GigaBlox Nano

Tiny 4 port Gigabit Ethernet Switch

Datasheet

Applies to:
MPN: BB-GGN-A-1
MPN: BB-GGN-A-1-NDAA

October 2023

Board revision A

Contents

1 General Information

1.1 Functionality and Features of GigaBlox Nano

The BotBlox GigaBlox Nano is a tiny form factor 4 port 10/100/1000Mbps (10BASE-T/100BASE-TX/1000BASE-T) layer 2 unmanaged ethernet switch. It has a non-blocking fabric, meaning that 1000Mbps speed can be achieved simultaneously on all ports.

The design of GigaBlox Nano is a modular, stackable board which places 4 ethernet ports onto a Samtec Razor Beam (LSHM-120-02.5-L-DV-A-S-K-TR) stackable header. This allows direct integration of GigaBlox Nano into any daughterboard design, allowing full connector and dimensional flexibility.

GigaBlox Nano runs from a wide input voltage range of 5.1 to 60V allowing integration into a wide range of applications and can work either as transformerless ethernet (backplane applications) or standard transformer based ethernet.

1.1.1 Features
- Stackable board (Ethernet Switch as a module)
- 4 x 10/100/1000M (10BASE-T/100BASE-TX/1000BASE-T) ethernet ports
- Input voltage range from 5.1 to 60V
- 26mm x 26mm board size
- Samtec RAZOR BEAM™ for power and ports
- Automatic MDI-X crossover
- Auto-negotiation with connected devices to achieve maximum speed
- Unmanaged (out-the-box) functionality

1.1.2 General Information

Voltage Input	5V to 60V DC (65V absolute max)
Supported Protocols	10BASE-T, 100BASE-TX, 1000BASE-T
Power Consumption	260mW (idle) to 900mW (full switching)
Weight	18 grams (without daughterboard)
Size	26mm x 26mm x 8mm (without daughterboard)
Operating Temperature	0°C to +70°C
Storage Temperature	-40°C to +120°C

Table 1: General Information

1.1.3 General Operating Instructions

GigaBlox Nano is designed for use in commercial and industrial environments, operating from a nominal supply voltage of 24V, but with the ability to operate from as low as 5.1V and as high as 60V.

A daughterboard needs to be used with GigaBlox Nano to provide access to the ports and power on the board. BotBlox provides two standard daughterboard configurations to provide connectivity on Picoblade connectors (**SKU: BB-GNP-A-1**) or standard RJ-45 connectors (**SKU: BB-GNR-A-1**).

GigaBlox Nano itself does not contain any transformers on the differential ethernet lines, instead using capacitive isolation. This approach is called transformerless ethernet and is typically used in backplane applications. If the daughterboard incorporates transformers, then the connection becomes standard transformer-based ethernet. For the smallest solution the daughterboard can omit the transformers and use transformerless ethernet.

To use GigaBlox Nano, first mate the board with a daughterboard then apply an input voltage from 5.1 to 60V. Then connect external devices and GigaBlox Nano will begin functioning as an unmanaged 10/100/1000Mbit/s network switch.

1.1.4 Transformerless Ethernet

GigaBlox Nano board does not use transformers on the differential ethernet lines, instead using capacitors to provide AC coupling on the differential lines. While this approach allows for the smallest possible solution size it introduces some compromises. These compromises are explained below.

Note: Using GigaBlox Nano with the RJConn daughterboard is no longer a transformerless ethernet system and thus can be used like any other IEEE 802.3 compliant switch.

Ground potential differences

The IEEE 802.3 specification (section 14.3.1.1) requires ethernet systems to be able to sustain cable faults inducing 1500V AC at 50/60Hz, or 2250 V DC for 60 seconds. This is typically achieved using 1:1 transformers on the physical layer transceivers used in ethernet.

This level of isolation also allows connected network devices to be at different ground potentials (up to 2250 V DC between them) without the risk of fault current flowing through the differential ethernet lines.

GigaBlox Nano uses series capacitors to provide up to 50V of capacitive isolation between devices, which falls short of the isolation requirements specification in IEEE 802.3. This means GigaBlox Nano in a transformerless configuration cannot be regarded as a drop in replacement for an IEEE 802.3 compliant switch. Instead, careful consideration as to whether the connected devices will ever be on different grounds needs to be made.

The general rule is that GigaBlox Nano is suitable in a network in which all devices are powered from the same source such as a battery. BotBlox does not recommend using GigaBlox Nano in any other configuration (unless using the RJConn or a custom daughterboard which does provide isolation compliant to IEEE 802.3).

Power over Ethernet (PoE)

All variants of power over ethernet (IEEE 802.3af-2003, IEEE 802.3at-2009 and IEEE 802.3bt-2018) require the use of transformers to safely combine the AC ethernet signals with the PoE voltage. As such GigaBlox Nano in a transformerless configuration (eg, using PicoConn) is incompatible with PoE.

Cable length

Increased cable length can increase DC voltage imbalances between connected devices, which cannot be adequately protected against without the use of transformers. Therefore cable length should be restricted to 1 meter or less when using GigaBlox Nano in a transformerless configuration.

Cabling topology

Assuming the above conditions are met for a transformerless configuration, GigaBlox Nano can be used in any of the following cabling topologies.

- A GigaBlox Nano transformerless ethernet connection to any transformer based PHY.
- A GigaBlox Nano transformerless ethernet connection to any other transformerless, capacitively isolated PHY.

1.2 Safety Information

- This device can operate on voltages near and above 60V. Please read this manual before operating.
- This device is provided "as is". In-application testing prior to integration is recommended.
- This device is provided as an electronic circuit board, and requires integration into chassis for full ingress protection.
- Do not use this product in wet environments without integrating into a chassis.
- Do not operate this product beyond the rated temperature and voltages.
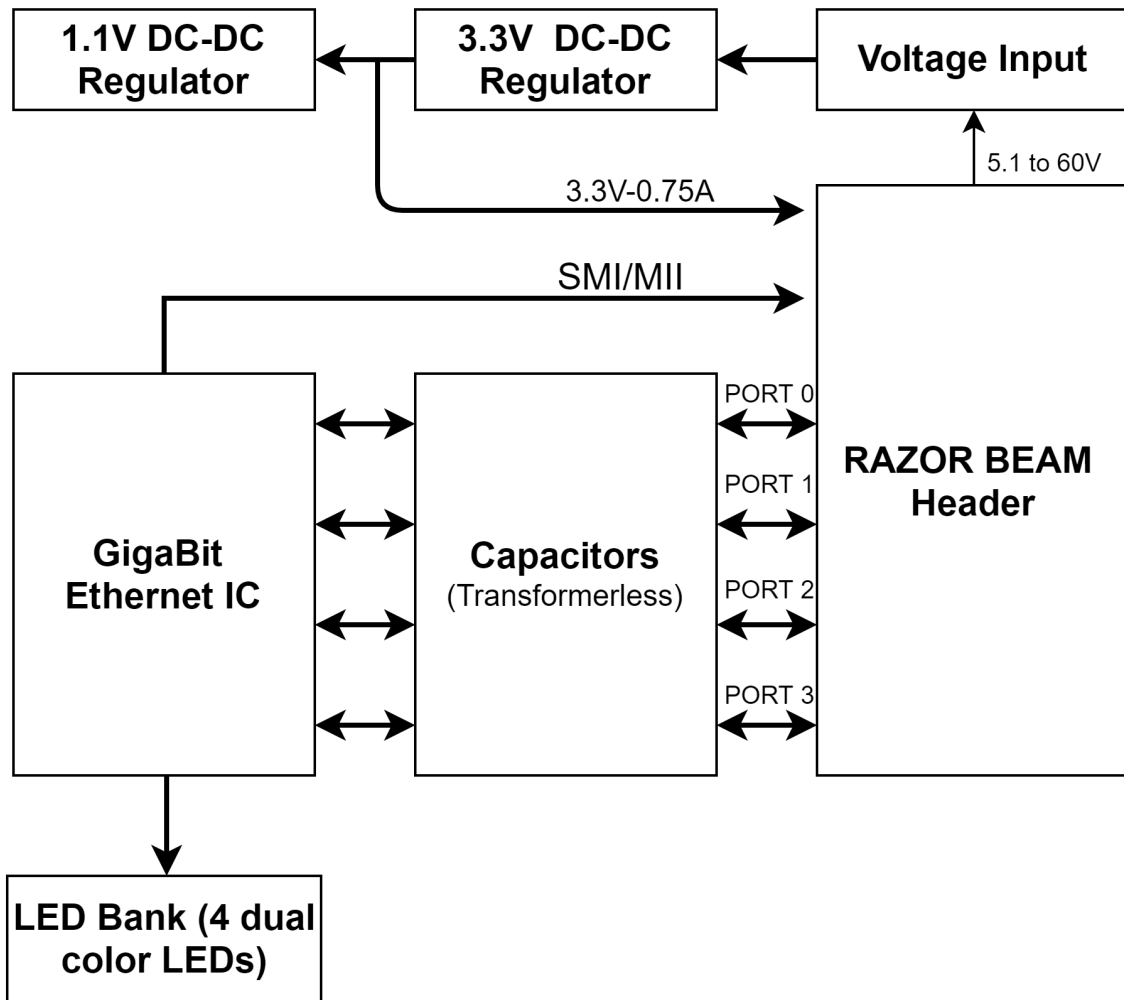
1.3 Block Diagram

Figure 1: GigaBlox Nano Block Diagram

1.4 Included Equipment

The product includes the following:
1 x GigaBlox Nano board

1.5 RoHS Certification of Compliance

The BotBlox GigaBlox Nano complies with the RoHS (Restriction of Hazardous Substances Directive) Certificate of Compliance.
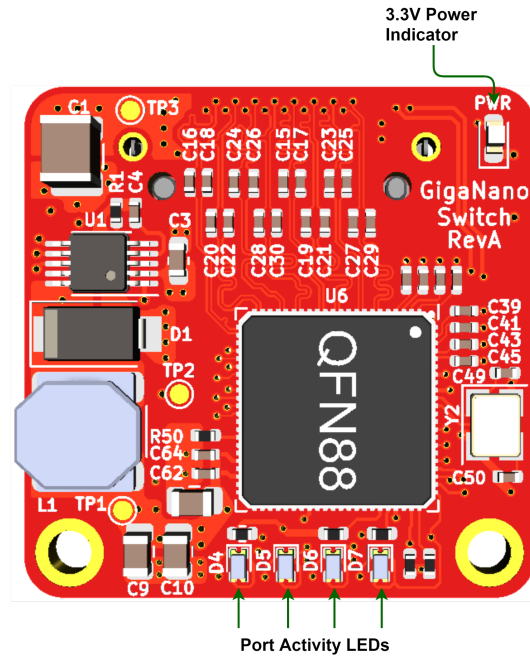
2 Hardware Interfaces

2.1 Board Map
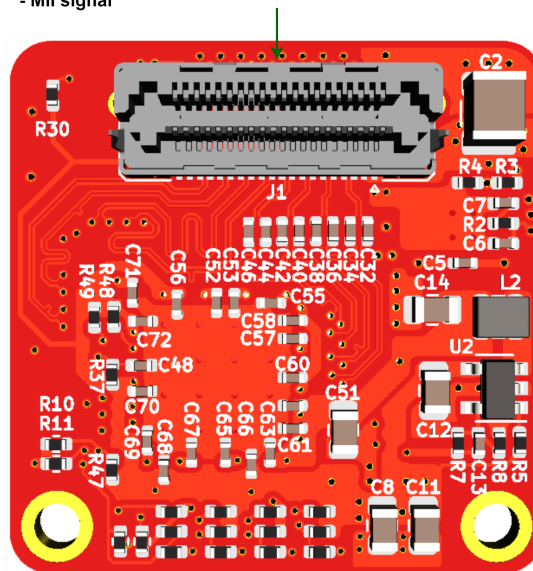

Figure 2: GigaBlox Nano Board Map (front)

Figure 3: GigaBlox Nano Board Map (back)

2.2 Connectors and Pinouts

The 4 ports, input voltage and output voltage are placed onto a Samtec Razor Beam™ (MPN: LSHM-120-02.5-L-DV-A-S-K-TR) stackable header. The Razor Beam connector on the GigaBlox Nano Board is shown in figure 4 below.
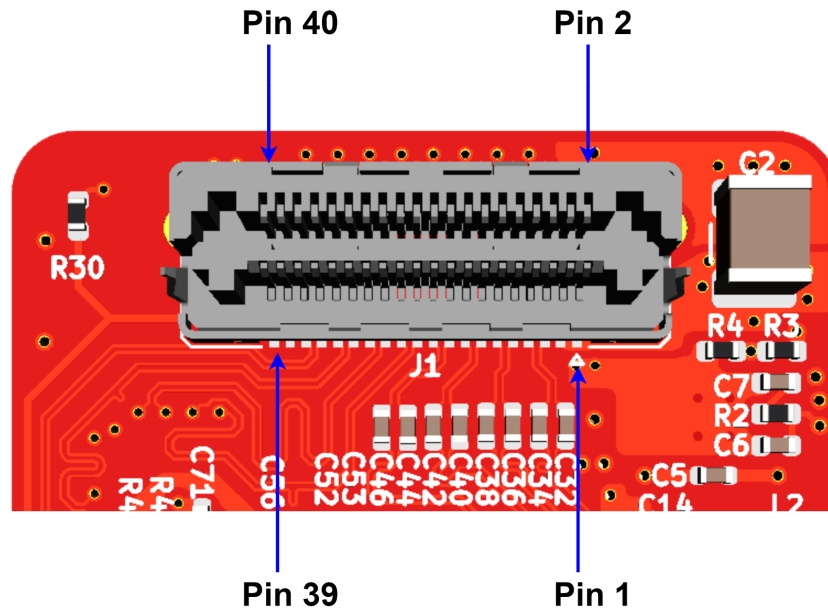

Figure 4: Razor Beam connector

The Razor Beam connector is a hermaphroditic (genderless) connector, meaning the same part is required on the daughtboard for mating. The mating method is shown in figure 5 below.
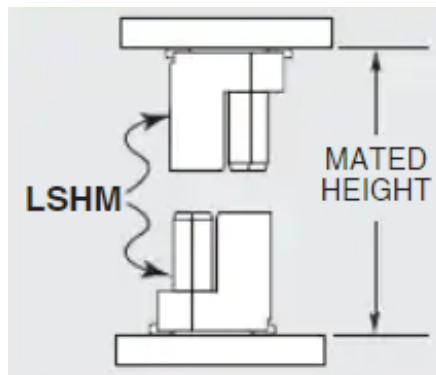

Figure 5: Razor Beam connector self-mating

The pin mapping between two mated LSHM-120-02.5-L-DV-A-S-K-TR Razor Beam connectors is shown in table 2 below.

Connector A Pin	Connector B Pin	Connector A Pin	Connector B Pin	Connector A Pin	Connector B Pin
1	2	15	16	29	30
2	1	16	15	30	29
3	4	17	18	31	32
4	3	18	17	32	31
5	6	19	20	33	34
6	5	20	19	34	33
7	8	21	22	35	36
8	7	22	21	36	35
9	10	23	24	37	38
10	9	24	23	38	37
11	12	25	26	39	40
12	11	26	25	40	39
13	14	27	28		
14	13	28	27		

Table 2: Pin matching for mating connector

The signal to pin assignments used on GigaBlox Nano is detailed in table 3 below.

Pin name	Pin number	Description
VBUS	1	Input supply voltage, 5.1V to 60V
VBUS	3	Input supply voltage, 5.1V to 60V
+3V3	39	Output 3.3V, maximum 0.75A
GND	2	Ground
GND	4	Ground
GND	40	Ground
P0_A_P	35	Port 0 Media Dependent Interface A~D.
P0_A_N	33	For 1000Base-T operation, differential data from the media is transmitted and received on all four pairs. For 100Base-TX and 10Base-T operation, only MDIAP/N and MDIBP/N are used. Auto MDIX can reverse the pairs MDIAP/N and MDIBP/N. Each of the differential pairs has an internal 100-ohm termination resistor
P0_B_P	31	
P0_B_N	29	
P0_C_P	27	
P0_C_N	25	
P0_D_P	23	
P0_D_N	21	
P1_A_P	36	Port 1 Media Dependent Interface A~D.
P1_A_N	34	For 1000Base-T operation, differential data from the media is transmitted and received on all four pairs. For 100Base-TX and 10Base-T operation, only MDIAP/N and MDIBP/N are used. Auto MDIX can reverse the pairs MDIAP/N and MDIBP/N. Each of the differential pairs has an internal 100-ohm termination resistor
P1_B_P	32	
P1_B_N	30	
P1_C_P	28	
P1_C_N	26	
P1_D_P	24	
P1_D_N	22	
P2_A_P	20	Port 2 Media Dependent Interface A~D.

P2_A_N	18	For 1000Base-T operation, differential data from the media is transmitted and received on all four pairs. For 100Base-TX and 10Base-T operation, only MDIAP/N and MDIBP/N are used. Auto MDIX can reverse the pairs MDIAP/N and MDIBP/N. Each of the differential pairs has an internal 100-ohm termination resistor
P2_B_P	16	
P2_B_N	14	
P2_C_P	12	
P2_C_N	10	
P2_D_P	8	
P2_D_N	6	
P3_A_P	19	Port 3 Media Dependent Interface A~D. For 1000Base-T operation, differential data from the media is transmitted and received on all four pairs. For 100Base-TX and 10Base-T operation, only MDIAP/N and MDIBP/N are used. Auto MDIX can reverse the pairs MDIAP/N and MDIBP/N. Each of the differential pairs has an internal 100-ohm termination resistor
P3_A_N	17	
P3_B_P	15	
P3_B_N	13	
P3_C_P	11	
P3_C_N	9	
P3_D_P	7	
P3_D_N	5	
SDA/MDIO	37	EEPROM SMI Interface Data/MII Management Interface (MMD) Data
SCK/MDC	38	EEPROM SMI Interface Clock/MII Management Interface (MMD) Clock

Table 3: GigaBlox Nano connector pin assignments

2.3 Daughterboard and Reference Design

BotBlox provides two Daughterboards for use with GigaBlox Nano, the RJConn and the PicoConn.

2.3.1 PicoConn (GigaBlox Nano Picoconn Daughterboard)
GigaBlox Nano PicoConn is a simple breakout board for GigaBlox Nano that routs the 4 ports and power to Molex Pico-Blade connectors.
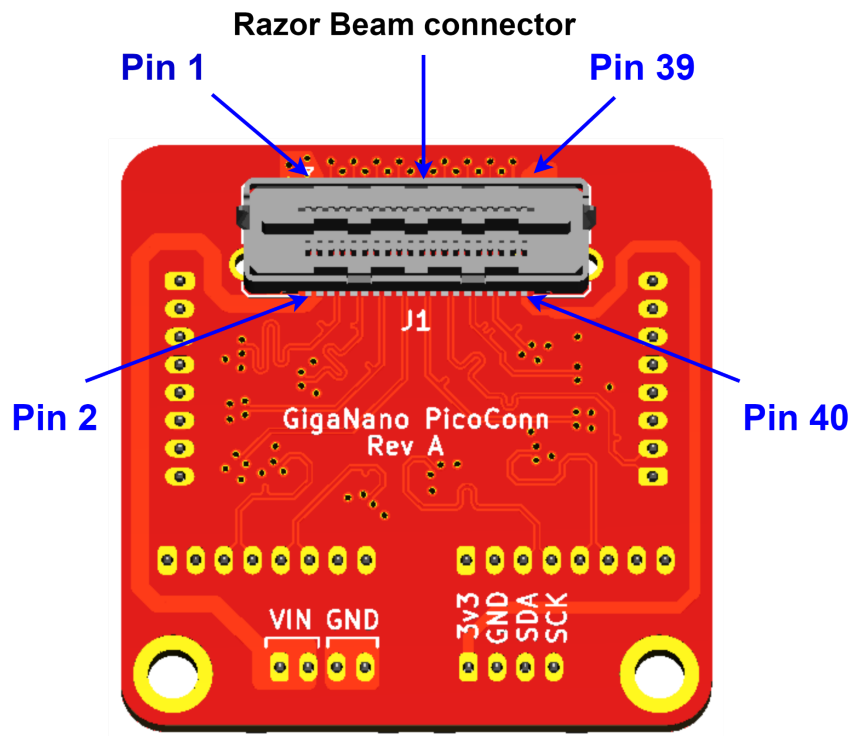

Figure 6: GigaBlox Nano PicoConn Board Map (front)

The mapping used on the connectors is shown below in figures 7 and 8.

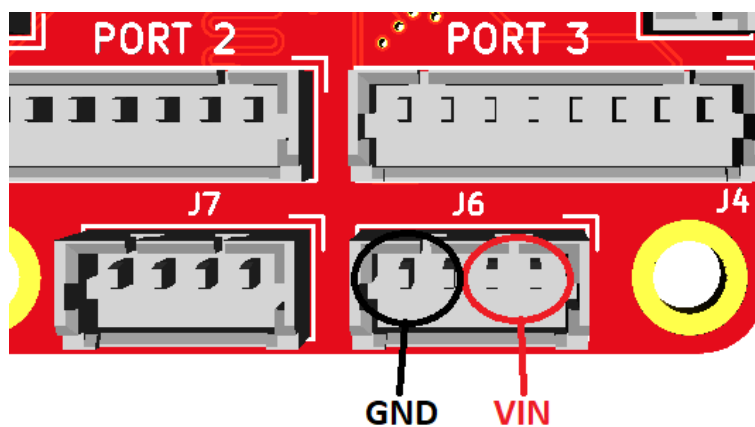*Figure 7: Mapping of ethernet signals onto PicoBlade connectors.*

Figure 8: Locations of power and ground onto PicoBlade connectors for the PicoConn board.

Be careful! RJConn uses J7 for power connections, while PicoConn uses J6 for power connections. Plugging power into the wrong connector will break the GigaBlox Nano.

The mapping of the signals on these connectors is identical to the mapping used on our GigaBlox board, thus the cables can be used interchangeably with GigaBlox.

2.3.2 GigaBlox Nano RJConn Daughterboard
GigaBlox Nano RJConn puts the 4 ports onto traditional RJ-45 mag-jacks allowing use in systems with traditional RJ-45 cables.
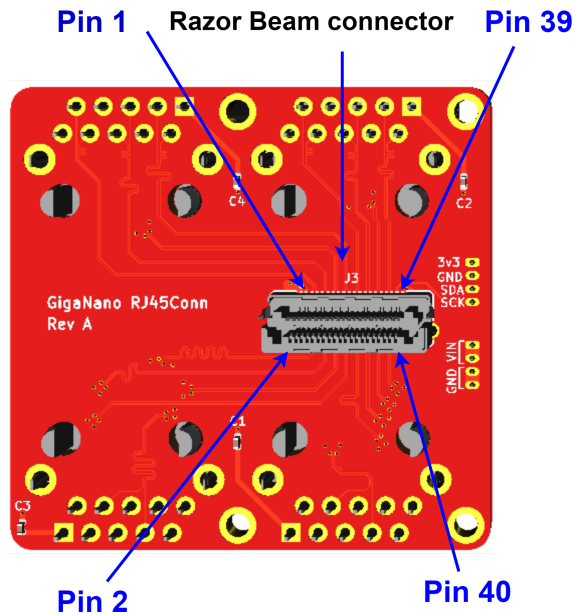
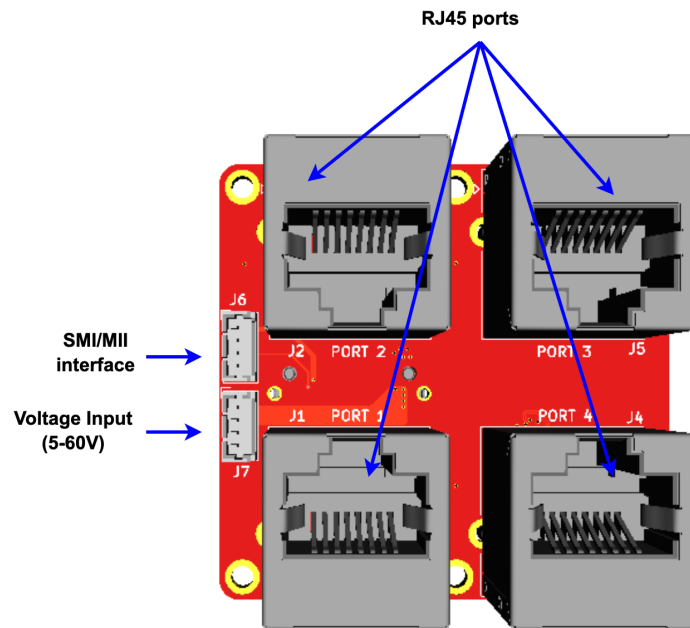*Figure 9: GigaBlox Nano RJConn Board Map (front)*

Figure 10: GigaBlox Nano RJConn Board Map (back)

The RJ-45 connectors used on this board house integrated transformers therefore this board allows GigaBlox Nano to be used as a standard IEEE 802.3 compliant switch.

2.3.3 Reference design for the Razor Board connector on daughterboards

Figure 12 below shows the correct signal mapping to use on any daughterboard for GigaBlox Nano.
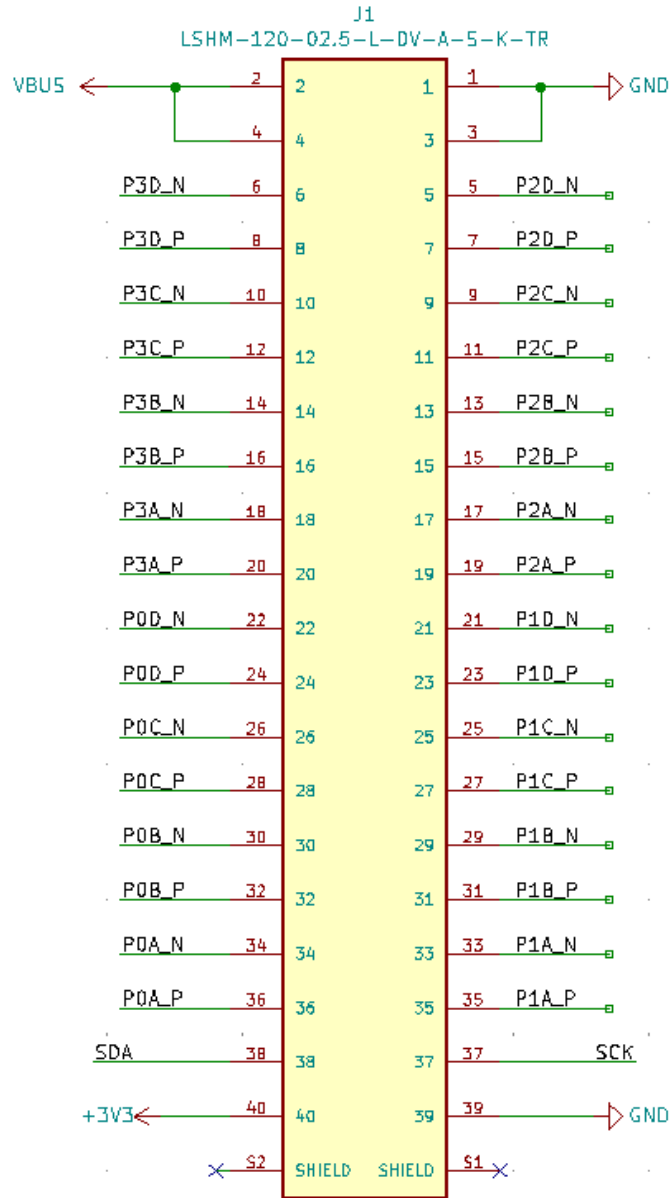

Figure 11: RAZOR BEAM connector on Daughterboards

2.4 Other Interfaces

LEDs
There are 5 LEDs on GigaBlox Nano in total. None of the LED signals can be taken off board.

The 3V3 Power Indicator LED (**Green**) indicates that voltage is present on the 3V3 line. It should be solid green in normal operation.

Each Port Activity LED (**Red**/**Green**) corresponds to a specific port. They indicate activity on each port and will blink when there is traffic on a port. The color of the LED indicates the link speed, with **Red** meaning 10/100M speed, and **Green** meaning 1G speed. They should be solid off when a port is not connected to any device, and they should blink under normal operation. A solid LED indicates either constant traffic, or a fault with the port.

3 Software Interfaces

There is currently no software interface on GigaBlox Nano. It functions solely as an unmanaged switch.

4 Device Configuration

4.1 Unmanaged Switch

To use GigaBlox Nano in an unmanaged application requires no configuration. Simply connect a voltage to the voltage input and connect downstream devices.

4.2 Managed Switch

Operating GigaBlox Nano as a managed switch is not possible at present.

5 Device Characteristics

5.1 Operating Conditions

5.1.1 Absolute Maximum Ratings
Operating in these ranges will reduce the lifetime of the device.

Voltage Input Maximum	65V
Storage Temperature	-40°C to +120°C
Operating Temperature	0 to +70°C

6 Datasheet Changelog

Date	Datasheet Version	Author	Notes
05/09/2021	A_A	Josh Elijah	Initial release
04/01/2022	A_B	Josh Elijah	Removed incorrectly labelled figure (figure 7, power connector was labelled incorrectly as J7, should be J6)
08/06/2022	A_C	Josh Elijah	Fixed incorrectly labelled power/SMI headers on RJConn figure
25/10/2023	A_D	Jaclyn Li	Table 1.1.2 General Information and Table 5.1.1 Operating Conditions updated to be correct values
19/11/2023	A_E	Josh Elijah	Clarified the wording around the connections of power and signals on the RJConn and PicoConn boards.

7 Contact

If you have any questions regarding this product, please contact us:

info@botblox.org
4 Pavilion Court 600 Pavilion Drive,
Northampton Business Park,
Northampton,
England
NN4 7SL

8 Certificate of Conformity

The full text of the Certificate of Conformity of this product is available at the following web address. https://botblox.io/documentation/