SwitchBlox Rugged

Small Rugged 5 port 10/100Mbps Ethernet Switch

MPN: BB-SWR-F-1

Datasheet

October 2023

Board revision F

Contents

1 General Information

1.1 Functionality and Features of SwitchBlox Rugged

SwitchBlox Rugged is a rugged form factor 5 port 10/100Mbps (10BASE-T/100BASE-TX) Layer 2 unmanaged and managed ethernet switch. It has a non-blocking fabric meaning that 100Mbps speed can be achieved simultaneously on all ports. It is a very small form factor Ethernet Switch designed for the harshest applications, which can operate from -40°C to 105°C.

It runs from a wide input voltage range of 5 to 60V, features PoE injection onboard, and houses a microcontroller for custom firmware upload.

The board is stackable so that two boards can be combined to create a 10 port switch.

1.1.1 Features

- 5 x 10/100M (10BASE-T/100BASE-TX) ethernet ports
- Input voltage range from 5 to 60V
- Reverse protected voltage input
- Transient protected voltage input
- -40°C to 105°C operation range
- Stackable header to allow 10 ports total
- 44.5mm x 44.5mm board size
- Molex PicoBlade connectors for power and ports
- Automatic MDI-X crossover
- Unmanaged (out-the-box) functionality
- Port Activity Indicators

1.1.2 General Information

Voltage Input	5V to 60V DC (65V absolute max)
PoE Maximum Power Output	N/A
Supported Protocols	10BASE-T, 100BASE-TX
Power Consumption	600mW (idle) to 1200mW (full switching)
Weight	16 grams
Size	44.5mm x 44.5mm x 11.17mm
Operating Temperature	-40°C to +105°C
Storage Temperature	-55°C to +125°C

Table 1: General Information

1.1.3 General Operating Instructions

SwitchBlox Rugged 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.

In the simplest case of an unmanaged switch application, SwitchBlox Rugged can be operated immediately by following the following steps.

1) Apply a voltage between 5V to 60V to the voltage input terminals.

2) Connect external devices to the ethernet ports using RJ45 to Picoblade cables.

3) SwitchBlox Rugged will automatically begin auto negotiation with connected devices and begin receiving and forwarding packets to/from all connected devices.

In managed mode SwitchBlox Rugged can implement VLAN setup, port mirroring and QoS.

Unlike revision E, revision F of this board contains a microcontroller. This allows custom firmware to be uploaded.

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.
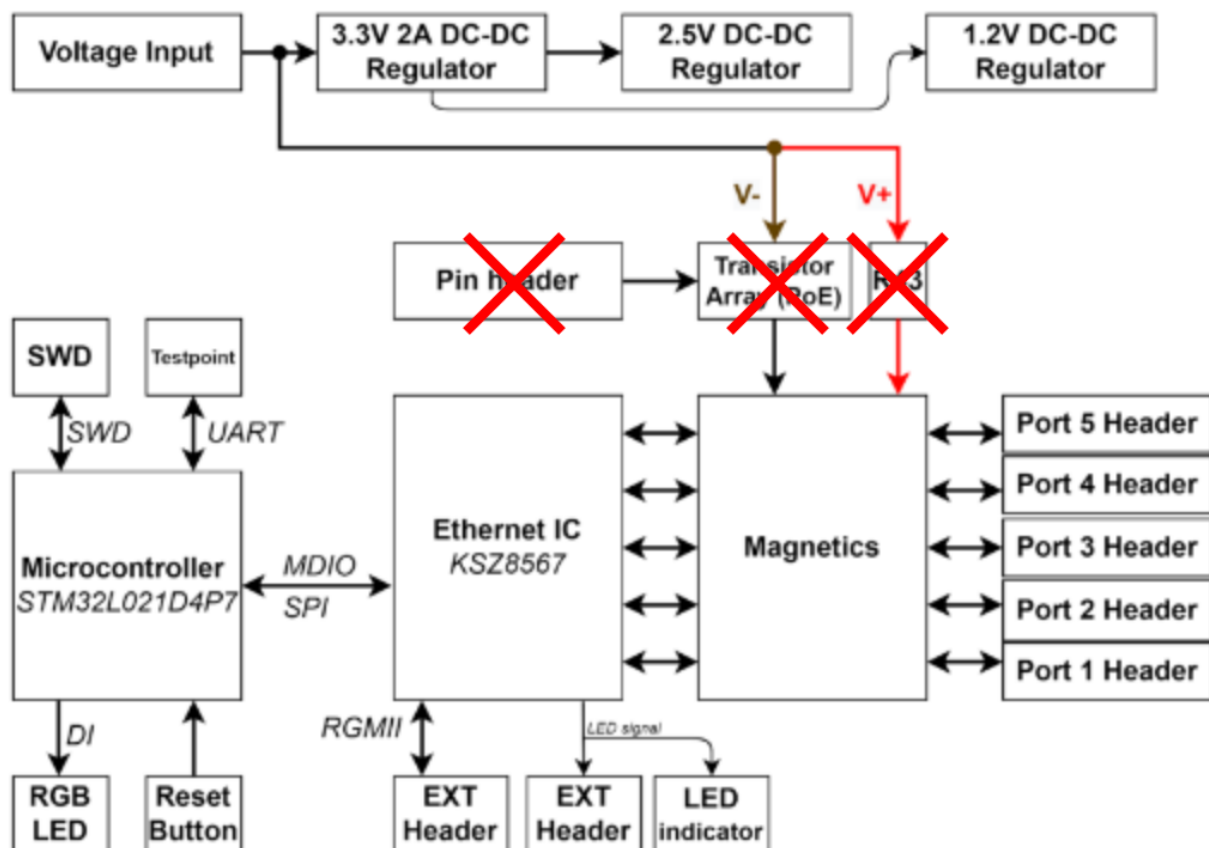
1.3 Block Diagram

Figure 1: SwitchBlox Rugged Block Diagram, red crosses show components removed between Revision D and Revision F

1.4 Included Equipment

The product includes the following:
1 x SwitchBlox Rugged board
5 x Molex Picoblade to RJ45 4-way Unshielded Twisted Pair cables (300mm)
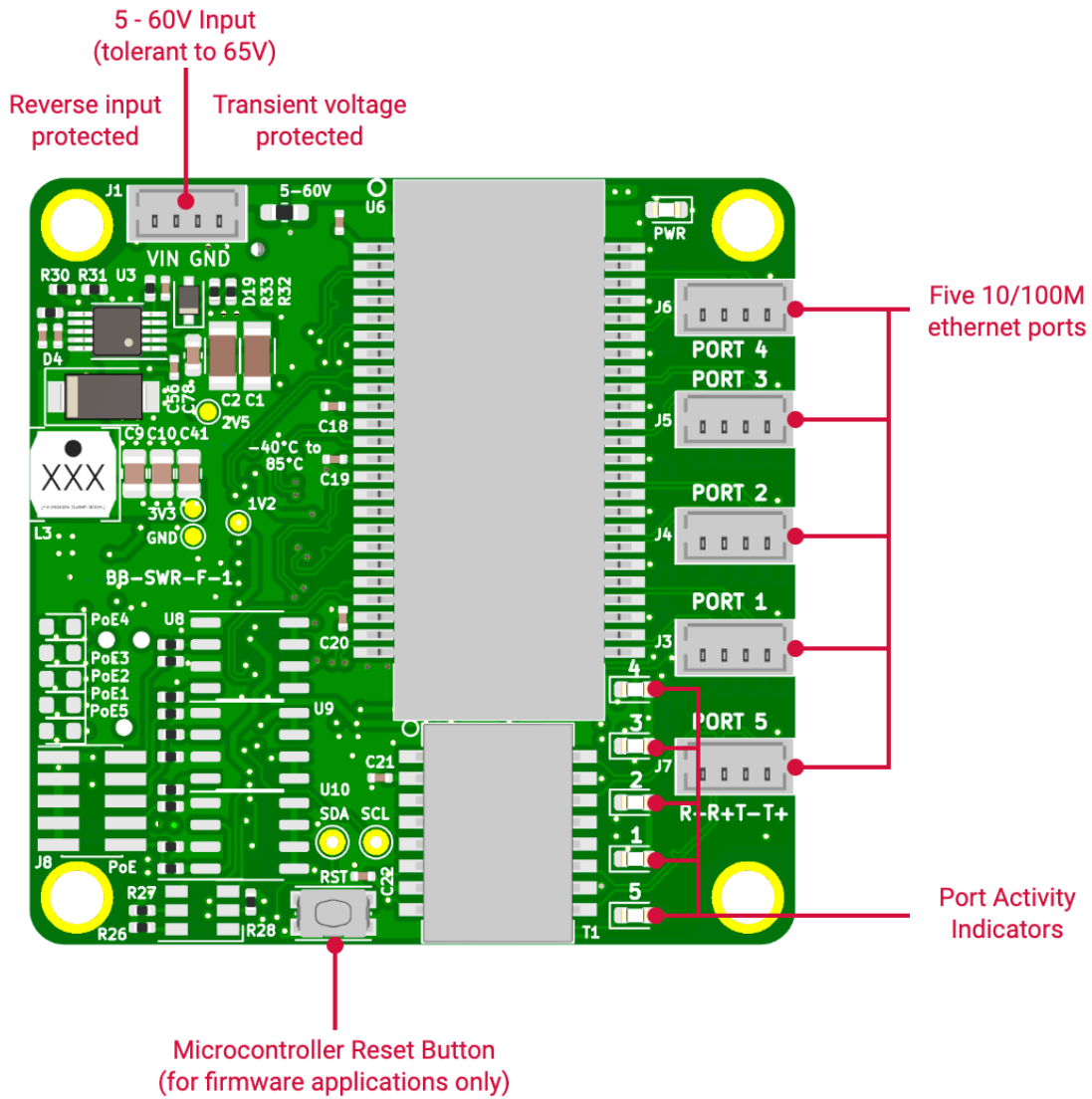1 x Molex Picoblade to bare, tinned leads (300mm)

1.5 RoHS Certification of Compliance

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

2 Hardware Interfaces

2.1 Board Map

5 - 60V Input
(tolerant to 65V)

Reverse input
protected

Transient voltage
protected

Five 10/100M
ethernet ports

Port Activity
Indicators

Microcontroller Reset Button
(for firmware applications only)

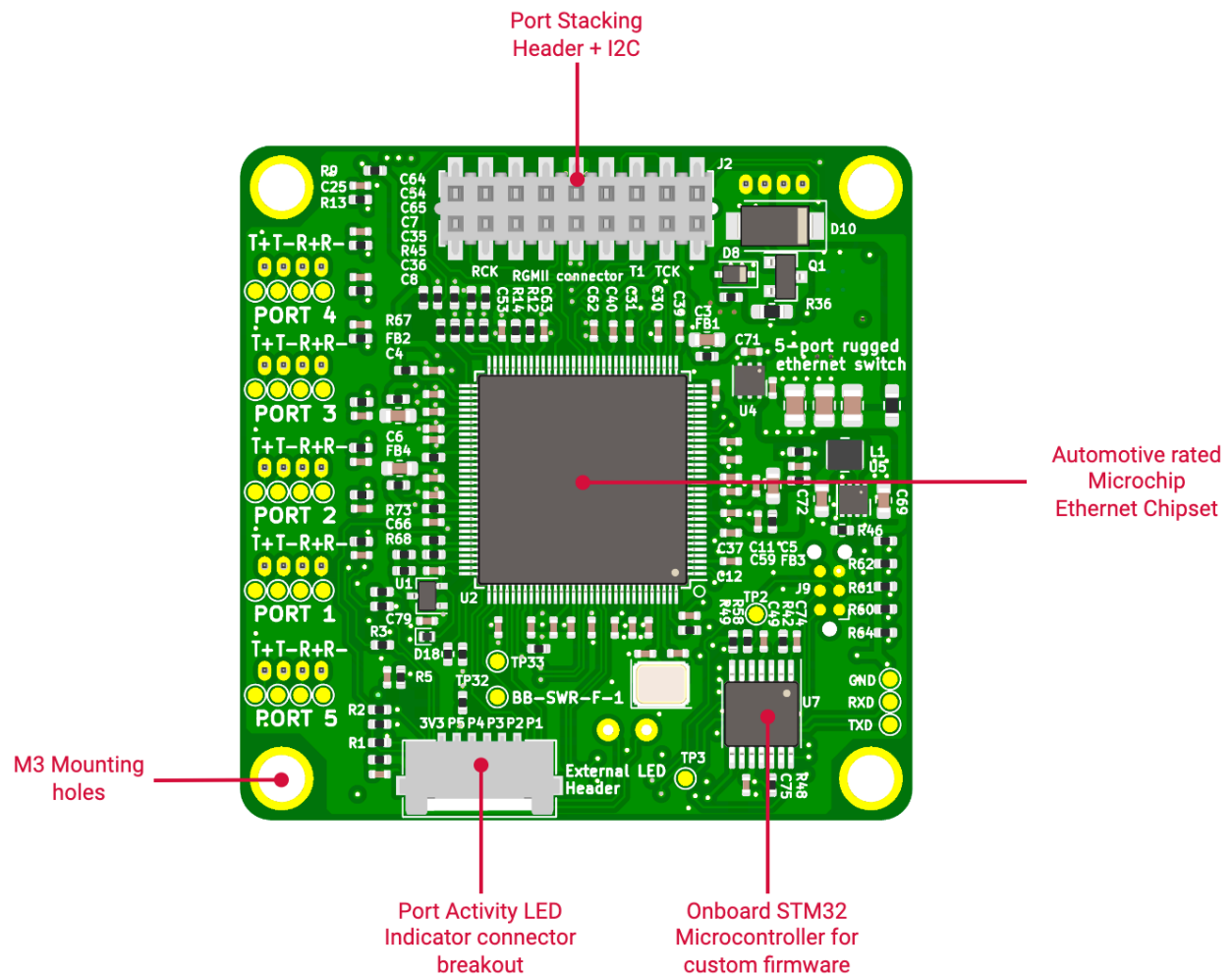*Figure 2: SwitchBlox Rugged Board Map (front)*

Figure 3: SwitchBlox Rugged Board Map (back)

2.2 Connectors and Pinouts

2.2.1 Voltage Input

The top left connector is the voltage input terminal. A four pin 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 5 to 60V
- Maximum allowable voltage of 65V
- Transient voltage protection above 66.3V
- Reverse polarity protection

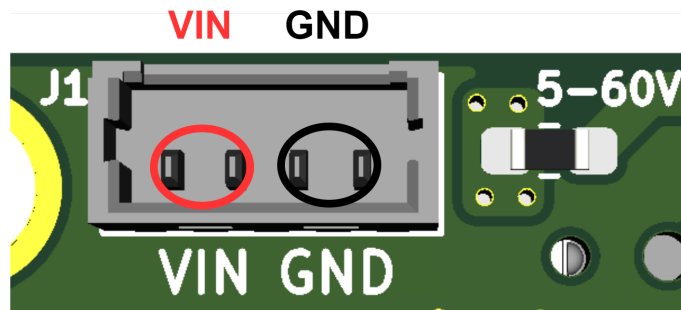The pinout of the voltage input connector is shown in figure 4 below.

Figure 4: Voltage input header pinout

Connector part numbers

Connector on board	Mating header	Crimp used	Wire used
10114829-10104LF	10114826-00004LF	500798000	UL1061, 28AWG

Table 2: Voltage input connector pinout and part numbers
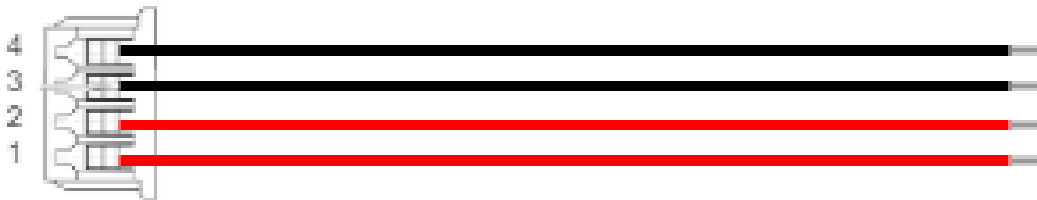
cable pinout

Figure 5: Voltage input cable pinout (red = V+, black = GND)

2.2.2 Ethernet Ports

There are five ethernet connectors on SwitchBlox Rugged. Each connector has four pins corresponding to the four signals required for 100BASE-TX which are R-, R+, T-, T+.. The pin mapping of all five connectors is identical.
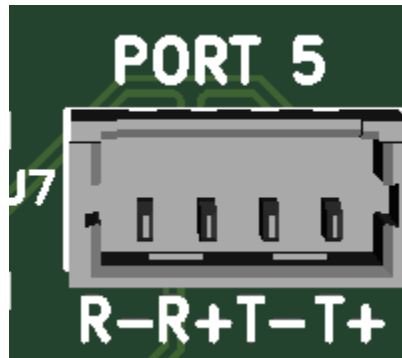
Figure 6: Ethernet port pinout

Connector on board	Mating header	Crimp used	Wire used
10114829-10104LF	10114826-00004LF	500798000	UL1061, 28AWG

Table 4: Ethernet connector pinout and part numbers
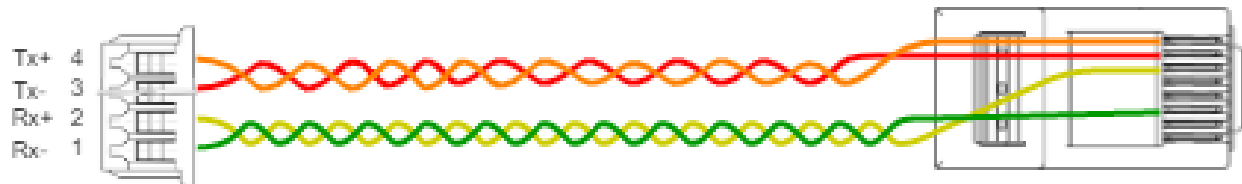
Cable pinout

Figure 7: Ethernet cable pinout

2.2.3 Extension RGMII header

SwitchBlox Rugged exposes RGMII and the I2C management bus on a stackable header, for board stacking purposes. This connection allows two boards to be stacked to form a 10 port switch. It also allows SwitchBlox Rugged to be stacked with Rugged SOM for full switch management. Stacking two SwitchBlox Rugged together to form a 10 port switch requires no additional configuration, however some minor additional mounting hardware is required:

- 1 x 16 position pin header (MPN: M22-2520805)
- 4 x 8mm hex standoffs (MPN: 24382)
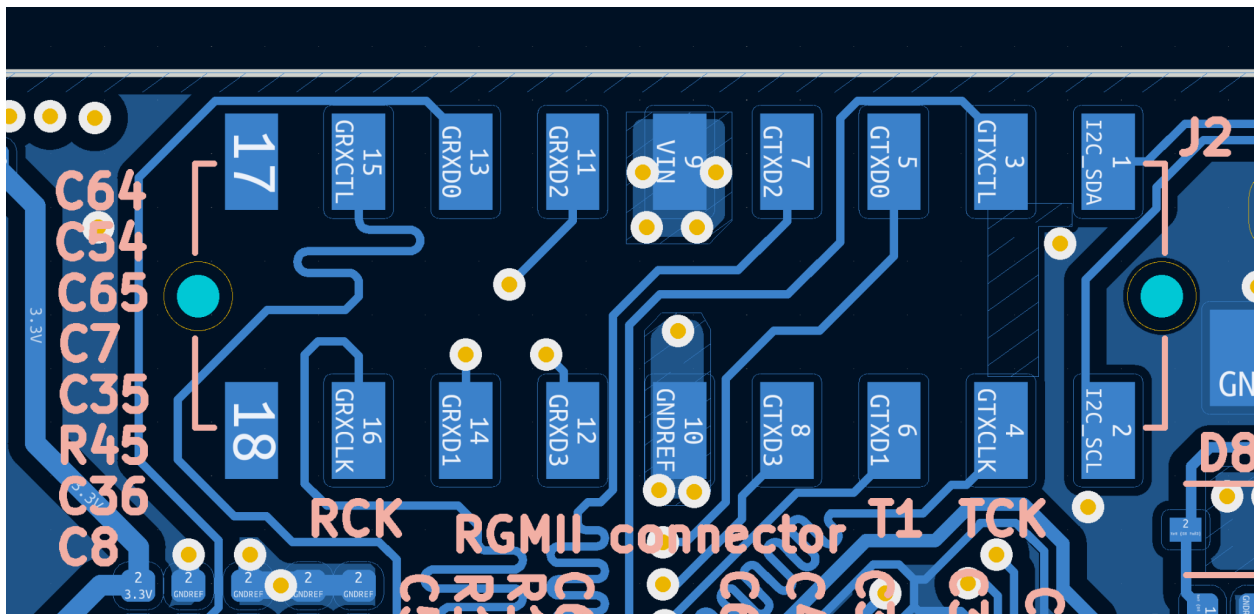- 4 x M2.5 machines screws (MPN: 29300)

Figure 8: Extension RGMII header pinout, Rx in this case refers to the received data from the switch, therefore is an output from this board. Tx is an input to this board. This is consistent with the PHY side of the RGMII

2.2.4 Using the RGMII header for Back-to-back or Rugged SOM assemblies

The 16 pin header for SwitchBlox Rugged can be plugged into the 18 pin header in either a left justified position (pins 1 and 2 are left unconnected) or a right justified position (pins 17 and 18 are left unconnected). How the pin header needs to be connected depends on whether you are connecting two SwitchBlox Rugged together to form a 10 port switch, or whether you are connecting a SwitchBlox Rugged to a Rugged SOM to form a managed switch.

For SwitchBlox Rugged to SwitchBlox Rugged (back-to-back) applications, you must connect the pin header in a left justified position, so that the I2C pins (pins 1 and 2) do not connect between both boards. This allows each board to maintain an isolated I2C management bus and is essential for correct operation.

For SwitchBlox Rugged to Rugged SOM (managed) applications, you must connect the pin header in a right justified position, so that the I2C pins (pins 1 and 2) are connected between both boards. This allows Rugged SOM to access the I2C management bus on SwitchBlox Rugged.

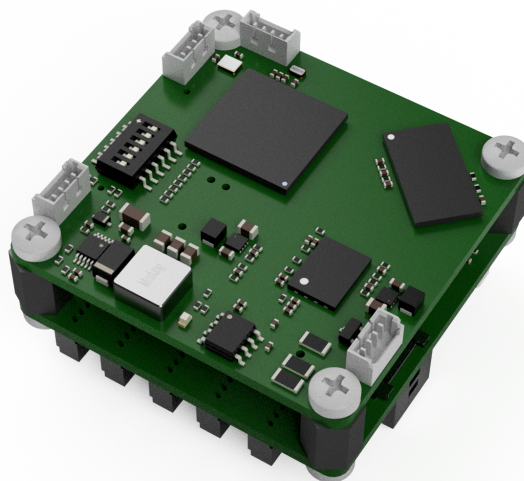

Figure 9: Back to Back operation (two SwitchBlox Rugged)

Figure 10: Managed operation (SwitchBlox Rugged + Rugged SOM)

2.2.4 SWD Programming Header

A programming header on the back of the board allows firmware to be flashed onto an STM32 microcontroller, when installed on SwitchBlox Rugged.
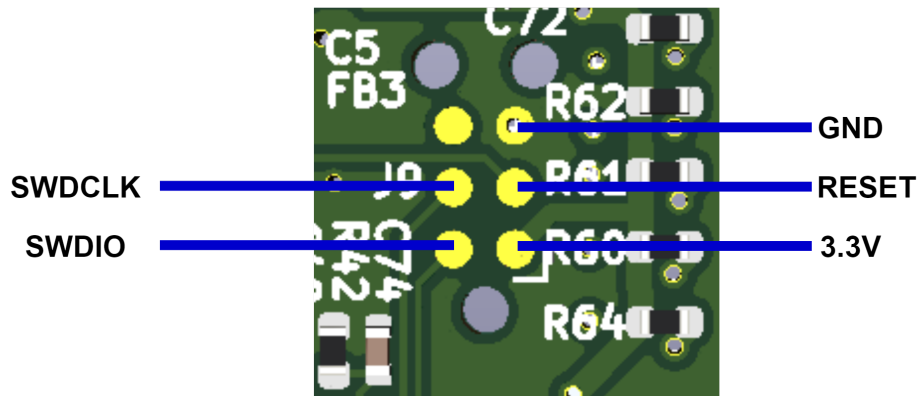

Figure 11: SWD programming header pinout

This header allows access to the SWD port on the a STM32 microcontroller (if mounted on the board), 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.

2.2.5 External LED header

An External LED header on the back of the board allows port activity indicator signals can be brought off - board for integration into a chassis. The LED signals are provided in a common anode configuration. The anode of all external LEDs should connect to the 3.3V on the External LED header, and the cathode of the external LED should connect to the corresponding "Px" connection on the header.
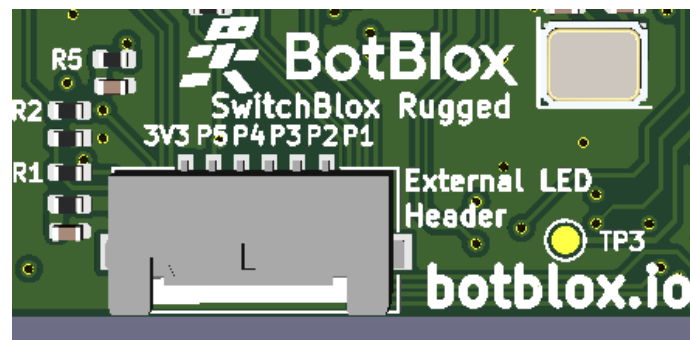

Figure 12: External LED header

The connector used on the board is 5037630691, which mates with 5037640601.

2.3 Other Interfaces

2.3.1 LEDs

There are 12 LEDs on SwitchBlox Rugged in total. Five of the LED signals can be taken off 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.

Each Port Activity LED (**Green**) 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. A solid green LED indicates either constant traffic, or a fault with the port.

The PoE on Port Indicator LEDs (**Orange**) indicates which of the ports currently has PoE injected onto it. This can be toggled on a port-by-port basis using the PoE Select DIP switch.

The RGB LED is controlled entirely by the onboard microcontroller, therefore is only used in managed applications.

3 Software Interfaces

3.1 I2C

SwitchBlox Rugged uses the KSZ8567S to perform the ethernet switching. The KSZ8567S is an integrated 5 port ethernet switch, which also supports managed functions such as QoS, Port Mirroring and VLAN management (amongst other functions). By default the IC runs as an unmanaged switch. Managed functions need to be configured via I2C.

On SwitchBlox Rugged SCK and SDA connect to the STM32 pins. PA4 connects to I2C_SCL and PA10 connects to I2C_SDA. This allows the STM32 to programmatically control the KSZ8567S, and implement custom managed switch features. Please contact us if you think your application requires custom firmware.

3.2 UART

Pins PA0 (UART2_RX) and PA9 (UART2_TX) on the onboard STM32L021D4P7 are exposed on test points.

4 Device Configuration

4.1 Unmanaged Switch

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

4.2 Managed Switch

Running SwitchBlox in a managed switch application requires configuring the KSZ8567S onboard over I2C. This can be done via custom firmware on STM32. On revision E, the STM32 is present and thus firmware can be uploaded via the JTAG header. You will need to contact us for assistance wit this.

The KSZ8567S only has volatile memory, meaning configuration is only stored while power is active. This means it is necessary to write the configuration to the KSZ8567S on every startup. The STM32 onboard circumvents this limitation by storing configuration variables in its internal EEPROM and then writing this to the KSZ8567S at power on. This is how the BotBlox firmware works, and it allows configurations to be stored even after power off.

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	-55°C to +125°C
Operating Temperature	-40°C to +105°C

5.1.2 Nominal (Test) Ratings

Voltage Input	65V

6 Datasheet Changelog

Date	Datasheet Version	Author	Notes
29/05/2021	ABC_A	Binh Ngyuen	Initial release
25/06/2021	ABC_B	Josh Elijah	Fixed the incorrect crimp terminal MPN stated for the connectors
21/02/2022	D_A	Josh Elijah	Revision D edit
30/01/2023	D_E	Josh Elijah	Revision E edit
20/09/2023	F_A	Josh Elijah	Revision F edit
25/10/2023	F_B	Jaclyn Li	Table 1.1.2 General Information updated to be correct values.

7 Contact

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

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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/