Description

The Arduino Portenta Mid Carrier streamlines project development for Portenta SOMs boards by offering easy access to high-density signals through specialized and dedicated headers. It is compatible with the Portenta C33, H7, and X8 boards and is perfect for many projects, including the Internet of Things applications, asset tracking, machine vision, robotics, and automation. This carrier boasts a variety of ports and interfaces like two CAN bus lines, Ethernet, microSD, and USB, along with camera and display connectors. It features debug pins and a real-time clock battery backup, easing development. Its onboard mini PCIe connector also enables quick cellular connectivity testing, ensuring reliable data transmission even in Wi-Fi® in scarce areas. These features make the Portenta Mid Carrier a vital tool for efficiently creating innovative, connected devices.

Target Areas

Rapid prototyping, asset tracking, Internet of Things, machine vision, robotics, and automatization

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1 Application Examples

The Arduino Portenta Mid Carrier enhances various prototyping applications thanks to its flexible design. The Portenta Mid Carrier provides a robust platform for many projects, from industry-ready prototypes to machine vision and cellular connectivity testing. Here are some application examples:

- **Rapid testing of cellular connectivity**: Use the mini PCIe connector on the Portenta Mid Carrier for swift cellular connectivity testing. This feature is invaluable for applications in smart cities/buildings, remote maintenance, and fleet management, ensuring rapid data transmission even in locations lacking Wi-Fi® coverage.

- **Prototyping**: The Portenta Mid Carrier is a versatile tool for prototyping, merging seamlessly with Portenta family boards to unveil essential peripherals like microSD, Ethernet, and USB. This integration facilitates industry-ready prototyping and streamlines debugging and inspection processes through dedicated CAN bus lines. Moreover, its compatibility extends to a wide array of external hardware components and devices, enhancing your Portenta boards for projects that demand embedded sensing or straightforward actuation. This dual functionality ensures the Portenta Mid Carrier provides comprehensive support, simplifying the development process and elevating the potential for innovative project creation.

- **Frictionless machine vision prototyping**: Pair the Portenta Mid Carrier with an MIPI or Arducam® camera to effortlessly embark on machine vision projects. Whether for object detection and recognition, defect identification, or asset tracking, the Portenta Mid Carrier streamlines the creation of complex vision-based applications.

- **Reference design**: The Portenta Mid Carrier serves as an excellent reference design and aids in the development of custom products within the Portenta ecosystem. Arduino PRO's full development, production, and operation support provides a solid foundation for tailoring solutions to specific business needs.

2 Features

2.1 General Specifications Overview

The Arduino Portenta Mid Carrier is an excellent tool for building scalable projects based on the Portenta family boards. The Portenta Mid Carrier was designed to give quick access to all the essential signals of the Portenta family boards, simplifying the addition of new features to enterprise projects with its Ethernet and Mini PCIe connectors. With this connector, the Portenta Mid Carrier capabilities are notably enhanced by including cellular connectivity to the carrier, allowing for rapid testing and deployment of applications requiring remote communication. The carrier includes a microSD card slot starting from an external source, and it has two CAN bus lines for connecting to actuators, which helps manage devices easily. Moreover, its onboard camera connectors enable the development of machine vision applications. The Carrier is also a straightforward reference design for creating new custom hardware.

The main features of the Portenta Mid Carrier are summarized and highlighted in the table below.

Feature	Description
Ethernet	RJ45 connector (x1)
USB Connectivity	USB-A 2.0 female connector for data logging operations (x1)
Power Supply	Various options for easily powering the Carrier: onboard USB-C® port of the Portenta family board connected to the Carrier, and external power supply connected through the onboard screw terminal block and dedicated pins of the breakout header connectors of the Carrier
Screw Terminal Block	Used to power the Carrier and for the CAN bus interface (CAN1)
Breakout Header Connectors	Available interfaces through the breakout headers are the following: UART (x4), I2S (x1), CAN bus (x2), SPDIF (x1), PDM (x1), GPIO (x7), SPI (x2), I2C (x3), SAI (x1), PWM (x10), ADC (x8)
Camera Connectors	MIPI camera (x1), Digital Video Port (DVP) interface (x1)
Mini PCIe Interface	Accessible through the Carrier's dedicated Mini PCIe connector, its High-Density connectors, and the dedicated Mini PCIe breakout header
Debugging	Onboard JTAG/SWD debug connector
Battery Socket	Onboard CR1225 battery socket used for Real-Time Clock (RTC) support
Dimensions	114 mm x 86.5 mm
Weight	67 g
Operating Temperature	-40 °C to +85 °C
Certifications	CE, FCC, IC, RoHS, REACH, UKCA, WEEE, Japan (No Radio)

In the following sections, as well as the tables presented in those sections, the communication interfaces and other important features of the Carrier are further detailed.

2.2 Communication Interfaces

Interfaces	Connector
Mini PCIe (x1)	Mini PCIe connector (J8), High-Density connectors (J1-J2) and breakout header connector[1] (J16)
Ethernet (x1)	RJ45 connector (J18)
SPI (x2)	- SPI0: Breakout header connector (J15) and High-Density connector (J2) - SPI1: Breakout header connector (J15) and High-Density connector (J2)
I2S (x1)	Breakout header connector (J14) and High-Density connector (J1)
I2C (x3)	- I2C0: Breakout header connector (J15) and High-Density connector (J1) - I2C1: Breakout header connector (J15) and High-Density connector (J1) - I2C2: Breakout header connector (J15) and High-Density connector (J2)
CAN bus (x2)	- CAN0[2]: Breakout header connector (J14) and High-Density connector (J1) - CAN1[3]: Breakout header connector (J14), High-Density connector (J1), and screw terminal block (J4)
UART (with flow control) (x4)	- SERIAL0: Breakout header connector (J14) and High-Density connector (J1) - SERIAL1: Breakout header connector (J14) and High-Density connector (J1) - SERIAL2: Breakout header connector (J14) and High-Density connector (J2) - SERIAL3: Breakout header connector (J14) and High-Density connector (J2)

[1]For debugging purposes only.

[2]CAN0 has no CAN PHY; an external one is needed.

[3]CAN1 has an onboard CAN PHY available through the Carrier's screw terminal block (J4); it can be enabled or disabled via a DIP switch (SW2).

2.3 Other Features

Feature	Description
Additional onboard storage	microSD card slot (J12) for data logging operations
SIM card support	Yes, available through the Carrier's Mini PCIe interface
RTC Support	Yes, available through the Carrier's onboard CR1225 battery socket
USB support	USB-A 2.0 female connector (J13) for data logging operations
Camera support	Yes, through the MIPI camera connector (J10) and the DVP interface connector (J11)
Display support	Yes, available through the Carrier's GIGA Display Shield connector (J19) (x1)
Video support	Only with the Portenta H7 and the Portenta X8 boards through its onboard USB-C® connector
Camera support[4]	Yes, available through the MIPI camera connector (J10) and the DVP interface connector (J11)
DIP switches	ETH CENTER TAP (SW3): All positions OFF to enable Ethernet for the Portenta X8 board; for the Portenta C33 and H7 boards, Ethernet is always enabled regardless of the switch positions

Feature	Description
	■ BOOT SEL: All positions ON to enable BOOT mode, all positions OFF to enable NORMAL operation mode

[4] MIPI cameras are only supported by the Portenta X8 board; DVP interface is compatible with Arducam® DVP camera modules.

2.4 Related Accessories (Not Included)

- MIPI camera
- microSD card
- CR1225 (3 VDC) coin cell
- Arducam® DVP camera modules
- SIM card (only data compatible)

> **Note:** The Portenta Mid Carrier requires a compatible Portenta family board to operate.

3 Ratings

3.1 Recommended Operating Conditions

The table below provides a comprehensive guideline for the optimal use of the Arduino Portenta Mid Carrier, outlining typical operating conditions and design limits. The operating conditions of the Portenta Mid Carrier are largely based on the specifications of its components.

Parameter	Symbol	Min	Typ	Max	Unit
USB Supply Input Voltage[1]	V_{USB}	-	5.0	-	V
Supply Input Voltage[2]	V_{IN}	-	5.0	-	V
Current delivered by the Carrier[3]	I_C	-	-	2.0	A
Operating Temperature	T_{OP}	-40	-	85	°C

[1] Carrier powered through the USB-C® port of the connected Portenta family board to the carrier.

[2] Carrier powered through its onboard screw terminal block (J4, IN 5V terminal) or its breakout pin header connector (J15, IN 5V pins).

[3] Available only for the Mini PCIe card connected to the carrier.

> **Note:** Remember to check out the power specifications of the Mini PCIe card intended to be connected to the carrier to avoid damage to both the card and the carrier. For more safety tips, refer to the carrier's user manual.

4 Functional Overview

The Arduino Portenta Mid Carrier is a powerful tool for developing scalable Portenta-based applications, providing quick access to all high-density signals. It enables expansion with Ethernet and the onboard Mini PCIe connector, with the added capability of cellular connectivity through the Mini PCIe interface for applications that need remote access or communication. This makes it even more versatile for projects like smart cities and IoT. Booting projects from external sources is easy with the microSD card slot, and interacting with actuators is straightforward with onboard CAN bus lines. The carrier also supports industrial machine vision with dedicated camera connectors and offers a reliable foundation for creating proprietary hardware, streamlining the development process across various projects.

4.1 Topology

An overview of the Portenta Mid Carrier topology is illustrated and described in the figure and table below.
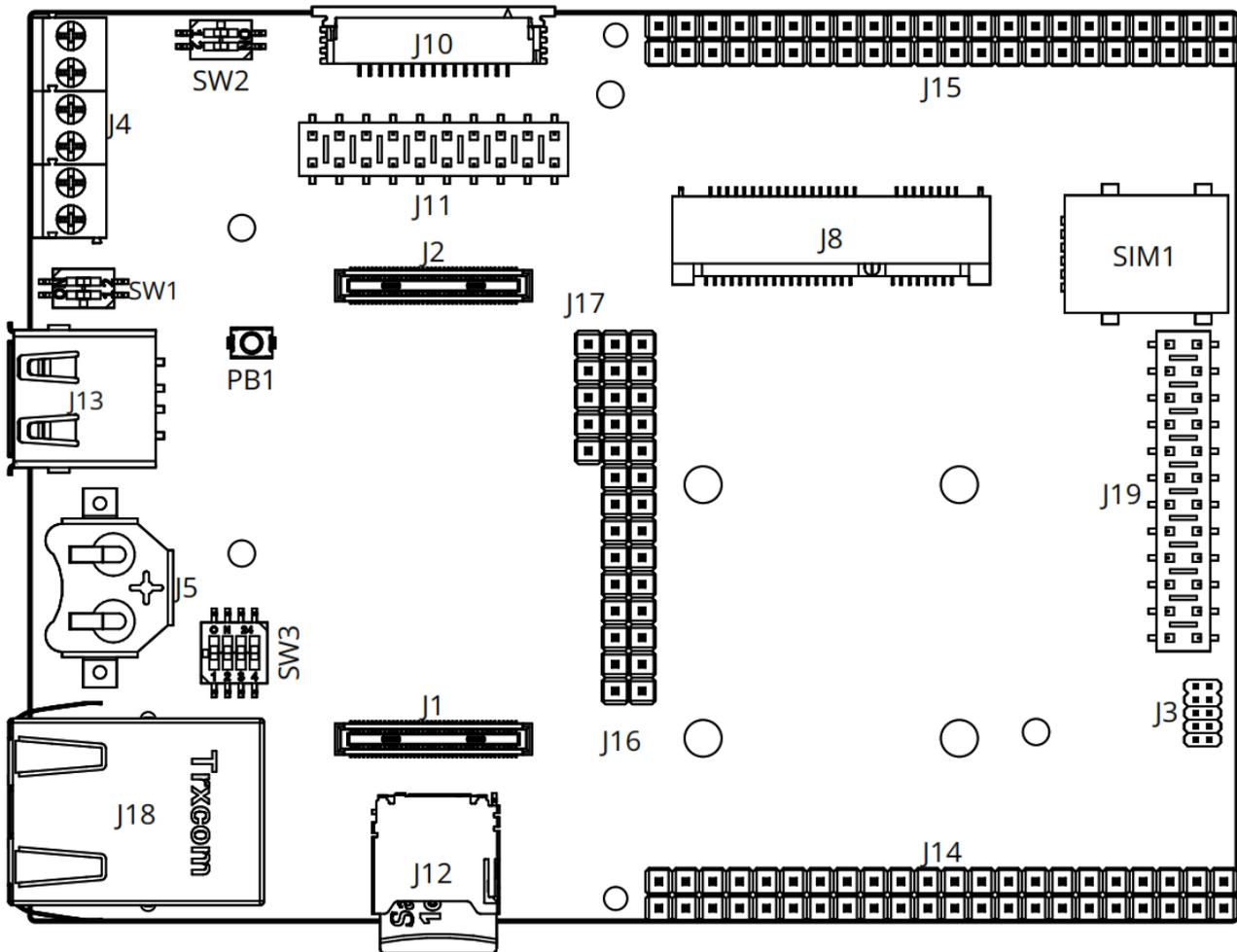
Item	Feature	Item	Feature
J1, J2	High-Density connectors of the Portenta family boards	J3	JTAG male connector for debugging

Item	Feature	Item	Feature
J4	Screw terminal block for power supply and CAN bus interface	J5	Battery socket
J8	Mini PCIe connector	J10	MIPI camera connector (only compatible with Portenta X8 boards)
J11	DVP interface connector	J12	microSD card slot
J13	USB-A 2.0 female connector for data logging operations	J14, J15	2.54 mm breakout header connectors
J16	Mini PCIe breakout header connector	J17	2.54 mm breakout header connectors
J18	RJ45 connector for Ethernet	J19	GIGA Display Shield Connector
SIM1	Nano SIM card connector	SW1	Boot select switch
SW2	CAN bus interface enable/disable switch	SW3	Ethernet enable/disable switch

4.2 Simple Pinout

The Portenta Mid Carrier simple pinout is shown in the figure below.
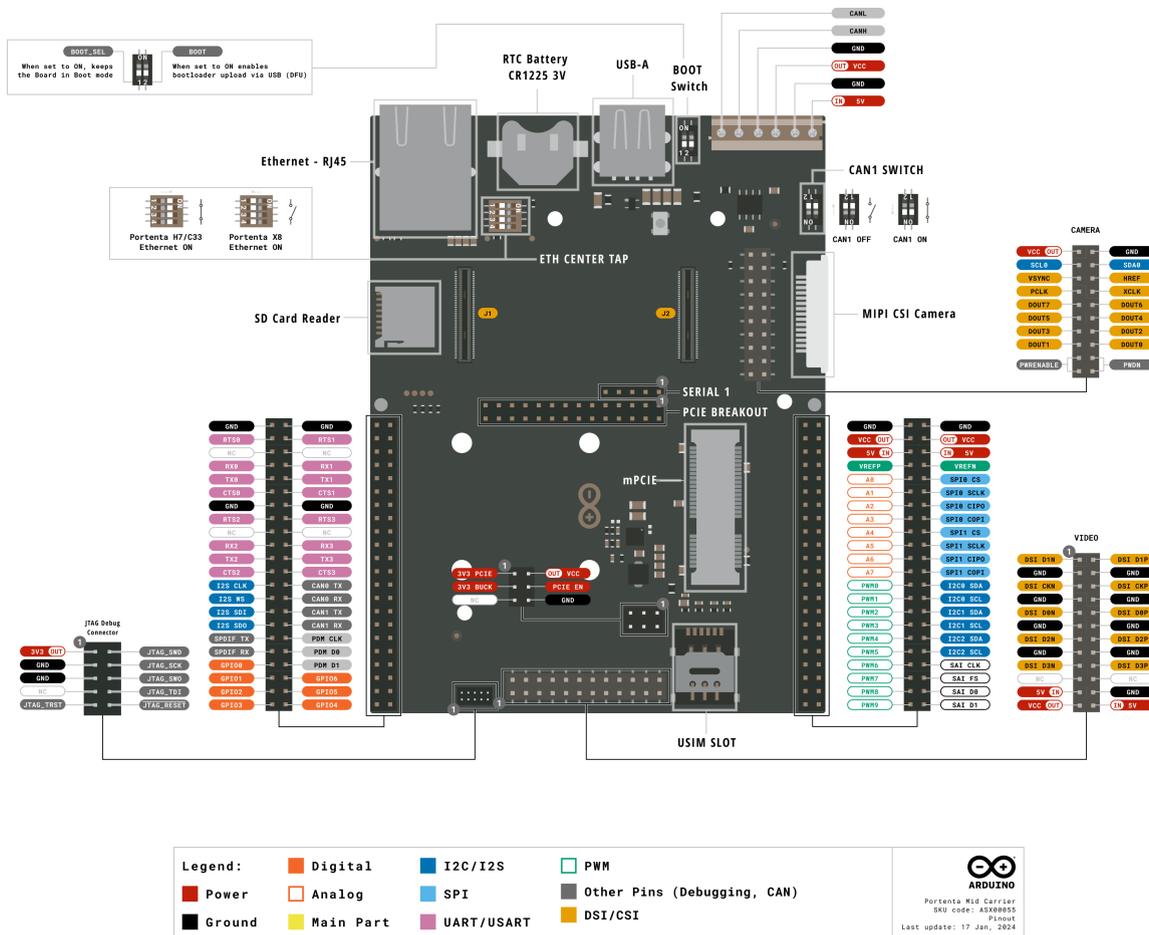
4.3 Full Pinout

The Portenta Mid Carrier full pinout is shown in the following sections, sorted by the components and connectors of the carrier.

4.3.1 Breakout Header Connector (J14)

The breakout header connector J14 is used in the Portenta Mid Carrier to expose the connected Portenta family board High-Density signals. J14 is a male header connector with a pin spacing of 2.54 mm.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
2	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
3	RTS0		SERIAL0_RTS	J1-38	UART 0 RTS
4	RTS1		SERIAL1_RTS	J1-37	UART 1 RTS
5	VIN	+5V	VIN	J1-21, J1-24, J1-32, J1-41, J1-48	
6	VIN	+5V	VIN	J1-21, J1-24, J1-32, J1-41, J1-48	
8	RX0		SERIAL0_RX	J1-36	UART 0 RX
9	RX1		SERIAL1_RX	J1-35	UART 1 RX
10	TX0		SERIAL0_TX	J1-34	UART 0 TX
11	TX1		SERIAL1_TX	J1-33	UART 1 TX
12	CTS0		SERIAL0_CTS	J1-40	UART 0 CTS
13	CTS1		SERIAL1_CTS	J1-39	UART 1 CTS
14	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
15	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
16	RTS2		SERIAL2_RTS	J2-30	UART 2 RTS
17	RTS3		SERIAL3_RTS	J2-29	UART 3 RTS
18	VIN	+5V	VIN	J1-21, J1-24, J1-32, J1-41, J1-48	
19	VIN	+5V	VIN	J1-21, J1-24, J1-32, J1-41, J1-48	
20	RX2		SERIAL2_RX	J2-28	UART 2 RX
21	RX3		SERIAL3_RX	J2-27	UART 3 RX
22	TX2		SERIAL2_TX	J2-26	UART 2 TX
23	TX3		SERIAL3_TX	J2-25	UART 3 TX
24	CTS2		SERIAL2_CTS	J2-32	UART 2 CTS
25	CTS3		SERIAL3_CTS	J2-31	UART 3 CTS
26	I2S CLK		I2S_CK	J1-56	I2S CK
27	CAN0 TX		CAN0_TX	J1-50	CAN 0 TX
28	I2S WS		I2S_WS	J1-58	I2S WS
29	CAN0 RX		CAN0_RX	J1-52	CAN 0 RX
30	I2S SDI		I2S_SDI	J1-60	I2S SDI
31	CAN1 TX		CAN1_TX	J1-49	CAN 1 TX

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
32	I2S SDO		I2S_SDO	J1-62	I2S SDO
33	CAN1 RX		CAN1_RX	J1-51	CAN 1 RX
34	SPDIF TX		SPDIF_TX	J1-74	SPDIF TX
35	PDM CLK		PDM_CK	J1-66	PDM CK
36	SPDIF RX		SPDIF_RX	J1-76	SPDIF RX
37	PDM D0		PDM_D0	J1-68	PDM D0
37	GPIO0		GPIO_0	J2-46	
38	PDM D1		PDM_D1	J1-70	PDM D1
39	GPIO1		GPIO_0	J2-48	
40	GPIO6		GPIO_6	J2-58	
41	GPIO2		GPIO_2	J2-50	
42	GPIO5		GPIO_5	J2-56	
43	GPIO3		GPIO_3	J2-52	
44	GPIO4		GPIO_4	J2-54	

4.3.2 Breakout Header Connector (J15)

The breakout header connector J15 is used in the Portenta Mid Carrier to expose the connected Portenta family board High-Density signals. J15 is a male header connector with a pin spacing of 2.54 mm.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
2	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
3	VCC	+3V3 Portenta	VCC	J2-23, J2-34, J2-43, J2-69	
4	VCC	+3V3 Portenta	VCC	J2-23, J2-34, J2-43, J2-69	
5	VIN	+5V	VIN	J1-21, J1-24, J1-32, J1-41, J1-48	
6	VIN	+5V	VIN	J1-21, J1-24, J1-32, J1-41, J1-48	
7	VREFP		ANALOG_VREF_P	J2-71	
8	VREFN		ANALOG_VREF_N	J2-72	
9	A0		ANALOG_A0	J2-73	
10	SPI0 CS		SPI0_CS	J2-53	SPI 0 CS
11	A1		ANALOG_A1	J2-75	
12	SPI0 SCLK		SPI0_CK	J2-37	SPI 0 CK
13	A2		ANALOG_A2	J2-77	
14	SPI0 CIPO		SPI0_MISO	J2-39	SPI 0 CIPO
15	A3		ANALOG_A3	J2-79	
16	SPI0 COPI		SPI0_MOSI	J2-41	SPI 0 COPI
17	A4		ANALOG_A4	J2-74	
18	SPI1 CS		SPI1_CS	J2-36	SPI 1 CS
19	A5		ANALOG_A5	J2-76	

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
20	SPI1 SCLK		SPI1_CK	J2-38	SPI 1 CK
21	A6		ANALOG_A6	J2-78	
22	SPI1 CIPO		SPI1_MISO	J2-40	SPI 1 CIPO
23	A7		ANALOG_A7	J2-80	
24	SPI1 COPI		SPI1_MOSI	J2-42	SPI 1 COPI
25	PWM0		PWM_0	J2-59	
26	I2C0 SDA		I2C0_SDA	J1-44	I2C 0 SDA
27	PWM1		PWM_1	J2-61	
28	I2C0 SCL		I2C0_SCL	J1-46	I2C 0 SCL
29	PWM2		PWM_2	J2-63	
30	I2C1 SDA		I2C1_SDA	J1-43	I2C 1 SDA
31	PWM3		PWM_3	J2-65	
32	I2C1 SCL		I2C1_SCL	J1-45	I2C 1 SCL
33	PWM4		PWM_4	J2-67	
34	I2C2 SDA		I2C2_SDA	J2-45	I2C 2 SDA
35	PWM5		PWM_5	J2-60	
36	I2C2 SCL		I2C2_SCL	J2-47	I2C 2 SCL
37	PWM6		PWM_6	J2-62	
38	SAI CLK		SAI_CK	J2-49	SAI CLK
39	PWM7		PWM_7	J2-64	
40	SAI FS		SAI_FS	J2-51	SAI FS
41	PWM8		PWM_8	J2-66	
42	SAI D0		SAI_D0	J2-53	SAI D0
43	PWM9		PWM_9	J2-68	
44	SAI D1		SAI_D1	J2-55	SAI D1

Reverse polarity protection: IN 5V pins of the carrier's screw terminal block (J4) and breakout header connector (J15) **do not have** reverse polarity protection. Double-check the polarity of your power supply before connecting it to the carrier to avoid damaging it.

4.3.3 Screw Terminal Block (J4)

The screw terminal block connector J4 is used to power the Portenta Mid Carrier and to expose the CAN bus interface (CAN1) to the user.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	VIN	+5V	VIN	J1-21, J1-24, J1-32, J1-41, J1-48	
2	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
3	VCC	+3V3 Portenta	VCC	J2-23, J2-34, J2-43, J2-69	
4	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
5	CANH		CAN1 TX	J1-49 (through U2)	CAN BUS 1 CANH
6	CANL		CAN1 RX	J1-51 (through U2)	CAN BUS 1 CANL

Reverse polarity protection: IN 5V pins of the carrier's screw terminal block (J4) and breakout header connector (J15) **do not have** reverse polarity protection. Double-check the polarity of your power supply before connecting it to the carrier to avoid damaging it.

4.3.4 JTAG/SWD Connector (J3)

The JTAG/SWD connector J3 can be used in the Portenta Mid Carrier to test and debug the connected Portenta family board.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	N/A	+3V3 Portenta	VCC	J2-23, J2-34, J2-43, J2-69	
2	N/A		JTAG_SWD	J1-75	JTAG SWD
3	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
4	N/A		JTAG_SCK	J1-77	JTAG SCK
5	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
6	N/A		JTAG_SWO	J1-79	JTAG SWO
7	N/A		NC	NC	
8	N/A		JTAG_TDI	J1-78	JTAG TDI
9	N/A		JTAG_TRST	J1-80	JTAG TRST
10	N/A		JTAG_RST	J1-73	JTAG RST

4.3.5 MIPI Connector (J10)

The MIPI connector J10 of the Portenta Mid Carrier can be used to connect compatible MIPI cameras to the carrier. Notice that **MIPI cameras are only compatible with the Portenta X8 board**.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
2	N/A		CAM_D0_D0_N	J2-16	
3	N/A		CAM_D1_D0_P	J2-14	
4	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
5	N/A		CAM_D2_D1_N	J2-12	
6	N/A		CAM_D3_D1_P	J2-10	
7	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
8	N/A		CAM_CK_CK_N	J2-20	
9	N/A		CAM_VS_CK_P	J2-18	
10	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
11	N/A		GPIO_5	J2-56	
12	N/A		NC	NC	
13	N/A		I2C1_SCL	J1-45	I2C 1 SCL
14	N/A		I2C1_SDA	J1-43	I2C 1 SDA
15	N/A	+3V3 Portenta	VCC	J2-23, J2-34, J2-43, J2-69	

4.3.6 DVP Interface Connector (J11)

The DVP interface connector J11 of the Portenta Mid Carrier can be used to connect compatible Arducam® DVP camera modules to the carrier.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	VCC	+3V3 Portenta	VCC	J2-23, J2-34, J2-43, J2-69	
2	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
3	SCL0		I2C0_SCL	J1-46	I2C 0 SCL
4	SDA0		I2C0_SDA	J1-44	I2C 0 SDA
5	VSYNC		CAM_VS_CK_P	J2-18	
6	HREF		CAM_HS	J2-22	
7	PCLK		CAM_CK_CK_N	J2-20	
8	XCLK		PWM_0	J2-59	
9	DOUT7		CAM_D7_D3_P	J2-2	
10	DOUT6		CAM_D6_D3_N	J2-4	
11	DOUT5		CAM_D5_D2_P	J2-6	
12	DOUT4		CAM_D4_D2_N	J2-8	

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
13	DOUT3		CAM_D3_D1_P	J2-10	
14	DOUT2		CAM_D2_D1_N	J2-12	
15	DOUT1		CAM_D1_D0_P	J2-14	
16	DOUT0		CAM_D0_D0_N	J2-16	
17	PWRENABLE		GPIO_3	J2-52	
18	PWDN		GPIO_4	J2-54	
19	PWRENABLE		GPIO_3	J2-52	
20	PWDN		GPIO_4	J2-54	

4.3.7 USB-A 2.0 Female Connector (J13)

The USB-A 2.0 female connector J13 of the Portenta Mid Carrier can be used for data logging operations and to manage external peripherals with the connected Portenta family board to the carrier.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	N/A	+5V	VIN	J1-21, J1-24, J1-32, J1-41, J1-48	
2	N/A		USB0_D_N	J1-28	USB D-
3	N/A		USB0_D_P	J1-26	USB D+
4	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	

4.3.8 microSD Card Slot (J12)

The microSD card slot J12 of the Portenta Mid Carrier can be used for bootloading and data logging operations.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	N/A		SDC_D2	J1-63	
2	N/A		SDC_D3	J1-65	
3	N/A		SDC_CMD	J1-57	
4	N/A	VDDSDCARD	VSD	J1-72	
5	N/A		SDC_CLK	J1-55	
6	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
7	N/A		SDC_D0	J1-59	
8	N/A		SDC_D1	J1-61	
CD1	N/A		SDC_CD	J1-67	
CD2	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	

4.3.9 RJ45 Ethernet Connector (J18)

The RJ45 Ethernet connector J18 of the Portenta Mid Carrier can be used for Internet connectivity and networking via Ethernet.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	N/A	VCC	VCC (through SW3)	J2-23, J2-34, J2-43, J2-69	
2	N/A		ETH_C_N	J1-11	
3	N/A		ETH_C_P	J1-9	
4	N/A		ETH_B_P	J1-5	
5	N/A		ETH_B_N	J1-7	
6	N/A	VCC	VCC (through SW3)	J2-23, J2-34, J2-43, J2-69	
7	N/A	VCC	VCC (through SW3)	J2-23, J2-34, J2-43, J2-69	
8	N/A		ETH_D_P	J1-13	
9	N/A		ETH_D_N	J1-15	
10	N/A		ETH_A_N	J1-3	
11	N/A		ETH_A_P	J1-1	
12	N/A	VCC	VCC (through SW3)	J2-23, J2-34, J2-43, J2-69	
13	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
14	N/A		ETH_LED2	J1-19 (through resistor)	
15	N/A		ETH_LED1	J1-17	
16	N/A	VCC	VCC (through resistor)	J2-23, J2-34, J2-43, J2-69	
17	N/A		NC	NC	

4.3.10 GIGA Display Shield Connector (J19)

The GIGA Display Shield connector J19 of the Portenta Mid Carrier can connect the GIGA Display Shield (SKU: ASX00039) to the carrier and the connected Portenta family board.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	DSI D1N		DSI_D1_N	J1-12	DSI D1 N
2	DSI D1P		DSI_D1_P	J1-10	DSI D1 P
3	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
4	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
5	DSI CKN		DSI_CK_N	J1-20	DSI CK N
6	DSI CKP		DSI_CK_P	J1-18	DSI CK P
7	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
8	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
9	DSI D0N		DSI_D0_N	J1-16	DSI D0 N
10	DSI D0P		DSI_D0_P	J1-14	DSI D0 P
11	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
12	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
13	DSI D2N		DSI_D2_N	J1-8	DSI D2 N
14	DSI D2P		DSI_D2_P	J1-6	DSI D2 P
15	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
16	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
17	DSI D3N		DSI_D3_N	J1-4	DSI D3 N
18	DSI D3P		DSI_D3_P	J1-2	DSI D3 P
19	NC		NC	NC	
20	NC		NC	NC	
21	VIN	+5V	VIN	J1-21, J1-24, J1-32, J1-41, J1-48	
22	GND	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
23	VCC	+3V3 Portenta	VCC	J2-23, J2-34, J2-43, J2-69	
24	VIN	+5V	VIN	J1-21, J1-24, J1-32, J1-41, J1-48	

4.3.11 Mini PCIe Connector (J8)

The Mini PCIe connector J8 of the Portenta Mid Carrier can connect compatible Mini PCIe cards, for example, the Arduino® Pro 4G Module EMEA (SKU: TPX00201), to the carrier and the connected Portenta family board.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	N/A				
2	N/A	+3V3 PCIE			
3	N/A				
4	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
5	N/A				
6	N/A				
7	N/A		GPIO_1	J2-48	
8	N/A				USIM PWR
9	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
10	N/A				USIM DATA
11	N/A		PCIE_CK_N	J2-19	PCIE CK N
12	N/A				USIM CLK
13	N/A		PCIE_CK_P	J2-17	PCIE CK P
14	N/A				USIM RST
15	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
16	N/A				
17	N/A				

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
18	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
19	N/A				
20	N/A		GPIO_2	J2-50	
21	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
22	N/A		PCIE_RST	J2-21	PCIE RST
23	N/A		PCIE_RX_N	J2-15	PCIE RX N
24	N/A	+3V3 PCIE			
25	N/A		PCIE_RX_P	J2-13	PCIE RX P
26	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
27	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
28	N/A				
29	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
30	N/A		I2C0_SCL	J1-46	I2C 0 SCL
31	N/A		PCIE_TX_N	J2-11	PCIE TX N
32	N/A		I2C0_SDA	J1-44	I2C 0 SDA
33	N/A		PCIE_TX_P	J2-9	PCIE TX P
34	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
35	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
36	N/A		USB0_D_N	J1-28	USB 0 D-
37	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
38	N/A		USB0_D_P	J1-26	USB 0 D+
39	N/A	+3V3 PCIE			
40	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
41	N/A	+3V3 PCIE			
42	N/A				
43	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	
44	N/A				
45	N/A				
46	N/A				
47	N/A				
48	N/A				
49	N/A				
50	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	

| Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
51	N/A				
52	N/A	+3V3 PCIE			

4.3.12 Mini PCIe Breakout Header Connector (J16)

The Mini PCIe breakout header connector J16 of the Portenta Mid Carrier can be used to debug the Mini PCIe interface.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	N/A		PCIE_CK_P	J2-17	PCIE CK P
2	N/A		PCIE_TX_P	J2-9	PCIE TX P
3	N/A		PCIE_CK_N	J2-19	PCIE CK N
4	N/A		PCIE_TX_N	J2-11	PCIE TX N
5	N/A		PCIE_RX_N	J2-15	PCIE RX N
6	N/A				
7	N/A		PCIE_RX_P	J2-13	PCIE RX P
8	N/A				
9	N/A		PCIE_RST	J2-21	PCIE RST
10	N/A				
11	N/A				
12	N/A				
13	N/A				
14	N/A				
15	N/A				
16	N/A				
17	N/A				
18	N/A				
19	N/A				
20	N/A				
21	N/A				
22	N/A				
23	N/A				
24	N/A	GND	GND	J1-22, J1-31, J1-42, J1-47, J1-54 J2-24, J2-33, J2-44, J2-57, J2-70	

4.3.13 Serial Breakout Header Connector (J17)

The serial breakout header connector J17 of the Portenta Mid Carrier can be used to debug the SERIAL1 interface.

Pin Number	Silkscreen	Power Net	Portenta HD Standard Pin	High-Density Pin	Interface
1	N/A		SERIAL1_RX	J1-35	UART 1 RX
2	N/A		SERIAL1_TX	J1-33	UART 1 TX
3	N/A		SERIAL1_RTS	J1-37	UART 1 RTS
4	N/A		SERIAL1_CTS	J1-39	UART 1 CTS
5	N/A		GPIO_6	J2-58	

4.4 Block Diagram

An overview of the high-level architecture of the Portenta Mid Carrier is illustrated in the figure below.
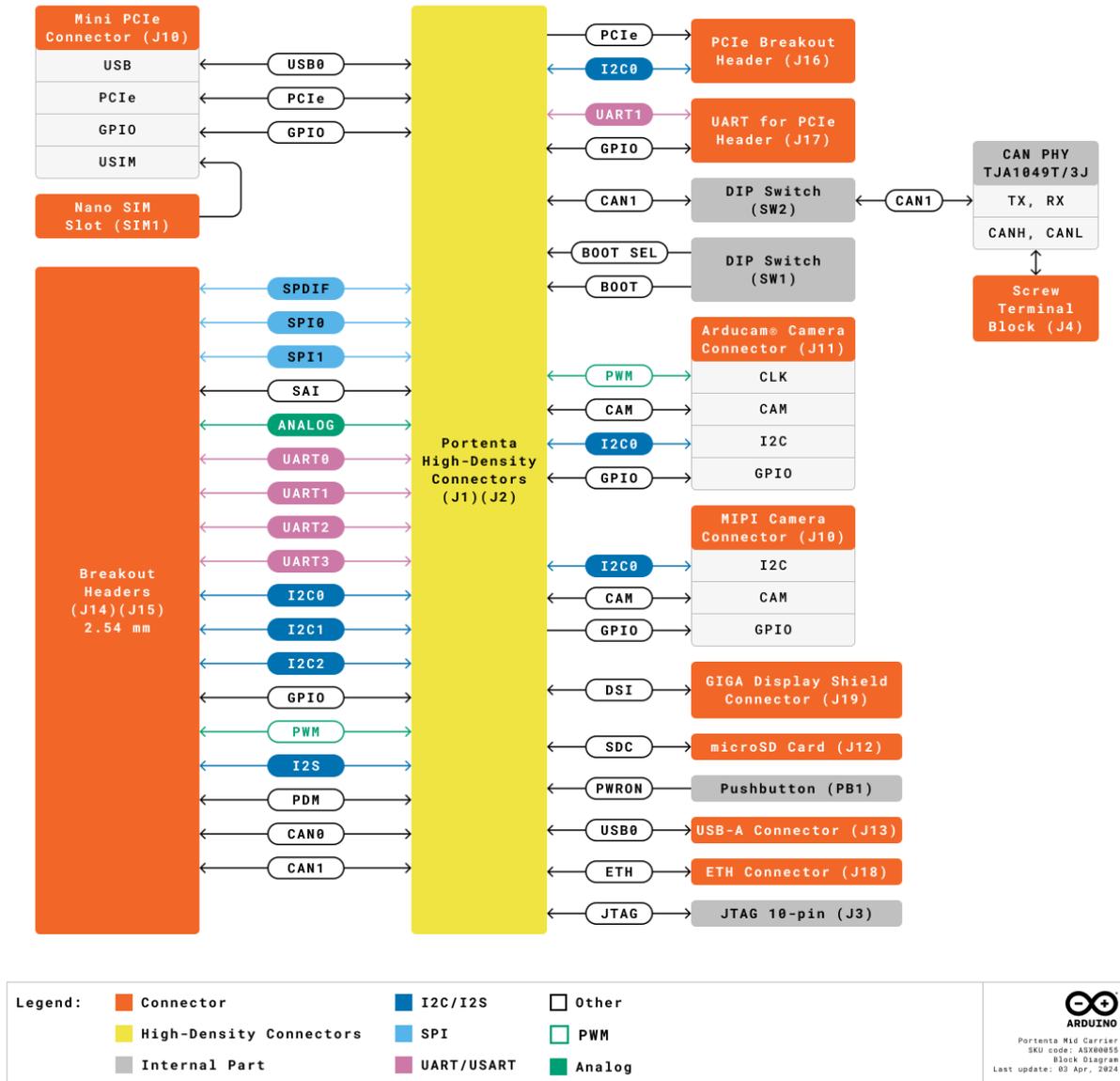
4.5 Power Supply

The figure below shows the power options available on the Arduino Portenta Mod Carrier and illustrates the Carrier's power architecture.
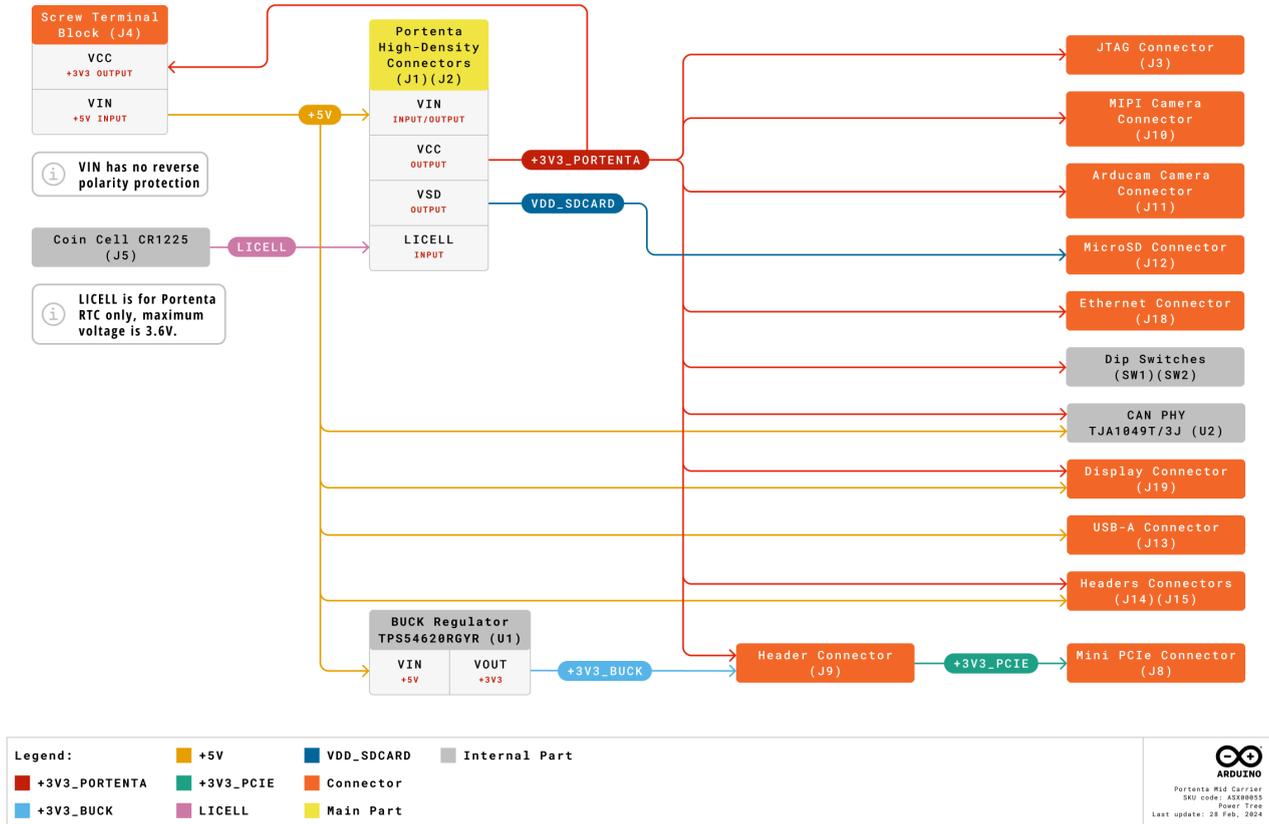
The Portenta Mid Carrier can be powered through one of these interfaces:

- **Onboard USB-C® port of the Portenta board**: Provides a convenient way to power the board using standard USB-C® cables and adapters.
- **External +5 VDC power supply**: This can be connected to the IN 5V pin of the carrier's screw terminal block J4; it can also be connected to the IN 5V pins of the breakout header connector J15.

> **Reverse polarity protection:** IN 5V pins of the carrier's screw terminal block (J4) and breakout header connector (J15) **do not have** reverse polarity protection. Double-check the polarity of your power supply before connecting it to the Carrier to avoid damaging it.

> **Safety note:** Disconnect power before modifying the carrier connections and configurations to avoid short-circuiting. For more safety tips, refer to the Carrier's user manual.

5 Device Operation

5.1 Getting Started - IDE

If you want to program your Arduino Portenta Mid Carrier with any of the Portenta family boards offline, install the Arduino® Desktop IDE **[1]**. To connect the Portenta family board to your computer, you will need a USB-C® cable.

5.2 Getting Started - Arduino Web Editor

All Arduino® devices work out of the box on the Arduino® Web Editor **[2]** by installing a simple plugin. The Arduino® Web Editor is hosted online. Therefore, it will always be up-to-date with all the latest features and support for all boards and devices. Follow **[3]** to start coding on the browser and upload your sketches onto your device.

5.3 Getting Started - Arduino Cloud

All Arduino® IoT-enabled products are supported on Arduino Cloud, which allows you to log, graph, and analyze sensor data, trigger events, and automate your home or business. Take a look at the official documentation to know more.

5.4 Sample Sketches

Sample sketches for the Portenta family boards can be found either in the "Examples" menu in the Arduino® IDE or the "Portenta Family" section of Arduino documentation **[4]**.

5.5 Online Resources

Now that you have gone through the basics of what you can do with the device, you can explore the endless possibilities it provides by checking exciting projects on ProjectHub **[5]**, the Arduino® Library Reference **[6]**, and the online store **[7]**, where you will be able to complement your Portenta Mid Carrier with additional extensions, sensors, and actuators.

6 Mechanical Information

The Arduino Portenta Mid Carrier is a one-sided 114 mm x 86.5 mm board with several connectors overhanging its edges. Portenta family boards and Mini PCIE cards are placed on the carrier using dedicated connectors.

6.1 Carrier Dimensions

The Portenta Mid Carrier board outline and mounting hole dimensions are shown in the figure below; all the dimensions are in millimeters (mm).
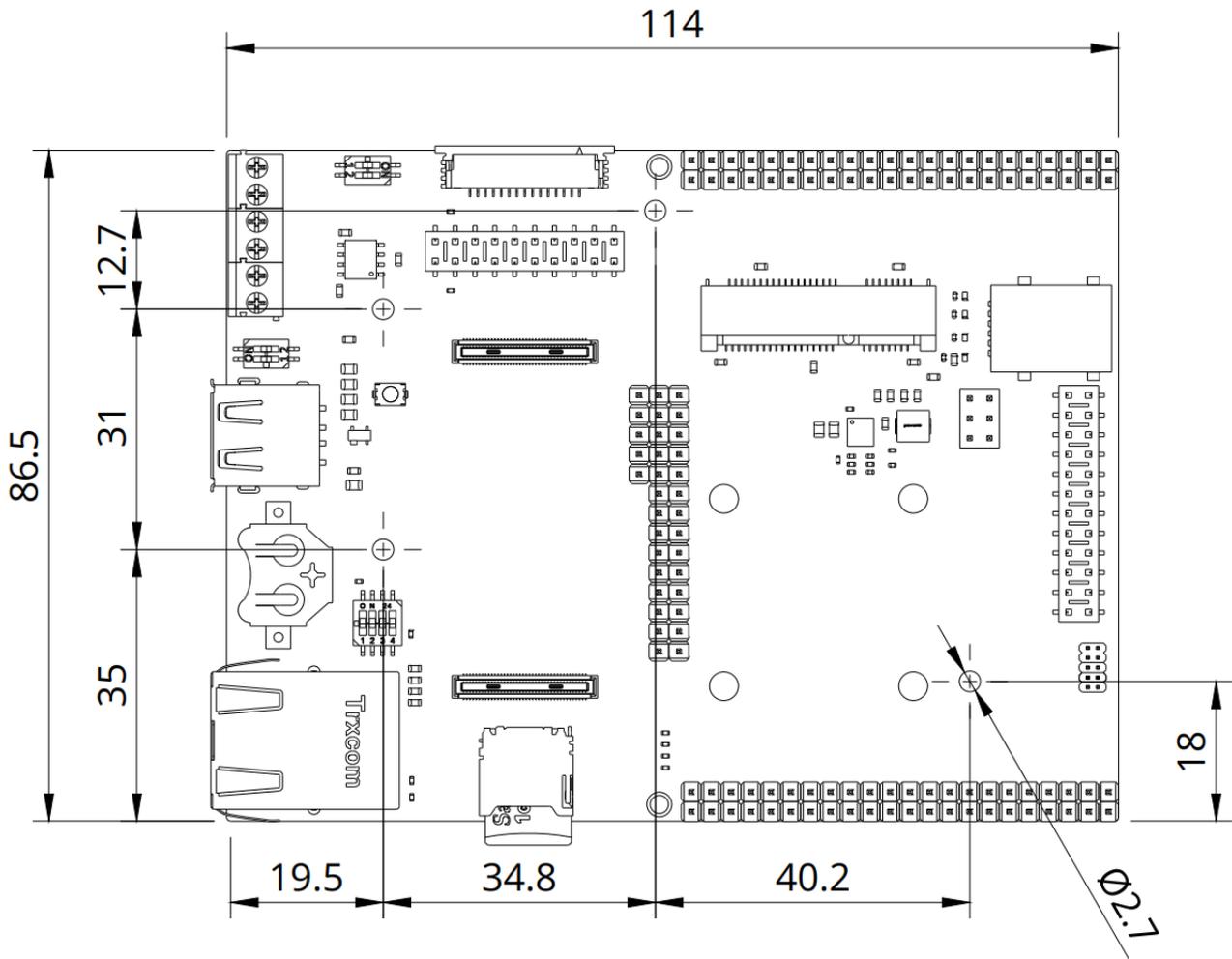
The carrier has four 2.7 mm drilled mounting holes for mechanical fixing.

6.2 Carrier Connectors

Connectors of the Portenta Mid Carrier are placed primarily on its edges, but there are also some connectors placed inside of the carrier; their placement is shown in the figure below. All the dimensions are in millimeters (mm).
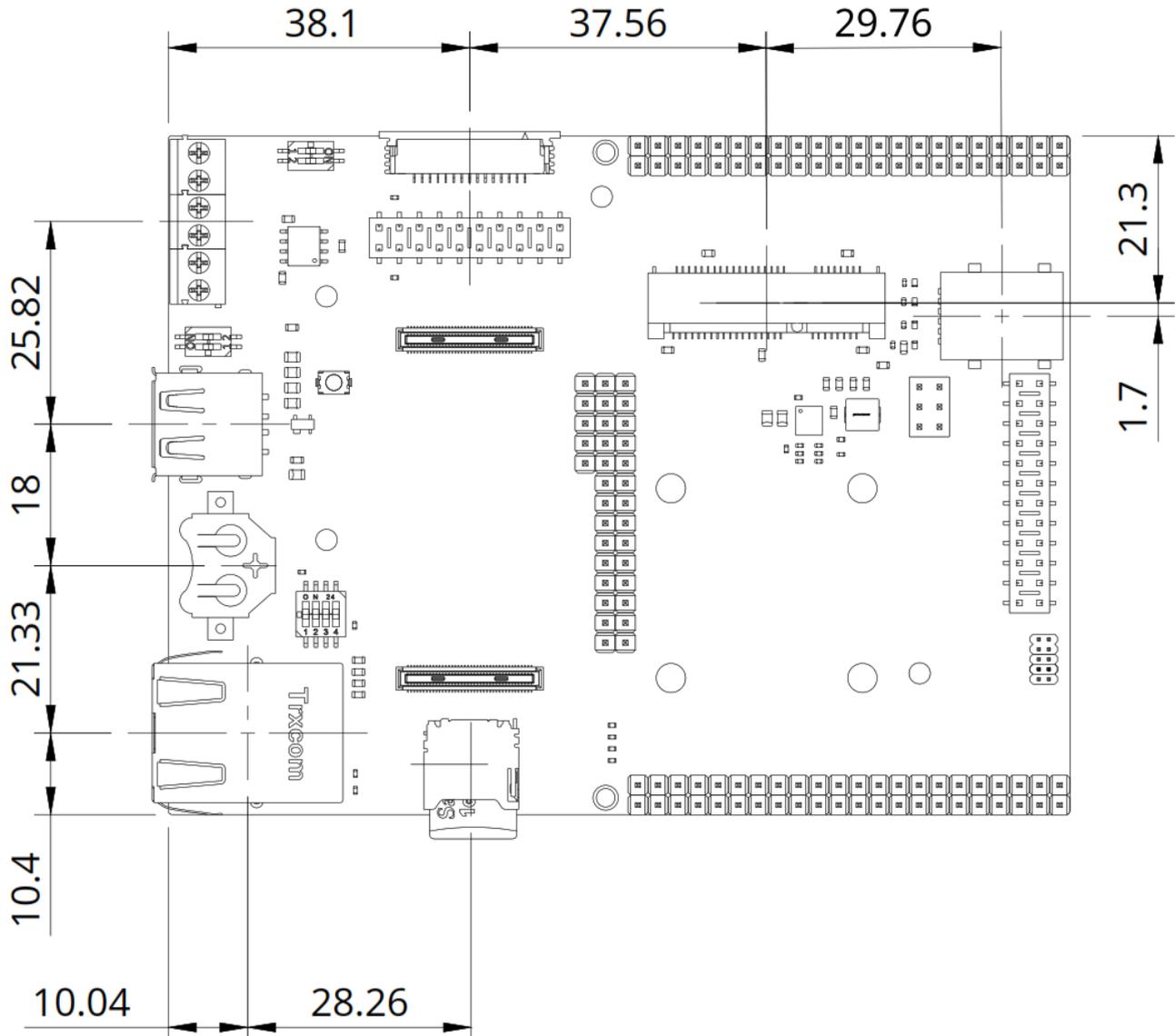
7 Product Compliance

7.1 Product Compliance Summary

Product Compliance
CE (European Union)
RoHS
REACH
WEEE
FCC (USA)
IC (Canada)
UKCA (UK)
Japan (No Radio)

7.2 Declaration of Conformity CE DoC (EU)

We declare under our sole responsibility that the products above are in conformity with the essential requirements of the following EU Directives and therefore qualify for free movement within markets comprising the European Union (EU) and European Economic Area (EEA).

7.3 Declaration of Conformity to EU RoHS & REACH 211 01/19/2021

Arduino boards are in compliance with RoHS 2 Directive 2011/65/EU of the European Parliament and RoHS 3 Directive 2015/863/EU of the Council of 4 June 2015 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

Substance	Maximum Limit (ppm)
Lead (Pb)	1000
Cadmium (Cd)	100
Mercury (Hg)	1000
Hexavalent Chromium (Cr6+)	1000
Poly Brominated Biphenyls (PBB)	1000
Poly Brominated Diphenyl ethers (PBDE)	1000
Bis(2-Ethylhexyl) phthalate (DEHP)	1000
Benzyl butyl phthalate (BBP)	1000
Dibutyl phthalate (DBP)	1000
Diisobutyl phthalate (DIBP)	1000

Exemptions: No exemptions are claimed.

Arduino Boards are fully compliant with the related requirements of European Union Regulation (EC) 1907 /2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). We declare none of the SVHCs (https://echa.europa.eu/web/guest/candidate-list-table), the Candidate List of Substances of Very High Concern for authorization currently released by ECHA, is present in all products (and also package) in quantities totaling in a concentration equal or above 0.1%. To the best of our knowledge, we also declare that our products do not contain any of the substances listed on the "Authorization List" (Annex XIV of the REACH regulations) and Substances of Very High Concern (SVHC) in any significant amounts as specified by the Annex XVII of Candidate list published by ECHA (European Chemical Agency) 1907 /2006/EC.

7.4 Conflict Minerals Declaration

As a global supplier of electronic and electrical components, Arduino is aware of our obligations concerning laws and regulations regarding Conflict Minerals, specifically the Dodd-Frank Wall Street Reform and Consumer Protection Act, Section 1502. Arduino does not directly source or process conflict minerals such as Tin, Tantalum, Tungsten, or Gold. Conflict minerals are contained in our products in the form of solder, or as a component in metal alloys. As part of our reasonable due diligence, Arduino has contacted component suppliers within our supply chain to verify their continued compliance with the regulations. Based on the information received thus far we declare that our products contain Conflict Minerals sourced from conflict-free areas.

8 FCC Caution

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference

2. This device must accept any interference received, including interference that may cause undesired operation.

FCC RF Radiation Exposure Statement:

1. This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter

2. This equipment complies with RF radiation exposure limits set forth for an uncontrolled environment

3. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

English: User manuals for license-exempt radio apparatus shall contain the following or equivalent notice in a conspicuous location in the user manual or alternatively on the device or both. This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference

2. This device must accept any interference, including interference that may cause undesired operation of the device.

French: Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. L' appareil nedoit pas produire de brouillage

2. L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IC SAR Warning:

English: This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

French: Lors de l' installation et de l' exploitation de ce dispositif, la distance entre le radiateur et le corps est d 'au moins 20 cm.

Important: The operating temperature of the EUT can't exceed 85 °C and shouldn't be lower than -40 °C.

Hereby, Arduino S.r.l. declares that this product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EU. This product is allowed to be used in all EU member states.

9 Company Information

Company name	Arduino S.r.l.
Company address	Via Andrea Appiani, 25 - 20900 Monza (Italy)

10 Reference Documentation

Reference	Link
Arduino IDE (Desktop)	https://www.arduino.cc/en/Main/Software
Arduino IDE (Cloud)	https://create.arduino.cc/editor
Arduino Cloud - Getting Started	https://docs.arduino.cc/arduino-cloud/getting-started/iot-cloud-getting-started
Portenta Mid Carrier Documentation	https://docs.arduino.cc/hardware/portenta-mid-carrier/
Project Hub	https://create.arduino.cc/projecthub?by=part&part_id=11332&sort=trending
Library Reference	https://www.arduino.cc/reference/en/
Online Store	https://store.arduino.cc/

11 Document Revision History

Date	Revision	Changes
27/03/2024	1	First release