binho

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PRODUCT DATASHEET

Binho Pulsar

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1 Key Features

- USB High Speed 480Mbps Connection to PC
- Support for SPI protocol
  - SPI Controller or Peripheral role
  - All 4 SPI Modes Supported
  - Up to 50MHz max clock speed (Controller)
  - Up to 16MHz max clock speed (Peripheral)
  - Up to 4 x CS signals
  - Configurable MSB/LSB
  - Up to 16KB transaction length
  - Voltage range from 1.2V to 3.3V
- Support for I2C protocol
  - I2C Controller or Target role
  - 1MHz max clock speed
  - 7-bit & 10-bit Addressing
  - Support for Clock Stretching
  - Configurable Pull-up Resistors
  - Up to 16KB transaction length
  - Voltage range from 1.2V to 3.3V
- Support for UART protocol
  - 2M Baud (max)
  - Support for Hardware Flow Control
  - Voltage range from 1.2V to 3.3V
- Support for RS-485
  - -7V to +12V Common-Mode Input
  - Half-Duplex
- Support for CAN-FD Protocol
  - Optimized for use in 12V systems
  - Up to 5 Mbps data rate
- Support for 1-Wire Protocol
  - Standard and Overdrive speeds
  - 3.3V and 5V operation
- GPIO pins
  - 6 x Digital IO pins
  - Voltage range from 1.2V to 3.3V
  - Configurable as Interrupts
  - PWM Support (coming soon)
- Provides downstream power to DUT
  - Programmable from 1.2V to 3.3V
- Robust Machined Aluminum Enclosure
  - 5 x RGB Status LEDS
  - Integrated mounting holes
  - Silent, Fanless design
- All cables and accessories included
  - USB Type A to Type C Adapter Included
  - Stored in custom zippered case
- Full-featured Software Support
  - Point-and-Click GUI
  - Cross-Platform: Windows, Mac, Linux
  - Python, C/C#/C++ SDKs
  - Field-Upgradeable Device Firmware

2 Target Applications

- → Device Driver Development
- → Firmware Development & Verification
- → Proof of Concept Development
- → Automated HW/FW Testing & Agentic Development
- → FLASH & EEPROM Programming
- → I2C / SMBus / PMBus Verification & Testing

3 Product Introduction

The Binho Pulsar USB Host Adapter allows one to interface a PC directly to hardware circuits. Featuring a USB 2.0 High Speed 480 Mbps link to the host, the Pulsar offers an unmatched value proposition in the test tool market. With support for I2C/SPI transaction sizes up to 16KB in a single transfer, the Binho Pulsar can exercise even the highest-performance devices on the market and is ideally suited for EEPROM and FLASH programming. Furthermore, support for I2C Target and SPI peripheral modes by means of an internal emulation engine enables Binho Pulsar to respond as if it were a real-world target device without delays and latency associated with a round-trip communication cycle with software running on the host PC as incurred when using many other host adapters.

The Pulsar features a modern USB Type-C port, 5 x RGB LEDs for visual status indication, and a variety of DUT-facing connections all in a compact, robust machined-aluminum enclosure including integrated mounting holes.

The host adapter is able to communicate on many digital buses: I2C, SPI, UART, RS-485, 1-Wire, and CAN-FD. All of these protocols are implemented on their own dedicated pins and can be operated simultaneously. A bank of 6 x dedicated digital GPIO pins can be assigned to other related or unrelated purposes such as GPIO, interrupts, resets, chip selects, etc, as well as operating as digital PWM outputs.

4 Table of Contents

5 Product Description

This section of the document includes detailed information about the Pulsar product, starting with an overview of all the included items, followed by a walkthrough of various ports, pinouts, and power domains of the Pulsar host adapter.

5.1 Included Components

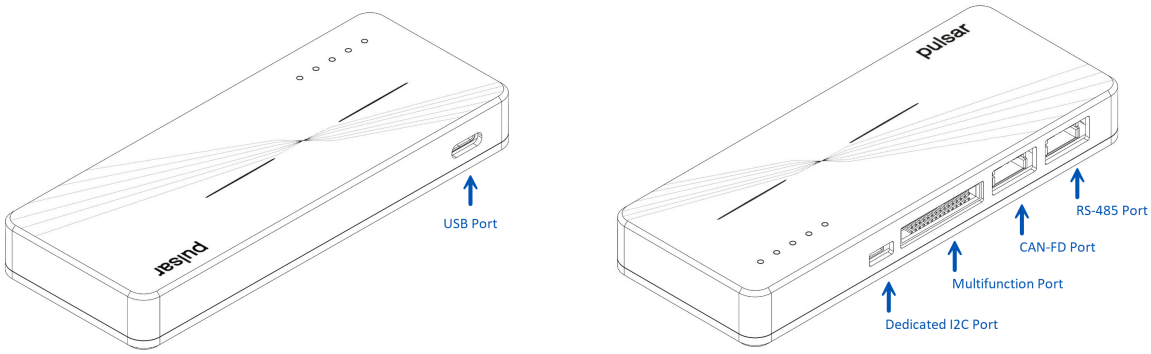
The Binho Pulsar comes with everything you need to get up and running. The following items are included in the box.

Pulsar Product Box Contents

- 1 x Binho Pulsar USB Host Adapter
- 1 x Differential Port Kit:
  - 1 x 4 pin JST PH cable with female headers
  - 1 x 4 pin JST PH cable with male headers
- 1 x Dedicated I2C Port Kit:
  - 1 x 4 pin JST SH (Qwiic compatible) to 4 pin JST SH cable
  - 1 x 4 pin JST SH (Qwiic compatible) cable with male headers
  - 1 x 4 pin JST SH (Qwiic compatible) cable with female headers
- 1 x Multifunction Port Kit:
  - 1 x 30 conductor IDC ribbon cable
  - 1 x Ribbon cable to 2.54mm pitch header breakout board
- 1 x USB Kit:
  - 1 x USB Type C to Type A Cable
  - 1 x USB Type A to Type C Adapter
- 1 x Mounting Kit:
  - 2 x mounting screws
  - 2 x washers
- 1 x Custom Protective Zippered Carry Case

5.2 Ports

The Pulsar has a total of five (5) ports, shown in the diagram below.



Rear View **Front View**

The rear of the Pulsar features a singular port for connecting the device to the Host PC. The front of the Pulsar features 4 ports which can be used to interface the host adapter with the DUT. The information in the following subsections provides specific information related to each port.

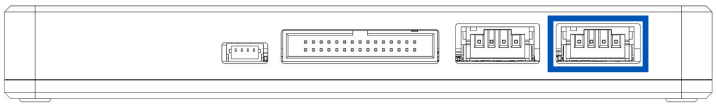
5.2.1 USB Port

This USB Type-C port is used to connect Pulsar to the host PC. This can be done with the provided USB Type-C to A cable or any other USB cable. A USB A to Type-C adapter is also included for the user's convenience. Note that The Binho Pulsar is a USB 2.0 High-Speed Device with a 480 Mbps link to the host PC. This connection also provides power to the device - no external power connection is needed.

More information about the USB link to the host PC facilitated over this port can be found in Section 8.1. Furthermore, the USB link is also used to update the Pulsar device firmware. Details of the firmware update process can be found in Section 8.2.

5.2.2 RS-485 Port

This differential port facilitates communication on an RS-485 bus, compatible with -7V to +12V Common-Mode input. This port uses a 4-pin JST PH equivalent connector. This port is part of the Differential Power Domain, which provides a fixed +5V output power rail and GND connections. The pinout for this connector can be found in Section 5.3.1.

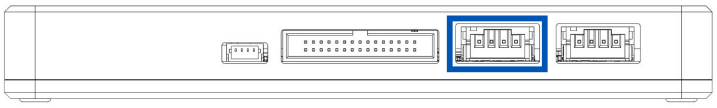


Front View - RS-485 Port

The wire harness, cables, and adapters that are part of the Differential Port Kit can be used interchangeably with the RS-485 and CAN-FD Ports.

5.2.3 CAN-FD Port

This differential port facilitates communication on a CAN-FD (or CAN) bus, compatible with 12V systems. This port uses a 4-pin JST PH equivalent connector. This port is part of the Differential Power Domain, which provides a fixed +5V output power rail and GND connections. The pinout for this connector can be found in Section 5.3.1.

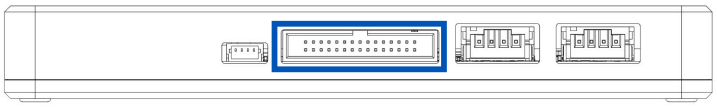


Front View - CAN-FD Port

The wire harness, cables, and adapters that are part of the Differential Port Kit can be used interchangeably with the RS-485 and CAN-FD Ports.

5.2.4 Multifunction Port

The multifunction port includes I2C, SPI, UART, 1-Wire, and GPIO signals on a 2 x 15 pin 1.27mm pitch connector. The Pulsar comes with a 30 pin ribbon cable which can be used to interface this port directly with a DUT or with the included Breakout Board which can be used to access the signals with standard 2.54mm jumper wires. This port is part of the Multifunction Power Domain, ranging from 1.2V to 3.3V. The 1-Wire bus can be operated at 3.3V or 5.0V independently of the voltage configuration of theMultifunction Power Domain. The pinout for this connector can be found in Section 5.3.2.

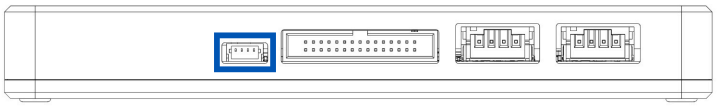


Front View - Multifunction Port

> Note that the I2C bus exposed on this port is the same bus that is included in the Dedicated I2C Port. The protocols and features available on this port can be used simultaneously with the Differential Ports. More information about the I2C, SPI, UART, 1-Wire, and GPIO specific features can be found below in Section 7.

5.2.5 Dedicated I2C Port

The dedicated I2C port includes I2C functionality on a Qwiic-compatible 4-pin JST connector. More details about the Qwiic Ecosystem can be found in section 11.1 Qwiic Ecosystem Overview**.** The Pulsar comes with a collection of cables to make it fast and easy to interface with other I2C devices using this port. This port is part of the Multifunction Power Domain, which ranges from 1.2V to 3.3V. The pinout for this connector can be found in Section 5.3.3.



Front View - Dedicated I2C Port

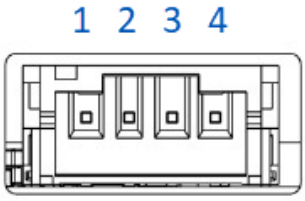
> The Pulsar has two independent I2C peripherals — one for the Qwiic/dedicated port (bus A), one for the multifunction port (bus B) — each with its own digitally-controlled pull-up potentiometer, so the two ports can run at different pull-up values simultaneously. More information about the I2C Protocol features supported by Pulsar can be found in Section 7.2.

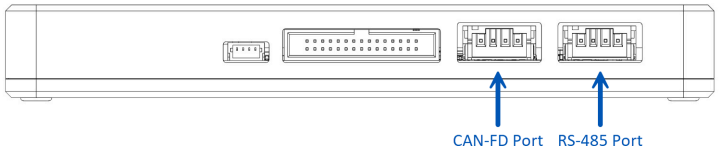
5.3 Pinouts

This section of the datasheet provides the pinout information for each of the DUT-facing connectors on the Binho Pulsar. The cables and accessories included with the Pulsar make it convenient and easy to break out and access the signals. Further information needed for integrating connectors and cabling specifically for Pulsar within custom fixtures and test bench setups can be found later in this document in Section 9.2.

5.3.1 Differential Ports

The figure and accompanying table below show the pinout for the 4 pin JST PH connectors used for the RS-485 and CAN-FD ports.





RS-485 Port Pinout

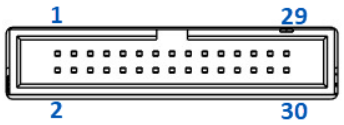
PIN NAME	PIN NUMBER	PIN FUNCTION(S)
A	1	Driver Output / Receiver Input, Non-Inverting
B	2	Driver Output / Receiver Input, Inverting
VTarget	3	Target Voltage Output, Fixed +5V
GND	4	Ground

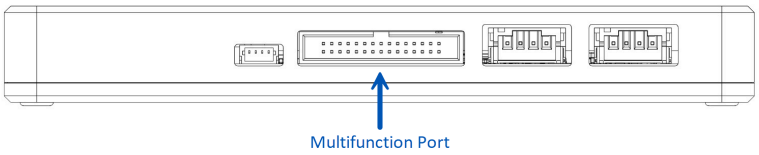
CAN-FD Port Pinout

PIN NAME	PIN NUMBER	PIN FUNCTION(S)
CAN-	1	Differential CAN Low Signal
CAN+	2	Differential CAN High Signal
VTarget	3	Target Voltage Output, Fixed +5V
GND	4	Ground

5.3.2 Multifunction Port

The figure and accompanying table below show the pinout for the 2 x 15 pin connector of the Multifunction Port.





PIN NAME	PIN NUMBER	PIN FUNCTION(S)
SCL	1	I2C Clock [1]
SDA	3	I2C Data [1]
RX	5	UART RX Data
TX	7	UART TX Data
RTS	9	UART Ready-To-Send (RTS) Signal for Hardware Flow Control
CTS	11	UART Clear-To-Send (CTS) Signal for Hardware Flow Control
MOSI	13	SPI MOSI
MISO	15	SPI MISO
CLK	17	SPI CLK
CS0	19	SPI Chip Select 0. Can also be used as a General Purpose Digital IO pin.
CS1	20	SPI Chip Select 1. Can also be used as a General Purpose Digital IO pin.
CS2	21	SPI Chip Select 2. Can also be used as a General Purpose Digital IO pin.
CS3	22	SPI Chip Select 3. Can also be used as a General Purpose Digital IO pin.

PIN NAME	PIN NUMBER	PIN FUNCTION(S)
GPIO1	23	General Purpose Digital IO pin.
GPIO2	24	General Purpose Digital IO pin.
GPIO3	25	General Purpose Digital IO pin.
GPIO4	26	General Purpose Digital IO pin.
GPIO5	27	General Purpose Digital IO pin.
GPIO6	28	General Purpose Digital IO pin.
VTarget	29	Target Voltage Reference / Output [2] [3]
1WIRE	30	1-Wire bus [4]
GND	2,4,6,8,10,12,14,16,18	Ground

[1]: The SCL and SDA pins of the I2C bus included on the Multifunction Port are also shared with the SCL and SDA pins on the Dedicated I2C Port in the section below.

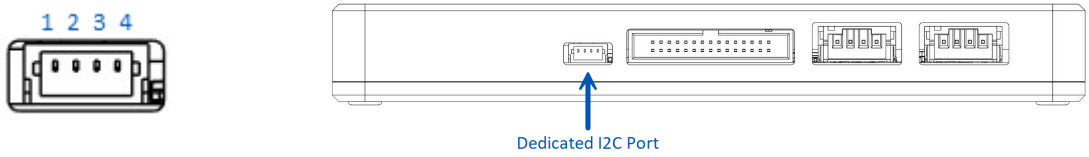
[2]: In the case of a self-powered DUT, the VTarget pin shall operate as an input for the voltage logic level reference for the Multifunction Power Domain. The Pulsar will adjust the voltage level to match the supplied voltage reference. In the case where the DUT is unpowered, the Pulsar can operate the VTarget pin as an output and provide downstream power to the DUT. Details of the available power for downstream devices can be found in Section 6.

[3]: The VTarget pin on the Multifunction Port is connected to the Multifunction Power Domain. This is shared with the VTarget pin on the Dedicated I2C Port in the section below.

[4]: The 1-Wire bus can be configured to operate at 3.3V or 5.0V independently of the voltage configuration of the Multifunction Power Domain / voltage applied to the VTarget pin.

5.3.3 Dedicated I2C Port

The figure and accompanying table below show the pinout for the 4 pin connector used for the Dedicated I2C port.



PIN NAME	PIN NUMBER	PIN FUNCTION(S)
GND	1	Ground
VTarget	2	Target Voltage Reference / Output [2] [3]
SDA	3	I2C Data [1]
SCL	4	I2C Clock [1]

[1]: The SCL and SDA pins of the I2C bus included on the Multifunction Port are also shared with the SCL and SDA pins on the Dedicated I2C Port in the section below.

[2]: In the case of a self-powered DUT, the VTarget pin shall operate as an input for the voltage logic level reference for the Multifunction Power Domain. The Pulsar will adjust the voltage level to match the supplied voltage reference. In the case where the DUT is unpowered, the Pulsar can operate the VTarget pin as an output and provide downstream power to the DUT. Details of the available power for downstream devices can be found in Section 6.

[3]: The VTarget pin on the Multifunction Port is connected to the Multifunction Power Domain. This is shared with the VTarget pin on the Multifunction Port in the section above.

5.4 Power Domains

The Binho Pulsar's DUT-facing ports are operating on two separate power domains. While this adds a bit of complexity, it also gives Pulsar incredible functionality and versatility to be used in multi-voltage domains that are becoming more and more common.

Differential Power Domain	→	RS-485 + CAN-FD Port
Multifunction Power Domain	→	Dedicated I2C + Multifunction Port

The key point to understand is that differential port features of Pulsar operate entirely independent of the voltage used for the other protocols. As such, You can have a 1.8V SPI bus operating at the same time while providing +5V output power from the differential ports. The details of each power domain are further specified in the sections below.

Finally, please note that a common ground is shared between all three power domains. This same ground connection is also connected to the ground of the host PC over the USB cable.

5.4.1 Differential Power Domain

This power domain is for the Differential Port, a set of ports consisting of the RS-485 and CAN-FD ports. It provides a fixed +5V power rail. The voltage is not configurable programmatically. It can provide downstream power to the DUT, or be left disconnected if there is no need to provide downstream power

to the DUT. Note that it cannot be disabled from providing power and cannot be used as a voltage reference for the logic level of the bus.

5.4.2 Multifunction Power Domain

This is the power domain for the Dedicated I2C Port and Multifunction Port, which collectively cover I2C, SPI, UART, and GPIO functionalities. This domain supports 1.2V to 3.3V. The voltage is configurable programmatically. It can provide downstream power to the DUT, or it can disengage from providing power and instead use the VTarget pin as a voltage reference for the logic level of the bus.

> Note that the 1-Wire bus can operate at 3.3V or 5V regardless of the voltage setting of the Multifunction Power Domain.

6 Electrical Specifications

This section aims to characterize the electrical performance and parameters of the Pulsar device.

6.1 Absolute Maximum Ratings

> Stresses beyond those listed in the tables in this section may cause permanent damage to the device. These are stress ratings only which do not imply functional operation of the device at these conditions. Exposure to absolute-maximum-rated conditions for extended durations may impact device reliability.

PARAMETER	MIN	MAX	UNIT
USB Input Voltage	-	5.5	V
USB Input Current	-	1000	mA
Operating Temperature	0	70	°C
Electrostatic Discharge (ESD) Rating	-	±4000	V

6.1.1 RS-485 Port

PARAMETER	MIN	MAX	UNIT
Differential Power Domain - Output Current	-	250	mA
Voltage on A, B	-15V	+15V	V

6.1.2 CAN-FD Port

PARAMETER	MIN	MAX	UNIT
Differential Power Domain - Output Current	-	250	mA
Voltage on CAN+, CAN-	-42V	+42V	V

6.1.3 Multifunction & Dedicated I2C Ports

PARAMETER	MIN	MAX	UNIT
Multifunction Power Domain - Input Voltage	-	4.2	V
Multifunction Power Domain - Output Current	-	250	mA
Voltage on any pin, except 1-Wire	-	4.2	V

PARAMETER	MIN	MAX	UNIT
Voltage on 1-Wire pin	-	5.5	V

6.2 Recommended Operating Conditions

PARAMETER	MIN	TYP	MAX	UNIT
USB Input Voltage	4.5	5.0	5.5	V
USB Input Current	-	500	1000	mA
Operating Temperature	0	25	70	°C

6.2.1 RS-485 Port

PARAMETER	MIN	TYP	MAX	UNIT
Differential Power Domain - Output Current	-	100	200	mA
Voltage on A, B	-7	-	12	V

6.2.2 CAN-FD Port

PARAMETER	MIN	TYP	MAX	UNIT
Differential Power Domain - Output Current	-	100	200	mA
Voltage on CAN+, CAN-	-12	-	12	V

6.2.3 Multifunction & Dedicated I2C Ports

PARAMETER	MIN	TYP	MAX	UNIT
Multifunction Power Domain - Voltage (Input or Output)	1.2	1.8	3.3	V
Multifunction Power Domain - Output Current	-	100	200	mA
Voltage on any pin, except 1-Wire	1.2	1.8	3.3	V
Voltage on 1-Wire pin	-	3.3	5.0	V

7 Supported Protocols

The Binho Pulsar supports I2C, SPI, UART, 1-Wire, RS-485, CAN-FD as well as digital GPIO. This section provides the specifics of Pulsar's capabilities for each of the supported protocols. Note that all the supported protocols have dedicated pins and can be operational at the same time as other protocols. Simultaneous protocol usage is supported and encouraged.

7.2 I2C

> *Note: The usage of I2C Master/Slave terminology is considered obsolete. Master and Slave are now Controller and Target per the latest release of NXP's I2C Specification in UM10204.*

The Binho Pulsar supports I2C protocol up to 1MHz clock frequency, with 7-bit device addressing and clock stretching. 10-bit device addressing is also supported. The I2C protocol pins are exposed on both the Dedicated I2C Port as well as the Multifunction Port and are part of the Multifunction Power Domain (1.2V to 3.3V). The I2C protocol is available for use along with all other supported protocols.

7.2.1 I2C Controller Mode

The Binho Pulsar supports I2C controller mode of operation with digitally-configurable Pull-Up Resistors. The table below shows the possible bus configurations that can be configured in I2C Controller mode of operation.

Supported Voltage	1.2V to 3.3V – **Multifunction Power Domain**
Supported Clock Rates	100kHz to 1MHz in 10kHz steps
Supports Clock Stretching	Yes
Supported Addressing	7 bit, 10-bit Addressing
Supported Pull-Up R Values	OFF, 150, 220, 330, 470, 680, 1K, 1.5K, 2.2K, 3.3K, 4.7K, 10K Ohms
Max Transfer Length	16,384 Bytes

> Note that the additional 6 x digital GPIO pins can be utilized for support signals such as RESET, INT, or other functions of connected I2C peripherals as needed.

I2C Controller support is available in Binho Mission Control Desktop GUI software as well as the Python SDK.

Python API Reference: I2C Controller API

7.2.2 I2C Target Mode

Binho Pulsar has support for I2C Target mode of operation. Pulsar employs an on-device target emulation engine supporting various common I2C target device behaviors. This enables the I2C target within Binho Pulsar to respond as if it were a real-world I2C target without delays and latency associated with a round-trip communication cycle with software running on the host PC as incurred when using many other host adapters.

There are currently three selectable emulation models available as shown in the table below:

MODEL	BEHAVIOR
Memory	Flat, byte-addressable memory with an auto-incrementing pointer; 8-bit or 16-bit register/sub-addressing.
EEPROM	Emulates a 24Cxx-style serial EEPROM: configurable total size and page size (page-wrapped writes), separate write-cycle and erase-cycle busy timing, selectable busy behavior (ACK-polling/NACK or clock-stretch), a write-protect region, and a host-triggered erase.
Register Map	Register file with per-region access policies (RW / RO / WO / read-to-clear / write-1-to-clear / reserved) and 8-bit or 16-bit register widths.

Note that it's possible to implement custom behaviors on the PC host side using our SDK in the case that your desired behavior is not covered by the modes listed above. Please reach out to techsupport@binho.io to inquire about supporting additional emulation models directly in firmware.

The I2C Target mode support within Binho Pulsar features the same capabilities as I2C Controller mode, as indicated in the table below:

Supported Voltage	1.2V to 3.3V – **Multifunction Power Domain**
Supported Clock Rates	100kHz to 1MHz in 10kHz steps
Supports Clock Stretching	Yes
Supported Addressing	7 bit, 10-bit Addressing
Supported Pull-Up R Values	OFF, 150, 220, 330, 470, 680, 1K, 1.5K, 2.2K, 3.3K, 4.7K, 10K Ohms
Max Transfer Length	16,384 Bytes

Note that the additional 6 x digital GPIO pins can be utilized for support signals such as RESET, INT, or other functions of connected I2C peripherals as needed.

7.3 SPI

> *Note: The usage of SPI Master/Slave terminology is considered obsolete. Master and Slave are now Controller and Peripheral.*

The Binho Pulsar supports SPI protocol up to 50MHz clock frequency, for SPI Modes 0, 1, 2, and 3 (CPOL and CPHA configurations). There are 4 dedicated Chip Select signals to communicate with multiple SPI peripheral devices on the same bus. Data can be configured for MSB or LSB first bit ordering. The SPI protocol pins are exposed on the Multifunction Port and part of the Multifunction Power Domain (1.2V to 3.3V). The SPI protocol is available for use along with all other supported protocols.

7.3.1 SPI Controller Mode

The Binho Pulsar supports SPI controller mode of operation with up to 4 SPI peripheral devices on the bus. The table below shows the possible bus configurations that can be configured in SPI Controller mode of operation.

Supported Voltage:	1.2V to 3.3V – **Multifunction Power Domain**
Supported Clock Rates:	10kHz, 50kHz, 500kHz, 1MHz, 2MHz, 4MHz, 8MHz, 16MHz, 32MHz, 50MHz
Supported Modes:	0, 1, 2, and 3
Data Size:	8 bits
Byte Order	MSB-first, LSB-first
Number of CS pins:	4
CS pin polarity:	Configurable Active HIGH, Active LOW
Max Transfer Length	16,384 Bytes

> Note that the additional 6 x digital GPIO pins can be utilized for support signals such as RESET, INT, or other functions of connected SPI peripherals as needed.

SPI Controller support is available in Binho Mission Control Desktop GUI software as well as the Python SDK.

Python API Reference: SPI Controller API

7.3.2 SPI Peripheral Mode

Binho Pulsar has support for SPI Peripheral mode of operation. Pulsar employs an on-device peripheral emulation engine supporting various common SPI device behaviors. This enables the SPI peripheral within

Binho Pulsar to respond as if it were a real-world SPI target without delays and latency associated with a round-trip communication cycle with software running on the host PC as incurred when using many other host adapters.

There are currently three selectable emulation models available as shown in the table below:

MODEL	BEHAVIOR
Memory	Full-duplex: each clocked byte returns on memory[ptr] on MISO while storing the MOSI byte to memory[ptr]; The pointer resets on chip-select.
Flash	Emulates a 25-series SPI flash command set: READ / FAST_READ / PAGE_PROGRAM / RDSR / WREN / WRDI / RDID, with WEL/WIP status, configurable address width (2 or 3 bytes), page size, program timing, and JEDEC ID.
Register Map	SPI-sensor convention: first byte = R/W bit + 7-bit register address, then auto-incrementing register access.

Note that it's possible to implement custom behaviors on the PC host side using our SDK in the case that your desired behavior is not covered by the modes listed above. Please reach out to techsupport@binho.io to inquire about supporting additional emulation models directly in firmware.

The SPI Peripheral mode support within Binho Pulsar features the same capabilities as SPI Controller mode, with the exception of a reduced max clock rate as indicated in the table below:

Supported Voltage:	1.2V to 3.3V – **Multifunction Power Domain**
Supported Clock Rates:	10kHz - 16MHz
Supported Modes:	0, 1, 2, and 3
Data Size:	8 bits
Byte Order	MSB-first, LSB-first
Number of CS pins:	4
CS pin polarity:	Configurable Active HIGH, Active Low
Max Transfer Length	16,384 Bytes

Note that the additional 6 x digital GPIO pins can be utilized for support signals such as RESET, INT, or other functions of connected SPI peripherals as needed.

7.4 UART

The Binho Pulsar supports UART protocol with baud rates up to 2M baud, with and without hardware flow control. The UART protocol pins are exposed on the Multifunction Port and part of the Multifunction Power Domain (1.2V to 3.3V). The UART protocol is available for use along with all other supported protocols. The table below shows the possible bus configurations that can be configured in UART mode of operation.

Supported Voltage:	1.2V to 3.3V – **Multifunction Power Domain**
Supported Baud Rates:	600 - 2M Baud
Supported Parity:	None, Even, Odd
Data Size:	7 bits, 8 bits
Hardware Flow Control:	No, Yes

> Starting with firmware version v4.4.x and higher, Binho Pulsar enumerates on USB with a dedicated USB CDC device along with its USB HID device, enabling its UART to be operated as a Virtual COM port with any standard serial console application while using the other supported protocol features in parallel over USB HID.

UART protocol support is available in Binho Mission Control Desktop GUI software as well as the Python SDK.

Python API Reference: UART Protocol API

7.5 1-WIRE

This feature is under active development.

The Binho Pulsar supports 1-Wire protocol at both Standard and Overdrive speeds. The 1-Wire protocol pin is exposed on the Multifunction Port and can operate at 3.3V or 5.0V (software configurable) and is independent of the Multifunction Power Domain. The 1-Wire protocol is available for use along with all other supported protocols. The table below shows the possible bus configurations that can be configured for 1-Wire operations.

Supported Voltage:	3.3V, 5.0V
Supported Speeds:	Standard, Overdrive
Adjustable timings:	t_{RSTL}, t_{MSP}, t_{W0L}, and t_{REC0}

1-Wire protocol support is planned for inclusion in Binho Mission Control Desktop GUI software as well as the C/C#/C++ SDK. 1-Wire protocol support is currently available directly from a serial console or programmatically from our binho-host-adapter python package with the Pulsar operating in Nova Compatibility Mode.

7.6 RS-485

The Binho Pulsar supports half-duplex RS-485 protocol with baud rates up to 2M baud on a -7V to +12V differential bus. The RS-485 protocol is available for use along with all other supported protocols. The table below shows the possible bus configurations that can be configured for RS-485 operations.

Supported Voltage:	-7V to +12V Common-Mode Input
Supported Baud Rates:	600 - 2M Baud
Supported Parity:	None, Even, Odd
Data Size:	7 bits, 8 bits

> Starting with firmware version v4.4.x and higher, Binho Pulsar enumerates on USB with a dedicated USB CDC device along with its USB HID device, enabling its RS-485 port to be operated as a Virtual COM port with any standard serial console application while using the other supported protocol features in parallel over USB HID.

RS-485 protocol support is planned for inclusion in Binho Mission Control Desktop GUI software as well as the C/C#/C++ SDK. In the meantime, it can be operated as any other serial port.

7.7 CAN-FD

This feature is under active development.

The Binho Pulsar supports CAN-FD (and CAN) protocol up to 5 Mbps. The CAN-FD protocol is available for use along with all other supported protocols and is compatible with the popular SLCAN software ecosystem. The table below shows the possible bus configurations that can be configured for CAN / CAN-FD bus operations.

Supported Voltage:	12V
Supported Speed:	Up to 5 Mbps

CAN-FD protocol support is planned for inclusion in Binho Mission Control Desktop GUI software as well as the C/C#/C++ SDK. In the meantime, the native support for SLCAN provides a rich set of tools providing support for CAN functionality on Pulsar.

7.8 GPIO

Pulsar features 6 dedicated digital GPIO pins which can be used as outputs, inputs, interrupt pins, or for PWM generation. All 6 GPIO pins are part of the Multifunction Power Domain. These pins are available for use along with all other supported protocols.

The GPIO features are available in Binho Mission Control Desktop GUI software as well as the Python SDK.

Python API Reference: GPIO API

7.5.1 Digital Output

All 6 of the dedicated GPIO pins can be configured to operate as a digital output signal. The logic low level will be 0V and the logic high level will be determined by the voltage configuration of the Multifunction Power Domain.

7.5.2 Digital Input

All 6 of the dedicated GPIO pins can be configured to operate as a digital input signal. Take care to ensure that the voltage of the input signal is within the suitable range for the configuration of the Multifunction Power Domain.

7.5.3 Interrupt

All 6 of the dedicated GPIO pins can be configured to raise an interrupt on Rising Edge, Falling Edge, or on both edges.

7.5.4 PWM Output

Support for PWM Output is coming soon and will be made available to all existing devices via firmware update. The frequency and duty cycle will be available for user configuration.

8 Application Information

> **NOTICE**
> The best source of the latest and most up-to-date information regarding the features of this product and the very specifics of how to operate the device can be found on our customer support portal. This support portal features a full set of comprehensive documentation and can be found at https://support.binho.io. More details on all of the items below can be found in the support portal.

8.1 USB Link to Host PC

The Pulsar can enumerate as both a USB HID device and USB CDC device simultaneously, as such no special device driver needs to be installed. This ensures Pulsar is compatible with any platform that has OS-level support for USB HID devices, which includes Windows, MacOS, and many distributions of Linux.

The USB connection with the host PC is a USB 2.0 High-Speed 480 Mbps link.

8.2 Device Firmware Update

The Binho Pulsar USB Host Adapter features field-upgradeable firmware over USB. This allows for new features to be developed and released to all devices, such as enhancements and customizations, and even support for new protocols. When in device firmware update mode, Pulsar will connect to the host PC as a USB Mass Storage Device, and the new firmware file can easily be downloaded by dragging and dropping the updated firmware file onto the drive. Firmware update is also available over USB HID as and can be updated directly from a compatible web browser from https://dfu.binho.io. Please see the “Device Firmware Update” section of our user guide for more information.

8.3 Cross-Platform Support

The Binho Pulsar works seamlessly on all modern PC operating systems, such as Windows, Mac OS, and Ubuntu (Linux). This is achieved by implementing the USB connection as a standard USB HID device, and as a mass-storage device while performing a firmware update. This means there is no need to install custom device drivers, allowing the device to be used on any operating system which provides a system driver for these device classes.

8.4 Point-and-Click GUI Software

Binho Mission Control, our point-and-click GUI software, available for Windows, MacOS, and Linux, provides an easy, no-code means to quickly get up and running with Pulsar (as well as other Binho devices). Binho Mission Control supports performing transactions as an I2C Controller, a SPI Controller, or on a UART bus. It also features support for GPIO operations. Support for 1-Wire, RS-485, and CAN transactions is coming soon. This software also provides the means to update the Pulsar device firmware. Additionally, numerous examples and tools are provided as open-source python scripts which can be run on any platform.

8.5 Automation API / SDK

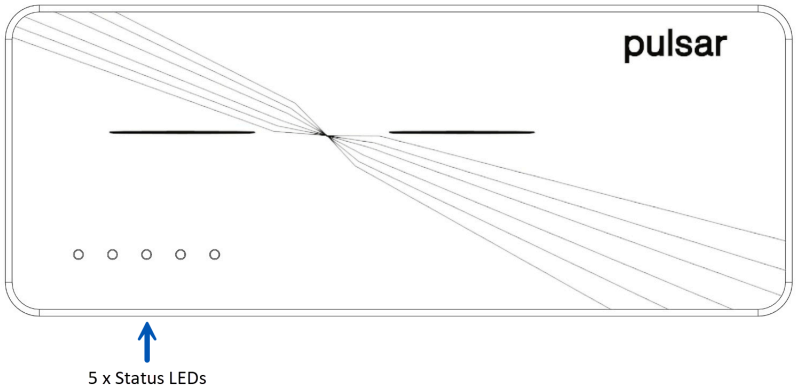
Binho provides cross-platform automation support by means of a fully-featured open-source python library (python 3.10 or later). A C/C#/C++ SDK is also available for Windows, MacOS, and Linux.

8.6 Multi-Adapter/Gang-able Operation

Binho Pulsar devices can be operated in gang-able fashion with many units connected to the same host PC. This allows for making complicated automated test fixtures or custom gang programming stations a breeze. Many examples exist demonstrating how easy it is to work with multiple devices.

8.7 RGB Status LEDs

The Binho Pulsar features 5 x RGB status LEDs. These can be used to provide clarity to the mode of the device, state of operation, and protocol/bus traffic.

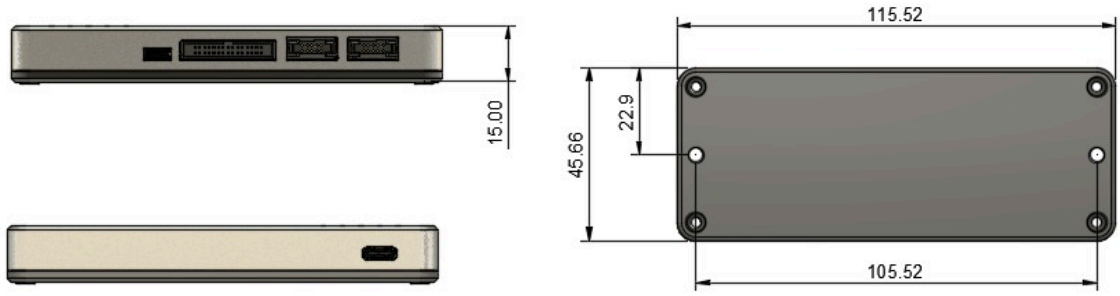


9 Integration Support

The Binho Pulsar has been designed in a way which lends itself to robust and elegant integration directly into test fixtures and other custom equipment. The information in this section is meant to aid in both the mechanical and electrical integration of the Pulsar into your own test stations. In case any additional information is needed for a particular integration, please reach out to techsupport@binho.io for assistance.

9.1 Mechanical Drawing

The machined aluminum enclosure for Binho Pulsar features two integrated mounting holes on the back of the device to facilitate simple and robust installation into test fixtures or other environments. A set of fasteners are included with the product.



Fasteners for 2 x Mounting Holes:

Socket Head Screw M3 x 0.5mm Thread, 10mm Long

McMaster Part Number: 92290A115

All dimensions in mm.

Scale: 1:1

Tolerancing: ISO 286 Grade IT7

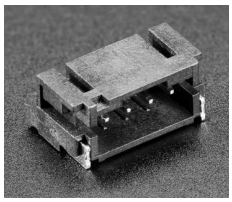
Binho Pulsar Mounting Geometry

9.2 Connectors & Wiring

The Pulsar comes with all cables and wire harnesses needed to interface it with the circuit under test. In an effort to make it convenient and straightforward to integrate into custom fixtures and test benches, Pulsar's ports use common industry standard connectors that are readily available off-the-shelf. This allows for a lot of flexibility and elegance when integrating the device with your custom hardware.

9.2.1 Differential Ports

The RS-485 and CAN-FD differential ports are both implemented with the same connector, and therefore are compatible with the same wiring harnesses and cables. The connector is a 4-pin 2mm pitch JST PH-series compatible header such as the ones shown on the next page.

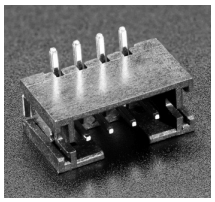


SMT, Right-Angle

JST PH 2mm 4pin

10-pack:

Adafruit / 4392 [Mouser]



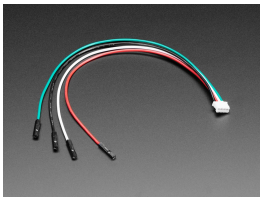
SMT, Vertical

JST PH 2mm 4pin

10-pack:

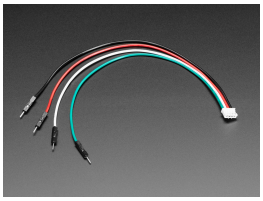
Adafruit / 4390 [Mouser]

A number of off-the-shelf cables are available for convenient integration, such as those shown below:



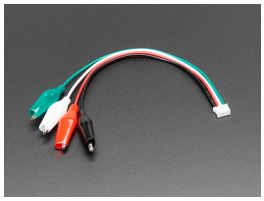
JST PH 4-Pin to Female Headers, 200mm Cable

Adafruit / 3950 [Mouser]



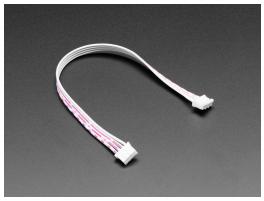
JST PH 4-Pin to Male Headers, 200mm Cable

Adafruit / 3955 [Mouser]



JST PH 4-Pin to Alligator Clips, 200mm Cable

Adafruit / 4029 [Mouser]



JST PH 4-Pin to JST PH 4-pin, 150mm Cable

Adafruit / 3568 [Mouser]

9.2.2 Multifunction Port

The Multifunction port is implemented with a generic 2 x 15 pin 1.27mm pitch IDC male header. The included ribbon cable can be used with any equivalent connector. Furthermore, it is simple to source or construct a compatible 30 pin ribbon cable of a custom length if needed.

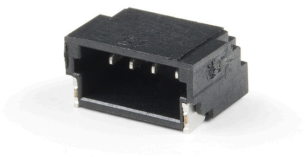
9.2.3 Dedicated I2C Port

As noted previously, the dedicated I2C port is implemented using a Qwiic-compatible 4-pin 1.0mm pitch JST SH series connector. More details about the Qwiic Ecosystem can be found in section 11.1 Qwiic Ecosystem Overview. The connectors and cables shown on the following page provide an excellent way to elegantly interface the I2C bus on your custom circuitry directly to the Pulsar.

Cables of Various Lengths

Cable Kit:

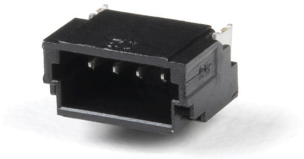
Sparkfun / KIT-15081 [Mouser]



SMT, Right-Angle

Single connector:

Sparkfun / PRT-14417 [Mouser]



SMT, Vertical

Single connector:

Sparkfun / PRT-16766 [Mouser]

10 Available Accessories

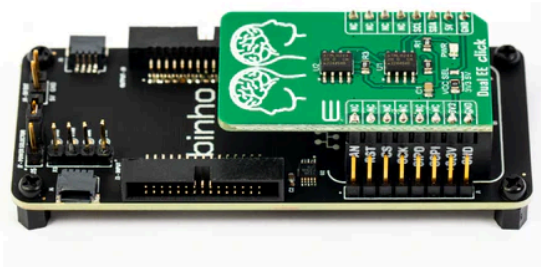
The Pulsar comes with everything needed to get up and running. In an effort to further enhance the productivity of our customers, we offer a number of accessories to aid in the R&D process, which are briefly presented below for consideration. For additional details on these items, please visit our website to learn more.

10.1 Hands-Free Probe Kits

Binho has partnered with the experts at Sensepeek, makers of the popular PCBite line of hands-free probes, in order to offer our customers the ultimate debugging experience that are perfect for usage with digital protocols such as I2C, SPI, UART, 1-Wire, RS-485, and CAN-FD. Binho is an authorized distributor for the full lineup of Sensepeek products.

10.2 Demonstration Boards

The following demonstration boards have been developed by the engineering team at Binho and are used extensively in our own internal development and testing of our tools. We have made them available publicly for our customers due to the strong demand for creating a quick-and-easy way to get up and running with various I2C, SPI, and other devices currently on the market.



MikroBUS Adapter Board

Model: BIN106

The mikroBUS Adapter Board is a perfect complement to both Supernova and Pulsar host adapters, making it easy to interface with 1700+ Click boards™ from MikroE. Our mikroBUS Adapter Board design

breaks out all 18 pins to headers and allows for devices to be communicated with over I3C, I2C, SPI, and UART. GPIO pins are also available as needed.

The I2C/I3C bus is available on QWIIC-compatible connectors. I2C, SPI, UART, and GPIO signals are made available via the 2×15 IDC connector. Pulsar & Supernova host adapters include the ribbon cable needed to make this connection. Each mikroBUS adapter board also comes with an additional 20mm long ribbon cable and qwiic-to-qwiic cable to facilitate daisy-chaining up to 4 boards at a time.

Using multiple SPI devices at the same time is achievable by adjusting the DIP switch to correctly assign the desired INT and CS pins for each SPI Target device.

MikroBUS Adapter Board used in SPI configuration

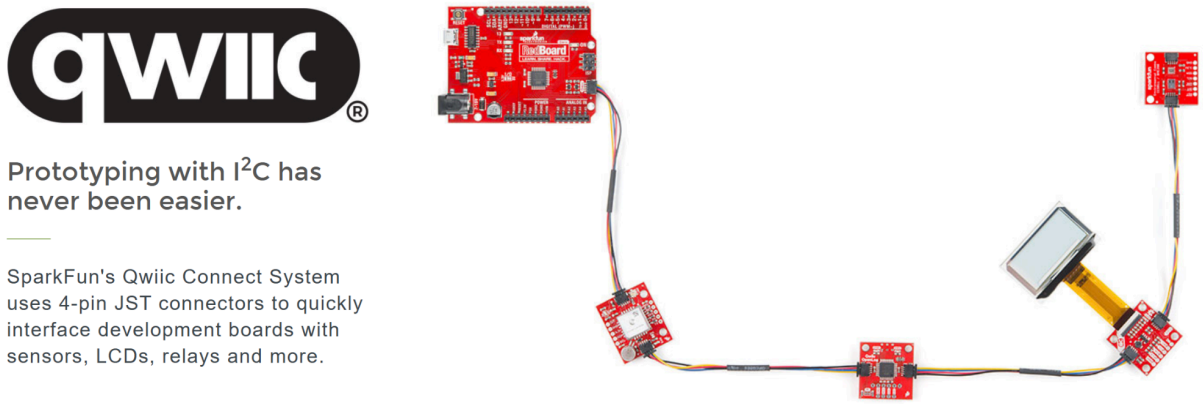
MikroBUS Adapter Board used in I2C Configuration

11 Appendices

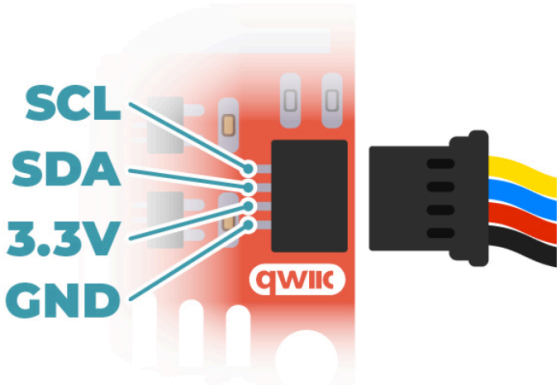
The content in the following section is meant to provide helpful contextual information and additional resources applicable to users of Pulsar.

11.1 Qwiic Ecosystem Overview

The dedicated I2C port on the Pulsar features a Qwiic compatible connector. This provides for a convenient means to interface with many evaluation boards and dev kits using this standard. Originally developed by Sparkfun, the Qwiic interface has been widely adopted by many others in the industry. In short, provides a standard pinout for a 4-pin JST connector and common color code for off-the-shelf wire harnesses.



The pinout for this connector can be seen in the graphic below:



Sparkfun Electronics, Adafruit Industries, and several others provide a large selection of breakout boards and cables for the Qwiic ecosystem that are also conveniently available for purchase from DigiKey and Mouser.

12 Revision Log

Rev	Description of Changes	Date
1.0	Initial Draft	9/24/24
1.1	Fixed connector pinout details – CAN- and CAN+ pins on CAN-FD Differential Port were swapped – Signals on the Dedicated I2C were listed in reverse order	9/30/24
1.2	Removed “Preliminary”Watermark Added Section 10.2 Demonstration Board Updated Office Address	2/24/25
1.3	Design/Formating & Various Editorial Updates Added information about enhancements and new features - I2C Target and SPI Peripheral role support - Max transfer size increased to 16KB - Increased UART baud rates - Support for 1-Wire - Support for RS-485 - Support for CAN-FD - New Firmware Update Interfaces	8/14/26