PCIE1_RST*	Reserved	PCIe	PCIe
PCIE1_CLKREQ*	Reserved	PCIe	PCIe
CSI4_CLK_P/N	CSI	CSI	PCIe
CSI4_D[3:0]_P/N	CSI	CSI	PCIe
SDMMC_CLK	SDMMC	SDMMC	PCIe
SDMMC_CMD	SDMMC	SDMMC	PCIe
SDMMC_DAT[3:0]	SDMMC	SDMMC	PCIe
PCIE_WAKE*	PCIe	PCIe	PCIe

Ethernet

Jetson Orin Nano series, Jetson Nano, and Jetson TX2 NX all support an MDI Gigabit Ethernet interface at the same module pins.

SDIO and SD Card

Jetson Nano and Jetson TX2 NX bring a single SDMMC interface to the module pins (SDCARD pins supporting SD card or SDIO). Jetson Orin Nano does not support this interface. The module SDMMC pins are used for PCIe functionality.

HDMI and DisplayPort

Jetson Orin Nano supports a single HDMI™, VESA® Embedded DisplayPort™ (eDP), and DisplayPort (DP) interface and supports multi-head support through MST (on the DP [DP1 pins] only). Jetson TX2 NX and Jetson Nano support two HDMI, eDP, and DP interfaces but does not support multi-head operation. On Jetson Orin Nano, two USB SS interfaces use a portion of the other display interface pins on Jetson Nano or Jetson TX2 NX.

Table 10. HDMI and DP Mapping Options

Connector Signal Group	Jetson Nano Functions	Jetson TX2 NX Functions	Jetson Orin Nano Series Functions
DP0_TXD0	DP/HDMI	DP/HDMI	USBSS1_RX

Connector Signal Group	Jetson Nano Functions	Jetson TX2 NX Functions	Jetson Orin Nano Series Functions
DP0_TXD1	DP/HDMI	DP/HDMI	USBSS1_TX
DP0_TXD2	DP/HDMI	DP/HDMI	USBSS2_RX
DP0_TXD3	DP/HDMI	DP/HDMI	USBSS2_TX
DP0_AUX	DP/HDMI	DP/HDMI	RSVD
DP0_HPD	DP/HDMI	DP/HDMI	RSVD
DP1_TXD0	DP/HDMI	DP/HDMI	DP/HDMI
DP1_TXD1	DP/HDMI	DP/HDMI	DP/HDMI
DP1_TXD2	DP/HDMI	DP/HDMI	DP/HDMI
DP1_TXD3	DP/HDMI	DP/HDMI	DP/HDMI
DP1_AUX	DP/HDMI	DP/HDMI	DP/HDMI
DP1_HPD	DP/HDMI	DP/HDMI	DP/HDMI

CSI

Jetson Orin Nano, Jetson Nano, and Jetson TX2 NX all support MIPI CSI (D-PHY only). The following configurations can be supported by each module to cameras or serializers:

Jetson Orin Nano supports eight lanes total.

- ▶ 2 x4
- ▶ 1 x4 + 2 x2
- ▶ 4 x2

Jetson TX2 NX supports 14 lanes.

- ▶ 3 x4 + 1 x2
- ▶ 2 x4 + 3 x2
- ▶ 1 x4 + 5 x2
- ▶ 6 x2

Jetson Nano supports 12 lanes.

- ▶ 3 x4
- ▶ 2 x4 + 2 x2
- ▶ 1 x4 + 3 x2
- ▶ 4 x2

Virtual channel support:

Jetson TX2 NX supports up to 12 channels. Jetson Orin Nano supports up to 16 channels. No support virtual channel on Jetson Nano.

Audio

Jetson Orin Nano series and Jetson Nano support two I2S interfaces.

Jetson TX2 NX supports four I2S interfaces.

In addition, both Jetson Nano and Jetson TX2 NX support a primary audio clock, Digital Microphone (DMIC), and Digital Speaker (DSPK) interfaces.

Jetson Orin Nano has no DSPK and DMIC support.

Table 11. Jetson Orin Nano, Jetson TX2 NX, and Jetson Nano Audio Interfaces

Pin #	Module Pin Name	Jetson Nano Function	Jetson TX2 NX Function	Jetson Orin Nano Function
211	GPIO09	MCLK	MCLK	MCLK
199	I2S0_SCLK	I2S 0 SCLK	I2S 0 SCLK	I2S 0 SCLK
197	I2S0_FS	I2S 0 FS / DMIC / DSPK	I2S 0 FS / DMIC / DSPK	I2S 0 FS
193	I2S0_DOUT	I2S 0 DOUT	I2S 0 DOUT	I2S 0 DOUT
195	I2S0_DIN	I2S 0 DIN / DMIC / DSPK	I2S 0 DIN / DMIC / DSPK	I2S 0 DIN
226	I2S1_SCLK	I2S 1 SCLK	I2S 1 SCLK	I2S 1 SCLK
224	I2S1_FS	I2S 1 FS	I2S 1 FS	I2S 1 FS
220	I2S1_DOUT	I2S 1 DOUT	I2S 1 DOUT	I2S 1 DOUT
222	I2S1_DIN	I2S 1 DIN	I2S 1 DIN	I2S 1 DIN
128	GPIO05	GPIO	I2S 2 SCLK	GPIO
127	GPIO04	GPIO	I2S 2 FS	GPIO
124	GPIO02	GPIO	I2S 2 DOUT	GPIO
126	GPIO03	GPIO	I2S 2 DIN	GPIO
212	GPIO10	GPIO	I2S 3 SCLK	GPIO
130	GPIO06	GPIO	I2S 3 FS	GPIO
218	GPIO12	GPIO	I2S 3 DOUT	GPIO
112	SPI1_CS1*	SPI / GPIO	I2S 3 DIN	SPI / GPIO

I2C

Jetson Orin Nano series, Jetson TX2 NX, and Jetson Nano all support four I2C interfaces as shown in the Table 12.

Table 12. Jetson Orin Nano, Jetson TX2 NX, and Jetson Nano I2C Interfaces

Module Pin #	Jetson Module Signal Name
185	I2C0_SCK
187	I2C0_SDA
189	I2C1_SCK
191	I2C1_SDA
232	I2C2_SCK
234	I2C2_SDA
213	CAM_I2C_SCK
215	CAM_I2C_SDA

SPI

Jetson Orin Nano series, Jetson TX2 NX, and Jetson Nano all support two SPI interfaces as shown in Table 13.

Table 13. Jetson Orin Nano, Jetson TX2 NX, and Jetson Nano SPI Interfaces

Module Pin #	Jetson Module Signal Name
91	SPI0_SCK
89	SPI0_MOSI
93	SPI0_MISO
95	SPI0_CS0
97	SPI0_CS1
106	SPI1_SCK
104	SPI1_MOSI
108	SPI1_MISO
110	SPI1_CS0
112	SPI1_CS1

UART

Jetson Orin Nano series, Jetson TX2 NX, and Jetson Nano support three UART interfaces.

Table 14. Jetson Orin Nano, Jetson TX2 NX, and Jetson Nano UART Interfaces

Module Pin #	Jetson Module Signal Name
99	UART0_TXD
101	UART0_RXD
103	UART0_RTS*
105	UART0_CTS*
203	UART1_TXD
205	UART1_RXD
207	UART1_RTS*
209	UART1_CTS*
236	UART2_TXD
238	UART2_RXD

Debug

Jetson Orin Nano, Jetson TX2 NX, and Jetson Nano support a debug UART.

Connector Pin Differences Details

Table 15 lists the pins that have different functionality between Jetson Nano, Jetson TX2 NX, and Jetson Orin Nano.

Table 15. Connector Pin Function Differences

Module Pin #	Jetson Module Signal Name	Jetson Nano Function	Jetson TX2 NX Function	Jetson Orin Nano Series Function
76	DSI_CLK_N	DSI	DSI	RSVD
78	DSI_CLK_P	DSI	DSI	RSVD
70	DSI_D0_N	DSI	DSI	RSVD
72	DSI_D0_P	DSI	DSI	RSVD
82	DSI_D1_N	DSI	DSI	RSVD
84	DSI_D1_P	DSI	DSI	RSVD
90	DP0_AUX_N	DP / DDC	DP / DDC	RSVD
92	DP0_AUX_P	DP / DDC	DP / DDC	RSVD
88	DP0_HPD	DP / HDMI	DP / HDMI	RSVD
52	CSI4_CLK_N	CSI	CSI	PCIE
54	CSI4_CLK_P	CSI	CSI	PCIE
46	CSI4_D0_N	CSI	CSI	PCIE
48	CSI4_D0_P	CSI	CSI	PCIE
58	CSI4_D1_N	CSI	CSI	PCIE
60	CSI4_D1_P	CSI	CSI	PCIE
40	CSI4_D2_N	CSI	CSI	PCIE
42	CSI4_D2_P	CSI	CSI	PCIE
64	CSI4_D3_N	CSI	CSI	PCIE
66	CSI4_D3_P	CSI	CSI	PCIE
229	SDMMC_CLK	SDIO / SD	SDIO / SD	PCIE
227	SDMMC_CMD	SDIO / SD	SDIO / SD	PCIE
219	SDMMC_DAT0	SDIO / SD	SDIO / SD	PCIE
221	SDMMC_DAT1	SDIO / SD	SDIO / SD	PCIE

Module Pin #	Jetson Module Signal Name	Jetson Nano Function	Jetson TX2 NX Function	Jetson Orin Nano Series Function
223	SDMMC_DAT2	SDIO / SD	SDIO / SD	PCIE
225	SDMMC_DAT3	SDIO / SD	SDIO / SD	PCIE
39	DP0_TXD0_N	DP / HDMI	DP / HDMI	USB 3.2
41	DP0_TXD0_P	DP / HDMI	DP / HDMI	USB 3.2
45	DP0_TXD1_N	DP / HDMI	DP / HDMI	USB 3.2
47	DP0_TXD1_P	DP / HDMI	DP / HDMI	USB 3.2
51	DP0_TXD2_N	DP / HDMI	DP / HDMI	USB 3.2
53	DP0_TXD2_P	DP / HDMI	DP / HDMI	USB 3.2
57	DP0_TXD3_N	DP / HDMI	DP / HDMI	USB 3.2
59	DP0_TXD3_P	DP / HDMI	DP / HDMI	USB 3.2
217	GND	GND	GND	MODULE_ID

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