

EdgeAI-ORN

Hardware Reference Guide

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1 Introduction

1.1 About this document

1.1.1 Purpose of this document

This hardware reference guide describes the electrical interfaces of the EdgeAI-ORN computer and provides the necessary information to operate and program the Compulab EdgeAI-ORN.

Unless specified, all the information is relevant to the with or without enclosure.

1.1.2 Intended audience

This document is written for system engineers, integrators, firmware developers and compliance specialists.

Installers and field technicians should consult the EdgeAI-ORN user manual.

1.2 Revision notes

Table 1 Document revision notes

Revision	Date	Description
1.0	July 2025	First release

Newer versions may be available on the Compulab Edge Computing website:

<https://edge.compulab.com/>

1.3 Related documents

It's recommended to read this document together with the latest versions of Nvidia documents for Jetson Orin NX/Nano, which are published by Nvidia.

For additional information not covered in this manual, please refer to the documents in Compulab Edge Computing Wiki, like the Owner's manual and datasheet.

2 Overview

2.1 Feature highlights

- NVIDIA® Jetson Orin™ NX/Nano
- MIL-STD-810G, up to 80°C
- RS-232/RS-485 + CAN + GPIOs
- 4x USB 3.2 for camera input
- 4x PoE 2.5GbE optional camera input
- 4x GMSL2 optional camera input
- 4x FPD Link IV optional camera input
- Optional Out-Of-Band management
- 9V – 36V DC power input

2.2 Specifications

Table 2 Specifications

Computation module	Jetson Orin™ NX 16GB	Up to 157 TOPS 16GB LPDDR5 10W / 15W / 25W / 40W
	Jetson Orin™ NX 8GB	Up to 117 TOPS 8GB LPDDR5 10W / 15W / 25W / 40W
	Jetson Orin™ Nano 8GB	Up to 67 TOPS 8GB LPDDR5 7W / 15W / 25W
	Jetson Orin™ Nano 4GB	Up to 34 TOPS 4GB LPDDR5 7W / 10W / 25W
Storage	M.2 Key-M	PCIe Gen. 4.1 x4, size up to 2280 for NVMe
Serial/GPIO	Serial port	Isolated RS-232/422/485 on terminal block
	CAN bus	Isolated CAN bus on terminal block
	GPIO	2x GPI + 2x GPO
Display	HDMI	HDMI 2.0, up to 4K @ 30Hz
Wireless Connectivity	M.2 Key-E	For Wi-Fi/BT M.2 2230 module
	M.2 Key-B	For M.2 LTE/5G modem
Ethernet, standard	1x 2.5 GbE	2.5Gbps Ethernet from Intel® i226 on RJ45
	1x 1 GbE	1 Gbps Ethernet from Jetson module on RJ45
USB	USB 2.0	2x USB 2.0 on Type-A
	USB 3.2	4x USB 3.2 10Gbps (20Gbps in total)
PoE input expansion	4x 2.5 GbE	4x 2.5Gbps PoE Ethernet from Intel® i226 on RJ45
	PoE power capability	4x 15.4W PoE power delivery
SerDes GMSL2 input expansion	4x GMSL2	4x GMSL2 deserializer input on FAKRA Z
	PoC power capability	4x Power over Coax, 12V up to 1A
SerDes FPD Link IV input expansion	4x FPD Link IV	4x FPD Link IV deserializer input on FAKRA Z
	PoC power capability	4x Power over Coax, 12V up to 1A

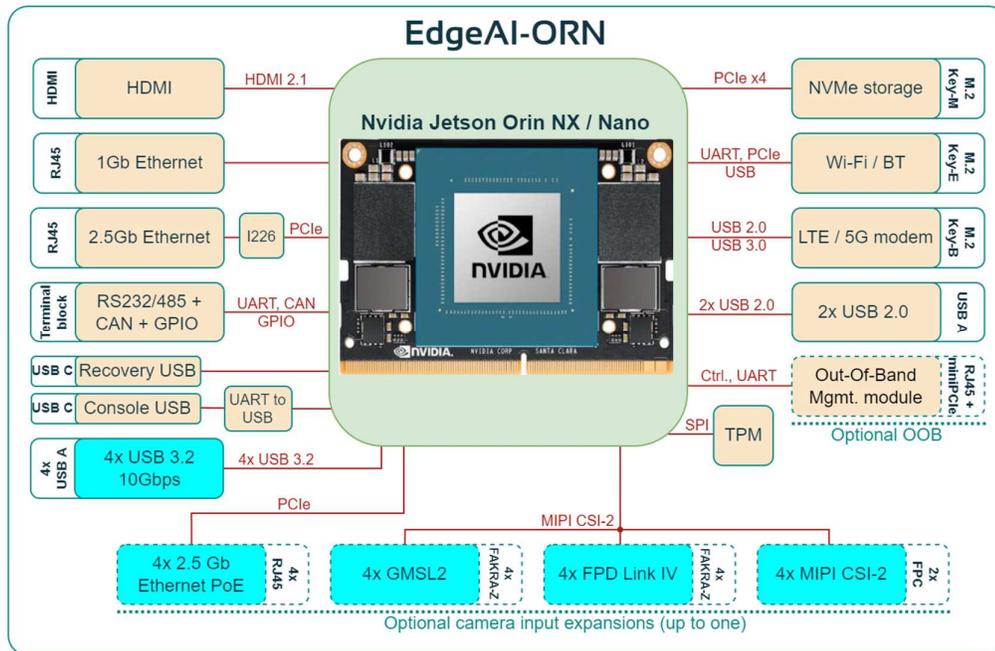
MIPI-CSI input expansion	4x MIPI-CSI	4-lane MIPI-CSI, 2.5Gbps per pair, on 2 FFC connectors
	Pin-out	2x 22-position, Jetson Orin standard pin-out
TPM	TPM 2.0	TPM 2.0, SLB9670
Optional OOB	Out-of-band module	Optional Allxon Bolt OOB enabler w/ dedicated Ethernet/modem
Debug and recovery ports	Recovery port	USB recovery port on USB Type-C
	Debug console port	Serial debug console w/ UART-to-USB on USB Type-C
OS support	Nvidia Jetpack 6.2	NVIDIA Jetson Linux 36.4.3 (Jetpack 6.2 on Ubuntu 22.04)
Power input	DC input	9V – 36V DC power input ² on a power jack with twist-locking
Operating Environment	Operation temperature	-25°C to 75°C
	Humidity	5% - 95% non-condensing
Heat dissipation	Cooling	Passive/active cooling
	Optional external fan	Optional, external speed-controlled fan for enhanced heat dissipation
Physical Characteristics	Dimensions	Fanless: 59 mm X 157 mm X 130 mm
	Weight	~ 1.2 Kg
	Mounting	Side / bottom VESA / DIN Rail mount

Notes:

1. The NVMe interface of Orin Nano modules is limited to Gen. 3.
2. PoE input expansion requires 12V or more DC input.

3 Hardware architecture

3.1 Block diagram



Note: This is a high-level block diagram and many hardware details do not appear. See below for more information.

3.2 Hardware architecture details

The EdgeAI-ORN is constructed from a main board (SB-ORN) and a terminal block board (EB-EDGETB), which also features a power button and a debug port via USB Type-C.

The Jetson module is directly connected to SB-ORN via a SODIMM connector.

Additional, optional electric boards are the Camera input expansions and the Out of band management module.

The TPM 2.0 chip is Infineon SLB9670 or compatible. It's connected to the Jetson module via SPI0 interface.

For more information on the interfaces, refer to the Interfaces and Connectors chapter.

4 Interfaces and connectors

Refer to Table 3 below for a summary of the EdgeAI-ORN interfaces. More details on each interface are listed afterwards.

Table 3 *Interface and connector summary*

Location	Interface	Connector	
Front Panel	4x USB 3.2 Gen. 2	4x USB Type-A	
	HDMI 2.0	HDMI	
	Recovery port	USB Type-C	
	2 x 2.5/1Gb Ethernet ports	2 x RJ45	
	2x USB 2.0	2x USB Type-A	
	9V – 36V DC power input2	1x 5.5 mm power jack with twist-locking	
	Console port	USB Type-C	
	Isolated RS-232/422/485	Terminal block	
	Isolated CAN bus	Terminal block	
	Isolated 2x GPI + 2x GPO	Terminal block	
	Power button	On/Off push button with power LED	
	2x antennas for Wi-Fi/BT or modem	2x SMA	
	Optional Camera input expansion 4x PoE	4x RJ45	
	Optional Camera input expansion 4x GMSL2	4x FAKRA Z	
Optional Camera input expansion 4x FPD Link IV	4x FAKRA Z		
Rear Panel	Micro-SIM Tray for M.2 LTE/5G modem	Micro-SIM Tray	
	4x antennas for Wi-Fi/BT or modem	4x SMA	
	Optional OOB management module	RJ45, Micro-SIM slot, LEDs + buttons	
Location	Form factor	Usage	Interface
Internal Bottom	M.2 Key-M up to 2280	NVMe storage	PCIe Gen 41 x4
	M.2 Key-B up to 3042 or 3052	LTE/5G modem	USB 3.2 + 2.0
	M.2 Key-E 2230	Wi-Fi/BT module	PCIe + UART + I2S + USB 2.0
	10-pin header	OOB module	UART, control
	4-pin header	Remote power button	Power button + LED signals

Notes:

1. The NVMe interface of Orin Nano modules is limited to Gen. 3
2. PoE input expansion requires 12V or more DC input

4.1 Industrial interface terminal block

4.1.1 General information

EdgeAI-ORN includes a 20-pin terminal block with several industrial interfaces:

- 2x isolated digital input signals
- 2x isolated digital output signals
- Isolated RS-232 or RS-485/422 half or full duplex
- Isolated CAN bus
- Isolated remote power button input signal
- System ground
- Chassis connection

Each of these interfaces can work in parallel with no dependency on others. (RS-232 and RS-485/422 or mutually exclusive).

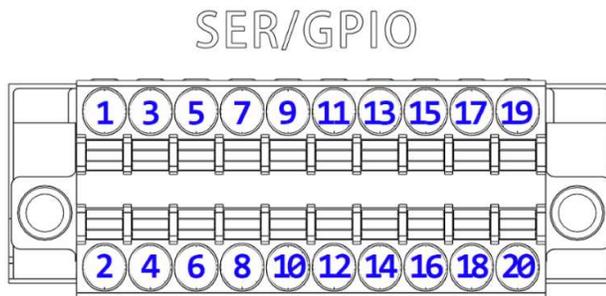
The terminal block plug has a capacity for wires of AWG 20 – 26, with a stripping length of 7mm to 8mm.

4.1.2 Connector type

2x10 terminal block (Kunacon HGCH25420500K) with wire matching plug (Kunacon PDFD25420500K)

4.1.3 Pinout

The terminal block pin enumeration is according to the illustration below (front view):



The pin names and descriptions are listed in Table 4.

Table 4 Terminal block pinout

Pin	Name	Type	Description
1	DIO_IN0	Iso. I	Isolated digital Input 0
2	DIO_VIN	Iso. PWR	DO isolated ref. voltage
3	DIO_IN1	Iso. I	Isolated digital Input 1
4	DIO_OUT0	Iso. O	Isolated digital output 0
5	DIO_GND	Iso. PWR	DIO isolated ref. ground
6	DIO_OUT1	Iso. O	Isolated digital output 1
7	RS232_RTS / RS485_FD_TXP/ RS485_HD_DP	Iso. IO	RS-232 mode: RTS RS-485 full duplex: TX+ RS-485 half duplex: D+

8	RS232_TX / RS485_FD_TXN / RS485_HD_DN	Iso. IO	RS-232 mode: TX RS-485 full duplex: TX- RS-485 half duplex: D-
9	RS232_CTS / RS485_FD_RXN	Iso. IO	RS-232 mode: CTS RS-485 full duplex: RX- RS-485 half duplex: Not connected
10	RS232_RX / RS485_FD_RXP	Iso. IO	RS-232 mode: RTS RS-485 full duplex: RX+ RS-485 half duplex: Not connected
11	RS485_TERM_CTRL	Iso. Ctrl	RS-485 120Ω termination control: Connected to GND (pin 12): Termination on Not connected: Termination off
12	RS232_485_CAN_GND	Iso. PWR	RS-232, RS-485, CAN bus and PWR_BTN isolated ground
13	RS485_HD-FD#_CTRL	Iso. Ctrl	RS-485 full duplex or half duplex control: Connected to GND (pin 12): Full duplex Not connected: Half duplex
14	RS485-RS232#_CTRL	Iso. Ctrl	RS-485 or RS-232 control: Connected to GND (pin 12): RS-232 Not connected: RS-485
15	CAN_H	Iso. IO	CAN bus High-level input/output line
16	CAN_L	Iso. IO	CAN bus Low-level input/output line
17	PWR_BTN	Iso. I	Isolated remote power button input
18	CAN_TERM_CTRL	Iso. Ctrl	CAN bus 120Ω termination control: Connected to GND (pin 12): Termination on Not connected: Termination off
19	GND_SYS	PWR	Internal system ground
20	CHASSIS	PWR	Device chassis (Protective earth connection)

4.1.4 Digital input (DI)

There are two isolated digital input pins. The input voltage levels and additional parameters are described in the table below. All voltages are referenced to the DIO_GND pin. The DI pins can also operate in a reverse direction (with a negative input voltage).

Table 5 DI parameters

Parameter	Description
Isolation	DIOs are isolated using optocouplers for up to 2500 VAC _{RMS}
VIH - Low to High state input voltage	Typ.: 9.4V, Max.: 11V
VIL - High to low state input voltage	Min.: 5V Typ.: 7.5V
Input triggering voltage hysteresis	1.2V to 2.6V
Input voltage for normal operation	-30V to 30V
ESD protection	<ul style="list-style-type: none"> IEC 61000-4-2 level 1: ±4kV (air discharge) IEC 61000-4-2 level 1: ±2kV (contact discharge)

Receiver and isolation devices	ST CLT03-2Q3 + On Semi MOCD207M or compatible
GPIO pins from Jetson SOM	<ul style="list-style-type: none"> • DIO_IN0: GPIO12 • DIO_IN1: GPIO13

4.1.5 Digital output (DO)

There are two isolated digital output pins. A reference voltage must be applied between DIO_VIN and DIO_GND for DO operation. The output voltage levels will be adjusted accordingly, as described in the table below.

DIO_VIN and DO voltages are referenced to the DIO_GND pin.

Table 6 DO parameters

Parameter	Description
Isolation	DIOs are isolated using optocouplers up to 2500 VACRMS
DIO_VIN voltage	6V to 36V
Ron – DIO_VIN to DO pin resistance	Typ.: 45mΩ, Max.: 78mΩ
ILNOM – Continues load current	2.0A per channel, 3.0A total
VIH - Low to High state input voltage	Typ.: 9.4V, Max.: 11V
VIL - High to low state input voltage	Min.: 5V Typ.: 7.5V
Input triggering voltage hysteresis	1.2V to 2.6V
Input voltage for normal operation	-30V to 30V
ESD and surge protection	<ul style="list-style-type: none"> • HBM per ANSI/ESDA/JEDEC JS-001: ±4kV • CDM per ANSI/ESDA/JEDEC JS-002: ±750V • Surge protection, 42Ω, IEC 61000-4-5; 1.2/50uS: ±1kV
Driver and isolation devices	TI TPS272C + On Semi MOCD207M or compatible
GPIO pins from Jetson SOM	<ul style="list-style-type: none"> • DIO_OUT0: GPIO01 • DIO_OUT1: GPIO11

4.1.6 RS-232

The RS-232 interface is mutually exclusive with RS-485 and uses the same pins.

To enable RS-232 interface, pin RS485-RS232#_CTRL (pin 14) must be tied to the interface GND (RS232_485_CAN_GND, pin 12).

The voltage levels are referenced to the RS232_485_CAN_GND pin.

Table 7 RS-232 parameters

Parameter	Description
Isolation	RS-232 is isolated using optocouplers for up to 2500 VACRMS
RS-232 data rate	Up to 1Mbps
VOOUT – Output voltage swing	Min.: ±5.0V Typ.: ±5.5V
VIN – Input voltage range	-15V to +15V

VIL – Input voltage low	Min.: 0.8V, Typ.: 1.5V
VIH – Input voltage high	Typ.: 1.8V, Max.: 2.4V
ESD protection	<ul style="list-style-type: none"> IEC 61000-4-2: ±15kV (air discharge) IEC 61000-4-2: ±8kV (contact discharge) Human Body Model (HBM): ±15kV
Transceiver and isolation devices	Maxlinear SP330e + On Semi MOCD207M or compatible
Jetson UART interface	UART0

4.1.7 RS-485 (RS-422)

The RS-485 interface is mutually exclusive with RS-232 and uses the same pins.

RS-485 supports both half-duplex or full duplex modes, and also supports RS-422 when in full-duplex mode.

To enable RS-485 interface, pin RS485-RS232#_CTRL (pin 14) must be left unconnected.

To configure RS-485 interface use the RS-485 control pins. See the table below for details.

Table 8 RS-485 control pins

Pin	Name	If tied to GND	If unconnected
13	RS485_HD-FD#_CTRL	Full duplex	Half Duplex
11	RS485_TERM_CTRL	120Ω Termination	No termination

The table below summarizes additional technical properties of the RS-485 interface.

The voltage levels are referenced to the RS232_485_CAN_GND pin.

Table 9 RS-485 parameters

Parameter	Description
Isolation	RS-485 is isolated using optocouplers for up to 2500 VAC _{RMS}
RS-485 data rate	Up to 20Mbps
VOL – Output voltage low	Max.: 0.4V
VOH – Output voltage high	Min.: 4.4V
VOD – Diff. driver output	1.5V to 5V @ RL=54Ω (RS-485); 2V to 5V @ RL=100Ω (RS-422)
VCM – Driver common mode voltage	Max. 3V
VTH – Receiver Diff. threshold voltage	Min.: -200mV, Typ.: -125mV, Max.: -50mV
Receiver Input Hysteresis	25mV
Receiver Input Resistance	Min. 96kΩ
ESD protection	<ul style="list-style-type: none"> IEC 61000-4-2: ±15kV (air discharge) IEC 61000-4-2: ±8kV (contact discharge) Human Body Model (HBM): ±15kV

4.1.8 CAN Bus

The CAN bus of EdgeAI-ORN supports CAN-FD with compatibility for automotive applications.

To enable CAN bus 120Ω termination, connect CAN_TERM_CTRL (pin 18) to RS232_485_CAN_GND (pin 12).

The table below summarizes additional technical properties of the CAN bus interface.

The voltage levels are referenced to the RS232_485_CAN_GND pin.

Table 10 CAN bus parameters

Parameter	Description
Isolation	DIN EN 60112 (VDE 0303-11); IEC 60112: >600V
CAN and CAN-FD data rate	2, 5 and 8 Mbps
Output dominant state (logic 0): Diff. voltage	1.4V to 3.3V ($45\Omega \leq R_L \leq 70\Omega$)
Output recessive state (logic 1): Diff. voltage	-120mV to 12mV ($R_L = 60\Omega$)
Receiver diff. input voltages	Dominant (logic 0): $\geq 0.9V$; Recessive (logic 1): $\leq 0.5V$
ESD protection	<ul style="list-style-type: none"> • HBM per AEC Q100-002: $\pm 10kV$ • CDM per AEC Q100-011 level C5: $\pm 750V$
Transceiver and isolation devices	TI TCAN1057AV-Q1 + CA-IS3722HS or compatible

4.1.9 Power button signal

PWR_BTN is an isolated power button input signal to connect a remote power button to the system.

The signal is pulled up internally to 5V using a 47kΩ resistor. Pull the signal below 3.5V to ensure proper triggering (in reference to the isolated ground, RS232_485_CAN_GND).

PWR_BTN is isolated by MOCD207M optocoupler.

4.2 Ethernet

Note: This chapter is about the two standard Ethernet ports. For the four PoE Ethernet ports of the camera input expansion, go to chapter 4.9.1.

The main board features two Ethernet ports on a dual RJ45 connector. The numbers below are according to the front-panel marking enumeration:

Ethernet No. 0: 2.5GbE by Intel i226 Ethernet controller, which is connected to the Jetson module via PCIe 3.

Ethernet No. 1: 1 GbE by Jetson module on-board PHY.

4.3 USB

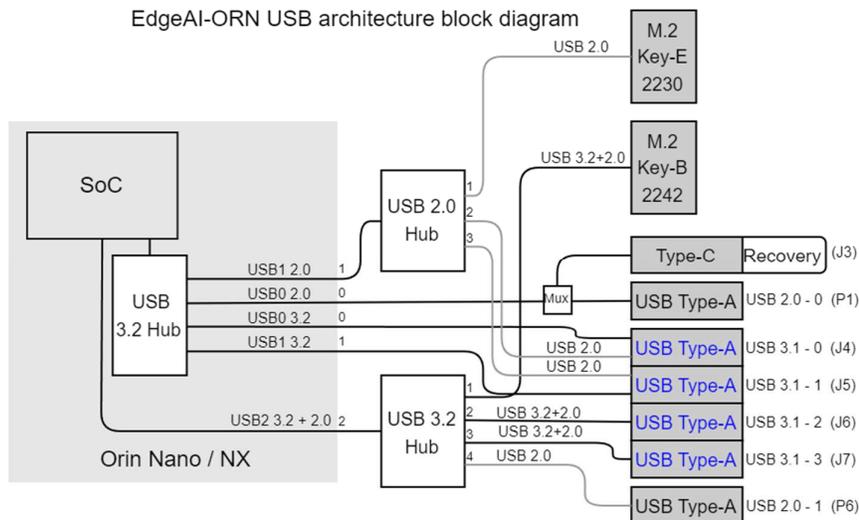
4.3.1 USB Architecture

EdgeAI-ORN features USB 3.2 and USB 2.0 interfaces for camera input, general-purpose USB connections, modem connections, and debugging.

The USB connector enumerations are as depicted below:



The USB architecture is described in the block diagram below. Details on the USB interfaces can be found in the following chapters.



Note: For the debug USB architecture, see the Debug USB section.

4.3.2 USB 3.2

EdgeAI-ORN features two USB 3.2 hubs: one in the Jetson NX/Nano module and the other on the baseboard. Both USB 3.2 hubs are of Realtek RTS5420 model.

EdgeAI-ORN has four USB Type-A connectors with a USB 3.2 Gen 2x1 interface. The throughput of each USB 3.2 interface is up to 10 Gbps, with a total throughput of up to 20 Gbps.

In accordance with the connection to the different USB 3.2 hubs, the throughput of each adjacent couple of connectors is up to 10 Gbps.

4.3.3 USB 2.0

The USB 2.0 signals come from one of the USB 3.2 hubs and from a USB 2.0 hub (SMSC (Microchip) USB2514B or compatible).

Each USB Type-A connector includes USB 2.0 interface.

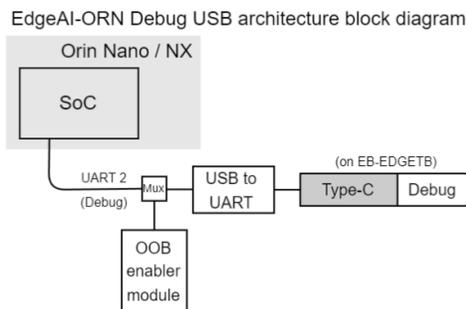
4.3.4 Recovery USB

The recovery USB is mutual with USB 2.0 Type-A no. 0. Connecting a USB host to the USB Type-C ‘Recovery’ connector will disconnect the USB Type-A connector from the interface, and the system will be functioning as a USB device for the recovery operation.

To prevent the recovery function from being available, the SW3 switch on the baseboard must be switched to OFF. By default, the recovery function is available upon connection of a USB host to the Type-C ‘Recovery’ connector.

4.3.5 Consol (Debug) USB

The console USB Type-C connector is located on the EB-EDGETB card. The architecture is described in the following diagram.



UART 2 is the main debug UART of the Jetson platform. A USB-to-UART bridge is included to facilitate usage of the debug port. By connecting a USB host the debug USB Type-C connector, the UART will be directed to the bridge and will become available.

When no USB host is connected, the UART is directed to the optional OOB management module for remote access debugging.

4.4 NVMe storage

The NVMe storage is available on an M.2 Key-M connector. M.2 of sizes 2230, 2242, 2260, and 2280 are supported.

4-lane PCIe is available on the M.2 Key-M, while the generation of PCIe depends on the type of Jetson module installed. See the table below for details.

Table 11 NVMe PCIe interface per Jetson module

Jetson module	PCIe Interface
Jetson Orin Nano 4GB	4-lane PCIe Gen. 3
Jetson Orin Nano 8GB	4-lane PCIe Gen. 3
Jetson Orin NX 8GB	4-lane PCIe Gen. 4
Jetson Orin NX 16GB	4-lane PCIe Gen. 4

The NVMe module is attached to a heat plate that dissipates the heat through the EdgeAI-ORN bottom cover. It helps the NVMe module maintain a low working temperature and operate at consistently high performance.

4.5 Wi-Fi/BT

Wi-Fi and Bluetooth functionality is possible using an M.2 Key-E 2230 module.

The M.2 Key-E connector includes the following interfaces:

- USB 2.0 (from the USB 2.0 hub)
- PCIe 1
- UART 1
- I2S

The Wake signal from the M.2 Key-E connector is routed to pin 124 of the Jetson module (GPIO02), with an on-board pull-up.

A 32KHz clock signal from the Jetson module is routed to the 32K clock input of the M.2 Key-E connector through a 3.3V buffer.

4.6 Modem

The EdgeAI-ORN features an M.2 Key-B slot for 5G or 4G/LTE modem connections.

The M.2 Key-B supports modem lengths of 42mm or 52mm (M.2 3042 or 3052) and includes the following interfaces:

- USB 2.0 (from the USB 3.2 hub)
- USB 3.2 (from the USB 3.2 hub)
- SIM card interface

The SIM card interface is routed to a Nano-SIM tray connector (U38), which is located on the back panel of the EdgeAI-ORN. The Tray can be extracted using a standard pin.

The M modem power off signal from the M.2 Key-B is routed to pin 110 of the Jetson module (GPIO3_PY.03), with an on-board pull-up.

4.7 HDMI

The supported features of the HDMI on the back panel depend on the Jetson module installed.

See the table below for details.

Table 12 *HDMI features per Jetson module*

Jetson module	HDMI version	Max. resolution	Max. PCLK
Jetson Orin Nano 4GB	HDMI 1.4	3840x2160 @ 30 Hz	388 MHz
Jetson Orin Nano 8GB	HDMI 1.4	3840x2160 @ 30 Hz	388 MHz
Jetson Orin NX 8GB	HDMI 2.0	3840x2160 @ 60 Hz	594 MHz
Jetson Orin NX 16GB	HDMI 2.0	3840x2160 @ 60 Hz	594 MHz

Note: While the HDMI with Jetson Orin Nano 4GB/8GB is compliant only with HDMI 1.4 due to the PCLK limitation, other features of HDMI 2.1 specification are supported. See Jetson Orin Nano documentation for additional details.

See Jetson Orin Nano/NX documentation for supported HDMI features.

4.8 Out-of-band management module (OOB)

EdgeAI-ORN supports both electrically and mechanically an Out-of-band management module of the Allxon Bolt model.

The OOB management module is mounted to the back panel with dedicated openings to RJ45, Nano-SIM, Power LED, Ethernet LED, two antenna holes and OOB module reset button.

The back panel with OOB management module is depicted below:



The reset button hole is located below the OOB SIM opening, and can be pushed using a pin.

The OOB module is connected to the EdgeAI-ORN base board using a customized cable, with the following interfaces (in addition to power and GND):

- UART2 (Jetson Debug UART)
- Power button signal
- System reset signal

Note: UART2 is mutual with the debug-port USB Type-C. When a host is connected to the debug port, the UART is disconnected from the OOB module.

See more information about the OOB management module in Allxon bolt documentation on Allxon's website.

4.9 Camera input expansions

The EdgeAI-ORN base board features a high-speed board-to-board connector (J9) with the following interfaces:

- 8 pairs of MIPI CSI-2
- PCIe 2 lane 0 (1-lane Gen. 4)
- I2C
- Power and power management signals

The B2B connector is used for attaching camera input expansions, to allow cameras with additional interfaces to be connected to the EdgeAI-ORN (The 4x USB 3.2 and 2x Ethernet interfaces are always available, from the main board).

The following chapters elaborate on the optional camera input expansion.

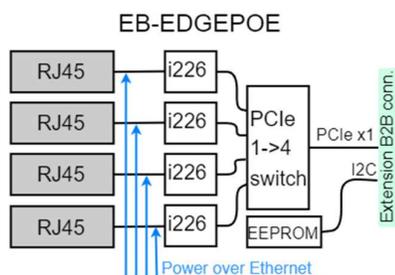
4.9.1 PoE Ethernet

PoE (Power over Ethernet) is used to deliver both power and data to cameras over a single Ethernet cable, simplifying installation, reducing wiring complexity, and enabling flexible placement without separate power supplies.

The 4x PoE camera input expansion module, EB-EDGEPOE, features four RJ45 connectors with 2.5GbE and PoE Type 1 power delivery (PSE), delivering up to 15.4W per port.

The module is connected to the main board using a high-speed B2B connector.

The expansion module architecture is described in the block diagram below.



PCIe 2 Lane 0 from the Jetson module is connected to PCIe packet switch (DIODES PI7C9X3G606GP or compatible). The downstream PCIe interfaces go to four Intel i226 Ethernet controllers with 2.5GbE.

Table 13 EB-EDGEPOE features

Feature	Parameter	Value
PCIe Switch	Model	DIODES PI7C9X3G606GP
	Ethernet controllers	4x Intel I226
Ethernet	Supported data rates	10/100/1000/2500 Mb/s
	Type	Type 1 PSE
Power over Ethernet	Power	-48V, Up to 15.4W /port

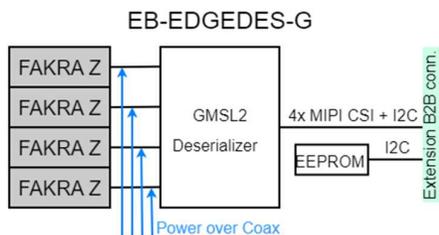
4.9.2 GMSL2

GMSL2 (Gigabit Multimedia Serial Link 2) is used to transmit high-bandwidth video, audio, and control data over a single coaxial or shielded twisted-pair cable with low latency and long cable reach.

The 4x GMSL2 camera input expansion module, EB-EDGEDES-G, features four FAKRA Z connectors with GMSL2 deserializer inputs and PoC (Power-over-Coax) for power supply to the cameras.

The module is connected to the main board using a high-speed B2B connector.

The expansion module architecture is described in the block diagram below.



Four 2-lane MIPI CSI-2 interfaces are connected to the GMSL2 deserializer (Analog Devices MAX96724). Four GMSL channels from 4 FAKRA Z connectors are connected to the deserializer.

Table 14 EB-EDGEDES-G features

Feature	Parameter	Value
GMSL2	Deserializer model	Analog Devices MAX96724
	Link rate per port	6 Gbps/3 Gbps GMSL2 or 3.12 Gbps GMSL1
Power over Coax (PoC)	Voltage	12V
	Current	Up to 1A in total

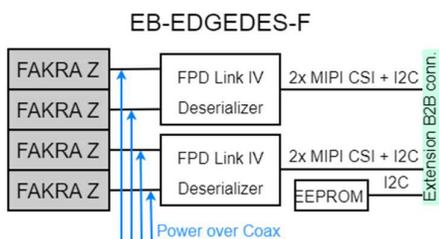
4.9.3 FPD Link IV

FPD Link IV is used to transmit high-bandwidth video, audio, and control data over a single coaxial or shielded twisted-pair cable with low latency and long cable reach. It plays the same role as GMSL2, just under Texas Instruments' ecosystem rather than Maxim's.

The 4x FPD Link IV camera input expansion module, EB-EDGEDES-F, features four FAKRA Z connectors with FPD Link IV deserializer inputs and PoC (Power-over-Coax) for power supply to the cameras.

The module is connected to the main board using a high-speed B2B connector.

The expansion module architecture is described in the block diagram below.



Four 2-lane MIPI CSI-2 interfaces are connected to two FPD Link-2 deserializers (TI DS90UB9702). Two FPD Link IV channels from 2 FAKRA Z connectors are connected to each deserializer.

Both FPD Link IV deserializers are connected to the same I2C bus (I2C 1 from the Jetson module), with different I2C addresses. See the table below for details.

Table 15 EB-EDGEDES-F deserializers

Feature	FAKRA Z connectors	I2C address (7-BIT)
Deserializer 0 (U8)	0, 1 (J2, J3)	0x30
Deserializer 1 (U9)	2, 3 (J4, J5)	0x3D

Both deserializers are configured to mode ‘FPD-Link IV Synchronous’.

See the table below for EB-EDGEDES-F features

Table 16 EB-EDGEDES-F features

Feature	Parameter	Value
FPD Link IV	Deserializer model	2x TI DS90UB9702
	Link rate per port	Up to 7.55 Gbps
Power over Coax (PoC)	Voltage	12V
	Current	Up to 1A in total

4.9.4 MIPI CSI-2

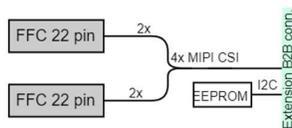
MIPI CSI-2 is used to connect cameras directly to processors through a high-speed, low-power serial interface, enabling efficient transmission of uncompressed image and video data to the Jetson SoC. It can be used for short distances between the computer and the camera.

An additional camera input expansion is EB-EDGEMIPI. It has two 22-pin FFC connectors with a pin-out identical to the Jetson Orin Nano evaluation board, and therefore, it’s compatible with any set of cameras designed for it.

MIPI CSI-2 is used for connecting cameras to the computer with a short, flat cable.

EB-EDGEMIPI isn’t mounted to the front panel of EdgeAI-ORN and is intended to be used without the enclosure. Nevertheless, it can be used with the enclosure and the EB-EDGEPOE front panel to wire the FFC cables outside of the enclosure.

The expansion module architecture is described in the block diagram below.



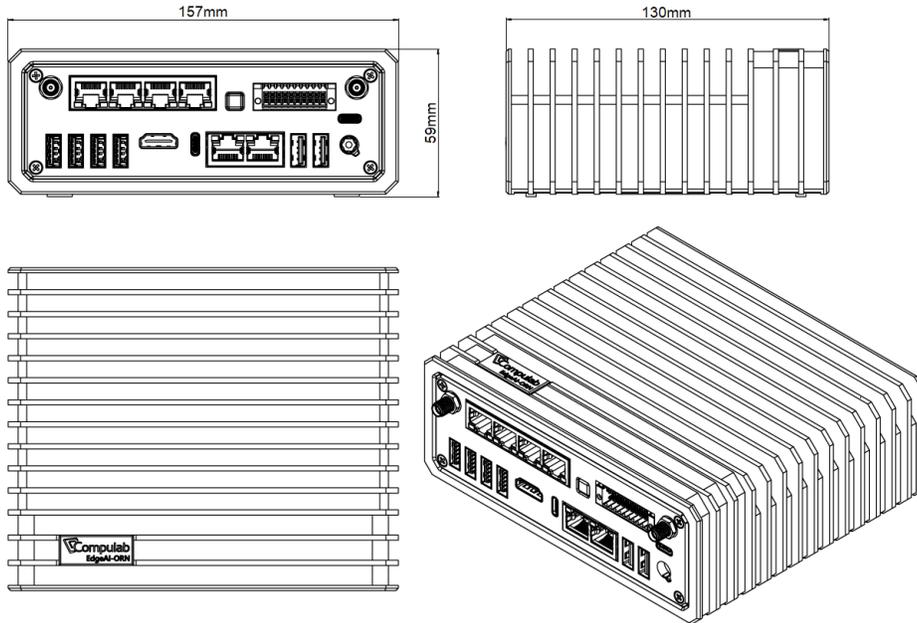
MIPI CSI 2 interfaces 0 and 1 are connected to FFC connector P1 and interfaces 2 and 3 are connected to FFC connector P2.

See Jetson Orin documentation for additional details.

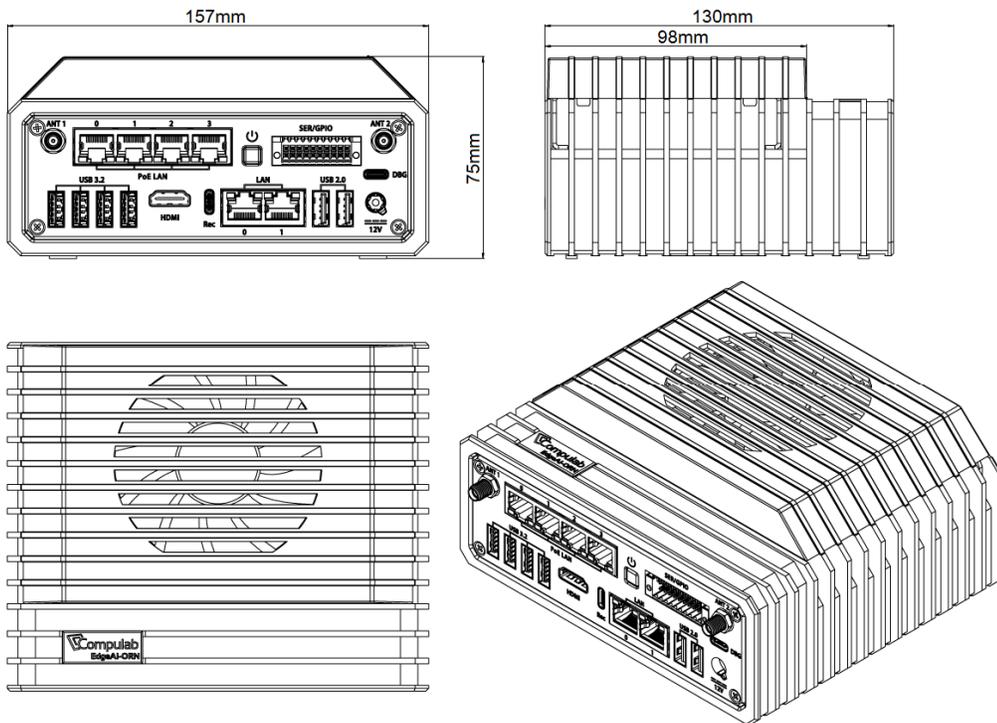
5 Mechanical specifications

5.1 External dimensions

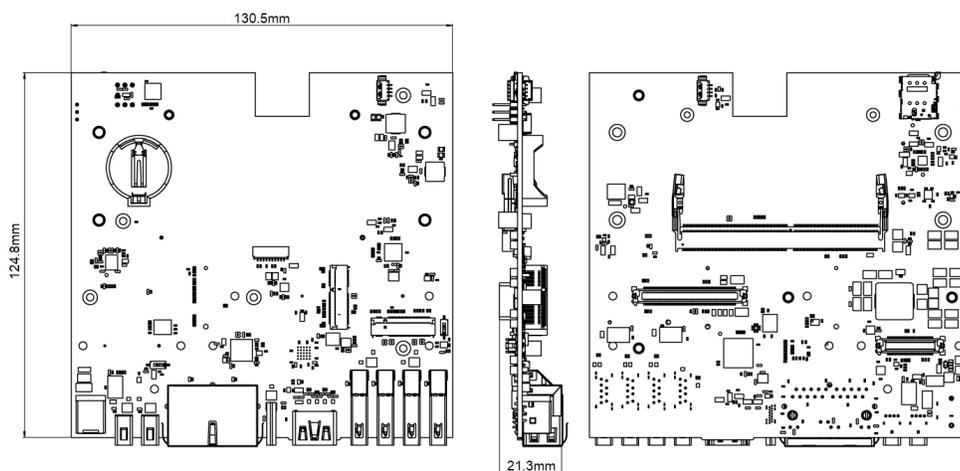
EdgeAI-ORN external dimensions of fanless configuration:



EdgeAI-ORN external dimensions of active heat dissipation (fan) configuration:



EdgeAI-ORN external dimensions of main board (SB-ORN):



6 Operational characteristics

6.1 Thermal management

EdgeAI-ORN supports either passive cooling or active cooling with an external fan to improve heat dissipation. The table below lists the recommended maximum operating temperatures to ensure full-performance operation.

Operation at higher temperatures is allowed, but the performance may be reduced occasionally when a full-power operation is required.

Table 17 Operation temperatures for full performance

Jetson module	Power state	Max. temp. on passive cooling	Max. temp. on active cooling
Jetson Orin Nano	Up to 15W	55°C	75°C
	MAXN mode (25W)	45°C	75°C
Jetson Orin NX	Up to 15W	55°C	75°C
	20W / 25W	45°C	75°C
	MAXN mode (40W)	(30°C)	70°C

Notes:

1. Operation at higher temperatures, up to 75°C, is possible, but throttling and performance degradation are expected.
 2. 40W power state is not recommended with passive cooling
 3. Selecting a power state does not guarantee operation at its defined maximum power; actual power usage depends on the workload. Consequently, the operating temperature may often exceed the listed values without any performance loss.
 4. PoE cameras connection via the 4x PoE camera input expansion may cause additional heat dissipation and lower the full-performance temperatures as a result.
- See more about Jetson Orin modules' power states on Jetson Orin documentation.

6.2 Power input considerations

The EdgeAI-ORN features a first-stage voltage regulator that operates with a regulated power input of 9V to 36V DC.

When using EB-EDGEPOE camera input expansion, the recommended input voltage is 12V to 36V. This limitation is especially important when using high-power PoE-powered equipment, due to the high currents required on the internal power circuitry.