UbiSwitch Baseboard
Daughterboard for UbiSwitch

DESCRIPTION

The Amphenol UbiSwitch Baseboard is a breakout system designed to provide a compact (70mm x 70mm) plug and play system for UbiSwitch. UbiSwitch Baseboard provides 3 x 10Gbps on SFP+ cages and 8 x 1Gbps ethernet ports on Molex PicoClasp headers.

The UbiSwitch Baseboard itself does not contain any ethernet switching silicon, rather it contains the necessary connectors and routing required to use UbiSwitch as a complete system. This includes three 10GBASE-R SFP+, and eight Molex PicoClasp headers for direct connection to an external system.

When used with UbiSwitch, UbiSwitch BaseBoard will automatically begin auto negotiation with any connected devices and begin receiving and forwarding frames as an unmanaged ethernet switch.

UbiSwitch BaseBoard runs from a wide input voltage range of 8V to 60V allowing integration into a wide range of applications.

FEATURES

- 3 x 10GBASE-R ethernet ports

- 8 x 10/100/1000BASE-T ethernet ports

- Input voltage range from 8V to 60V

- 69.8mm x 69.8mm board size

- Positive Locking Molex PicoClasp connectors for power and Ethernet ports

- SFP+ connector for 10G capable SFPs

- I2C Mux for access to all I2C busses on SFPs (currently unimplemented in software)

HOW TO ORDER

Part Number	CF-02BBUD1	UbiSwitch Baseboard

GENERAL SPECIFICATIONS

| Voltage Input	8V to 60V DC
Supported Protocols	10BASE-T, 100BASE-TX, 1000BASE-T, 10GBASE-R
Power Consumption	7.2W (idle)
Weight	60 grams
Size	69.8mm x 69.8mm x 18mm (without heatsink)
Operating Temperature	-70°C to +110°C
Storage Temperature	-70°C to +125°C

GENERAL OPERATING INSTRUCTIONS

UbiSwitch Baseboard 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 8V and as high as 60V. UbiSwitch Baseboard is purely a breakout board, and contains no switching capabilities by itself. It must be used with UbiSwitch to create a full ethernet switch system.
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To use UbiSwitch Baseboard, first mate the board with UbiSwitch then apply an input voltage from 8 to 60V. Then connect external devices and the Ubi system will begin functioning as an unmanaged switch with up to 3 x 10GBASE-R SFP+ ports and 8 x 1GBASE-T ports.
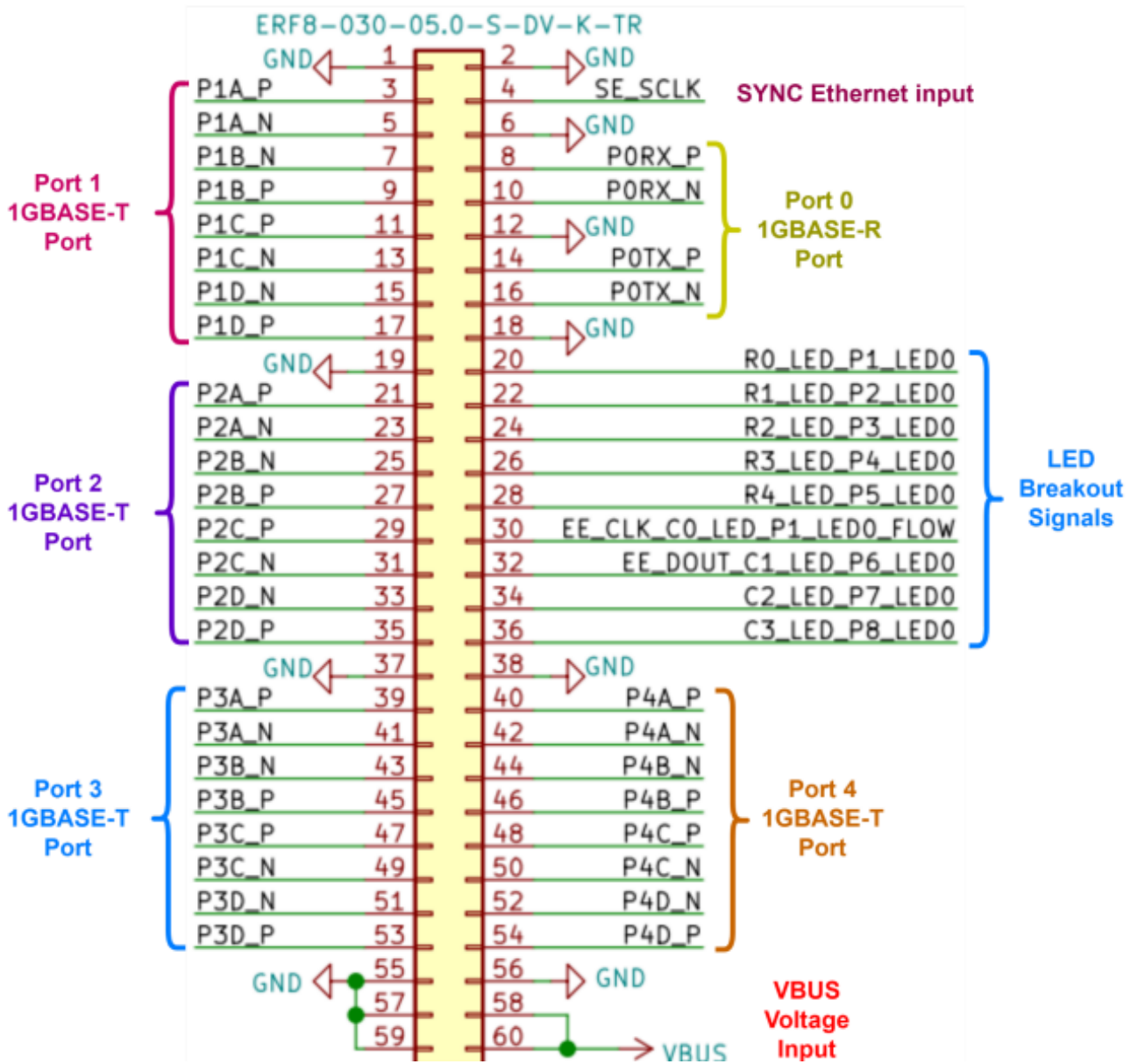
SAFETY INFORMATION

- 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.
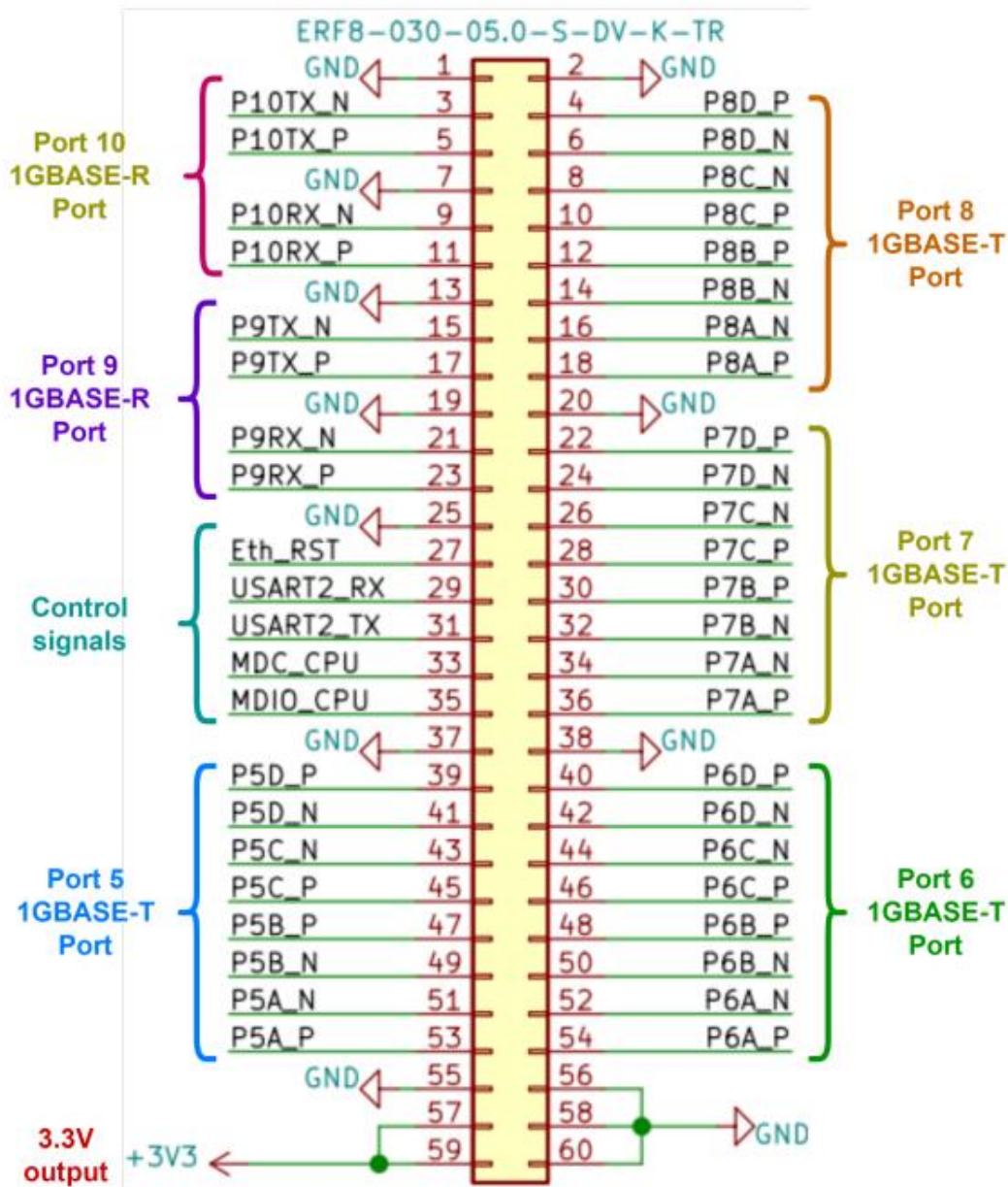
BLOCK DIAGRAM
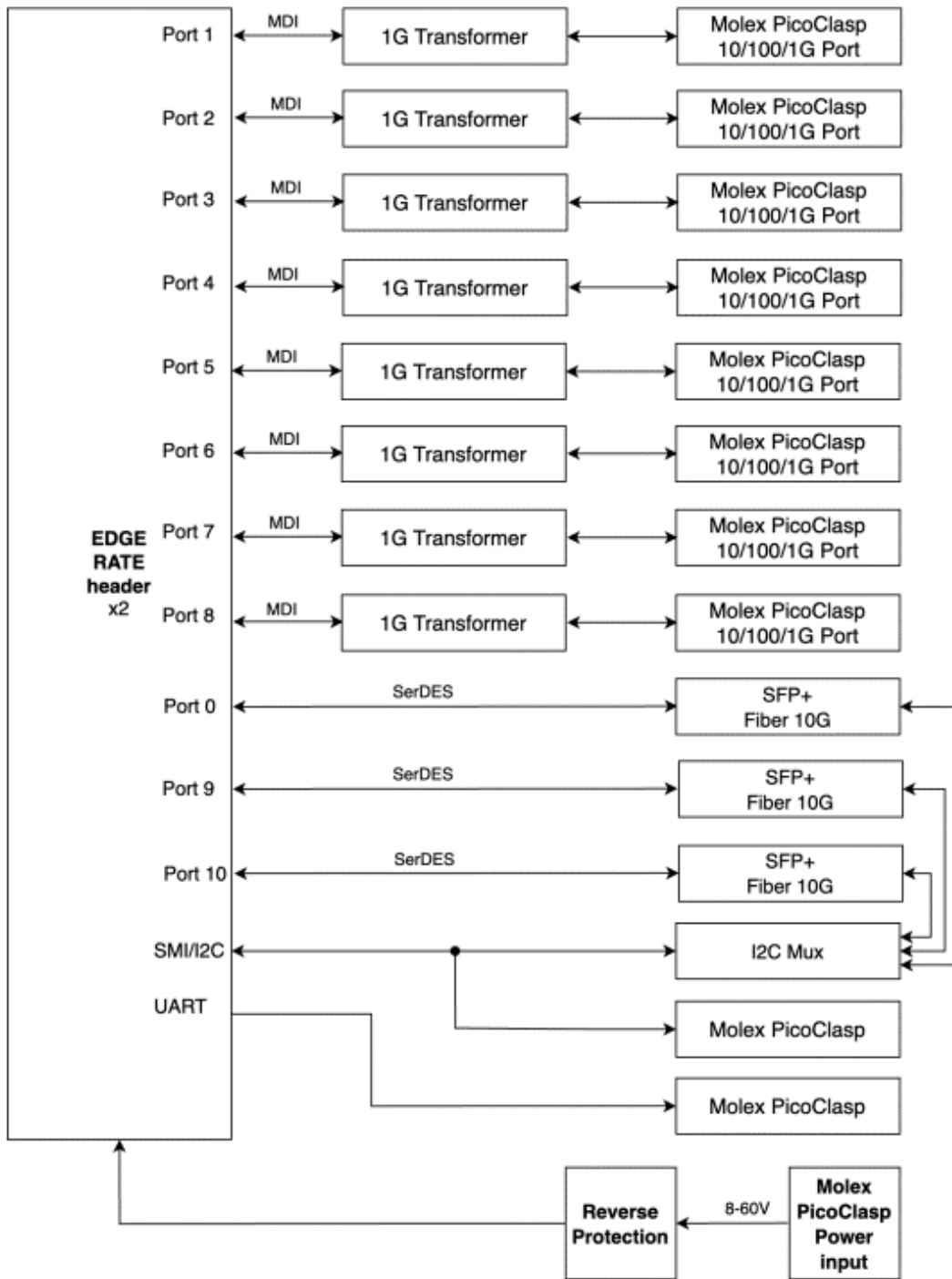
SYSTEM DESIGN

UbiSwitch contains the main ethernet switch IC. This IC provides eight 1GBASE-T ethernet ports and three 10Gbps 10GBASE-R ports. These eleven ports are routed directly to a Samtec Edge Rate connector on UbiSwitch, along with several other power and control lines.

ERF8-030-05.0-S-DV-K-TR

GND	1	2	GND	
P1A_P	3	4	SE_SCLK	SYNC Ethernet input
P1A_N	5	6	GND	
P1B_N	7	8	P0RX_P	
P1B_P	9	10	P0RX_N	Port 0
P1C_P	11	12	GND	1GBASE-R
P1C_N	13	14	P0TX_P	Port
P1D_N	15	16	P0TX_N	
P1D_P	17	18	GND	
GND	19	20	R0_LED_P1_LED0	
P2A_P	21	22	R1_LED_P2_LED0	
P2A_N	23	24	R2_LED_P3_LED0	
P2B_N	25	26	R3_LED_P4_LED0	
P2B_P	27	28	R4_LED_P5_LED0	LED Breakout Signals
P2C_P	29	30	EE_CLK_C0_LED_P1_LED0_FLOW	
P2C_N	31	32	EE_DOUT_C1_LED_P6_LED0	
P2D_N	33	34	C2_LED_P7_LED0	
P2D_P	35	36	C3_LED_P8_LED0	
GND	37	38	GND	
P3A_P	39	40	P4A_P	
P3A_N	41	42	P4A_N	
P3B_N	43	44	P4B_N	
P3B_P	45	46	P4B_P	Port 4
P3C_P	47	48	P4C_P	1GBASE-T
P3C_N	49	50	P4C_N	Port
P3D_N	51	52	P4D_N	
P3D_P	53	54	P4D_P	
GND	55	56	GND	
	57	58		VBUS Voltage Input
	59	60	VBUS	

Port 1 1GBASE-T Port (pins 3–17)
Port 2 1GBASE-T Port (pins 21–35)
Port 3 1GBASE-T Port (pins 39–53)

Signals on the UbiSwitch carried on the Samtec Edge Rate header 1

Signals on the UbiSwitch carried on the Samtec Edge Rate header 2

The signals shown in the previous diagrams enter UbiSwitch Baseboard through its corresponding Samtec EdgeRate header. UbiSwitch Baseboard then routes these signals in the following ways

- Ports 1-8 (the 10/100/1GBASE-T ports) are routed to Molex PicoClasp headers through ethernet magnetics.

- Ports 0, 9 and 10 (the 10GBASE-R ports) are routed to 1x3 SFP+ connector.

- UbiSwitch Baseboard houses a Molex PicoClasp header for 8-60V power input (VBus). This is then routed to the Samtec Edge Rate header to power the UbiSwitch.

- Serial signals are routed to a Molex PicoClasp header.

- SMI signals are routed to a Molex PicoClasp header, and also to an I2C mux that connects to the I2C busses on all three SFP ports.

Auto negotiation

All ports on the UbiSwitch system support auto negotiation, auto-MDI/MDIX and polarity correction. Each port will auto negotiate with the connected device to achieve the fastest possible speed. The fastest possible speed will depend on what the connected device is capable of, and the quality of the cabling between UbiSwitch Baseboard and the connected device. This simplifies system connectivity, meaning eight of the ports on UbiSwitch Baseboard are compatible with any 10/100/1G device and three ports are compatible with Fiber SFP+ devices.

INCLUDED EQUIPMENT

The product includes the following:

1 x UbiSwitch Baseboard board

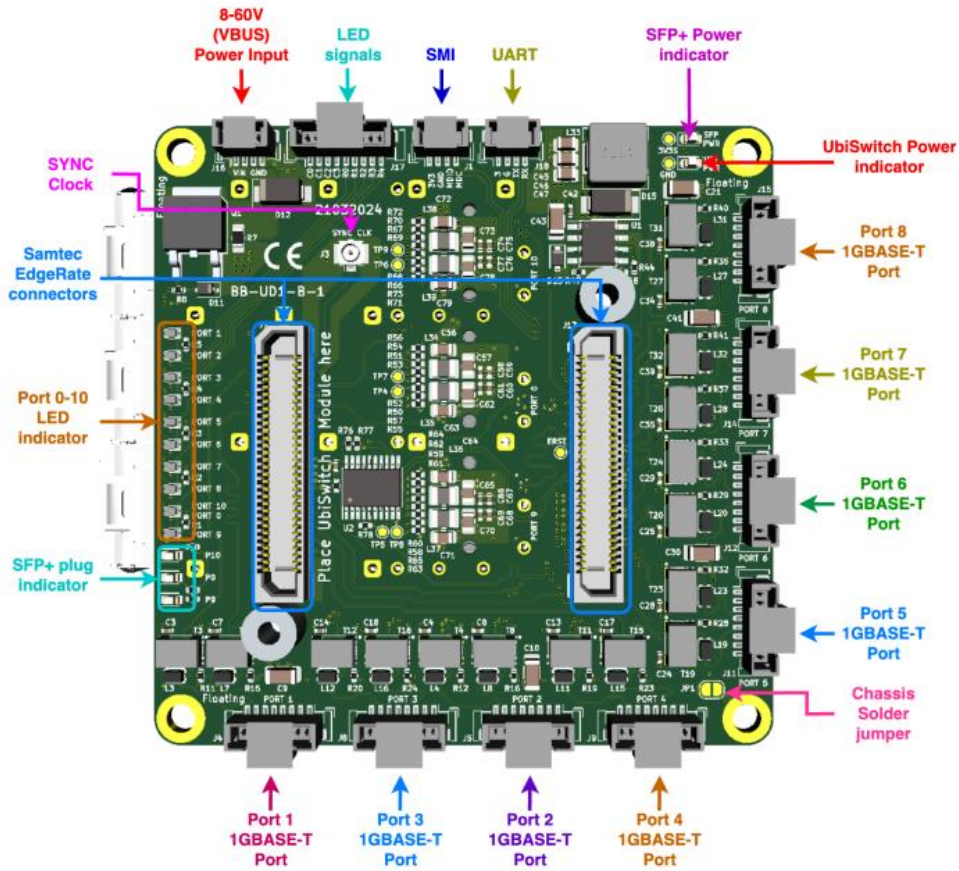8 x Molex PicoClasp to RJ45 4-way Shielded Twisted Pair cables (300mm)

1 x Molex PicoClasp Power Cable to bare, tinned leads (300mm)

RoHS Compliance

The Amphenol UbiSwitch Baseboard complies with the RoHS (Restriction of Hazardous Substances Directive) Certificate of Compliance.
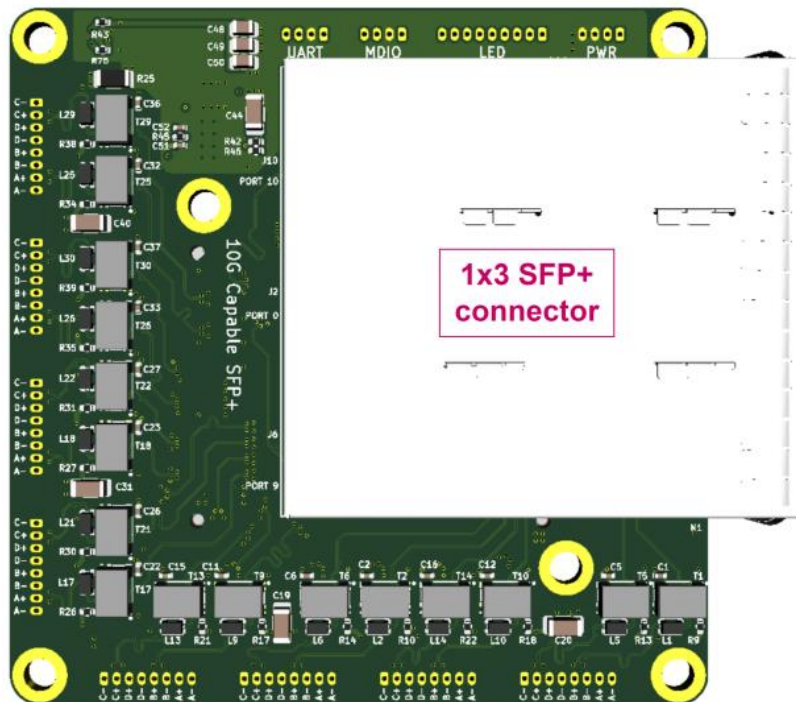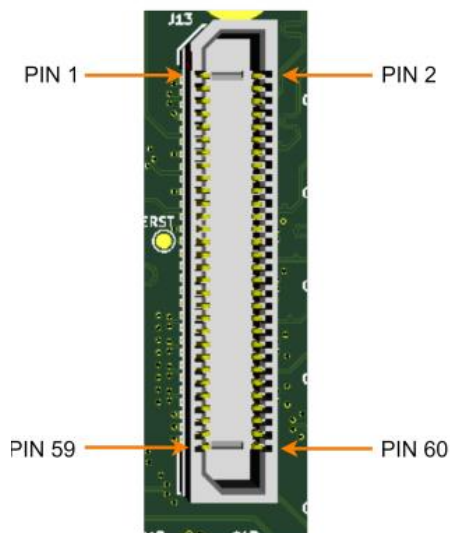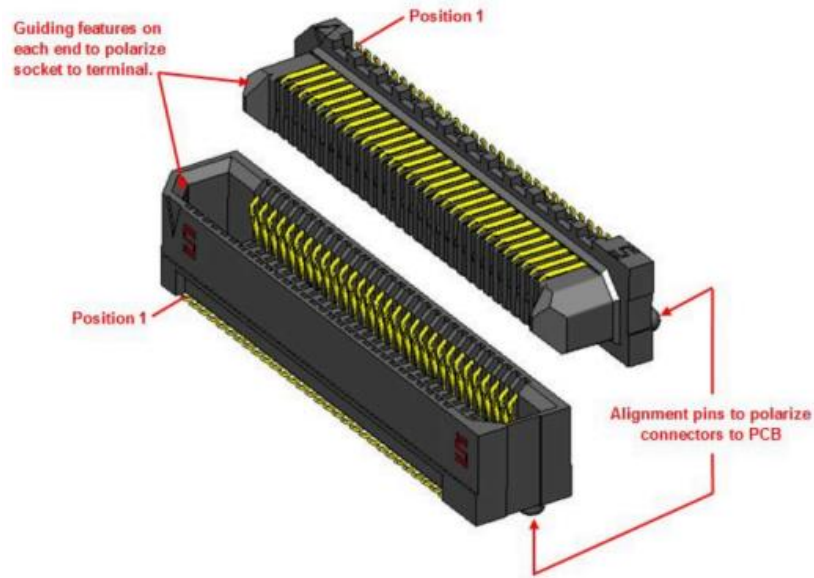
Board Map (front)

Board Map (Back)

CONNECTORS AND PINOUTS

Edge Rate connector
The 8 ports, 3 SerDES, SMI, LED signals, UART, input voltage and output voltage are placed onto a Samtec Edge Rate™ (MPN: ERF8-030-05.0-S-DV-K-TR) stackable header. The Edge Rate connector on the UbiSwitch Baseboard Board is shown below.

Edge rate connector mating

SIGNAL TO PIN ASSIGNMENTS

Connector	Pin Name	Pin Number	Description
J7	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, 8V to 60V
	VBUS	60	Input supply voltage, 8V to 60V

P1A_P	3	Port 1 1000BASE-T Differential Data Pair A ~ D	
P1A_N	5	Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.	
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	
P2A_N	23	Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.	
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	
P3A_N	41	Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.	
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	34	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	2	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.

Connector	Pin Name	Pin Number	Description
J13	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
	P5A_N	51	Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.
	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
	P6A_N	52	Note: 100BASE-TX and 10BASE-Te are also 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
	P7A_N	34	Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.
	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
	P8A_N	16	Note: 100BASE-TX and 10BASE-Te are also supported on the A and B pairs.
	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
MDC_CPU	33	Management Data Clock, 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.
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
USART2_RX	29	Microcontroller USART RX line
USART2_TX	31	Microcontroller USART TX line

SFP+ connector

UbiSwitch Baseboard supports 3x10Gbps Fiber SFP+ module. To achieve a very small form factor, a 1x3 SFP+ cage is used.
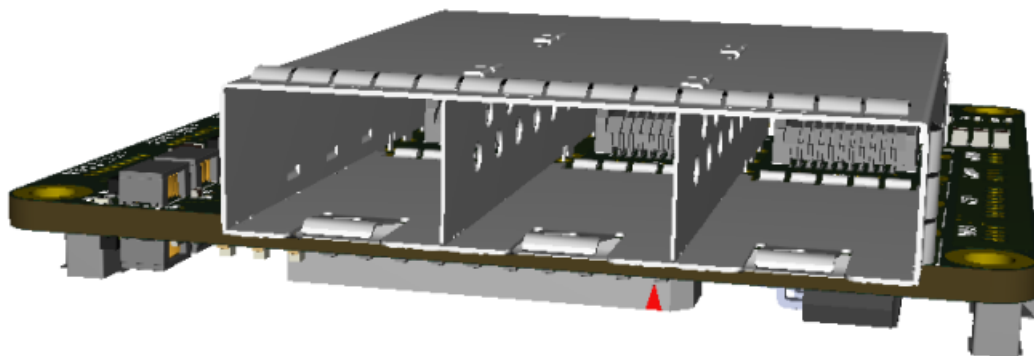
1x3 SFP+ connector on UbiSwitch Baseboard

Out the box, only 10G capable SFPs can be used with the UbiSwitch module, the SFP ports on UbiSwitch BaseBoard are only compatible with 10G capable SFPs. These three ports are configured by default with a 10GBASE-R interface. A 10G SFP, such as the Cisco SFP-10G-T-X module should be used.

Ports 9 and 10 SFPs can be configured to run in 1000BASE-X mode for 1G SFPs by making a small solder connection on UbiSwitch Module. All three SFPs (ports 0, 9 and 10) will be able to be configured via the UbiSwitch running BloxOsLite.

Please note that these cages can occasionally be quite stiff on initial installation of an SFP. You may need to apply a fair amount of force, see image below.
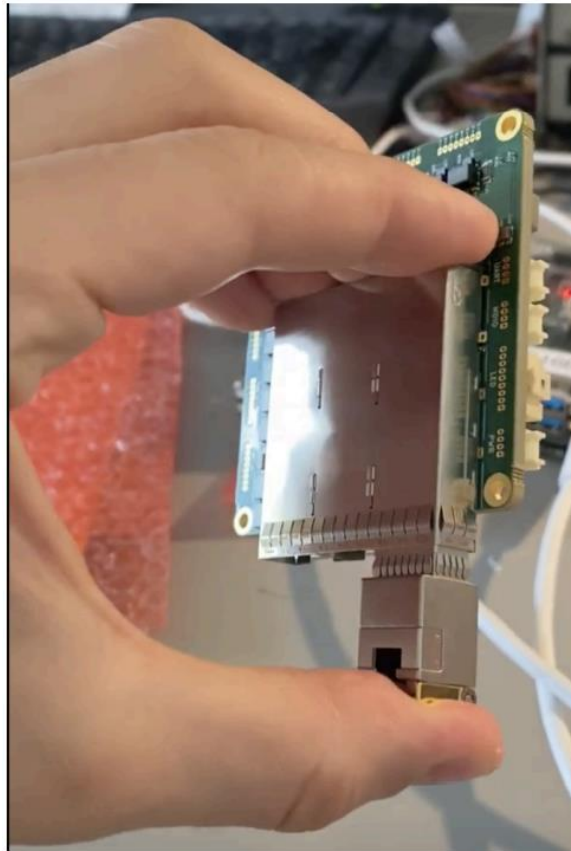
How to insert an SFP into the SFP cage without risking damage to any components on the board.

Voltage Input

The top left connector is the voltage input terminal. A four pin PicoClasp connector is used to allow the input voltage to be easily daisy chained between boards (two wires per power rail).

The voltage input has the following features:

● Voltage input can range from 8 to 60V

● Maximum allowable voltage of 65V

● Transient voltage protection above 66.3V

● Reverse polarity protection
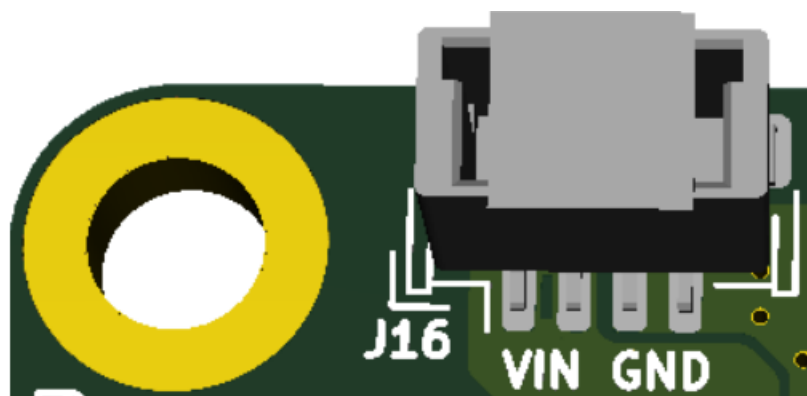
Voltage input header pinout

Voltage input connector part numbers

Connector on board	Mating header	Crimp used	Wire used
5019400407	5019390400	5013340000	UL1061, 28AWG

Cable pinout
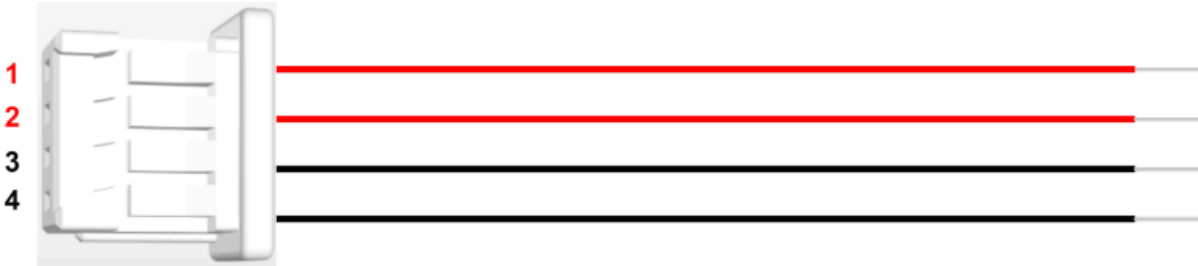
Voltage input cable pinout (red = V+, black = GND)

Ethernet Ports

There are eight ethernet connectors on UbiSwitch Baseboard. Each connector has eight pins corresponding to the eight signals required for 1000BASE-T which are A-, A+, B-, B+, D-, D+, C+, C-. The pin mapping of all eight connectors is identical.
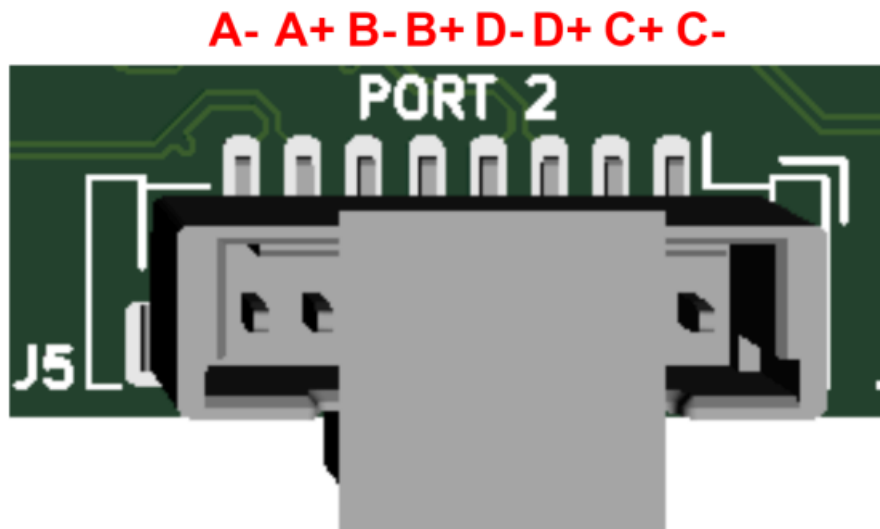
Ethernet Port Pinout

Ethernet connector pinout and part numbers

Connector on board	Mating header	Crimp used	Wire used
5013310807	5013300800	5013340000	UL1061, 28AWG

Ethernet Cable pinout
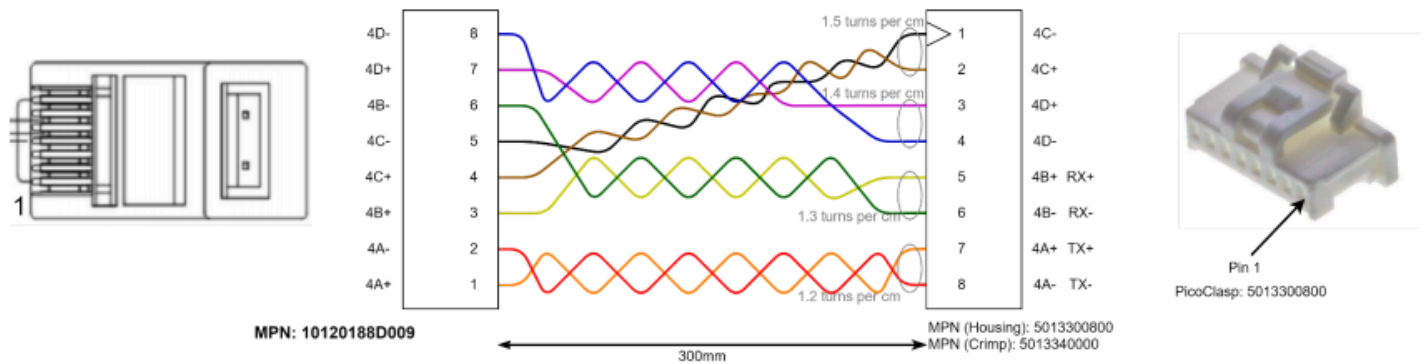
External LED Header

An External LED header on the top of the board allows port activity indicator signals can be brought off-board for integration into a chassis.
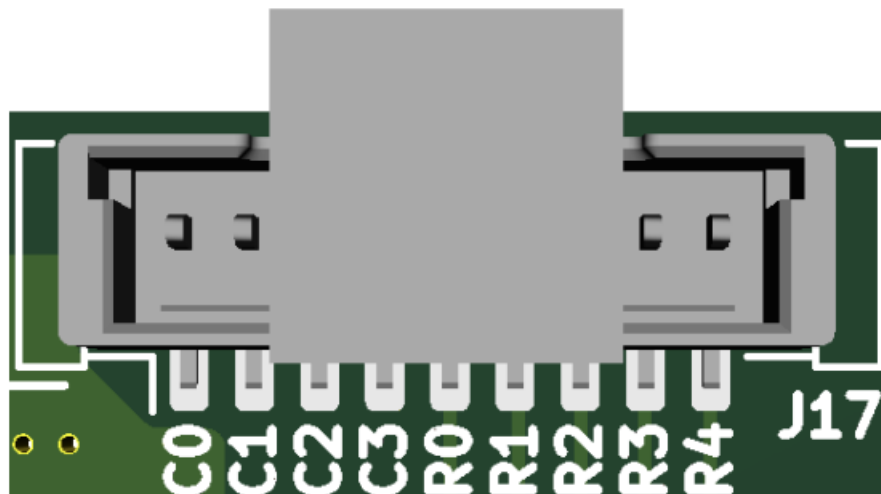
External LED header pinout

Ethernet connector pinout and part numbers

Connector on board	Mating header	Crimp used	Wire used
5013310907	5013300900	5013340000	UL1061, 28AWG

External LEDs connection should be followed below diagram:
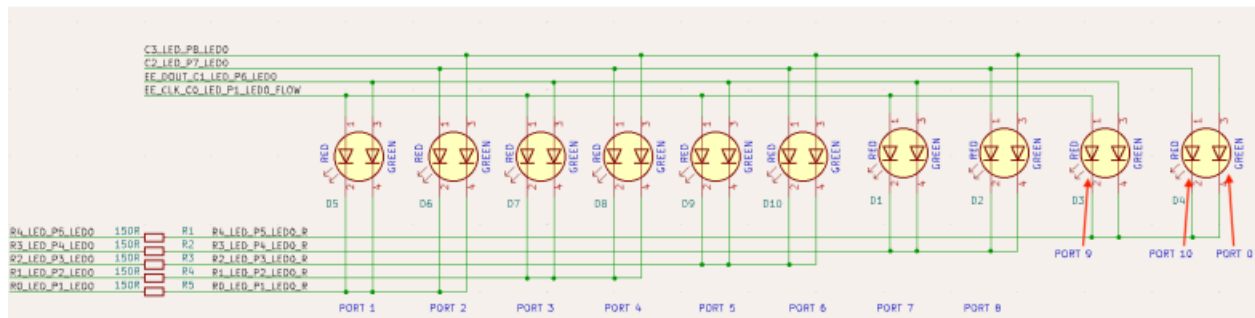
Ports 1 to 8 use two LED signals to indicate link speed and activity. In figure 14 above, these two LED signals are mapped to a dual color LED, but this could alternatively be two single color LEDs. In figure 14 above, the color corresponds to the link speed and activity is shown via blinking. (Green blinking indicates a 1000 Mbps connection, Red blinking indicates a 100Mbps connection, Orange blink indicates a 10Mbps connection). A solid on LED indicates Link/No Activity.

Ports 0, 9 and 10 each use a single LED signal to indicate activity. In the diagram above, Port 10 uses the red part of a dual color LED while Port 0 uses the green part of a dual color LED to save space. Port 9 uses the red/green part of another dual color LED.

150 Ω resistors are embedded onto the board and hence will already be in series with any external LEDs. This means that additional series resistors may not need to be added to any external LEDs.

SMI header

The SMI header on the top of the board allows access to the registers of Switch IC on the UbiSwitch module, in addition to

three SFPs. This header is generally used for troubleshooting, it is not recommended to use the SMI header for switch

configuration. Instead, use the serial header that provides access to the command line interface on UbiSwitch.
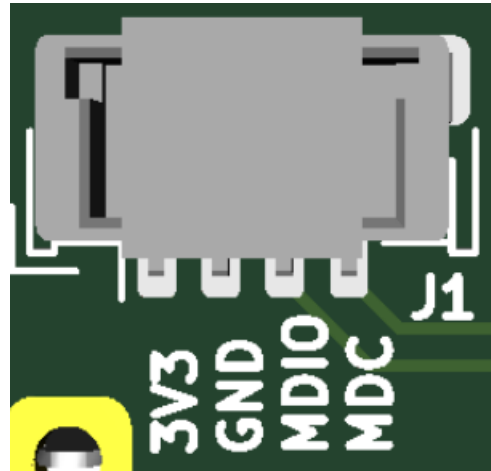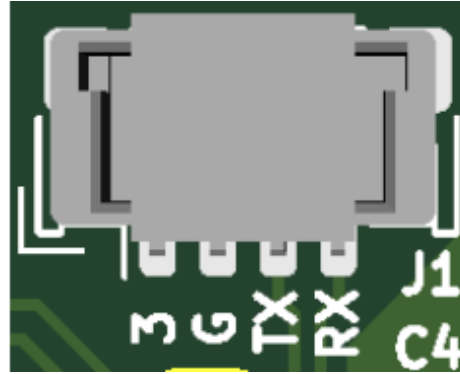
SMI header pinout

SMI connector part numbers

Connector on board	Mating header	Crimp used	Wire used
5019400407	5019390400	5013340000	UL1061, 28AWG

Serial header

The serial header allows control messages to be sent/received to/from the microcontroller on UbiSwitch to configure the device. This allows the user to wire any external serial device to UbiSwitch Baseboard, and send serial commands to the system to provide switch configuration

SMI header pinout

UART connector and part numbers

Connector on board	Mating header	Crimp used	Wire used
5019400407	5019390400	5013340000	UL1061, 28AWG

IPEX header

LEDs

There are 15 LEDs on UbiSwitch Baseboard in total. Ten of these LEDs are dual color LEDs, allowing for a total of twenty-five LED signals on this board. Ten of the LED signals can be taken off the board.

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

The 3.3V UBI Power Indicator LED (Green) indicates that 3.3V of the UbiSwitch module is present. That indicates that the UbiSwitch is stacked on the UbiSwitch Baseboard board correctly and both are powered. It should be solid green in normal operation.
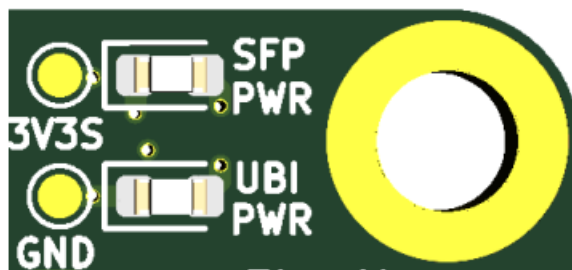
Power Indicator LED

There are three LEDs (Green) at bottom left of UbiSwitch Baseboard indicating when SFP+ module is plugged to the SFP+ connector. Each LED indicates one SFP+ module at port 0, 9, 10. It should be solid green when SFP+ module is plugged.
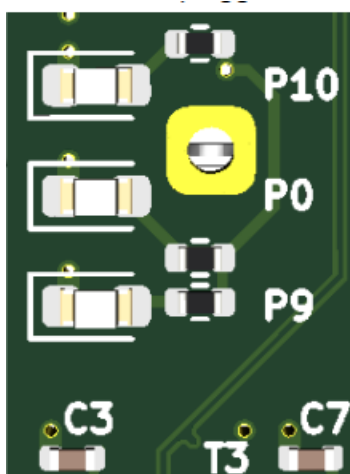
SFP+ module Indicator LED

Each Port from 1 to 8 Activity LED is a Red/Green dual color LED and each corresponds to a specific port. They indicate activity on each port and will blink when there is traffic on a port. They should be solid off when a port is not connected to any device, and they should blink under normal operation (Green blinking indicates a 1000 Mbps connection, Red blinking indicates a 100Mbps connection, Orange blink indicates a 10Mbps connection). A solid on LED indicates Link/No Activity.
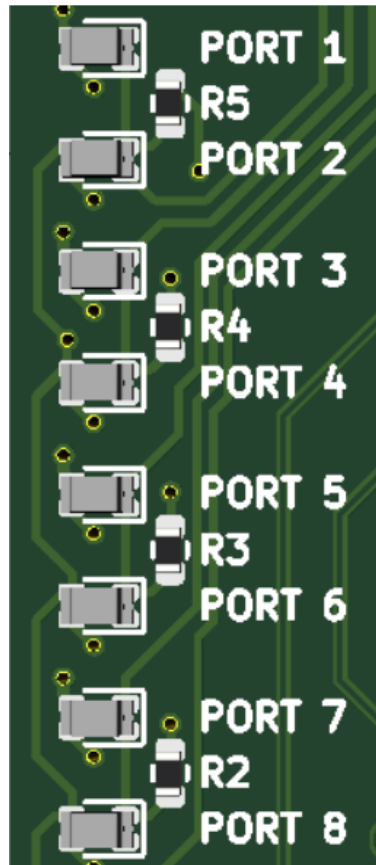
Port 1-8 Link/Activity LEDs

Port 10/0 Activity LED is D4 - Red/Green . Port 9 activity LED is D3 - Red. They should blink under normal operation.
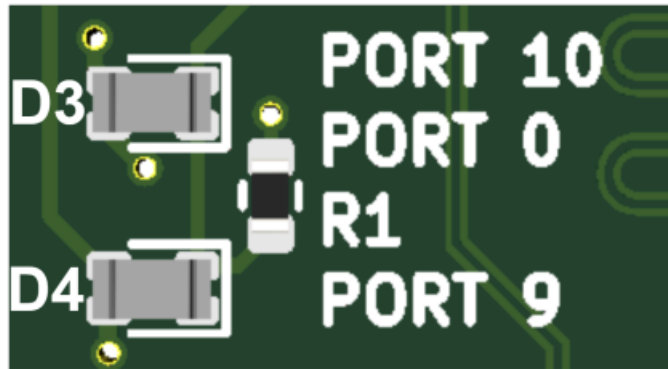
Port 0,9,10 Activity LEDs

Mounting holes

There are six mounting holes on the UbiSwitch Baseboard which are floating by default (not connected to any electrical NET on the board). These holes are designed to accept M3 screws. Mounting holes 5,6 are used to fix UbiSwitch on UbiSwitch Baseboard, and are populated with board mounted threaded M3 standoffs to allow for easy assembly. Mounting holes 1,2,3,4 are used to fix UbiSwitch Baseboard to an enclosure. If external access to the shield ground is required on UbiSwitch Baseboard, mounting hole 3 can be connected to UbiSwitch Baseboard's chassis ground by solder bridge jumper JP1. JP1 is open by default.

DEVICE CONFIGURATION

UbiSwitch Baseboard itself is a passive board and requires no configuration. For information on

how to configure UbiSwitch, please refer to the UbiSwitch Datasheet.

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