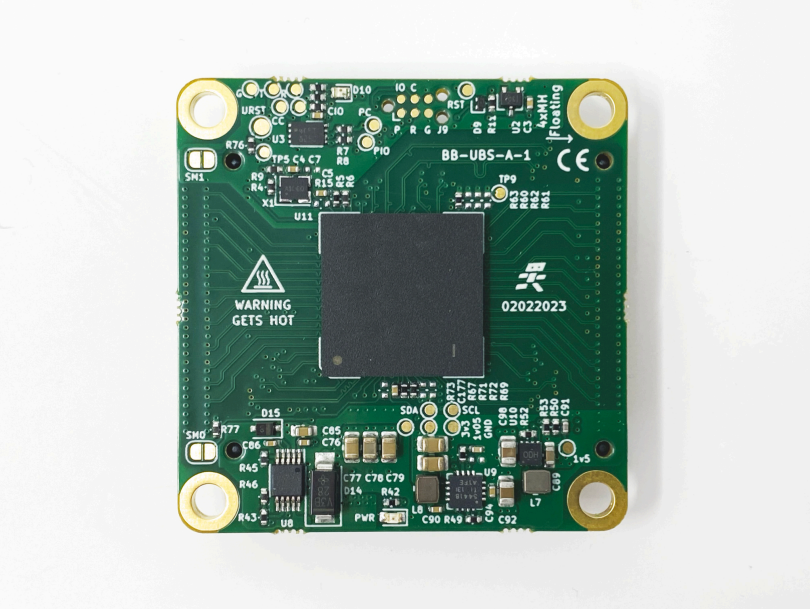
BotBlox



UbiSwitch

Compact 11 Port Module with 1Gbps and 10Gbps Ethernet

Datasheet

Applies to:
MPN: BB-UBS-B-1
MPN: BB-UBS-B-1-NDAA

January 2025
Board revision B

BotBlox

Contents

BotBlox

1 General Information

1.1 Functionality and Features of UbiSwitch

The BotBlox UbiSwitch is a compact embeddable ethernet switch module that houses 8 x 1GBASE-T ports and 3 10G MAC ports, designed for challenging environments.

UbiSwitch is a modular board and has to be mated with a baseboard to provide power supply and connector breakout. This allows UbiSwitch to form the heart of any flexible ethernet system through a custom baseboard design. UbiSwitch can be used immediately with the BotBlox UbiSwitch BaseBoard or UbiSwitch BaseBoard Mini, which provides a plug-and-play ethernet switch solution with 8 x 1Gbps PHY ports and 3 x 10Gbps SFP+ ports.

When used with UbiConn, UbiSwitch does not require any configuration or software to function as an unmanaged switch. When used with a custom baseboard that uses different ethernet hardware on the 10G MAC ports (eg, 10GBASE-T copper PHYs), BotBlox currently provides BloxOsLite management command line interface, which is pre-loaded onto UbiSwitch for switch management functions.

1.1.1 Hardware Features

- 3 x 10GBASE-R/1000BASE-X/SGMII ethernet ports (universal 10G/1G connectivity)
- 8 x 10/100/1000BASE-T ethernet ports
- Input voltage range from 5V to 60V
- 3.3V TTL Serial (UART) management port (for CLI)
- Command Line Interface for management
- 42mm x 42mm board size
- Samtec EDGE RATE® rugged modular connector for interconnection to baseboard
- Automatic MDI-X crossover and polarity correction on the 8 10/100/1000BASE-T ports
- Auto-negotiation on all ports with connected devices to achieve maximum speed
- Onboard command line interface management for Port, VLAN and LACP management
- Less than 5 Watts maximum power draw
- Three onboard solder jumpers for static (in-the-field) firmware configuration
- Plug and play functionality (no configuration necessary) when used with BotBlox UbiSwitch Baseboard and Baseboard Mini.

1.1.2 Software Features (as of January 2025)

- 802.1Q tag-based VLANs + port-based VLANs
- Link aggregation groups
- PHY control and status
- PCS mode control for ports 0, 9 and 10 (SFP ports) (1000BASE-X/SGMII/2500BASE-X/5GBASE-R/10GBASE-R USXGMII)
- Instantaneous temperature of main chip

1.1.2 General Information

Voltage Input	5V to 60V DC (65V Absolute maximum)
Supported Protocols	10BASE-T, 100BASE-TX, 1000BASE-T, 2.5GBASE-T,5GBASE-T, 10GBASE-T, 10GBASE-R
Power Consumption	4.6W maximum
Weight	20 grams
Size	42mm x 42mm x 9.8mm (without heatsink)
Operating Temperature	-70°C to +110°C
Storage Temperature	-70°C to +125°C

Table 1: General Information

1.1.3 General Operating Instructions

UbiSwitch is designed for use in harsh environments, operating from a nominal supply voltage of 24V, but with the ability to operate from as low as 5V and as high as 60V.

A baseboard needs to be used with UbiSwitch to provide access to the ports and power on the board.

To use UbiSwitch, first mate the board with a baseboard then apply an input voltage from 5 to 60V.

If the BotBlox UbiSwitch Baseboard is used (or any baseboard that incorporates 10GBASE-R SFPs on the 10G ports) then UbiSwitch will begin functioning as an unmanaged switch on all 11 ports without any configuration necessary.

If other SFP types are needed, this can be configured using the BloxOSLite CLI.

1.2 Safety Information

- This device can operate on voltages near and above 60V. Please read this manual before operating.
- This device is fully functionally tested prior to shipment however 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 Included Equipment

The product includes the following:
1 x UbiSwitch Module
1 x UbiSwitch Heatsink
1 x 16mm x 16mm thermal Pad (for Heatsink)
3 x M3 12m crosshead machine screws
3 x M3 nuts (for mounting heatsink to UbiSwitch)
3 x M3 22mm crosshead machine screws (for mounting UbiSwitch to baseboard)

1.4 RoHS Compliance

The BotBlox UbiSwitch complies with the RoHS (Restriction of Hazardous Substances Directive) Certificate of Compliance.

2 Hardware Interfaces

2.1 Board Map

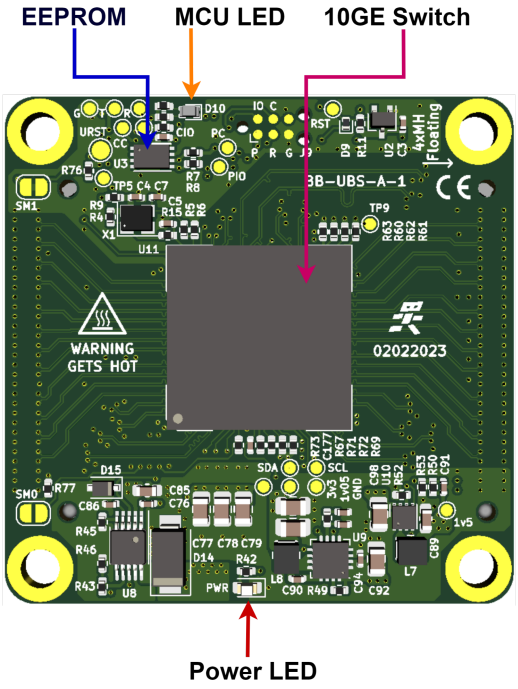


Figure 2: UbiSwitch Board Map (front)

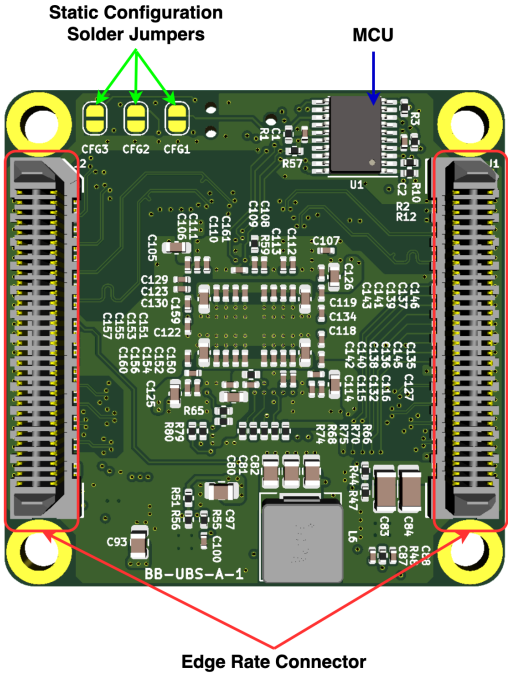


Figure 3: UbiSwitch Board Map (back)

2.2 Connectors and Pinouts

2.2.1 Edge Rate connector

The 8 ports, 3 SerDES, SMI, LED signals, UART, input voltage and output voltage are placed onto two Samtec Edge Rate™ (MPN: ERM8-030-02.0-S-DV-TR) stackable headers. The Edge Rate connector on the UbiSwitch Board is shown in figure 4 below. The Edge Rate connector provides a high quality connection optimized for signal integrity and a 0.8mm spacing for isolation protection.

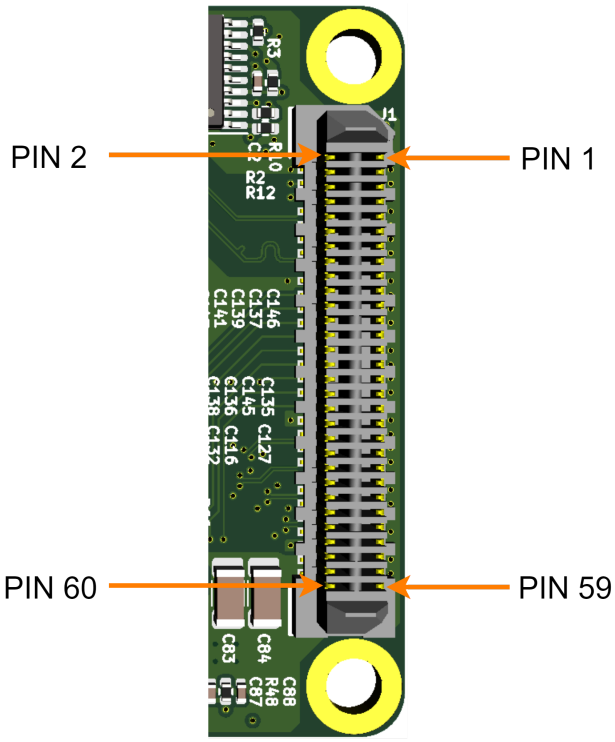


Figure 4: Edge Rate connector on UbiSwitch

Mating part: ERF8-030-05.0-S-DV-K-TR (used on UbiConn board)
The mating method is shown in figure 5 below.

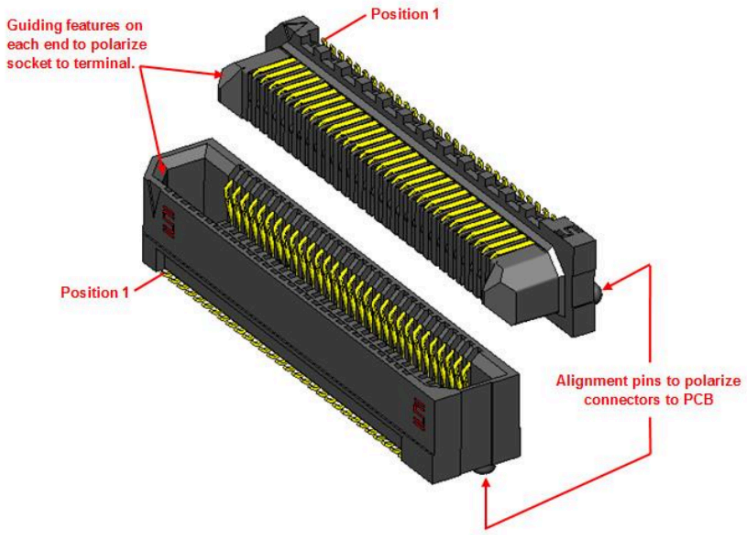


Figure 5: Edge Rate connector mating

The signal to pin assignments used on UbiSwitch is detailed in table 3 and table 4 below.

Connector	Pin name	Pin number	Description
J1	GND	1	Ground
	GND	2	Ground
	GND	6	Ground
	GND	12	Ground
	GND	18	Ground
	GND	19	Ground
	GND	37	Ground
	GND	38	Ground
	GND	55	Ground
	GND	56	Ground
	GND	57	Ground
	GND	59	Ground
	VBUS	58	Input supply voltage, 5V to 60V

	VBUS	60	Input supply voltage, 5V to 60V
	P1A_P	3	Port 1 1000BASE-T Differential Data Pair A ~ D Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.
	P1A_N	5	
	P1B_P	9	
	P1B_N	7	
	P1C_P	11	
	P1C_N	13	
	P1D_P	17	
	P1D_N	15	
	P2A_P	21	Port 2 1000BASE-T Differential Data Pair A ~ D Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.
	P2A_N	23	
	P2B_P	27	
	P2B_N	25	
	P2C_P	29	
	P2C_N	31	
	P2D_P	35	
	P2D_N	33	
	P3A_P	39	Port 3 1000BASE-T Differential Data Pair A ~ D Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.
	P3A_N	41	
	P3B_P	45	
	P3B_N	43	
	P3C_P	47	
	P3C_N	49	
	P3D_P	53	
	P3D_N	51	
	P4A_P	40	Port 4 1000BASE-T Differential Data Pair A ~ D

	P4A_N	42	Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.
	P4B_P	46	
	P4B_N	44	
	P4C_P	48	
	P4C_N	50	
	P4D_P	54	
	P4D_N	52	
	P0TX_P	14	SerDES Port 0 Transmit Data bus positive
	P0TX_N	16	SerDES Port 0 Transmit Data bus negative
	P0RX_P	8	SerDES Port 0 Receive Data bus positive
	P0RX_N	10	SerDES Port 0 Receive Data bus negative
	R0_LED	20	Parallel multiplexed LED outputs. These active low LED pins directly drive the port's LEDs supporting a range from 1 to 20 LEDs in a multiplexed fashion. In this mode the cathode of each LED connects to these pins through a series current limiting resistor. The anode of each LED connects to one of the Cx_LED pins below
	R1_LED	22	
	R2_LED	24	
	R3_LED	26	
	R4_LED	28	
	C0_LED	30	Connect to the anode of LED column 0 for each row
	C1_LED	32	Connect to the anode of LED column 1 for each row
	C2_LED	24	Connect to the anode of LED column 2 for each row
	C3_LED	36	Connect to the anode of LED column 3 for each row
	SE_SCLK	4	Synchronous Ethernet Source Clock. This is a 25 MHz reference clock which can be used as a synchronous clock input from the board or system. This signal must come from a high quality clock conditioning circuit or Synchronous Ethernet PLL.

Table 2: UbiSwitch J1 connector pin assignments

Connector	Pin name	Pin number	Description
J2	GND	1	Ground
	GND	2	Ground
	GND	7	Ground
	GND	13	Ground
	GND	19	Ground
	GND	20	Ground
	GND	25	Ground
	GND	37	Ground
	GND	38	Ground
	GND	55	Ground
	GND	56	Ground
	GND	58	Ground
	GND	60	Ground
	+3V3	57	**Output** 3.3V, maximum 0.5A
	+3V3	59	**Output** 3.3V, maximum 0.5A
	P5A_P	53	Port 5 1000BASE-T Differential Data Pair A ~ D Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.
	P5A_N	51	
	P5B_P	47	
	P5B_N	49	
	P5C_P	45	
	P5C_N	43	
	P5D_P	39	
	P5D_N	41	
	P6A_P	54	Port 6 1000BASE-T Differential Data Pair A ~ D Note: 100BASE-TX and 10BASE-Te are also

	P6A_N	52	supported on the A and B pairs.
	P6B_P	48	
	P6B_N	50	
	P6C_P	46	
	P6C_N	44	
	P6D_P	40	
	P6D_N	42	
	P7A_P	36	Port 7 1000BASE-T Differential Data Pair A ~ D Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.
	P7A_N	34	
	P7B_P	30	
	P7B_N	32	
	P7C_P	28	
	P7C_N	26	
	P7D_P	22	
	P7D_N	24	
	P8A_P	18	Port 8 1000BASE-T Differential Data Pair A ~ D Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.
	P8A_N	16	
	P8B_P	12	
	P8B_N	14	
	P8C_P	10	
	P8C_N	8	
	P8D_P	4	
	P8D_N	6	
	P9TX_P	17	SerDES Port 9 Transmit Data bus positive
	P9TX_N	15	SerDES Port 9 Transmit Data bus negative
	P9RX_P	23	SerDES Port 9 Receive Data bus positive

	P9RX_N	21	SerDES Port 9 Receive Data bus negative
	P10TX_P	5	SerDES Port 10 Transmit Data bus positive
	P10TX_N	3	SerDES Port 10 Transmit Data bus negative
	P10RX_P	11	SerDES Port 10 Receive Data bus positive
	P10RX_N	9	SerDES Port 10 Receive Data bus negative
	ETH_RST	27	Active low system reset, (internal pulled up). Will hardware reset the ethernet switch chip, but not the onboard microcontroller.
	MDC_CPU	33	Management Data Clock for the ethernet switch, Slave. MDC_CPU is the reference clock input for the serial management interface (SMI) that connects to an external SMI master, typically a CPU. A continuous clock stream is not expected. The maximum frequency supported is 20.0 MHz The CPU's SMI interface is used to access the device's registers but it cannot be used until the device's INTn pin becomes active low. We do not recommend using this bus in your application for switch configuration, instead, the serial port should be used.
	MDIO_CPU	35	Management Data I/O, Slave. MDIO_CPU is used to transfer management data in and out of the device synchronously to MDC_CPU. We do not recommend using this bus in your application for switch configuration, instead, the serial port should be used.
	USART2_RX	29	**Input** UART RX line. This is a 3.3V TTL level serial port used to access the onboard Command Line Interface. **This pin is NOT 5V Tolerant!**
	USART2_TX	31	**Output** UART TX line. This is a 3.3V TTL level serial port used to access the onboard Command Line Interface. **This pin is NOT 5V Tolerant!**

Table 3: UbiSwitch J2 connector pin assignment

2.2.2 SWD Programming Header

A programming header on the front of the board allows the microcontroller on UbiSwitch to be programmed over SWD.

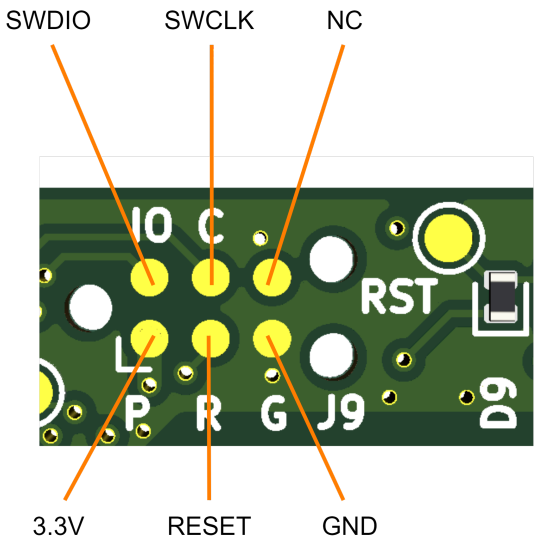


Figure 6: SWD programming header pinout

This header allows access to the SWD port on the onboard microcontroller, and requires the use of a 6-pin needle adapter such as the J-Link 6-pin needle adapter along with an in-circuit programmer such as the J-Link.

UbiSwitch ships with firmware preloaded. We do not suppot directly uploading firmware to UbiSwitch for switch configuration. Instead we support using our command line interface (BloxOSLite) on the 3.3V UART serial interface which can achieve switch configuration without needing to change or upload firmware.

2.3 System Information

UbiSwitch has the following capabilities.

2.3.1 Switch Fabric

Packet Buffer Memory	2Mbit
Jumbo Frame Support	10K Bytes (enabled by default)
# of MAC Addresses	16K
Ports 1-8 Capability	10/100/1000BASE-T (Triple speed, autonegotiation)
Port 0 Capability	RGMII, RMII, MII, SGMII, 5GBASE-X, SFI, USXGMII
Port 9 & 10 Capability	SGMII, 5GBASE-X, SFI, USXGMII

Table 4: UbiSwitch switch fabric capabilities

2.3.2 Switch Management

The following switch management features are currently possible.

Link Aggregation (LAG/Port Trunking)	Yes
802.1p, TOS/DS/ IPv6 TC, MAC	Not yet
Programmable Weighting	Not yet
Port-based VLANs	Yes
802.1Q VLANs	Yes, 4096 total
Double Tagging (Q in Q)	Not yet
LMP Entries	Not yet
802.1BR ECID	4K
Wake on LAN/ Wake On Frame	Not yet
Remote Mgmt/Ethertype DSA	Not yet
TCAM	Not yet
802.1D/s/w Spanning Tree	Not yet
802.1X Port & MAC	Not yet

Authentication	
Port Mirroring	Yes
IGMP/MLD Snooping	No
802.1AS / Qat / Qav / 1588v2	Not yet
802.1Qbv	Not yet
Synchronous Ethernet	Not yet
Cut Through Switch Fabric	Not yet

Table 5: UbiSwitch switch management features

2.3.3 Fundamental Frequencies

The main board level frequencies on UbiSwitch are listed below.

- 25MHz
- 403KHz
- 3MHz
- 1.29MHz
- 597KHz

2.4 Interfaces

2.4.1 8 x 10/100/1000BASE-T Ethernet Ports

There are 8 copper ethernet ports on UbiSwitch that can operate in 10BASE-T, 100BASE-TX and 1000BASE-T modes of operation.

2.4.1.1 Auto negotiation

These 8 ports support auto negotiation and will automatically negotiate with any connected device to achieve the highest possible link speed based on the connected device's capabilities. This is the default configuration of these ports on UbiSwitch. Auto negotiation can be disabled through switch configuration, and the port can be fixed to a particular speed. In most cases it is not advisable to do this since it is simpler to just let the auto negotiation protocol handle any differences in port capabilities.

2.4.1.2 Auto-MDI/X

The 8 ports support Auto-MDI/X by default, meaning the ports will automatically determine whether or not they need to cross over between its pairs as shown in table 6. This means that an external crossover cable is not required when using these ports.

If a connected device cannot automatically correct for crossover the ports on UbiSwitch will make the necessary adjustments prior to commencing auto negotiation. If a connected device

can automatically correct for crossover, UbiSwitch will implement a random algorithm as described in IEEE 802.3 clause 40.4.4 to determine which device performs the crossover. This feature can be disabled through switch configuration, however this is not advised.

Pin	MDI			MDIX		
	1000BASE-T	100BASE-TX	10BASE-T	1000BASE-T	100BASE-TX	10BASE-T
MDIP/N[0]	BI_DA±	TX±	TX±	BI_DB±	RX±	RX±
MDIP/N[1]	BI_DB±	RX±	RX±	BI_DA±	TX±	TX±
MDIP/N[2]	BI_DC±	Unused	Unused	BI_DD±	Unused	Unused
MDIP/N[3]	BI_DD±	Unused	Unused	BI_DC±	Unused	Unused

Table 6: MDI/MDIX Pin Mapping

2.4.1.3 Polarity Correction
UbiSwitch will automatically correct polarity (+ and - wiring mistakes) errors in the receive connections in 1000BASE-T and 10BASE-T. In 100BASE-TX, the polarity does not matter. This allows UbiSwitch to compensate for an incorrect polarity.

2.4.2 3 x MAC ports

Ports 0, 9 and 10 on UbiSwitch are SERDES interfaces that implement MAC ports on the switch. These are different to the 8 x 1G ports described above, because they are not capable of being directly connected to an external system by themselves.

They require a physical layer transceiver (PHY) to be converted from a MAC level interface to a field level interface such as 10GBASE-T (10Gbps on four copper pairs) or 10GBASE-R (10Gbps backplane for connection to SFP). While this may seem like a limitation, this allows flexibility on these ports, as many types of PHY can be connected to them to achieve any type of ethernet media connection.

Ports 9 and 10 can support SGMII, 5GBASE-X, SFI and USXGMII while port 0 can support SGMII, 5GBASE-X, SFI and USXGMII. By default, UbiSwitch configures all these ports to operate in SFI mode as 10GBASE-R, which is the required mode when connecting to an external SFP, as is the case on the UbiConn breakout board.

When using these ports to connect to an SFP cage on a baseboard, no configuration is necessary and the ports will work immediately with 10GBASE-R SFPs. When using a different PHY, or using a 1000BASE-X SFP on the baseboard, these ports will need to be configured using the BloxOSL

The MAC ports can integrate with copper PHYs using 100BASE-Tx, 1000BASE-T, 2.5GBASE-T, 5GBASE-T and 10GBASE-T. When integrating with SFPs, these ports can also run at 100M, 1G, 2.5G, 5G and 10G, assuming the SFP that is plugged in can also support these speeds.

2.4.3 3.3V TTL Serial (UART) Port

UbiSwitch contains a serial port that allows the user to interact with the BloxOSLite Command Line Interface, allowing switch configuration.

Note that both RX and TX are 3.3V level signals and do not require any external pull ups. For external connections, ensure that GND is common between UbiSwitch and the connected device.

WARNING! These pins are not 5V tolerant. You must ensure that you only connect it to a 3.3V level device.

Using a 5V device on these pins will permanently damage UbiSwitch!

2.4.4 Power supply

UbiSwitch contains its own power supply circuitry and can run from any voltage between 5 - 60V. This input voltage is not isolated on the UbiSwitch Module.

2.4.5 LED port indicator signals

UbiSwitch breaks out nine LED signals which, when multiplexed correctly, allow the link and activity from each port to be indicated on LEDs. These signals are available on the stackable header, allowing the baseboard to contain these port LEDs, or allowing an external connector to be added to break-out the LEDs further. On UbiConn, the LED signals are connected to port activity LEDs on the board and also broken out to an LED signal breakout header for convenience. To understand how the LED signals need to be connected, please refer to section 2.2.5 of the UbiConn datasheet.

2.4.6 Temperature Sensor

UbiSwitch contains an integrated temperature sensor that can be queried over serial. This allows for monitoring of the junction temperature inside the main switch chip. This feature is available over the onboard CLI.

2.4.7 Static configuration jumpers

In some production environments, it is desirable to have different static configurations enabled on UbiSwitch, that can be set up by field engineers without needing to use software. For these situations, UbiSwitch contains three static configuration jumpers that can be set/reset via soldering the jumpers, allowing up to eight different configurations to be selected on UbiSwitch without any software needed in the field. This feature is enabled by custom firmware provided by BotBlox. Figure 8 shows the location of these on the board.

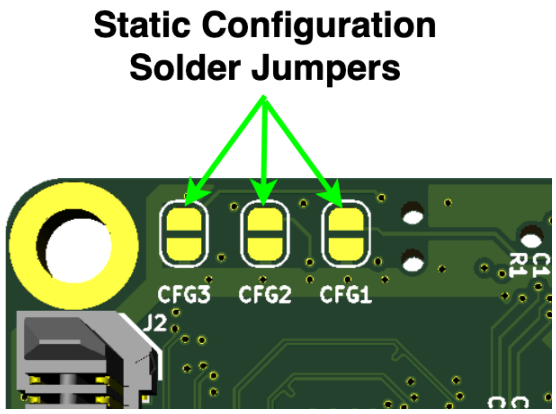


Figure 7 - The static configuration headers on UbiSwitch

These solder jumpers are housed on the bottom of UbiSwitch, so are not easily visible when UbiSwitch is plugged into a baseboard. However this can be mitigated through the use of the onboard microcontroller LED, which can be configured to flash a number of times to indicate the current configuration state based on these jumpers.

This feature is currently unimplemented. Please get in touch with us if you are interested.

2.4.8 Onboard LEDs

There are two LEDs on UbiSwitch in total. One of these LEDs are dual color LEDs, meaning there are a total of three LED signals on this board.

The 3.3V Power Indicator LED (**Green**) indicates that voltage is present on the 3.3V line. It should be solid green in normal operation.

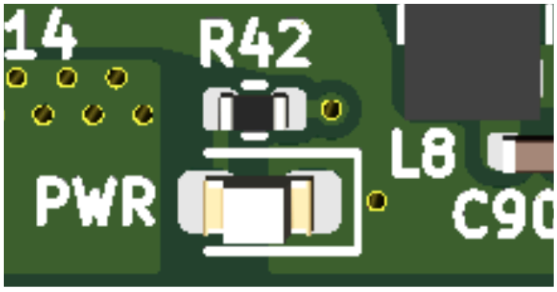


Figure 9: Power Indicator LED

Microcontroller LED is a **Red**/**Green** dual color LED that has a flexible use depending on the microcontroller firmware.

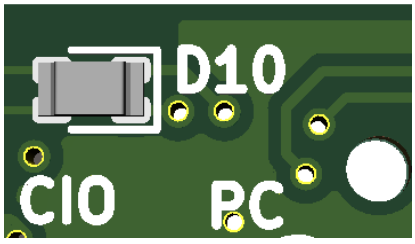


Figure 8: Microcontroller Dual Red/Green LED

2.5 Environmental Performance

UbiSwitch has been to MIL-STD-810G, to ensure performance as listed below. These test results can be found on the technical documentation tab of the product page.

Test Name	Test Description
Low Pressure (Altitude)	MIL-STD-810G, Method 500.6 - Low Pressure (Altitude), Procedure II - Operation: 1 hour, <10m/s, 30,000 ft
Low Pressure (Decompression)	Method 500.6 – Low Pressure (Altitude), Procedure III – Rapid Decompression: 8,000ft to 40,000ft, 15 seconds
High Temperature	Method 501.6 – High Temperature, Procedure II – Operation, Constant Temperature Exposure: 100°C, 2 hours, <3°C/minute, uncontrolled humidity
Low Temperature	Method 502.6 – Low Temperature, Procedure II – Operation: -45°C, 2 hours, <3°C/minute, uncontrolled humidity
Temperature Shock	Method 503.6 – Temperature Shock, Procedure I-A – One-way Shock(s) from Constant Extreme Temperature: -45°C to 100°C, 1 minute

	100°C to -45°C, 1 minute
Humidity	Method 507.6 – Humidity, Procedure I – Storage and Transit Cycles: 27°C, 95%, 2 hours
Vibration	Method 514.7 – Vibration, Procedure I – General Vibration, Category 13 – Fixed Wing Propeller Aircraft: Vibration Type: Broadband background with superimposed narrow band spikes Frequency Range: 15Hz – 2000Hz Orientation: In each of 3 mutually orthogonal axes, 1 hour per axis

Table 7: MDI/MDIX Pin Mapping

3 Software Interfaces

As of May 2024, UbiSwitch can now run configuration software. This requires firmware to be flashed onto UbiSwitch. Revision B UbiSwitch comes pre-loaded with this firmware, (with some exceptions for units shipped between May and June 2024).

More information can be found here.

4 Device Configuration

4.1 Unmanaged Switch

To use UbiSwitch in an unmanaged application requires no configuration. Simply connect the daughter board and apply a voltage to the voltage input and connect downstream devices.

4.2 Managed Switch

To use UbiSwitch in a managed application requires a 3.3V UART device to be connected. Please refer to our documentation on BloxOSLite.

5 Mechanical drawing

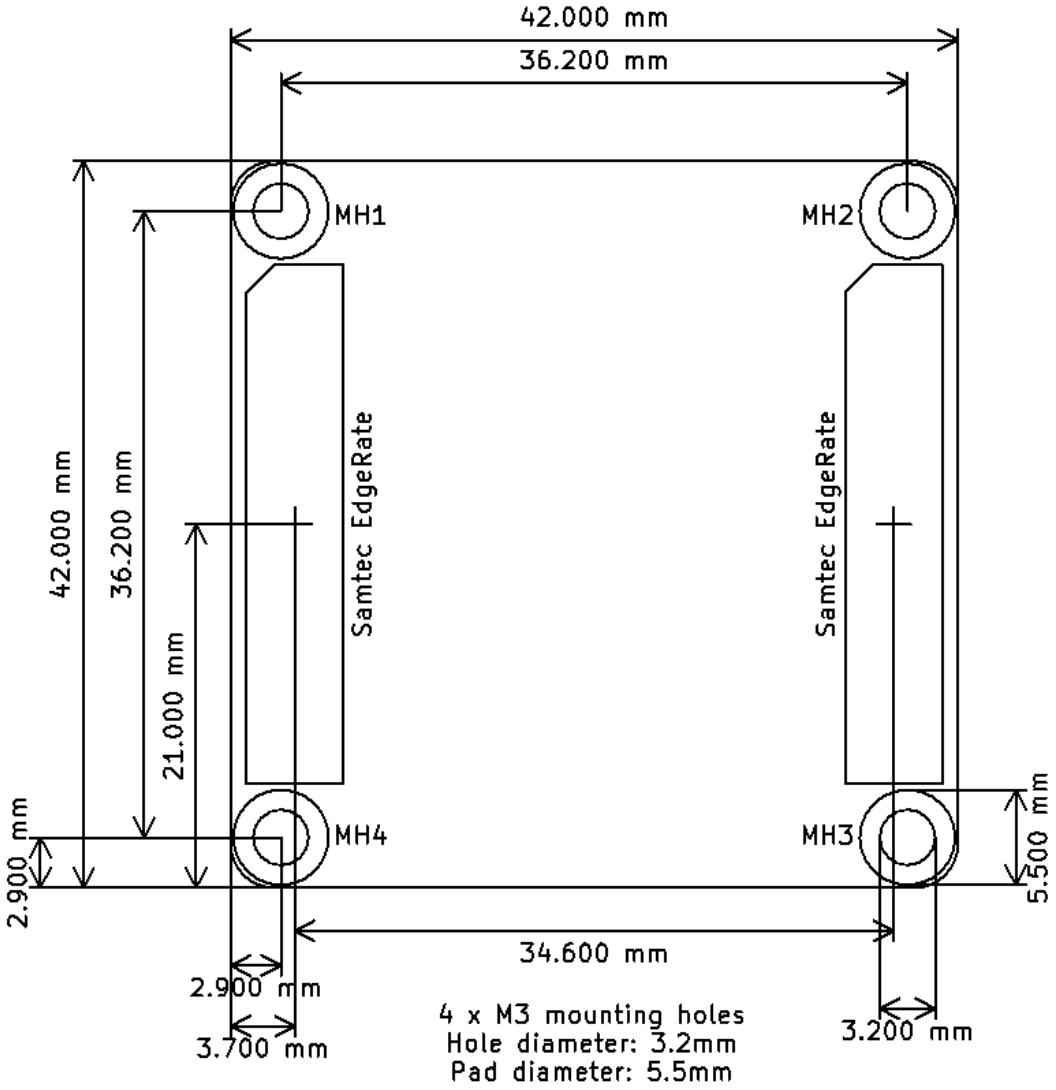


Figure 9. UbiSwitch mechanical drawing, viewed from top down

Full dimensional drawings and 3D CAD can be found in the links below.

https://botblox.io/content/UbiSwitch%20Rev%20A%20Dim%20Drawing.pdf
https://botblox.io/content/UbiSwitch%20Rev%20A%20Dim%20Drawing.DXF
https://grabcad.com/library/ubiswitch-revision-a-1

6 Thermal Considerations

The main switch chip on UbiSwitch dissipates significant power under full load conditions, hence it is recommended to run the device with a thermal heat sink solution.

6.1 Thermal Characteristics

Parameter	Condition	Typical Value
θJA - Thermal resistance, junction to ambient	JEDEC 3 in. x 4.5 in 4-layer PCB with no air flow	22.28 °C/W
	JEDEC 3 in. x 4.5 in 4-layer PCB with 1m/s air flow	20.13 °C/W
	JEDEC 3 in. x 4.5 in 4-layer PCB with 2m/s air flow	19.38 °C/W
	JEDEC 3 in. x 4.5 in 4-layer PCB with 3m/s air flow	18.92 °C/W
ψJT - Thermal characteristic parameter, junction to top-center of package	JEDEC 3 in. x 4.5 in 4-layer PCB with no air flow	0.13 °C/W
	JEDEC 3 in. x 4.5 in 4-layer PCB with 1m/s air flow	0.21 °C/W
	JEDEC 3 in. x 4.5 in 4-layer PCB with 2m/s air flow	0.26 °C/W
	JEDEC 3 in. x 4.5 in 4-layer PCB with 3m/s air flow	0.20 °C/W
θJC - Thermal resistance, junction to case	JEDEC with no air flow	5.08 °C/W
θJB - Thermal resistance, junction to board	JEDEC with no air flow	12.68 °C/W

Table 8: Thermal characteristics of the main chip on UbiSwitch

6.2 Passive heat sinking

UbiSwitch is supplied with a heatsink that mounts to the top of the main chip.

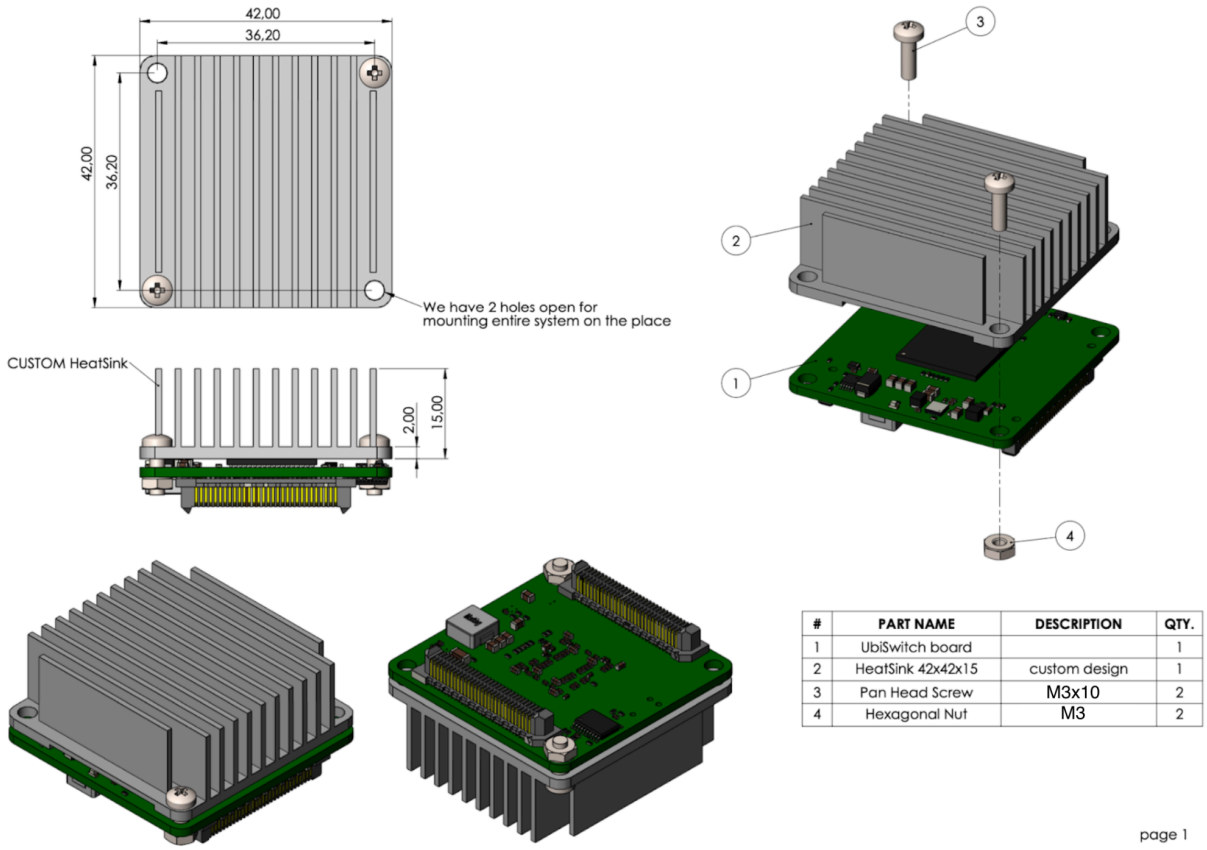


Figure 10. Illustration showing the UbiSwitch heat spreader plate that is included with the board

The thermal resistance of the heatsink with zero air flow is around 1.82 °C/W. We suggest using thermal paste with around 79W/m-K (for example, TC4-10G) to achieve a paste thermal resistance of 0.675 °C/W when used on the 15mm x 15mm chip.

Figure 11 below shows more information on the thermal characteristics of heatsink supplied with UbiSwitch.

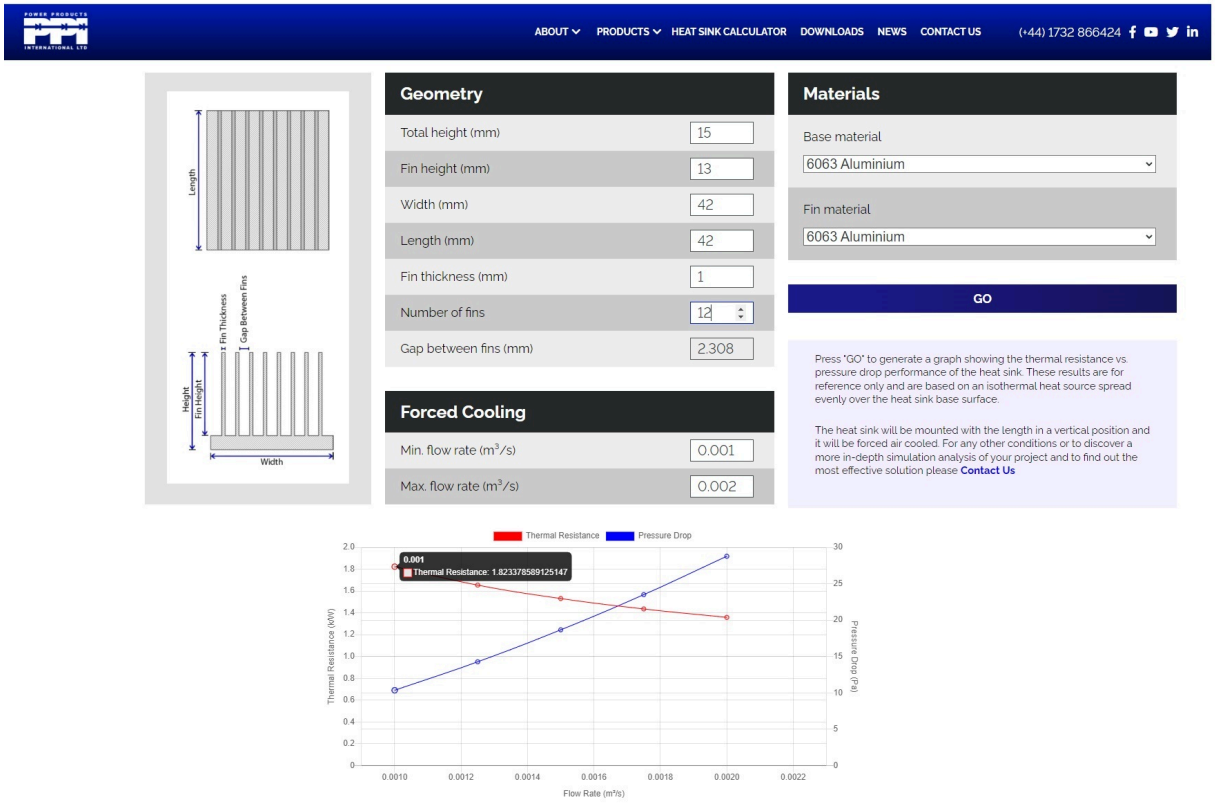


Figure 11. Thermal characteristics of the heatsink supplied with UbiSwitch

6.3 Temperature Calculations

6.3.1 No heat sink, 0 m/s air flow (not recommended)

Power dissipation, Pd = 4.604 W
θJA = 22.28 °C/W
ψJT = 0.13 °C
Ambient temperature = 25 °C

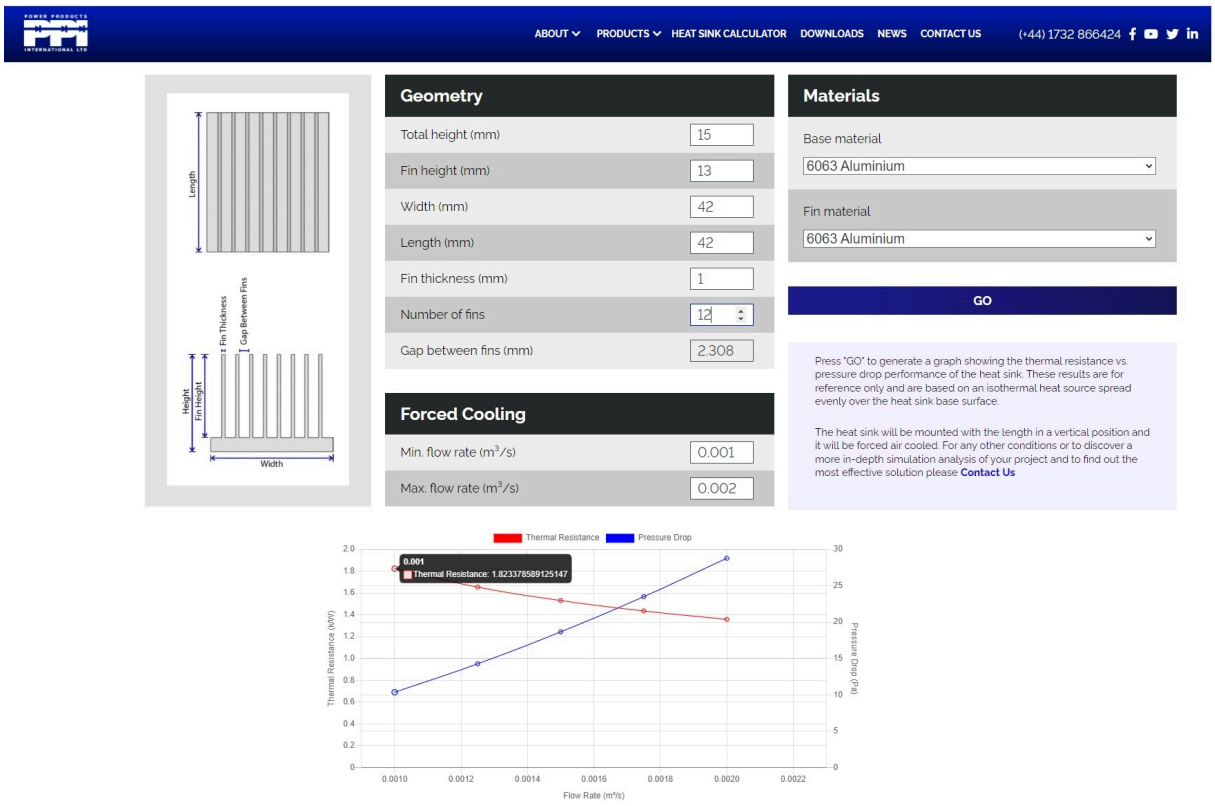
Case temperature = 4.604 * 22.28 = 102.57 °C *(above ambient)*
Junction temperature = (0.13 * 4.604) + 102.57 = 103.16 °C *(above ambient)*
Actual temperature of junction at ambient = 128.16 °C

6.3.2 Standard Heatsink 0 m/s air flow

Power dissipation, Pd = 4.604 W
θJC = 5.08 °C/W
θCH (Case to heatsink) = 0.675 °C/W (Mainly thermal resistance of thermal paste)
θHA (Heatsink to ambient) = 1.82 °C/W
ψJT = 0.13 °C
Ambient temperature = 25 °C

Heatsink temperature rise = 4.604 * (5.08 + 0.675 + 1.82) = 34.87 °C *(above ambient)*

Estimated junction temperature = ~70°C



7 Assembly and Mounting Information

7.1 Required Hardware

- UbiSwitch Module
- UbiSwitch Heatsink (included with UbiSwitch Module)
- UbiSwitch BaseBoard
- 2mm Thermal Pad (we recommend TP-GP05-D)
- 2 x M3 pan head machine screws, 10mm length (example)
- 2 x M3 pan head machine screws, 20mm length (example)
- 4 x M3 hex nuts (example)
- 4 x 2mm nylon washer (example)

7.2 Assembling the heatsink

The first step in assembling UbiSwitch is to mount the heatsink onto the UbiSwitch Module. The steps below assuming the use of the standard included heatsink (BB-UBH-A-1); steps may vary when using a custom heatsink.

Step 1: Add thermal paste
Cut the thermal pad to size, and attach it to the top of the main chip on the UbiSwitch Module

Step 2: Identify correct heatsink polarity
Some material is removed on the underside of the heatsink; this is to accommodate the taller circuitry on the UbiSwitch Module. It is important to ensure the heatsink is mounted as shown in figure 13 to ensure that this gap aligns with the taller circuitry on UbiSwitch.

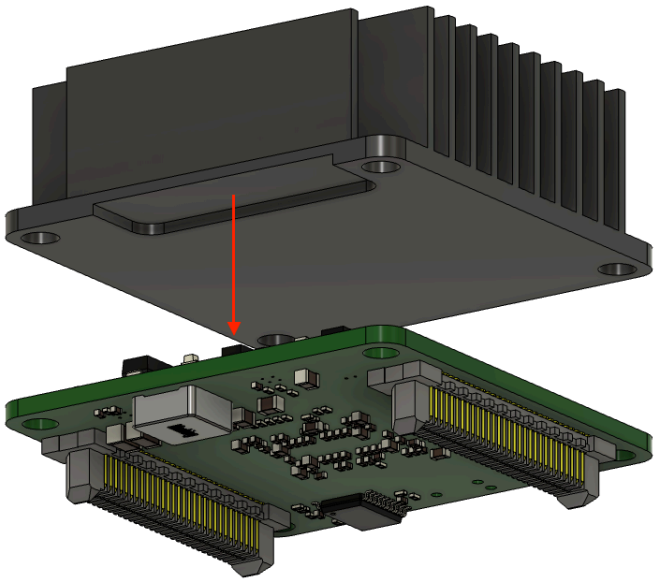


Figure 12. Applying thermal paste to UbiSwitch

Step 3: Place washers and screws

Once the correct heatsink alignment is achieved, place the two M3 12mm machine screws through two of the holes on the heatsink, and place two washers on these same holes. Figure 14 shows which holes to put the M3 12mm screws through; it is important that only these holes are used for mounting the heatsink.

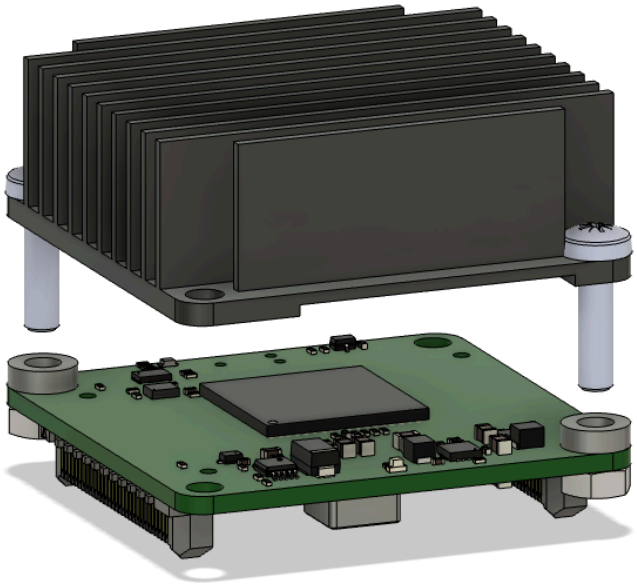


Figure 13. The machine screws and washers for mounting the heatsink

Step 4: Add hex nuts to the bottom

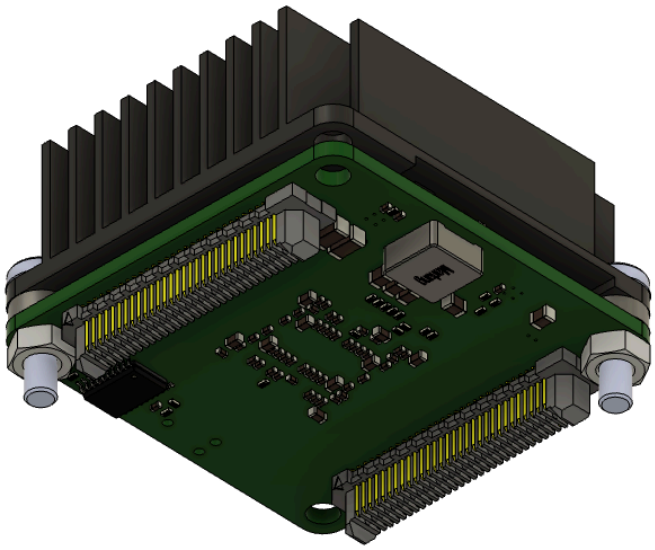


Figure 14. Adding the hex nuts to secure the heatsink

Step 5: Mount the UbiSwitch Module + Heatsink assembly onto UbiSwitch Baseboard

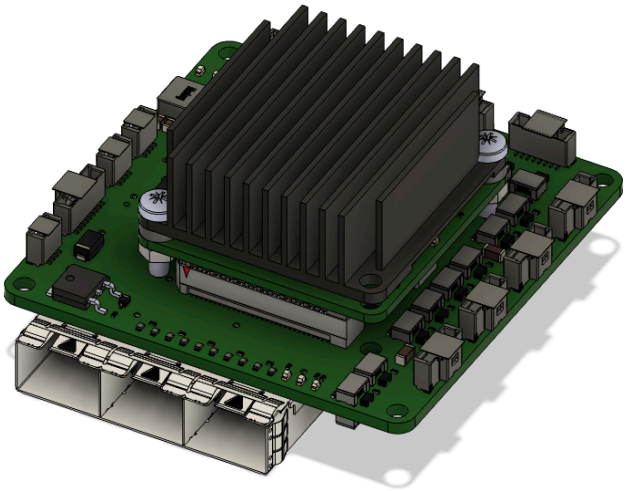


Figure 15. Mounting the UbiSwitch Module assembly onto the UbiSwitch BaseBoard

Step 6: Add washers and screws to the remaining mount holes

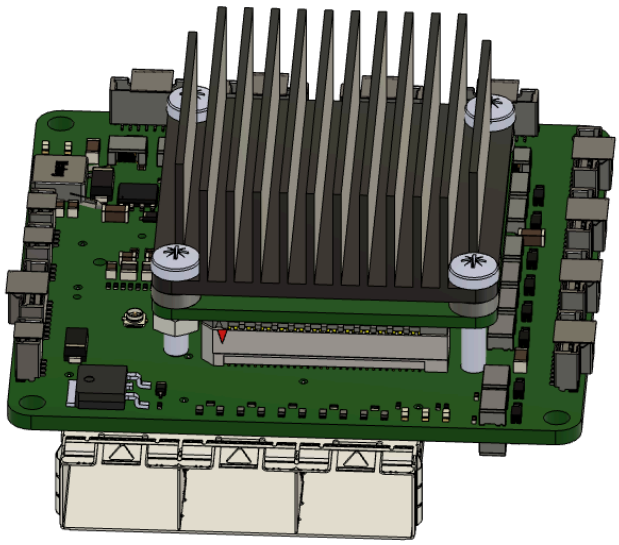


Figure 16. Mounting screws and washers added to the remaining mount holes

Step 7: Add hex nuts to the two remaining screws to secure the UbiSwitch Module to the UbiSwitch Baseboard

These hex nuts fix the UbiSwitch Module to the UbiSwitch BaseBoard. This is necessary as the stacking header system on UbiSwitch is not locking. The arrow in figure 18 shows one of the hex nuts that is close to the onboard transformers; care should be taken to not damage the transformers when tightening this nut.

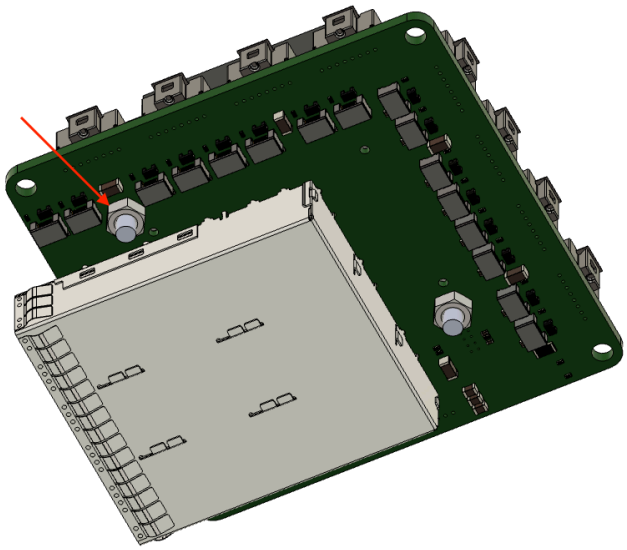


Figure 17. Hex screws added to secure the UbiSwitch Module to the UbiSwitch BaseBoard

Revision B of the UbiSwitch BaseBoard (BB-UD1-B-1) has integrated M3 threaded spacers, meaning you do not need hex nuts to mount the UbiSwitch module.

The updated version of the heatsink also includes spacers so they are no longer needed. The above assembly instructions are out of date.

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8 Datasheet Changelog

Date	Datasheet Version	Author	Notes
5/2/2023	A_A	Josh Elijah	Initial release
9/2/2023	A_B	Josh Elijah	Added new heatsink information and amended calculations with improved heatsink
21/03/2023	A_C	Josh Elijah	Added 7 Assembly and Mounting Information and updated heatsink calculations
03/04/2023	A_D	Josh Elijah	Changed M3 12mm bolt to M3 10mm to address the fact that the 12mm bolt was too long and hitting the board
27/04/2023	A_E	Josh Elijah	Changed wording of some sections
29/06/2023	A_F	Binh Nguyen	Fixed errors in pins, clk is on pin4 not pin2 and one of the diff pairs has a pin number of 23 which is also incorrect
18/07/2023	A_G	Josh Elijah	Changed input voltage range requirement from 8-60V to 5-60V, based on testing.
01/08/2023	A_H	Josh Elijah	Fixed reference to M2.5 screws in figure 10, updated them to M3 screws.
25/10/2023	A_I	Jaclyn Li	Table 1.1.2 General Information and Temperature range in 2.5 Environmental Performance updated to be correct values.
09/01/2024	A_J	Jaclyn Li	Updated to Revision B and updated IGMP/MLD Snooping information
01/05/2024	B_K	Jaclyn Li	Updated operating temperature range from “-40°C to +85°C” to “-70°C to +110°C”. Updated storage temperature range from “-40°C to +125°C” to “-70°C to +125°C”.
10/05/2024	B_B	Josh Elijah	Added note about UbiSwitch CLI, and added a note about Baseboard Revision B integrated spacers

22/08/2024	B_C	Josh Elijah	Updated table 5 to make more clear the features that are currently available in BloxOSLite.
26/08/2024	B_D	Josh Elijah	Removed reference to thermal paste and replaced it with a thermal pad suggestion.
30/01/2025	B_E	Josh Elijah	• Added section on software management features • Removed reference to UbiConn • Added additional mounting hardware under 1.3 Included Equipment • Added extra guidance on 3.3V TTL serial port protection • Removed section about SMI port

9 Contact

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

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10 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/