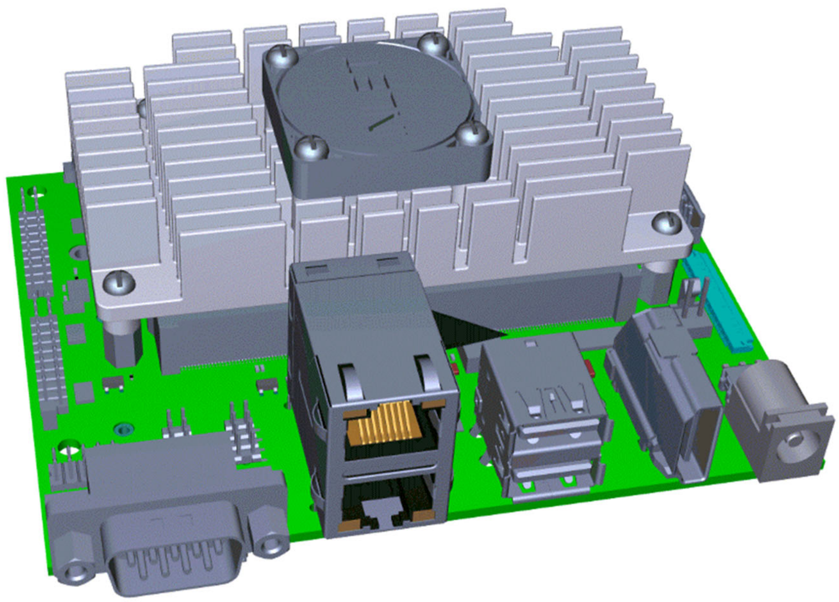
JACKSON

Carrier for NVIDIA® Orin Nano / NX
User Manual



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1.01	22 Feb 2023	Initial version

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1. IMPORTANT SAFE HANDLING INFORMATION

WARNING!

ESD-Sensitive Electronic Equipment

Observe ESD-safe handling procedures when working with this product.

Always use this product in a properly grounded work area and wear appropriate ESD-preventive clothing and/or accessories.

Always store this product in ESD-protective packaging when not in use.

Safe Handling Precautions

Diamond Systems boards are designed with complex circuitry and electronic components that are ESD-sensitive. This increases the likelihood of the boards incurring accidental damage during handling, installation, and connection to other equipment.

It is highly recommended that the following precautionary measures and best practices be observed in sequential order:

- Wear an anti-static Wristband/Strap or/and an antistatic Lab Coat or/and Rubber-soled shoes.
- Spread anti-static mats over the table or work surface or/and anti-static mats on the floor.
- Unpack components and remove them from their anti-static bags only when they are ready to be used.
- Avoid ungrounded surfaces such as plastic, carpets, floors, or tables, in the work area.
- Handle boards by the edges and their metal mounting brackets. Avoid touching components on the boards and the edge connectors that connect to expansion slots.

The following information describes common causes of failure found on boards and components returned to Diamond Systems for repair. It is provided as a guideline to avoid accidental damage.

ESD Damage: This type of damage is typically impossible to detect because there is no visual sign of failure or damage. In this type of damage, the board eventually stops functioning because of some defective components. Usually, the failure can be identified, and the chip can be replaced. To prevent ESD damage, always follow proper ESD-prevention practices when handling computer boards.

Damage During Handling or Storage: Physical damage on boards also occur due to mishandling. A common observation is that of a screwdriver slipping on the board during installation, causing a gouge on the PCB surface, cutting signal traces or damaging components.

Another common observation is damaged board corners, indicating the board was dropped. This may or may not cause damage to the circuitry, depending on components located near the edges. Most Diamond System boards are designed with a minimum 25 mils clearance between the board edge and component pad. The ground/power planes are located a minimum of 20 mils from the edge to avoid possible shorting from this type of damage. However, these design rules do not prevent damage in all situations.

Sometimes boards are stored in racks with slots that grip the edge of the board. This is a common practice for board manufacturers. Though Diamond Systems boards are resilient to damages, the components located close to the board edges can be damaged or even knocked off the board if the board lies tilted in the rack.

Diamond Systems recommends that all boards be stored only in individual ESD-safe packaging units. If multiple boards are stored together, they should be contained in bins with dividers placed between the boards. Do not pile boards on top of each other or cram too many boards within a small location. This can cause damage to connector pins or fragile components.

Bent Connector Pins: This type of problem can be resolved by re-bending the pins to their original shape using needle-nose pliers.
The most common cause of a bent connector pin is pulling a ribbon cable off a pin header in a manner not directly in line with the mating direction. To remove a ribbon cable, rock the cable back and forth on an axis parallel to the length of the connector until it can be easily pulled off. If the pins are bent too severely, bending them back can cause them to weaken or break. In this case, the connector must be replaced.

Power Damage: There are various causes of power-specific damage that can occur while handling the board. Some common causes such as –a metal screwdriver tip slipping, or a screw dropping onto the board while it is powered-up, causes a short between a power pin and a signal pin on a component.
These faults can cause over-voltage/power supply problems besides other causes described below.
To avoid such damages, assembly operations must be performed when the system is powered off.

Power Supply Wired Backwards: Diamond Systems power supplies and boards are not designed to withstand a reverse power supply connection. This will destroy almost all ICs connected to the power supply. In this case, the board will likely be irreparable and must be replaced. A chip destroyed by reverse or excessive power will often have a visible hole or show some deformation on the surface due to vaporization inside the package.

Overvoltage on Analog Input: If a voltage applied to an analog input exceeds the power specification of the board, the input multiplexer and/or parts behind it can be damaged. Most Diamond Systems boards will withstand an erroneous connection of up to 36V on the analog inputs, even when the board is powered off, but not on all boards, and not under all conditions.

Overvoltage on Analog Output: If an Analog output is accidentally connected to another output signal or a power supply voltage, the output can be damaged. On most Diamond boards, a short circuit to ground on an analog output will deter any damage to the board.

Overvoltage on Digital I/O Line: If a Digital I/O signal is connected to a voltage above the maximum specified voltage, the digital circuitry can be damaged. The acceptable voltage range on most Diamond Systems boards connected to digital I/O signals is 0-5V, with overvoltage protection up to 5.5V (-0.5 to 5.5V). Overvoltage beyond this limit can damage the circuitry.

IMPORTANT! Always check twice before Powering Up!

1. INTRODUCTION

Jackson is an Nvidia Jetson Orin Nano / Orin NX module-based board with rich graphics and camera input capability. This base board converts the module into a complete embedded system by providing interface circuitry, I/O connectors for all the major features of the module, camera interface, power supply and additional I/O capabilities.

This Base Board redefines possibility; a combination of performance, power efficiency, integrated deep learning capabilities and rich I/O remove the barriers to a new generation of low-cost products.

The base board also contains M.2 x4 lane PCIe SSD as storage options along with interfaces like HDMI, USB3.2, CAN, Serial ports, Utility connector etc.

1.1 Module features

Features	Jetson Orin Nano 4GB/8GB
AI Performance	20 TOPS (Sparse) |10 TOPS (Dense) / 40 TOPS (Sparse) |20 TOPS (Dense)
GPU	512 core NVIDIA Ampere GPU with 16 Tensor Cores / 1024 core NVIDIA Ampere GPU with 32 Tensor Cores
CPU	6core NVIDIA Arm® Cortex A78AE v8.2 64-bit CPU, 1.5 GHz 1.5MB L2 + 4MB L3
VIDEO	1x 8K @ 30 Encode (HEVC) 1x 4K @ 60 Decode (HEVC)
MEMORY	4GB 64bit LPDDR5 @2133 MHZ, 34 GB/s / 8GB 128bit LPDDR5 @2133 MHZ, 68 GB/s
CAMERA	8 lanes (2x4 or 4x2) MIPI CSI-2 D-PHY 1.2 (2.5 Gb/s per pair)
CONNECTIVITY	1 Gigabit Ethernet, 3 x1 + 1 x4 PCIe lanes
DISPLAY	HDMI 2.1 and eDP 1.4
USB	3x USB 3.2, 3x USB 2.0
OTHERS	GPIO, I2C, I2S, SPI, UART
POWER	5W to 10W / 7W to 15W

Features	Jetson Orin NX 8GB/16GB
AI Performance	70 INT8 Sparse TOPs /100 INT8 Sparse TOPS
GPU	1024 core NVIDIA Ampere GPU with 32 Tensor Cores
CPU	6-core NVIDIA A78 CPU /8-core NVIDIA A78 CPU
VIDEO	1x 8K @ 30 Encode (HEVC) 1x 4K @ 60 Decode (HEVC)
MEMORY	8GB 128bit LPDDR5 @2133 MHZ, 102GB/s / 16 GB 128-bit LPDDR5, 3200MHz 102GB/s
CAMERA	8 lanes (2x4 or 4x2) MIPI CSI-2 D-PHY 1.2 (2.5 Gb/s per pair)
CONNECTIVITY	1 Gigabit Ethernet, 3 x1 + 1 x4 PCIe lanes
DISPLAY	HDMI 2.1 and eDP 1.4
USB	3x USB 3.2, 3x USB 2.0
OTHERS	GPIO, I2C, I2S, SPI, UART
POWER	10W to 20W / 10W to 25W

1.2 I/O Features & Connectors

Feature	***Description***	***Connector Type***
Power	7V - 20V wide input supply	DC barrel jack (J3) or Terminal Block (J2)
RTC	1.85V – 5.5V power input for RTC functionality	1x2 connector (J16)
Ethernet	1x 10/100/1000Mbps from the Orin NX module 1x 10/100/1000Mbps from the I210 controller (Not supported when expansion card is used)	1x Dual port RJ45 (J5)
Mass Storage	1x M.2 PCIe SSD socket	M.2 2280/2242 (J20)
	1x M.2 E key	M.2 2230 (J17)
Minicard	Minicard expansion with x1 PCIe and x1 USB2.0 with SIM connector	Mini Card Connector (J18)
USB	2x USB 3.2 / USB 2.0	1x USB3 Dual port RA (J4)
	1x USB2.0	1x4 Header (J21)
	1x USB3.2 / USB2.0 (Not supported when expansion card is used)	2x5 Header (J12)
Serial Ports	1x RS-232/485 port via jumper configuration	1 x DB9 Connector (J1)
	1x RS232 1xRS232/RS485 (Shared with DB9 port)	2x5 Header (J7)
Display	1x HDMI 2.1 a/b directly from the module with audio	1x Upright HDMI connector (J6)
Camera	2x4 lane CSI-2 Camera Interface	2x 22-pin FPC cable connector (J22 & J23)
Digital IOs	16x Digital IOs 3.3V/5V realized using I2C GPIO expander	2x10 Header (J10)
Expansion Connector	1x USB3.2, 1x USB2.0 and PCIe x1 lane	FPC 40-Pin 0.5mm Pitch (J9)
CAN	1x CAN interface	1x4 SMD connector (J14)
Fan	Active Thermal Solution with PWM & Tach Input	1x4 SMD connector (J15)
Utility	Power Button, Reset, Force Recovery Force OFF, I2C(3.3V), SPI(3.3V), Debug UART	2x10 Header (J13)

Operating System Support	
Linux Kernel version 4.9	
Mechanical, Electrical and Environmental Properties	
Form-Factor	85mm x 110mm
Cooling Mechanism	Conduction Cooling
Power Input Range	7V – 20V; 12V Typical
Operating Temperature Range	-25°C to +80°C at Thermal Transfer Plate (TTP) surface of Orin Module

1.3 Jackson Ordering Guide

The table below lists the current and planned part numbers.

JAX-BB01	**Jackson carrier board for Nvidia Jetson Orin Nano and Orin NX**
JAX-ASY-ONA8	**Jackson carrier board with Orin Nano 8GB module installed and programmed, with fan sink**
JAX-ASY-ONX8	**Jackson carrier board with Orin NX 8GB module installed and programmed, with fan sink**
JAX-ASY-ONX16	**Jackson carrier board with Orin NX 16GB module installed and programmed, with fan sink**

2. PRODUCT PHOTOS

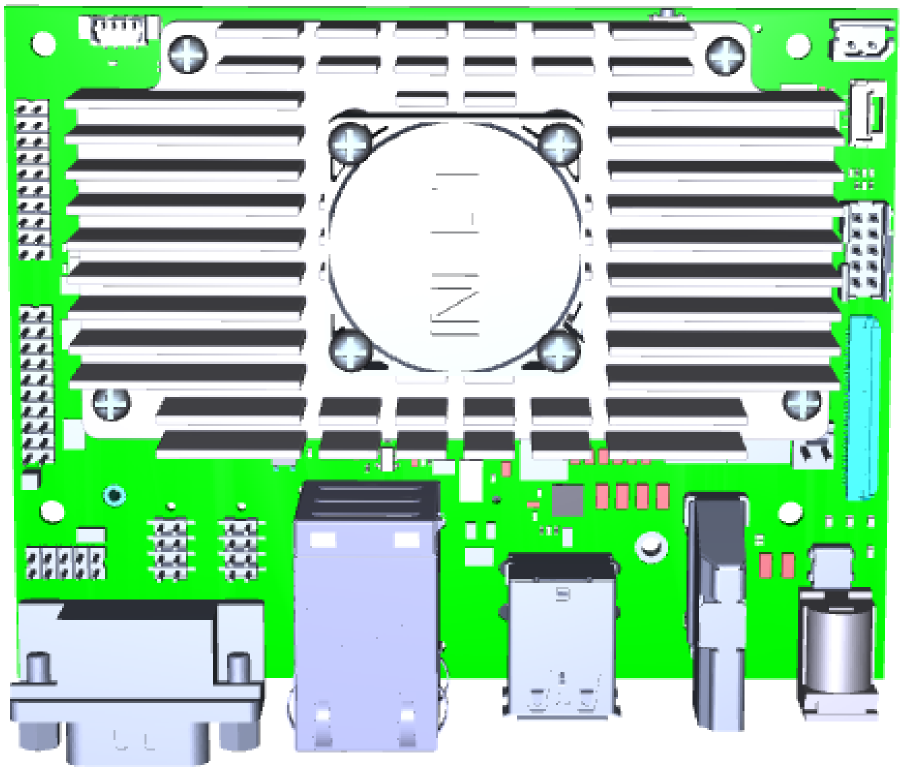


Figure 2-1: Orin Nano / NX module installation side

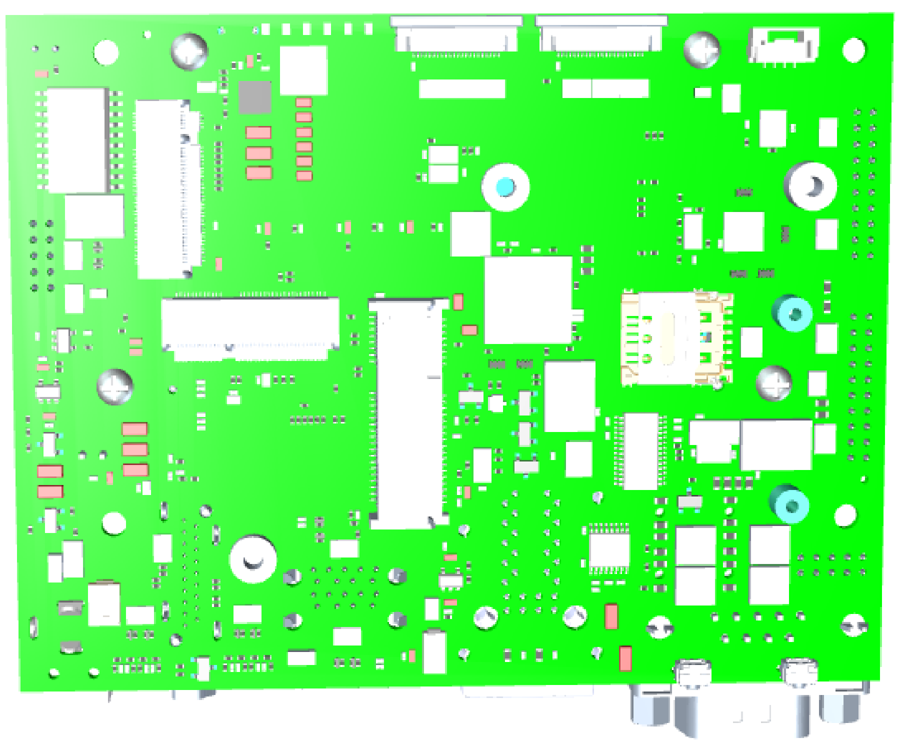


Figure 2-2: IO Expansion Side

3. CONNECTOR AND JUMPER LOCATIONS

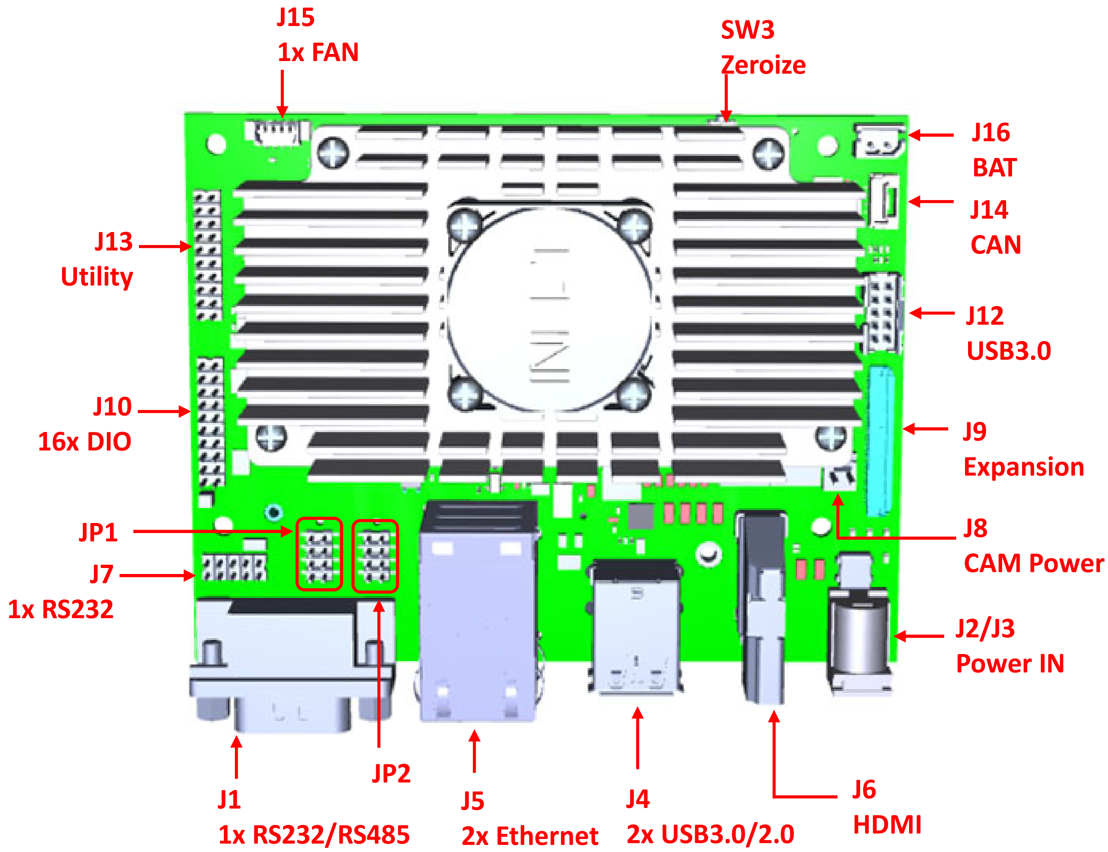


Figure 3-1: Orin Nano / NX module installation side

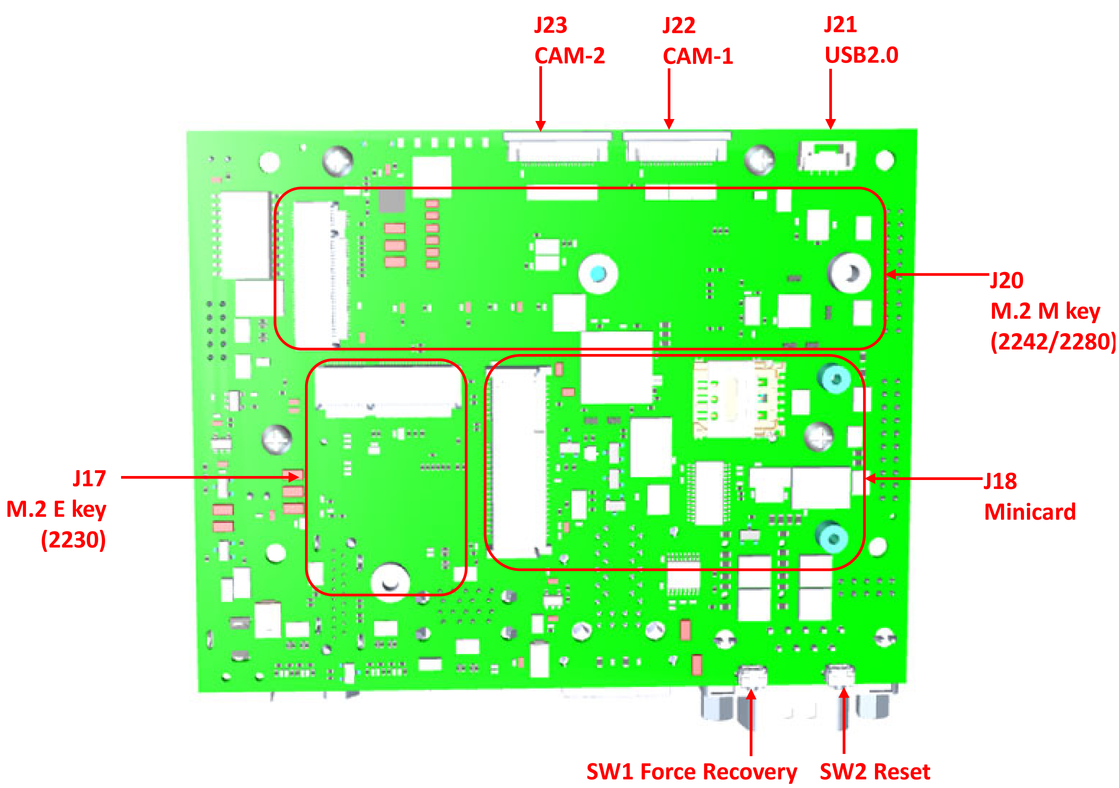


Figure 3-2: IO Expansion Side

4. BASE DIMENSION DRAWING

Below figures represent the board dimension drawing.

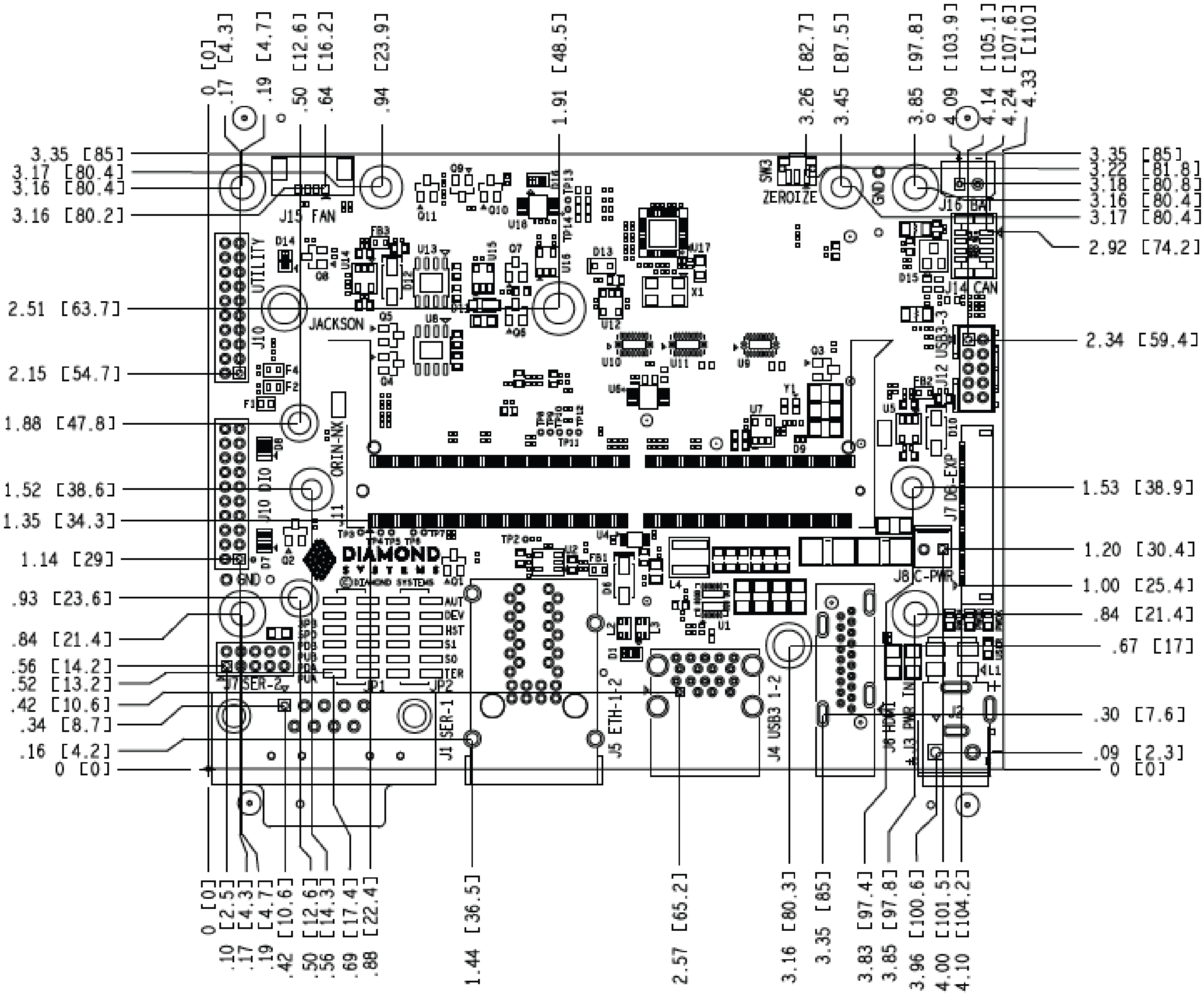


Figure 4-1: Dimension Drawing of module installation side

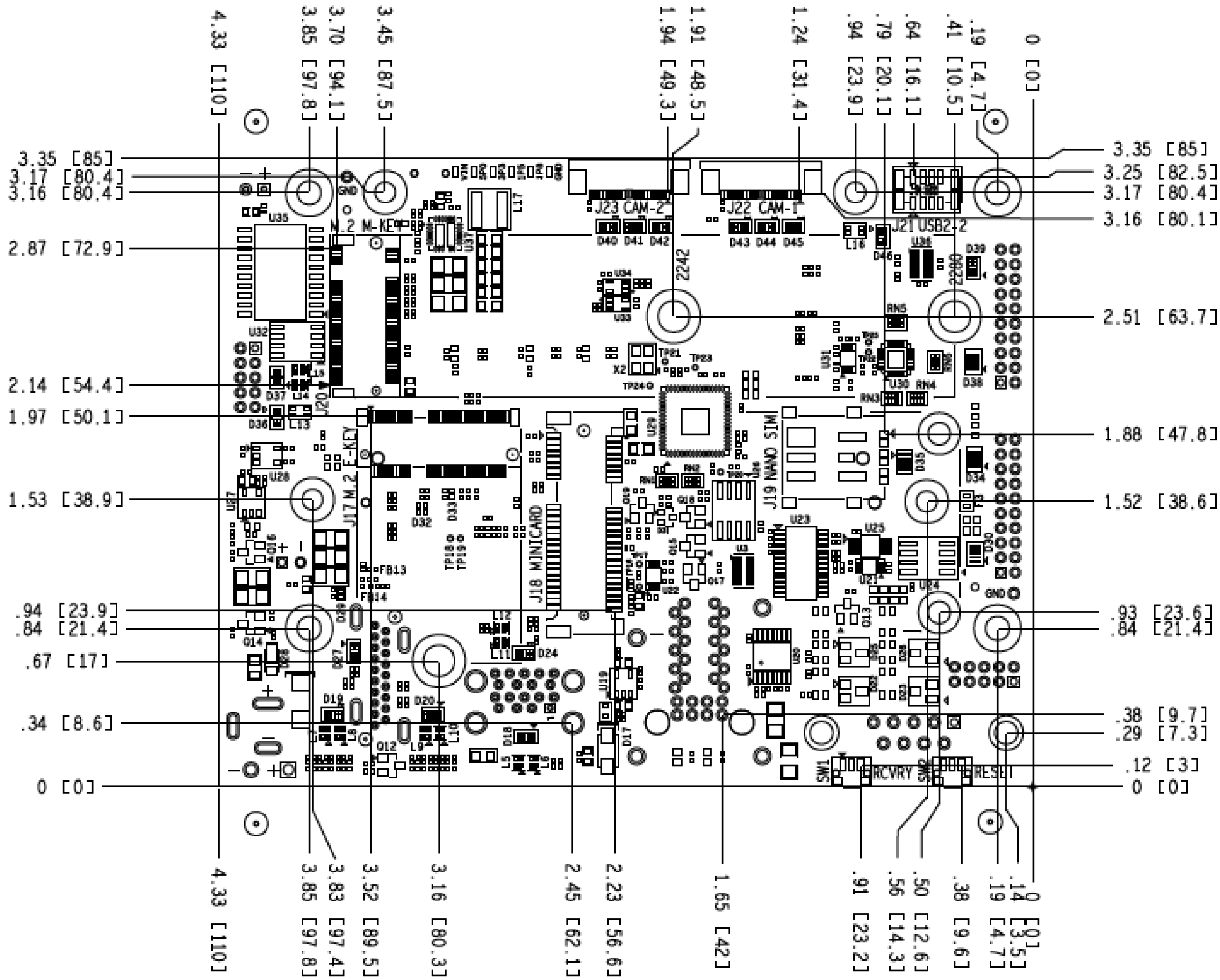


Figure 4-2: Dimension Drawing of IO Expansion side

5. FUNCTIONAL OVERVIEW

5.1 Processor Module

The baseboard supports the Orin NX / Nano module. NVIDIA® Jetson Orin™ NX brings AI supercomputer performance to the edge in a compact system-on-module (SOM) which is smaller than a credit card. Jetson Orin NX is built around a low-power version of the NVIDIA Orin SoC, combining the NVIDIA Ampere™ GPU architecture with 64-bit operating capability, integrated advanced multi-function video and image processing, and NVIDIA Deep Learning Accelerators, loaded with 16 GB of memory and 102 GB/s of memory bandwidth. It features a variety of standard hardware interfaces that make it easy to integrate it into a wide range of products and form factors.

5.2 Power Supply

The board can be powered from wide input voltage range of +5V to +20V for full feature.

All required supply voltages for the board are derived from the +(5V-20V) input. These power supplies must be sized to support the highest capacity on-board memory and have enough reserve capacity to support the below add-on features.

Input	5V	3.3V	1.5V	Feature
	5A			Orin Nano/ NX Module
	2.7A			USB3.0/2.0
		1.3A	0.15A	mPCIe
		1.5A		M.2
		0.5A		CSI Camera
	0.2A			HDMI
2.5A				Daughter card/Expansion

5.3 Ethernet

The base board provides two 10/100/1000 Ethernet ports, one directly from the module and second 10/100/1000 Ethernet port is derived from the Intel WGI210IT PCIe Ethernet controller. This controller is accessed via x1 PCIe lane from the Orin NX / Nano module which is also muxed with the expansion connector used to plug expansion cards. Either the second ethernet port or expansion cards are supported by the base board.

The ethernet ports are terminated on R/A dual port RJ45 MagJack connector. Connectors are equipped with LINK and ACT LEDs on the front.

5.4 Display

The board offers one HDMI2.1 a/b video output option with audio. The HDMI video output is terminated on a single port vertical RA type HDMI connector.

5.5 Expansion connector

The board offers an optional Expansion connector for customers who want additional Ethernet, USB3.0 and USB2.0 options.

The expansion board will have a PCIe Ethernet controller and an Ethernet switch to support additional Ethernet ports. USB3.0 as well as USB2.0 hub are provided on the expansion board to support additional USB3.0 and USB2.0 ports. The power to the Expansion board will be provided by the carrier board through the FFC connector. The variable input power is routed to the FFC connector; 5V and 3.3V are also routed to the FFC connector.

The PCIex1 lane is muxed with I210 ethernet controller and the expansion connector; one of the two features are supported by the base board.

Also, the USB3.0 and USB2.0 interfaces on the expansion connector are made available at 2x5 pin header through a mux and either of the one is supported by the base board.

5.6 Camera

The module brings eight MIPI CSI lanes to the connector. Two quad-lane camera streams or four dual lane camera streams are supported. Each data lane has a peak bandwidth of up to 2.5Gbps.

The board supports 2 MIPI CSI x4 cameras which are interfaced through 22-pin connectors. Supporting signals like I2C and control signals for the CSI are available through connector so that user can directly interface the camera to the board. Both the connectors support Quad-lane CSI channels.

5.7 Serial Ports

The baseboard provides two serial ports, one with jumper selectable RS232/RS485 protocol modes and one with RS232 mode.

RS232 port is made available on 2x5 pin header. RS232/RS485 are available via DB9 connector on the front edge and part of 2x5 serial port header. For RS232/RS485 either of the one connector can be used at a time.

5.8 PCIe Link Routing

The base board utilizes the PCIe lanes from module as per below table:

Lane	Port	Lane width	Peripheral
UPHY0, Lane 4	C4	x4	M.2 PCIe SSD
UPHY0, Lane 5			
UPHY0, Lane 6			
UPHY0, Lane 7			
UPHY0, Lane 3	C1	x1	I210/ Expansion
UPHY2, Lane 0	C7	x1	M.2 E Key
UPHY2, Lane 1	C9	x1	Minicard

5.9 M.2 Socket

The board is equipped with an M.2 M-Key socket to plug-in 2280/2242 x4 PCIe NVMe cards. As there is no onboard memory on the Orin NX/Nano module, a PCIe SSD must be utilized always.

Base board provides onboard M3 4mm spacer along with a screw to mount M.2 2280 module.M3 4mm spacer along with 2nos of screws are provided to mount M.2 2242 SSD.

The board supports M.2 E key with x1 PCIe and x1 USB2.0 interfaces which provides additional options for expansion.

Base board provides onboard M3 2mm spacer along with a screw to mount M.2 E key 2230 module.

5.10 Minicard

The board offers one full (51mm length) size Minicard socket. Minicard interface supports PCIex1 lane and USB2.0 x1 interfaces. Nano sim connector is also supported to extend the functionality.

Baseboard provides 2nos onboard M2 4mm spacer and screws on the minicard sockets to mount the modules.

5.11 USB

The board provides access to 3x USB3.2 ports and 3x USB2.0 ports.

1x USB3.2 and 1x USB2.0 ports from the module are muxed between the expansion connector and the header; It will be available only in the expansion connector on plugging the expansion card.

2x USB3.2 and 1x USB2.0 ports from the module, along with x1 USB2.0 port from the USB2.0 hub is provided on dual RA stacked USB3.0 connector where x1 USB2.0 port from the module can be used for programming in the recovery mode. No separate connector is provided for recovery mode.

The USB3.2 / USB2.0 port mapping is done as per the below table:

<table>
<tr><th colspan="3">USB3.2 Ports</th></tr>
<tr><th>Port from Module</th><th colspan="2">Port Termination</th></tr>
<tr><td>Port 0</td><td colspan="2">USB3 Connector 1</td></tr>
<tr><td>Port 1</td><td colspan="2">Expansion Connector / Header</td></tr>
<tr><td>Port 2</td><td colspan="2">USB3 Connector 2</td></tr>
<tr><th colspan="3">USB2.0 Ports</th></tr>
<tr><th>Port from Module</th><th colspan="2">Port Termination</th></tr>
<tr><td>Port 0 (Recovery)</td><td colspan="2">USB3 Connector 1</td></tr>
<tr><td>Port 1</td><td colspan="2">Expansion Connector / Header</td></tr>
<tr><td rowspan="4">Port 2</td><td rowspan="4">USB 2.0 HUB
(1:4)</td><td>M.2 E Key</td></tr>
<tr><td>Minicard Socket</td></tr>
<tr><td>USB3 Connector 2</td></tr>
<tr><td>1x4 Header</td></tr>
</table>

5.12 Digital I/O

The board provides 16x digital I/Os, which are individually configurable as an output or input. Digital I/Os are realized using an I2C GPIO expander. The I2C control for the expander is directly fed from the module. This I2C is 3.3V compliant, hence no level translation is necessary. This expander device is accessible on the I2C address 0x22.The I/Os are made available on a 2x10 header.

5.13 Controller Area Network (CAN)

The base board is equipped with a CAN interface. The interface can be realized with a non-isolated TJA1042T,118 transceiver or with an isolated ADM3053BRWZ transceiver, available as assembly options. By default, the CAN is realized with the non-isolated TJA1042T,118 transceiver.

5.14 Utility

Some of the house keeping & additional interfaces signals like Power button, Debug TTL UART, Reset, I2C, SPI and Force recovery signals are available through a 2x10 utility header.

5.15 LED Indicators

The board provides the following LED indicators. All LEDs are located near to board edge or their respective features. All LEDs are labeled in silkscreen with their function.

PWIN	Green LED for Power IN
PWGD	Green LED for Power Good indication.
USER	Green LED for user /boot indication

6. JUMPER CONFIGURATIONS

6.1.1 JP1 Jumper Configuration

JP1 Jumpers are provided to select the voltage level and Pullup/pull down configuration of the DIO. By default, the DIOs are 3.3 Voltage pulled down. The configuration is as shown below:

Position	Function	IN	OUT
3P3	DIO Voltage Level	***3.3V**	
5P0	DIO Voltage Level	5V	
PDB	DIO PORT B Pull Down Enable	***Enabled**	Disabled
PUB	DIO PORT B Pull up Enable	Enabled	Disabled
PDA	DIO PORT A Pull Down Enable	***Enabled**	Disabled
PUA	DIO PORT A Pull up Enable	Enabled	Disabled
***Default Mode**			

6.1.2 JP2 Jumper Configuration

USB1 port of the base board is used as a device in the recovery mode to flash the module and is used as a Host in normal operation. This selection is achieved by changing the jumper positions on Jp2 as tabulated below:

Position	Function	IN	OUT
AUT	Auto Power ON	Disabled	***Enabled**
DEV	USB2 J4 Bottom Port Device Mode	Enabled	Disabled
HST	USB2 J4 Bottom Port Host Mode	***Enabled**	Disabled
S1	Serial Port Protocol Select1	Refer Table	
S0	Serial Port Protocol Select0		
TER	RS485 Termination	Enabled	***Disabled**
***Default Mode**			

Serial port Protocol selection Jumper (Detailed):

S1	S0	Protocol
OUT	OUT	Not Valid
OUT	IN	RS232
IN	OUT	RS485
IN	IN	Not Valid

7. BLOCK DIAGRAM

The overview of the key functional blocks of the Orin NX / Nano Base Board is shown below.

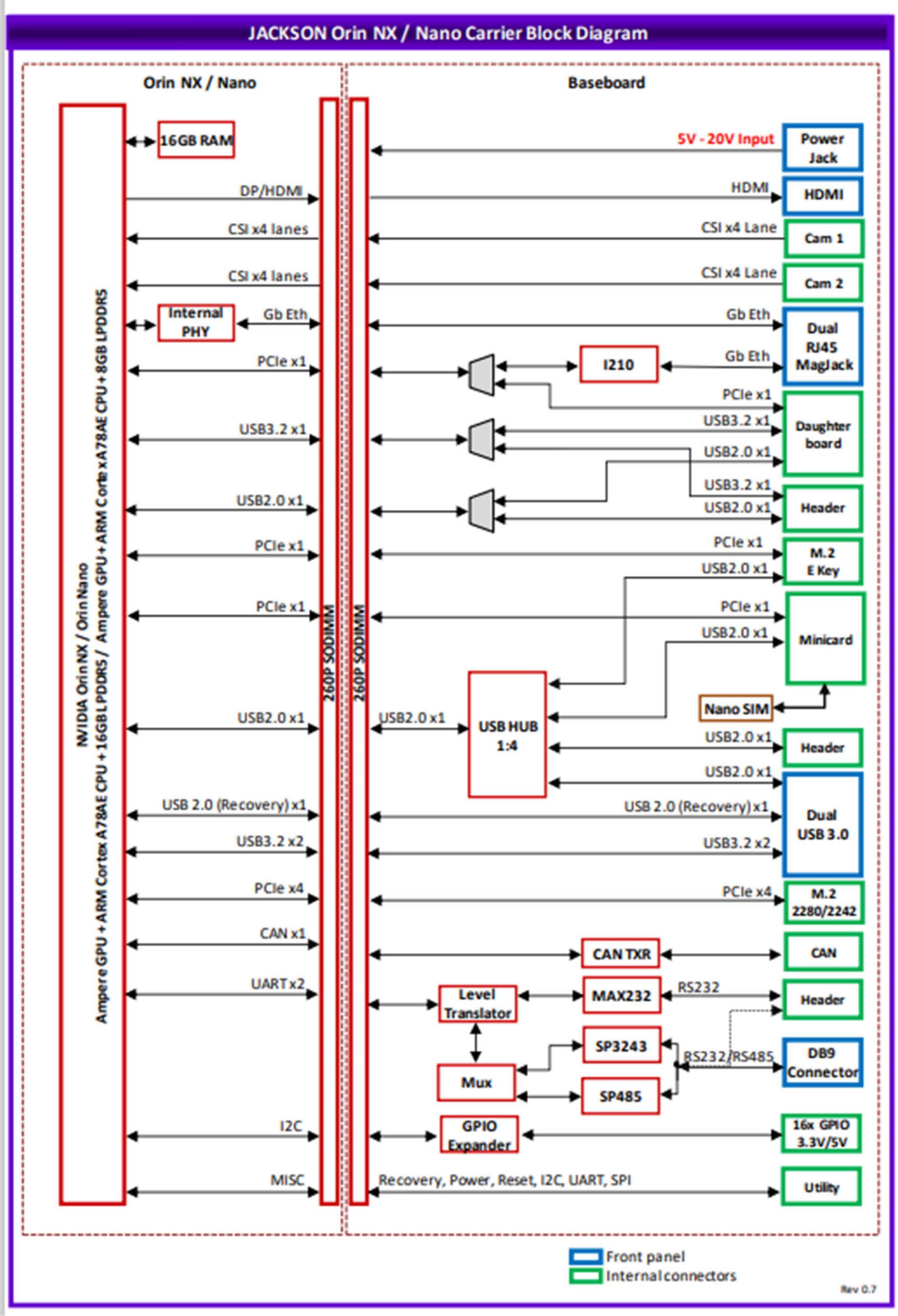


Figure 7-1: Block Diagram of Orin NX / Nano Baseboard

8. HEAT SINK

The heat sink is constructed of a single piece of aluminum with Black finish. The custom shaped heat sink has a form factor of 90mm x 50mm. The heat sink not only covers entire the module but has extended wings to cope up for the additional power dissipation from the module. The mounting posts are integrated into the heat sink and not provided as press-in or bolted-on components. All exterior corners and edges are slightly beveled for handling comfort. Deburring / tumbling are kept to a minimum to retain a smooth surface finish uniform in appearance. The heat sink is mounted on the top side of the board to contact the processor surface on the module. The heat sink uses thermal pads with 1mm thickness and 4.5 W/m K thermal conductivity. The thermal pads are provided with approximately 10% crush at nominal dimensions of all related components.

The heat sink also contains a recess in the middle with four M2.5 threaded bosses. These bosses are used to mount an optional fan in the heat sink to act as an active thermal solution.

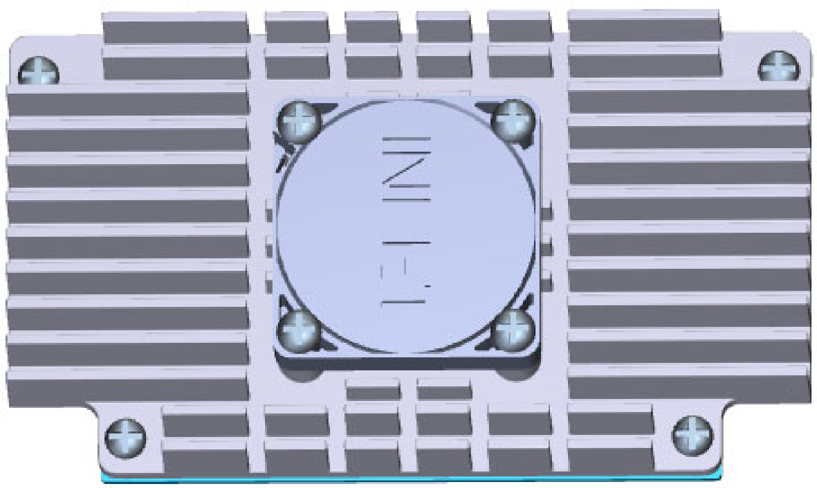


Figure 8-1: Heat Sink Top View

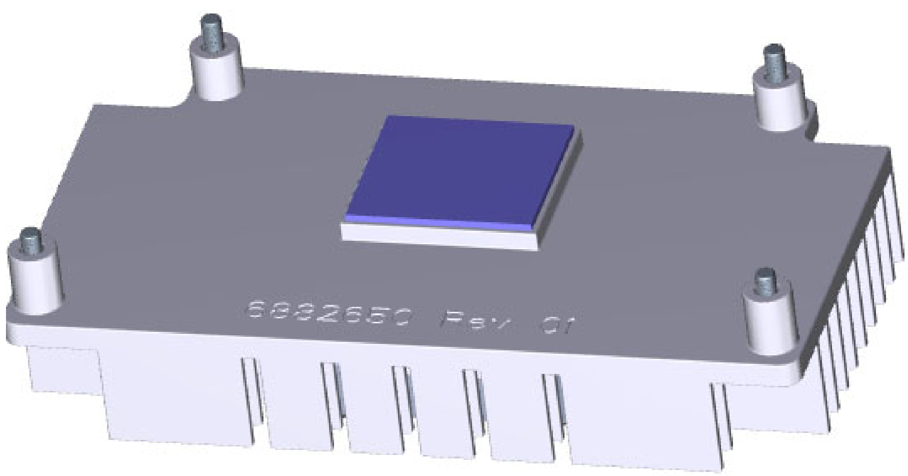


Figure 8-2: Heat Sink Bottom View

9. I/O CONNECTORS

9.1 Power In

The pinouts for power input are as shown below:

VIN	1
GND	2
GND	3

VIN = +7V to +20V

Connector PN: PJ-202BH

Mating Cable PN: TBD

9.2 RTC Battery

The pinouts for RTC battery power input are as shown below:

RTC_BATT	1
GND	2

RTC BATT = +1.85V – +5.5V

Connector PN: 0022035025

Mating Cable PN: 6980524

9.3 Fan

The pinouts for the fan connector are as shown below:

PWM	1
TACH	2
5V	3
GND	4

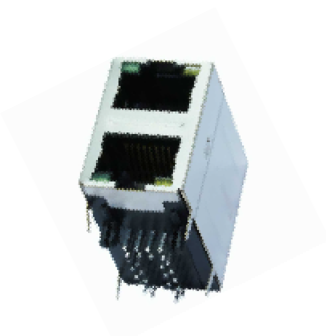
Connector PN: 0533980471

Supported fan: ASB0305HP-00CP4

9.4 Ethernet

The Ethernet ports are terminated on a double stacked R/A RJ45 connector with integrated transformer (Magjacks). The Top as well as bottom ports follows standard pinouts.

J1	TX1+
J2	TX1-
J3	RX+
J6	RX-
J4	TX2+
J5	TX2-
J7	TX3+
J8	TX3-



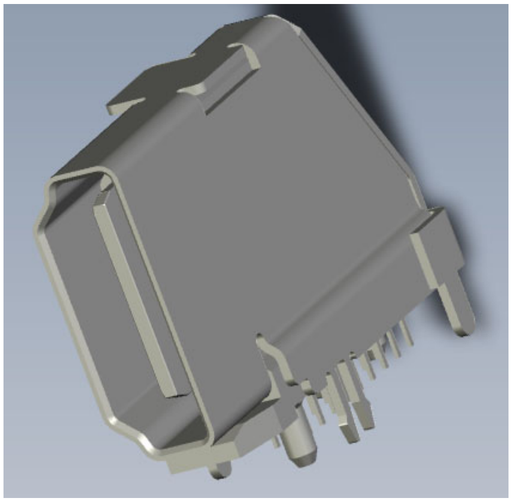
Connector PN: LPJG17561BHNL
Mating Cable PN: Standard LAN cable

9.5 HDMI

HDMI port is available from module and will be available on an HDMI vertical stacked standard connector as shown below:

The connector follows standard pinouts.

1	DATA2+
2	GND_2
3	DATA2-
4	DATA1+
5	GND_5
6	DATA1-
7	DATA0+
8	GND_8
9	DATA0-
10	CLK+
11	GND_11
12	CLK-
13	CEC
14	NC
15	DDC CLCK
16	DDC DATA
17	GND_17
18	+5V
19	HPD



Connector PN: QJ3119C-WFB1-4F

Mating cable PN: Standard HDMI cable

9.6 Camera

There are two identical 22-pin connectors on board connectors for CSI Cameras. FFC cable is used to directly plug the camera modules. Pinouts is compatible with Raspberry Pi 22 camera connector.

The pinouts for CSI connectors are as shown below:

Connector -1

1	GND_DIG
2	CSI0_D0_N
3	CSI0_D0_P
4	GND_DIG
5	CSI0_D1_N
6	CSI0_D1_P
7	GND_DIG
8	CSI0_CLK_N
9	CSI0_CLK_P
10	GND_DIG
11	CSI0_D2_N
12	CSI0_D2_P
13	GND_DIG
14	CSI0_D3_N
15	CSI0_D3_P
16	GND_DIG
17	CAM0_PWDN_1P8
18	CAM0_MCLK_1P8
19	GND_DIG
20	CAM1_I2C_SCL_3P3
21	CAM1_I2C_SDA_3P3
22	V_3P3

Connector -2

1	GND_DIG
2	CSI2_D0_N
3	CSI2_D0_P
4	GND_DIG
5	CSI2_D1_N
6	CSI2_D1_P
7	GND_DIG
8	CSI2_CLK_N
9	CSI2_CLK_P
10	GND_DIG
11	CSI2_D2_N
12	CSI2_D2_P
13	GND_DIG
14	CSI2_D3_N
15	CSI2_D3_P
16	GND_DIG
17	CAM2_PWDN_1P8
18	CAM2_MCLK_1P8
19	GND_DIG
20	CAM2_I2C_SCL_3P3
21	CAM2_I2C_SDA_3P3
22	V_3P3

Connector PN: 2-1734592-2

Camera supported: TBD

Mating Cable PN: FFC Cable included with camera.

9.7 Serial Ports

Two serial ports one supporting RS232 and the second with RS232/RS485 (selected based on Jumper settings) are connected to one single 2x5 2mm header. One half of this connector has 1st Serial port which is RS232 protocol, and second half has 2nd Serial port which is either RS232/S485. The RS232/RS485 is also available in DB9 connector on the front edge but at a time only one of the connectors must be used.

TX1	1	2	RTS1
RX1	3	4	CTS1
GND	5	6	GND
TX2/TX2_P/RX2_P	7	8	RTS2/TX2_N/RX2_N
RX2	9	10	RX2

Connector type: 2x5 2mm Header

Connector PN: 0877581016

Mating Cable PN: 6981075

DB9 connector Pinout is as follows

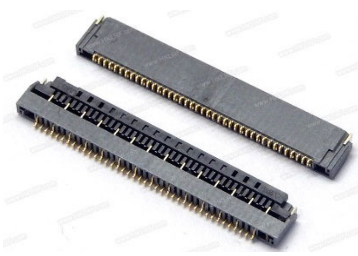
1	NC
2	RX2
3	TX2/TX2_P/RX2_P
4	NC
5	NC
6	NC
7	RTS2/TX2_N/RX2_N
8	CTS2
9	NC

Connector type: D-SUB Male 9POS R/A
Connector PN: A-DS 09 A/KG-T2S
Mating Cable PN: Generic

9.8 Expansion connector

1x PCIe x1 lane, 1x USB3.0 and 1x USB2.0 ports are routed to the Expansion connector to support additional Ethernet, USB3.0 and USB2.0 ports to customers who wants additional interface availability. Pinout is as follows:

VIN	1	21	USB2_D1_DB_P
VIN	2	22	GND
VIN	3	23	USB3_TX1_DB_P
VIN	4	24	USB3_TX1_DB_N
VIN	5	25	GND
VIN	6	26	USB3_RX1_DB_P
VIN	7	27	USB3_RX1_DB_N
VIN	8	28	GND
PCIE RESET#	9	29	PCIE1_CLKREQ_NX_3P3#
GND	10	30	DB_PRESENT_3P3#
PCIE1_XNX_DB_TX_P	11	31	GND
PCIE1_XNX_DB_TX_N	12	32	NC
GND	13	33	NC
PCIE1_XNX_DB_RX_P	14	34	NC
PCIE1_XNX_DB_RX_N	15	35	NC
GND	16	36	NC
PCIE1_XNX_DB_CLK_P	17	37	NC
PCIE1_XNX_DB_CLK_N	18	38	GND
GND	19	39	NC
USB2_D1_DB_N	20	40	PCIE_MOD_WAKE_3P3#



Connector type: 40 position 0.5mm Header

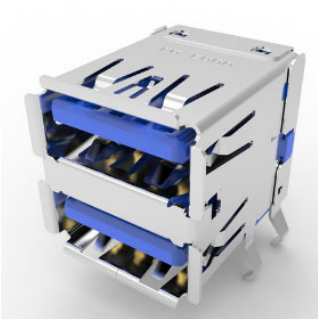
Connector PN: FH55-40S-0.5SH

9.9 USB 3.0/2.0

Two USB3.0/USB2.0 ports of the board are accessed with a RA stacked standard connector as shown below:

Both top and bottom ports follow the standard pinout.

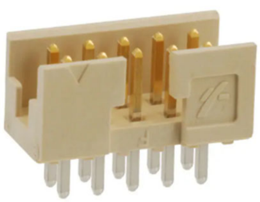
1	USB_PWR
2	USB2_D-
3	USB2_D+
4	GND
5	USB3_RX-
6	USB3_RX+
7	GND
8	USB3_TX-
9	USB3_TX+



Connector PN: 484060003
Mating Cable PN: NA

One USB3.0/USB2.0 port muxed between the expansion connector and 2x5 pin header follows the below pinout:

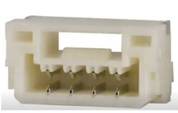
USB3_RX-	**1**	**2**	GND_CH
USB3_RX+	**3**	**4**	GND
GND	**5**	**6**	USB2_D+
USB3_TX-	**7**	**8**	USB2_D-
USB3_TX+	**9**	**10**	USB_PWR



Connector PN: 98414-G06-10LF
Connector Type: Vertical Header TH
Mating Cable PN: 6980603

One USB2.0 port from the USB2.0 hub is available at 1x4 pin header and follows the below pinout: By default vertial header is used and option for RA connector is provided on the baseboard

USB PWR	**1**	**5**	USB PWR
USB2_D-	**2**	**6**	USB2_D-
USB2_D+	**3**	**7**	USB2_D+
GND	**4**	**8**	GND



Connector PN: BM04B-GHS-TBT(LF)(SN)(N)

Connector Type: 1x4 1.25mm pitch SMD

Mating Cable PN: 6980106

9.10 M.2 PCIe SSD Socket

An M.2 M-key connector is provided for storage applications interfaced by the x4 PCIe lanes directly from the Orin NX module. All TX/RX signals are with respect to the Module.

The connector pinouts are as given below:

GND	1	2	3.3V
GND	3	4	3.3V
PERn3	5	6	ERASE MEMORY
PERp3	7	8	NC
GND	9	10	NC
PETn3	11	12	3.3V
PETp3	13	14	3.3V
GND	15	16	3.3V
PERn2	17	18	3.3V
PERp2	19	20	NC
GND	21	22	NC
PETn2	23	24	NC
PETp2	25	26	NC
GND	27	28	NC
PERn1	29	30	NC
PERp1	31	32	NC
GND	33	34	NC
PETn1	35	36	NC
PETp1	37	38	NC
GND	39	40	I2C_CLK
PERn0	41	42	I2C_DAT
PERp0	43	44	ALERT
GND	45	46	NC
PETn0	47	48	NC
PETp0	49	50	PERST#
GND	51	52	CLKREQ#
REFCLKN	53	54	PEWake#
REFCLKP	55	56	NC
GND	57	58	NC
	KEY		
NC	67	68	SUSCLK
NC	69	70	3.3V
GND	71	72	3.3V
GND	73	74	3.3V
GND	75		

Connector PN: 10128798-005RLF

Connector Type: M-Key

Mating Cable PN: NA

9.11 M.2 E-Key

An M.2 E-Key connector is provided with x1 PCIe and x1 USB2.0. All TX/RX signals are with respect to the Module. TX on the socket drives RX on the installed module, and RX on the socket is driven by TX on the installed module. One mounting standoff is used at the far end of the module installation site. This standoff is not connected to ground.

GND	1	2	V_3P3
USB2_AP_P	3	4	V_3P3
USB2_AP_N	5	6	NC
GND	7	8	NC
NC	9	10	NC
NC	11	12	NC
NC	13	14	NC
NC	15	16	NC
NC	17	18	GND
NC	19	20	NC
NC	21	22	NC
NC	23	32	NC
	KEY		
GND	33	34	NC
PCIE1_M2_TX0_P	35	36	NC
PCIE1_M2_TX0_N	37	38	NC
GND	39	40	NC
PCIE1_RX0_P	41	42	NC
PCIE1_RX0_N	43	44	NC
GND	45	46	NC
PCIE1_CLK_P	47	48	NC
PCIE1_CLK_N	49	50	M2E_SUSCLK_32KHZ
GND	51	52	PCIE1_RST
PCIE1_CLKREQ	53	54	W_DISABLE2
PCIE_WAKE	55	56	W_DISABLE1
GND	57	58	I2C2_M2E_SDA
NC	59	60	I2C2_M2E_SCL
NC	61	62	NC
GND	63	64	NC
NC	65	66	NC
NC	67	68	NC
GND	69	70	NC
NC	71	72	V_3P3

NC	73	74	V_3P3
GND	75	76	GND
GND	77		

Connector PN: 2199230-4

Connector Type: E-Key

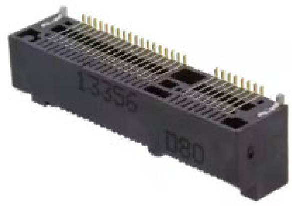
Mating Cable PN: NA

9.12 Minicard

The minicard provides extension options with x1 PCIe and x1 USB2.0 with SIM connector. All TX/RX signals are with respect to the host. TX on the socket drives RX on the installed module, and RX on the socket is driven by TX on the installed module. The mounting standoffs of the module installation site are not connected to ground.

PCIe WAKE#	1	2	V_3P3
NC	3	4	GND
NC	5	6	+1.5V
PCIe CLKREQ#	7	8	UIM PWR
GND	9	10	UIM CLK
PCIe CLK-	11	12	UIM DATA
PCIe 1 Clk+	13	14	UIM RESET
GND	15	16	UIM VPP
	KEY		
NC	17	18	GND
NC	19	20	NC
GND	21	22	PCIe Reset-
PCIe RX-	23	24	V_3P3
PCIe RX+	25	26	GND
GND	27	28	+1.5V
GND	29	30	NC
PCIe TX-	31	32	NC
PCIe TX+	33	34	GND
GND	35	36	USB D-
GND	37	38	USB D+
V_3P3	39	40	GND
V_3P3	41	42	NC
GND	43	44	NC
NC	45	46	NC
NC	47	48	+1.5V

NC	49	50	GND
NC	51	52	V_3P3



Connector PN: 1759547-1

9.13 Digital I/O

The board provides 16x GPIOs which can be individually programmed for input or output functionalities. The GPIOs are accessible on a 2x10 header.

The pinout of the connector is as given below:

DIO_PA0	1	2	DIO_PA1
DIO_PA2	3	4	DIO_PA3
DIO_PA4	5	6	DIO_PA5
DIO_PA6	7	8	V_DIO_PA7
GND	9	10	3.3V / 5V
DIO_PB0	11	12	DIO_PB1
DIO_PB2	13	14	DIO_PB3
DIO_PB4	15	16	DIO_PB5
DIO_PB6	17	18	V_DIO_PB7
GND	19	20	3.3V / 5V

Connector PN: 2011-2X40G00SD025/SN

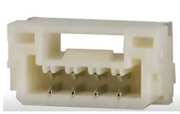
Connector Type: 2x10 2mm Header

Cable PN: 6980108

9.14 CAN

The pinouts for the CAN connector are as shown below:

GND CAN	1
CAN_L	2
CAN_H	3
GND CAN	4



Connector PN: BM04B-GHS-TBT(LF)(SN)(N)

Connector Type: 1x4 1.25mm pitch SMD

Mating Cable PN: 6981182

9.15 Utility

The base board provides access to a few housekeeping signals on a 2x10 header. The connector pinouts are as follows:

+3P3	1	2	+5P0
Force Off 5P0	3	4	SPI SS 3P3
Force Recovery 1P8	5	6	SPI MISO 3P3
Power Button 5P0	7	8	SPI CLK 3P3
Reset 1P8	9	10	SPI MOSI 3P3
GND	11	12	GND
Debug UART RX 3P3	13	14	I2C CLK 3P3
Debug UART TX 3P3	15	16	I2C DATA 3P3
GND	17	18	GND
GND	19	20	GND

Connector PN: 220-97-36GB01

Connector Type: 2x10, 2mm Header

Cable PN: NA

9.16 Orin Nano/NX Module Connector Pinout

Jetson SODIMM Signal Name	Jetson Orin NX Function	Pin # Top Odd		Pin # Bottom Even	Jetson SODIMM Signal Name	Jetson Orin NX Function
GND	GND	1		2	GND	GND
CSI1_D0_N	CSI1_D0_N	3		4	CSI0_D0_N	CSI0_D0_N
CSI1_D0_P	CSI1_D0_P	5		6	CSI0_D0_P	CSI0_D0_P
GND	GND	7		8	GND	GND
CSI1_CLK_N	CSI1_CLK_N	9		10	CSI0_CLK_N	CSI0_CLK_N
CSI1_CLK_P	CSI1_CLK_P	11		12	CSI0_CLK_P	CSI0_CLK_P
GND	GND	13		14	GND	GND
CSI1_D1_N	CSI1_D1_N	15		16	CSI0_D1_N	CSI0_D1_N
CSI1_D1_P	CSI1_D1_P	17		18	CSI0_D1_P	CSI0_D1_P
GND	GND	19		20	GND	GND
CSI3_D0_N	CSI3_D0_N	21		22	CSI2_D0_N	CSI2_D0_N
CSI3_D0_P	CSI3_D0_P	23		24	CSI2_D0_P	CSI2_D0_P
GND	GND	25		26	GND	GND
CSI3_CLK_N	CSI3_CLK_N	27		28	CSI2_CLK_N	CSI2_CLK_N
CSI3_CLK_P	CSI3_CLK_P	29		30	CSI2_CLK_P	CSI2_CLK_P
GND	GND	31		32	GND	GND
CSI3_D1_N	CSI3_D1_N	33		34	CSI2_D1_N	CSI2_D1_N
CSI3_D1_P	CSI3_D1_P	35		36	CSI2_D1_P	CSI2_D1_P
GND	GND	37		38	GND	GND
DP0_TXD0_N	USBSS1_RX_N	39		40	CSI4_D2_N	PCIE2_RX0_N
DP0_TXD0_P	USBSS1_RX_P	41		42	CSI4_D2_P	PCIE2_RX0_P
GND	GND	43		44	GND	GND
DP0_TXD1_N	USBSS1_TX_N	45		46	CSI4_D0_N	PCIE2_TX0_N
DP0_TXD1_P	USBSS1_TX_P	47		48	CSI4_D0_P	PCIE2_TX0_P
GND	GND	49		50	GND	GND
DP0_TXD2_N	USBSS2_RX_N	51		52	CSI4_CLK_N	PCIE2_CLK_N
DP0_TXD2_P	USBSS2_RX_P	53		54	CSI4_CLK_P	PCIE2_CLK_P
GND	GND	55		56	GND	GND
DP0_TXD3_N	USBSS2_TX_N	57		58	CSI4_D1_N	PCIE2_RX1_N (PCIE3_RX0_N)
DP0_TXD3_P	USBSS2_TX_P	59		60	CSI4_D1_P	PCIE2_RX1_P (PCIE3_RX0_P)
GND	GND	61		62	GND	GND
DP1_TXD0_N	DP1_TXD0_N	63		64	CSI4_D3_N	PCIE2_TX1_N (PCIE3_TX0_N)
DP1_TXD0_P	DP1_TXD0_P	65		66	CSI4_D3_P	PCIE2_TX1_P (PCIE3_TX0_P)
GND	GND	67		68	GND	GND
DP1_TXD1_N	DP1_TXD1_N	69		70	DSI_D0_N	RSVD
DP1_TXD1_P	DP1_TXD1_P	71		72	DSI_D0_P	RSVD
GND	GND	73		74	GND	GND
DP1_TXD2_N	DP1_TXD2_N	75		76	DSI_CLK_N	RSVD
DP1_TXD2_P	DP1_TXD2_P	77		78	DSI_CLK_P	RSVD
GND	GND	79		80	GND	GND
DP1_TXD3_N	DP1_TXD3_N	81		82	DSI_D1_N	RSVD
DP1_TXD3_P	DP1_TXD3_P	83		84	DSI_D1_P	RSVD
GND	GND	85		86	GND	GND
GPIO00	GPIO00	87		88	DP0_HPD	RSVD
SPI0_MOSI	SPI0_MOSI	89		90	DP0_AUX_N	RSVD
SPI0_SCK	SPI0_SCK	91		92	DP0_AUX_P	RSVD
SPI0_MISO	SPI0_MISO	93		94	HDMI_CEC	HDMI_CEC
SPI0_CS0*	SPI0_CS0*	95		96	DP1_HPD	DP1_HPD
SPI0_CS1*	SPI0_CS1*	97		98	DP1_AUX_N	DP1_AUX_N
UART0_TXD	UART0_TXD	99		100	DP1_AUX_P	DP1_AUX_P
UART0_RXD	UART0_RXD	101		102	GND	GND
UART0_RTS*	UART0_RTS*	103		104	SPI1_MOSI	SPI1_MOSI
UART0_CTS*	UART0_CTS*	105		106	SPI1_SCK	SPI1_SCK
GND	GND	107		108	SPI1_MISO	SPI1_MISO
USB0_D_N	USB0_D_N	109		110	SPI1_CS0*	SPI1_CS0*
USB0_D_P	USB0_D_P	111		112	SPI1_CS1*	SPI1_CS1*
GND	GND	113		114	CAM0_PWDN	CAM0_PWDN

Jetson SODIMM Signal Name	Jetson Orin NX Function	Pin # Top Odd		Pin # Bottom Even	Jetson SODIMM Signal Name	Jetson Orin NX Function
USB1_D_N	USB1_D_N	115		116	CAM0_MCLK	CAM0_MCLK
USB1_D_P	USB1_D_P	117		118	GPIO01	GPIO01 (CLK)
GND	GND	119		120	CAM1_PWDN	CAM1_PWDN
USB2_D_N	USB2_D_N	121		122	CAM1_MCLK	CAM1_MCLK
USB2_D_P	USB2_D_P	123		124	GPIO02	GPIO02
GND	GND	125		126	GPIO03	GPIO03
GPIO04	GPIO04	127		128	GPIO05	GPIO05
GND	GND	129		130	GPIO06	GPIO06
PCIE0_RX0_N	PCIE0_RX0_N	131		132	GND	GND
PCIE0_RX0_P	PCIE0_RX0_P	133		134	PCIE0_TX0_N	PCIE0_TX0_N
GND	GND	135		136	PCIE0_TX0_P	PCIE0_TX0_P
PCIE0_RX1_N	PCIE0_RX1_N	137		138	GND	GND
PCIE0_RX1_P	PCIE0_RX1_P	139		140	PCIE0_TX1_N	PCIE0_TX1_N
GND	GND	141		142	PCIE0_TX1_P	PCIE0_TX1_P
CAN_RX	CAN_RX	143		144	GND	GND
CAN_TX	CAN_TX	145		146	GND	GND
GND	GND	147		148	PCIE0_TX2_N	PCIE0_TX2_N
PCIE0_RX2_N	PCIE0_RX2_N	149		150	PCIE0_TX2_P	PCIE0_TX2_P
PCIE0_RX2_P	PCIE0_RX2_P	151		152	GND	GND
GND	GND	153		154	PCIE0_TX3_N	PCIE0_TX3_N
PCIE0_RX3_N	PCIE0_RX3_N	155		156	PCIE0_TX3_P	PCIE0_TX3_P
PCIE0_RX3_P	PCIE0_RX3_P	157		158	GND	GND
GND	GND	159		160	PCIE0_CLK_N	PCIE0_CLK_N
USBSS_RX_N	USBSS0_RX_N	161		162	PCIE0_CLK_P	PCIE0_CLK_P
USBSS_RX_P	USBSS0_RX_P	163		164	GND	GND
GND	GND	165		166	USBSS_TX_N	USBSS0_TX_N
PCIE1_RX0_N	PCIE1_RX0_N	167		168	USBSS_TX_P	USBSS0_TX_P
PCIE1_RX0_P	PCIE1_RX0_P	169		170	GND	GND
GND	GND	171		172	PCIE1_TX0_N	PCIE1_TX0_N
PCIE1_CLK_N	PCIE1_CLK_N	173		174	PCIE1_TX0_P	PCIE1_TX0_P
PCIE1_CLK_P	PCIE1_CLK_P	175		176	GND	GND
GND	GND	177		178	MOD_SLEEP*	MOD_SLEEP*
PCIE_WAKE*	PCIE_WAKE*	179		180	PCIE0_CLKREQ*	PCIE0_CLKREQ*
PCIE0_RST*	PCIE0_RST*	181		182	PCIE1_CLKREQ*	PCIE1_CLKREQ*
PCIE1_RST*	PCIE1_RST*	183		184	GBE_MDI0_N	GBE_MDI0_N
I2C0_SCL	I2C0_SCL	185		186	GBE_MDI0_P	GBE_MDI0_P
I2C0_SDA	I2C0_SDA	187		188	GBE_LED_LINK	GBE_LED_LINK
I2C1_SCL	I2C1_SCL	189		190	GBE_MDI1_N	GBE_MDI1_N
I2C1_SDA	I2C1_SDA	191		192	GBE_MDI1_P	GBE_MDI1_P
I2S0_DOUT	I2S0_DOUT	193		194	GBE_LED_ACT	GBE_LED_ACT
I2S0_DIN	I2S0_DIN	195		196	GBE_MDI2_N	GBE_MDI2_N
I2S0_FS	I2S0_FS	197		198	GBE_MDI2_P	GBE_MDI2_P
I2S0_SCLK	I2S0_SCLK	199		200	GND	GND
GND	GND	201		202	GBE_MDI3_N	GBE_MDI3_N
UART1_TXD	UART1_TXD	203		204	GBE_MDI3_P	GBE_MDI3_P
UART1_RXD	UART1_RXD	205		206	GPIO07	GPIO07
UART1_RTS*	UART1_RTS*	207		208	GPIO08	GPIO08
UART1_CTS*	UART1_CTS*	209		210	CLK_32K_OUT	CLK_32K_OUT
GPIO09	GPIO09	211		212	GPIO10	GPIO10
GND	GND	241		242	GND	GND
GND	GND	243		244	GND	GND
GND	GND	245		246	GND	GND
GND	GND	247		248	GND	GND
GND	GND	249		250	GND	GND
VDD_IN	VDD_IN	251		252	VDD_IN	VDD_IN
VDD_IN	VDD_IN	253		254	VDD_IN	VDD_IN
VDD_IN	VDD_IN	255		256	VDD_IN	VDD_IN
VDD_IN	VDD_IN	257		258	VDD_IN	VDD_IN
VDD_IN	VDD_IN	259		260	VDD_IN	VDD_IN

9.17 Orin Nano / NX Module Block Diagram

The following Block Diagram illustrates a high-level view of the Orin Nano / NX Series components. The I/O ports are accessible via the carrier board.