



# ConnectCore 8X

SBC Pro

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Hardware Reference Manual

## Revision history—90002297

Revision	Date	Description
1P	December 2018	Initial release
2P	September 2019	Added specifications, updated features and functionality, updated block diagram, clarified expansion connector pinout table, and made miscellaneous edits and enhancements.
3P	October 2019	Added XBee socket note
4P	June 2020	Updated USB 3.0 note with SBC version 3 information.
A	November 2020	Added regulatory information and certifications; clarified MCA expansion connector functionality.
B	March 2021	Modified MCA signal information, fixed memory spec on features page.
C	October 2021	Added safety instructions and UKCA labeling requirements.

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# About the ConnectCore 8X SBC Pro

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## Overview

The ConnectCore 8X SBC Pro is an ultra compact Pico-ITX board featuring the Digi ConnectCore 8X system-on-module that integrates an NXP i.MX 8X application processor, LPDDR4 memory, eMMC flash memory, WLAN/Bluetooth, power management IC for optimized power consumption applications and a microcontroller assistant (MCA) for supporting additional functionality. This standalone product serves as the reference design for the ConnectCore 8X system-on-module and can also be used on its own to accelerate time to market.

## Features and functionality

- ConnectCore 8X System-on-Module:
  - MX8X Dual/Quad ARM Cortex-A35 and single Cortex-M4F cores
  - 2 GB, 32-bit LPDDR4-1200 memory
  - 16 GB, 8-bit eMMC memory
  - IEEE802.11 a/b/g/n/ac and Bluetooth 5.0
- Power:
  - Power jack and industrial dedicated 5V power connector
  - Coin-cell battery charger, supplying the on-module RTC
  - Power and reset buttons
- Boot source configuration: internal eMMC, microSD, USB
- Debug:
  - Standard IEEE 1149.1-2001 JTAG interface
  - Single Wired Debug (SWD) interface for the microcontroller assistant
  - TTL serial console
- Communication:
  - Two 10/100/1000 Mbps Ethernet interfaces
  - Two USB Host 2.0 interfaces on stacked USB A-type connector
  - USB3.0 on USB C-type connector
  - USB 2.0 OTG on micro AB-type connector
  - PCI Express Mini Card slot supporting full-size cards and Micro-SIM connection
  - XBee socket
  - MIMO IEEE 802.11 a/b/g/n/ac + Bluetooth 5.0 dual mode

- Multimedia:
  - Two LVDS/MIPI-DSI interfaces, each one supporting up to four differential data pairs
  - One MIPI CSI-2 camera
  - One 8-bit parallel camera interface
  - Audio CODEC supporting stereo headphone jack, speakers, mic-in, line-out and two line-in lines
- Storage:
  - microSD card slot
- Expansion/User interfaces
  - Two 40-pin expansion connectors providing access to many different interfaces
  - Two user LEDs
- Dimensions:
  - Pico-ITX form factor, 10 cm x 7.2 cm
  - PCB height 2 mm
  - Maximum part height:
    - TOP side: 15.6 mm (USB connector)
    - BOTTOM side: 6.8 mm (PCIe connector) (Host PCBs must have a cutout to accommodate the components on the bottom side of the module.)

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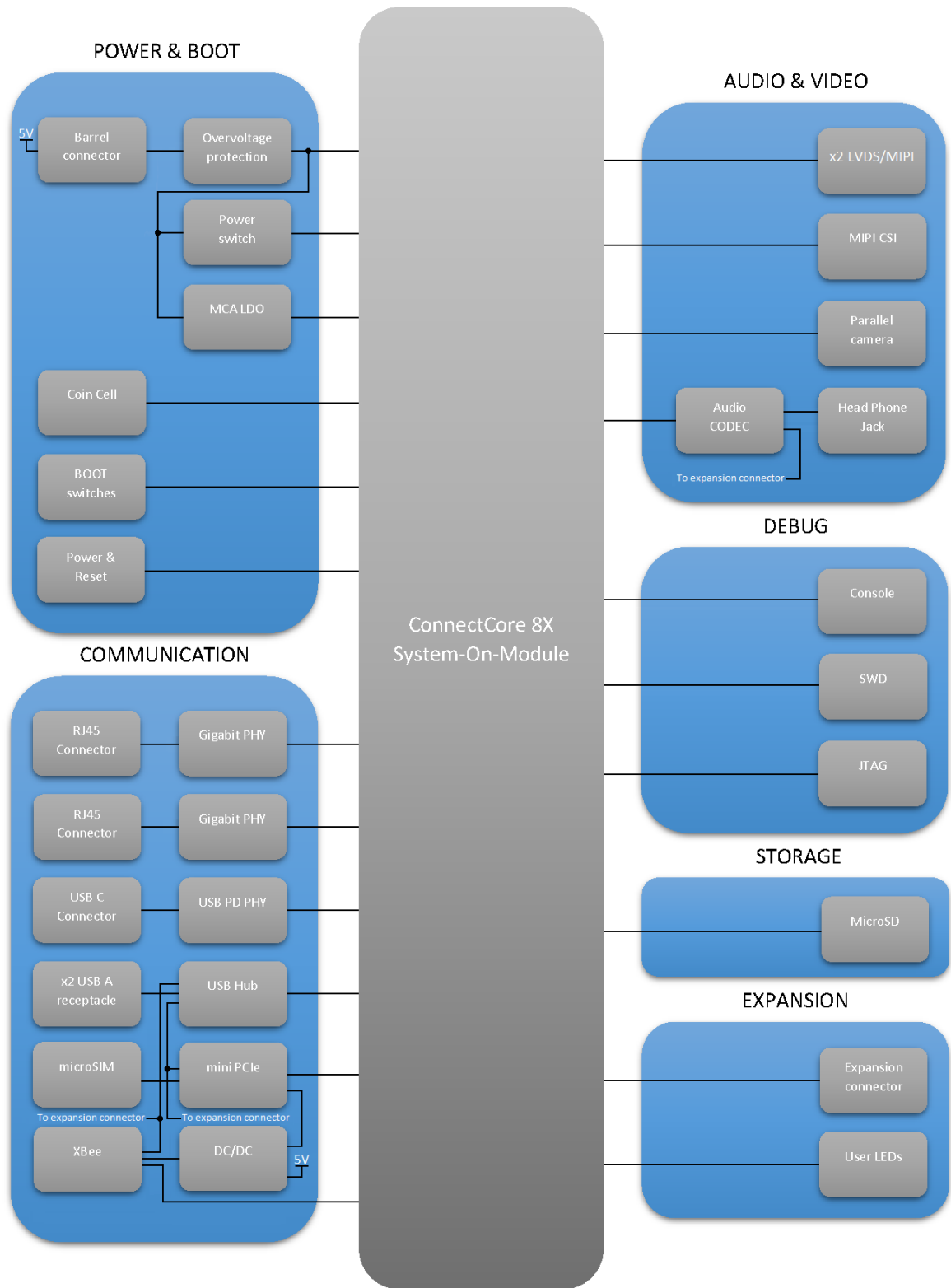
**Note** Some of the functionality mentioned above is specific to a ConnectCore 8X SBC Pro variant.

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## Safety instructions

- The ConnectCore 8X SBC Pro cannot be guaranteed operation due to the radio link and so should not be used for interlocks in safety critical devices such as machines or automotive applications.
- The ConnectCore 8X SBC Pro has not been approved for use in (this list is not exhaustive):
  - nuclear applications
  - explosive or flammable atmospheres
- There are no user serviceable components inside the ConnectCore 8X SBC Pro. Do not remove the shield or modify the ConnectCore 8X in any way. Modifications may exclude the SBC Pro from any warranty and can cause the ConnectCore 8X to operate outside of regulatory compliance for a given country, leading to the possible illegal operation of the radio.
- Use industry standard ESD protection when handling the ConnectCore 8X SBC Pro.
- Take care while handling to avoid electrical damage to the PCB and components.
- Do not expose ConnectCore 8X SBC Pros to water or moisture.
- Use this product with the antennas specified in the ConnectCore 8X SBC Pro user guides.
- The end user must be told how to remove power from the ConnectCore 8X SBC Pro or to locate the antennas 20 cm from humans or animals.

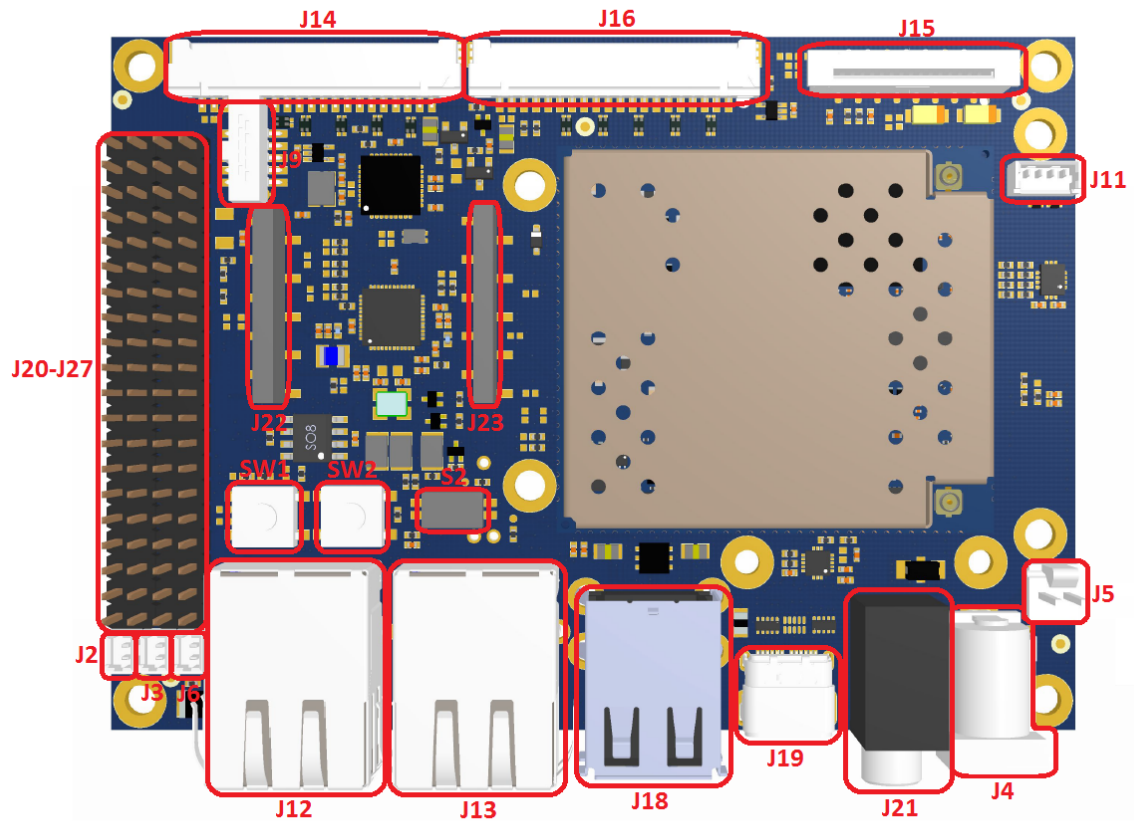
# Block diagram



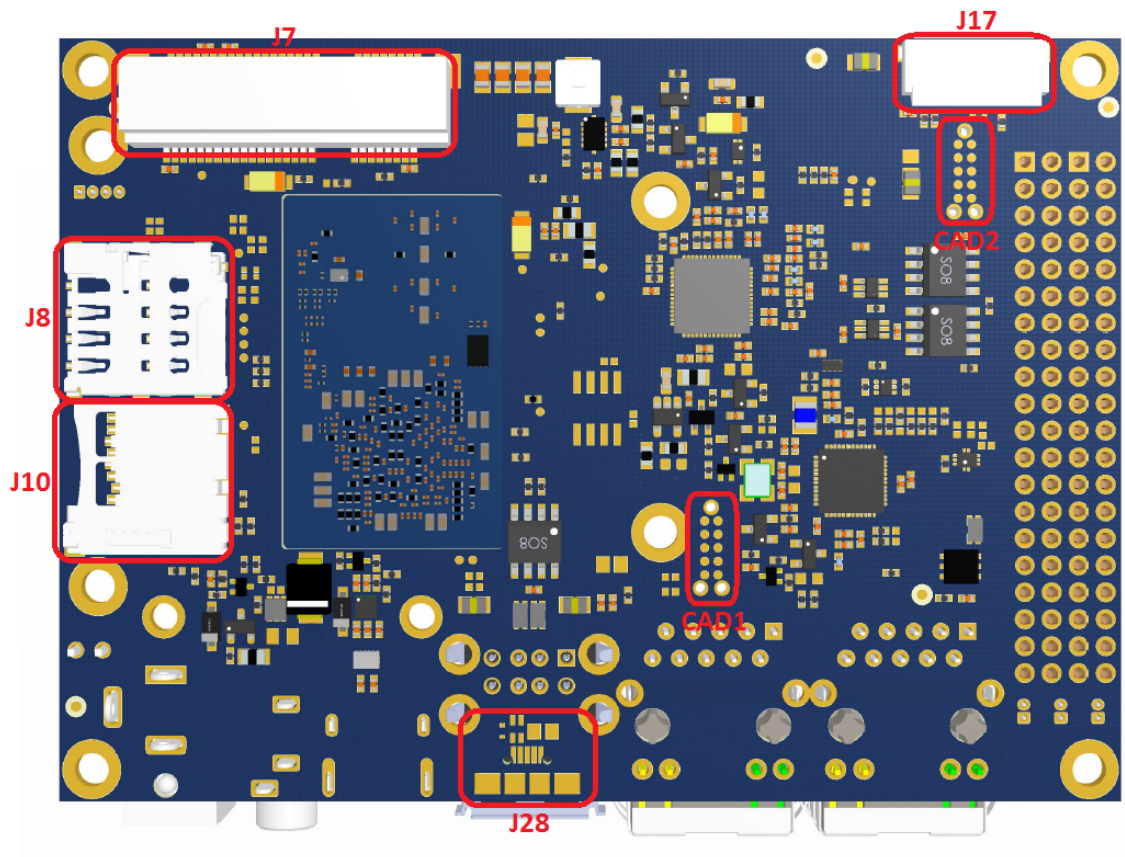


## Connectors, jumpers, and switches

### Top view



## Bottom view



## Description

Connector	Interface	Manufacturer	Manufacturer part number
J2	3.3V output	Molex	53047-0210
J3	5V output	Molex	53047-0210
J4	5V power-in jack	Bobbintron	CSCD443CCS011B00G
J5	5V power in	TE Connectivity	640456-2
J6	Coin cell	Molex	53047-0210
J7	Mini PCIe	Foxconn	AS0B226-S68Q-7H
J8	Micro SIM	Molex	78727-0001
J9	SWD	Samtec	FTSH-105-01-F-DV
J10	MicroSD	Molex	500873-0806

Connector	Interface	Manufacturer	Manufacturer part number
J11	Console	Molex	53047-0410
J12	Ethernet 1	XMultiple	XMG-J1B2211NPA-1-DIG
J13	Ethernet 2	XMultiple	XMG-J1B2211NPA-1-DIG
J14	LVDS 0	Hirose	DF14A-20P-1.25H
J15	MIPI camera	FCI	SFW15S-2STE1LF
J16	LVDS 1	Hirose	DF14A-20P-1.25H
J17	Parallel camera	Omron	XF2M-2015-1A
J18	Stacked USB A-type connector	KYCON	KUSBX-AS2N
J19	USB C-type connector	Molex	201267-0005
J20-J27	Expansion connectors	Würth Electronics Inc	61304021121
J22-J23	XBee socket	Samtec	SMM-110-02-F-S-P-TR
J28	USB micro AB-type connector	KYCON	KMMX-ABSMT5SG-30TR
CAD1	i.MX8X JTAG Tag Connect	-	-
CAD2	MCA SWD Tag Connect	-	-
SW1	Power button	ITT	KSC221JLFS
SW2	Reset button	ITT	KSC221JLFS
S2	Boot switches	TDA02H0SB1	C&K Components

# Interfaces

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## Power interfaces

### DC-in jack connector

A 5V DC-in power jack connector (J4) provides power to the entire ConnectCore 8X SBC Pro system. An overvoltage circuit protects the SBC from voltages higher than 6.5V (up to 12V). Behind the overvoltage protection, a 5V load switch (U2) controls the power delivered to the SBC. The enable pin of the power switch is controlled through 5V\_SBC\_PWR\_ON signal from the CPU (GPIO0\_13).

### Additional power connector

In addition to the power jack assembled on the SBC Pro, a 2-pin, 2.54 mm pitch, latched vertical connector on the top side of the board offers an alternative power rail to the whole system. This power input is also protected against overvoltage events.

The following table shows the pinout of the power connector (J5):

Pin	Signal name	Description
1	VIN	5 power supply line.
2	GND	

### Coin cell connector

A 2-pin, 1.25 mm pitch straight connector (J6), provides battery charging functionality and power the real-time-clock (RTC) interface when the main supply of the board is off. The main power supply rail powers the RTC while it is connected. You can supply the RTC with a primary Lithium cell (non-rechargeable), a secondary Lithium cell (rechargeable) or a supercap.

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**Note** For more information about the coin cell, see [Electrical specification](#).

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The following table shows the pinout of the coin cell connector:

Pin	Signal name	Description
1	VCC_LICELL	Power supply line for RTC.
2	GND	

### 5V supply connector

The ConnectCore 8X SBC Pro provides a 2-pin, 1.25 mm pitch straight connector with a regulated 5V supply for powering external circuitry. The 5V supply is generated on the on-board 5V regulator, which is also used internally in the ConnectCore 8X SBC for powering the video interfaces. The following table shows the pinout of the 5V supply connector (J3):

Pin	Signal name	Description
1	5V	5V power supply line.
2	GND	

### 3.3V supply connector

Together with the 5V supply connector, another 2-pin, 1.25 mm pitch straight connector is supported on the ConnectCore 8X SBC Pro providing a regulated 3.3V supply for powering external circuitry. The 3.3V power supply is generated on a buck regulator of the ConnectCore 8X PMIC (3V3\_EXT power rail), which is also used on-board for powering many interfaces of the ConnectCore 8X SBC Pro carrier board. The following table shows the pinout of the 3.3V supply connector (J2):

Pin	Signal name	Description
1	3V3_EXT	3.3V power supply line.
2	GND	

### Power and reset buttons

The ON/OFF button (SW1) on the SBC Pro is connected to the on-module MCA, and provides the following functionality:

Board status	Power button action	Response
OFF	Short press	Power on
ON or SLEEP	Long press for 5 seconds	Power off
SLEEP	Short press	Wake up
ON	Short press	Sleep

The RESET button (SW2) is also connected to the MCA, and by pressing it, the system will be reset.

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**Note** The duration of some power button actions can be configured by the user. See the [ConnectCore 8X online documentation](#) for more information.

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## Boot mode

By default, the ConnectCore 8X module boots from the internal board settings, allowing it to boot from the internal eMMC flash memory. For advanced functionality, the ConnectCore 8X SBC Pro provides two switches (S2) to configure the SOM boot mode, as explained below:

SW2	SW1	Boot mode
Open	Open	eMMC
Open	Close	Fuses
Close	Open	microSD
Close	Close	Serial downloader

Serial downloader mode allows you to boot from USB. This booting process is ideal for recovery purposes, such as if the boot loader is erased or cannot boot. If the system is configured to boot from any other source (internal eMMC, microSD) but the booting process fails (e.g. wrong images loaded)

the system will also fall back to booting into USB debug mode, regardless the state of the switches. For more information about the boot mode configuration, see the [ConnectCore 8X System-on-Module Hardware Reference Manual](#).

## Debug interfaces

### JTAG

The ConnectCore 8X SBC Pro provides a Tag Connect footprint for accessing the i.MX 8X JTAG debug port. This footprint is located on the bottom side of the board.

### SWD

The ConnectCore 8X SBC Pro provides two options for programming and debugging the Microcontroller Assist carried by the ConnectCore 8X SOM:

The first option is a 2x5, 1.27 mm pitch pin header (J9) on the top side of the board that, by default, is not populated. The following table shows the pinout of the SWD connector:

Pin	Schematic signal name	Description
1	VCC_MCA	MCA power supply line.
2	SWD_DIO/PWR_IO	SWD bidirectional data line.
3	GND	
4	SWD_CLK/PWR_IO	SWD clock signal.
5	GND	
6	NC	
7	NC	
8	NC	
9	GND	
10	SYS_RESET	Reset signal for the MCA.

The second option is the ARM 10-pin standard-compliant Tag Connect footprint on the bottom side of the board.

### Console port

As the debug console port, the ConnectCore 8X SBC Pro provides a 4-pin, 1.25 mm pitch connector (J11). The UART2 port of the ConnectCore 8X module is used for this purpose. The console signals is a serial TTL, which travels through the console connector directly to the i.MX8X processor. A TTL-to-USB cable can be used for accessing this console port from a host PC USB port. The following table shows the pinout of this console connector:

Pin	Signal name	Description
1	CONSOLE_TX	Transmission line.
2	CONSOLE_RX	Receiver line.
3	3V3_EXT	3.3V power supply line.
4	GND	

The default console setting are as follows:

Baud rate	115200
Data	8 bit
Parity	none
Stop	1 bit
Flow control	none

## Communication interfaces

### 10/100/1000 Mbps Ethernet

The ConnectCore 8X SBC Pro provides two 10Base-T/100Base-Tx/1000Base-T Ethernet interfaces, by using two Qualcomm Atheros AR8031 10/100/1000 Ethernet PHYs. These Ethernet PHYs are connected to the i.MX8X ENET0 and ENET1 interfaces, respectively. Both Ethernet interfaces area accessible through RJ-45 connectors (J12 and J13) with integrated link/activity LEDs, as specified in the following table:

Green LED	Yellow LED	Link/activity status
ON	OFF	10M Link
BLINK	OFF	10M Active
ON	OFF	100M Link
BLINK	OFF	100M Active
ON	ON	1000M Link
BLINK	ON	1000M Active

For power management purposes, a dedicated power switch allows you to control the power over the Ethernet PHYs.

### USB Host

The ConnectCore 8X SBC Pro offers support for four USB Host interfaces through a USB Hub controller:



- Two of them are available over a stackable dual USB A-type connector (J18) located on the front of the board.
- One USB host is connected to the PCI Express Mini card connector.
- One USB host is connected to the XBee socket.

Both the PCI Express and the XBee USB buses can be disconnected from these interfaces and accessed on the Expansion connector. These connections are managed through 0-ohm resistors:

USB_PCIe/EXPANSION_USB1 bus configuration		
	USB_PCIe connected	EXPANSION_USB1 connected
<b>R228/R229</b>	Populated	Not populated
<b>R191/R192</b>	Not populated	Populated

XBEE/EXPANSION_USB2 bus configuration		
	XBEE connected	EXPANSION_USB2
<b>R76/R77</b>	Populated	Not populated
<b>R78/R79</b>	Not populated	Populated

For power management purposes, a dedicated power switch allows you to control the power over the USB Hub.

### USB 3.0

One USB 3.0 bus is available through a USB C-type connector (J19) located on the top side of the board. The USB 3.0 adds the SuperSpeed (SS) transfer rate, which works up to 5 Gb/s.

This interface can work at both USB 2.0 and USB 3.0 modes, and it can also work in both Host and Device modes.

When the interface is configured to work in Host mode, the power delivered to the device can be configured up to 3A.

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**Note** While the USB 3.0 bus was not supported in ConnectCore 8X SBC Pro first-availability kits, **USB 3.0 is supported on the USB C-type connector starting with version 3 of the ConnectCore 8X SBC Pro (Digi part number 30015752-03 or 50001990-01 from revision 1P on (1P, 2P, A, B, ...)).**

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### PCI Express

The ConnectCore 8X SBC Pro provides a Mini PCI Express connector with the following interfaces:

- I2C.
- USB Host port (see USB Host section).
- PCIe interface, only available in carrier boards with non-wireless ConnectCore 8X SOM variants.
- One GPIO for the low-level PCIe wake-up signal.
- One GPIO for the low-level PCIe disable signal.

- One GPIO for the low level PCIe reset signal.
- SIM interface. The micro-SIM card slot is located on the bottom side of the board (J10).

For power management purposes, a dedicated 3.3V regulator allows you to control the power over the PCIe interface.

The ConnectCore 8X SBC Pro has two 2.6 mm metalized drills supporting full-size PCI Express cards. The following table shows the pinout of the PCIe connector:

Pin	Signal name	Description
1	PCIE_WAKE_N	Wake-up signal.
2	PCIE_VCC	3.3V power supply line.
3	NC	Not connected.
4	GND	
5	NC	Not connected.
6	VLDO4_1V5	1.5V power supply line.
7	NC	Not connected.
8	PCIE_UIM_PWR	Power supply for SIM card.
9	GND	
10	PCIE_UIM_DATA	SIM card data line.
11	PCIE_CLK_N	PCIe clock pair line (-).
12	PCIE_UIM_CLK	SIM card clock line.
13	PCIE_CLK_P	PCIe clock pair line (+).
14	PCIE_UIM_RST	SIM card reset line.
15	GND	
16	PCIE_UIM_VPP	Power supply for SIM programming.
17	NC	Not connected.
18	GND	
19	NC	Not connected.
20	PCIE_DIS_N	Disable signal.
21	GND	
22	PCIE_RESET_N	Reset signal.
23	PCIE_RX_N	PCIe reception pair line (-).
24	PCIE_VCC	3.3V power supply line.
25	PCIE_RX_P	PCIe reception pair line (+).

Pin	Signal name	Description
26	GND	
27	GND	
28	VLDO4_1V5	1.5V power supply line.
29	GND	
30	PCIE_I2C_SCL	I2C clock line.
31	PCIE_TX_N	PCIe transmission pair line (-).
32	PCIE_I2C_SDA	I2C data line.
33	PCIE_TX_P	PCIe transmission pair line (+).
34	GND	
35	GND	
36	USB_PCIE_D_N	USB differential data line (-).
37	GND	
38	USB_PCIE_D_P	USB differential data line (+).
39	PCIE_VCC	3.3V power supply line.
40	GND	
41	PCIE_VCC	
42	NC	Not connected.
43	GND	
44	NC	Not connected.
45	NC	Not connected.
46	NC	Not connected.
47	NC	Not connected.
48	VLDO4_1V5	1.5V power supply line.
49	NC	Not connected.
50	GND	
51	NC	Not connected.
52	PCIE_VCC	3.3V power supply line.

## XBee

The ConnectCore 8X SBC Pro provides an XBee socket supporting the connection of Digi XBee/XBee-PRO modules. The XBee socket consist of two 10-pin, 2 mm pitch connectors (J22 and J23) which follow the standard pinout of the XBee modules:

Description	Signal name	J12 pin	XBee standard pin	J13 pin	Signal name	Description
3.3V power supply line.	XBEE_VCC	1	<b>1 - VCC</b>	<b>ADC0/DIO0 - 20</b>	1	-
XBee UART output data line.	MCA_UART2_RX	2	<b>2 - DOUT</b>	<b>AD1/DIO1 - 19</b>	2	-
XBee UART input data line.	MCA_UART2_TX	3	<b>3 - DIN/CONFIG_N</b>	<b>AD2/DIO2 - 18</b>	3	-
	-	4	<b>4 - D08</b>	<b>AD3/DIO3 - 17</b>	4	-
XBee reset line, connected to MCA_IO15.	XBEE_RESET_N	5	<b>5 - RESET_N</b>	<b>RTS_N/DIO6 - 16</b>	5	MCA_UART2_RTS XBee UART clear to send line.
	-	6	<b>6 - PWM0/RSSI</b>	<b>AD5/DIO5 - 15</b>	6	-
	XBEE_DP	7	<b>7 - Reserved</b>	<b>VREF - 14</b>	7	-
	XBEE_DN	8	<b>8 - Reserved</b>	<b>ON/SLEEP_N - 13</b>	8	XBEE_ON/SLEEP_N XBee status line, connected to MCA_IO16.
XBee request line, connected to MCA_IO11.	XBEE_SLEEP_RQ	9	<b>9 - DTR_N/SLEEP_RQ/DI8</b>	<b>CTS_N/DIO7 - 12</b>	9	MCA_UART2_CTS XBee UART request to send lind.
	GND	10	<b>10 - GND</b>	<b>AD4/DIO4 - 11</b>	10	-

**Note** The XBee socket is powered through an external DC/DC regulator(U23 - MP2316). The purpose of this external regulator is to provide higher current than using 3V3 supply coming from the module. **Disabling this regulator doesn't guarantee that the XBee socket is fully disconnected from the module.** In fact, some current travels through the I/Os to the module even after the regulator is disabled.

If your design requires fully disconnecting the XBee socket from the ConnectCore 8X module, Digi recommends you use bus switches for all I/Os connected to the XBee socket.

The XBee can communicate with the ConnectCore 8X SOM in two different ways:

- Using the UART2 bus of the ConnectCore 8X on-module MCA.
- Using the USB bus.

**Note** The USB bus connected to the XBee socket is also connected to the expansion header. See [USB Host](#) for detailed information.

## Multimedia interfaces

### LVDS/MIPI-DSI display

The two MIPI-DSI/LVDS combo PHYs supported by the ConnectCore 8X module are available over two different display connectors (J14 and J16) on the top side of the board:

- MIPI\_DSI0 bus is connected to J14.
- MIPI\_DSI1 bus is connected to J16.

These are 20-pin, 1.25 mm pitch connectors, which provide access to the following capabilities:

- Up to four differential data pairs.
- One differential clock pair.
- Interrupt signal with 10K pull-up resistor for touch screen.
- Control of the backlight contrast.
- I2C.
- 3.3V power supply.
- 5V power supply.

Both the connectors exhibit the same pinout:

Pin	Signal name	Description
1	3V3_EXT	3.3V power supply line.
2	MIPI_DSI0/1_DATA0_N	Transmission pair 0 data line (-).
3	MIPI_DSI0/1_DATA0_P	Transmission pair 0 data line (+).
4	GND	
5	MIPI_DSI0/1_DATA1_N	Transmission pair 1 data line (-).
6	MIPI_DSI0/1_DATA1_P	Transmission pair 1 data line (+).
7	GND	
8	MIPI_DSI0/1_DATA2_N	Transmission pair 2 data line (-).
9	MIPI_DSI0/1_DATA2_P	Transmission pair 2 data line (+).
10	GND	
11	MIPI_DSI0/1_CLK_N	Transmission pair clock line (-).
12	MIPI_DSI0/1_CLK_P	Transmission pair clock line (+).
13	GND	

Pin	Signal name	Description
14	MIPI_DSI0/1_DATA3_N	Transmission pair 3 data line (-).
15	MIPI_DSI0/1_DATA3_P	Transmission pair 3 data line (+).
16	MIPI_DSI0/1_PWM0_OUT	Backlight PWM.
17	MIPI_DSI0/1_I2C0_SCL	I2C bus clock line.
18	MIPI_DSI0/1_I2C0_SDA	I2C bus data line.
19	MIPI_DSI0/1_IRQ_N	Display interrupt line.
20	VIN	5V power supply line.

### MIPI camera

The ConnectCore 8X SBC Pro provides one MIPI camera interface compliant with the MIPI CSI-2 specification. A MIPI D-PHY is supported by the i.MX8X CPU, allowing direct connections between the module and a MIPI CSI-2 compliant camera sensor.

This MIPI interface is available over a 15-pin, 1mm pitch, FCC connector on the top side of the board (J15), whose pinout is described in the following table:

Pin	Signal name	Description
1	3V3_EXT	3.3V power supply line.
2	MIPI_CSI0_I2C0_SDA	I2C bus data line.
3	MIPI_CSI0_I2C0_SCL	I2C bus clock line.
4	NC	Not connected.
5	MIPI_CSI0_RESET_N	Camera reset line.
6	GND	
7	MIPI_CSI0_CLK_P	Transmission pair clock line (+).
8	MIPI_CSI0_CLK_N	Transmission pair clock line (-).
9	GND	
10	MIPI_CSI0_DATA1_P	Transmission pair 1 data line (+).
11	MIPI_CSI0_DATA1_N	Transmission pair 1 data line (-).
12	GND	
13	MIPI_CSI0_DATA0_P	Transmission pair 0 data line (+).
14	MIPI_CSI0_DATA0_N	Transmission pair 0 data line (-).
15	GND	

## Parallel camera

The ConnectCore 8X SBC Pro provides one parallel camera interface (CSI). It is composed of an 8-bit data bus, a master clock from the i.MX8X CPU and three synchronization signals (PIXCLK, HSYNC and VSYNC).

This interface is available over a 20-pin, 0.5 mm pitch FCC connector (J17) located in top side of the board, which has the following pinout:

Pin	Signal name	Description
1	GND	
2	CSI_D00	Camera data line 0.
3	CSI_D01	Camera data line 1.
4	CSI_D02	Camera data line 2.
5	CSI_D03	Camera data line 3.
6	CSI_D04	Camera data line 4.
7	CSI_D05	Camera data line 5.
8	CSI_D06	Camera data line 6.
9	CSI_D07	Camera data line 7.
10	GND	
11	CSI_MCLK	Camera master clock line.
12	CSI_PCLK	Camera pixel clock line.
13	CSI_HSYNC	Camera horizontal sync line.
14	CSI_VSYNC	Camera vertical sync line.
15	CSI_EN	Camera enable signal.
16	CSI_RESET	Camera reset line.
17	GND	
18	CSI_SCL	I2C bus clock line.
19	CSI_SDA	I2C bus data line.
20	3V3_EXT	3.3V power supply line.

## Audio

Audio functionality on the ConnectCore 8X SBC Pro supports headphone, speakers, line-out, two line-in and microphone signals. A Maxim MAX98089 audio codec manages the audio interface, which communicates with the i.MX8X CPU through I2C. For power management purposes, a dedicated power switch allows you to control the power over the audio codec.

The headphone audio output of the audio codec is connected to a stereo audio jack (J21) located on the front edge of the SBC Pro. The remaining audio signals mentioned above are available over the expansion connector. See [Expansion connector](#) for more information.

## Storage interfaces

### MicroSD

A microSD socket (J10) is located on the bottom side of the board. This interface is connected to the USDHC1 controller of the i.MX 8X CPU.

## Expansion and user interfaces

### Expansion connector

Two 2-row, 40-pin, 2.54 mm pitch headers (J20 and J27) are supported by the ConnectCore 8X SBC Pro board. This headers acts as an expansion connector, offering access to many different interfaces of the CPU and the MCA.

The following table show the pinout of the expansion connectors:

Description	Signal name	Pin		Signal name	Description
<b>J20</b>					
	GND	<b>2</b>	<b>1</b>	VCC_MCA	MCA power supply line.
1.8V power supply line.	1V8_EXT	<b>4</b>	<b>3</b>	MCA_CLKOUT32K	MCA 32 kHz clock output.
MCA GPIO.	MCA_IO7	<b>6</b>	<b>5</b>	MCA_IO6	MCA GPIO. <b>Line not available for general purpose usage.</b>
MCA GPIO. <b>Line not available for general purpose usage.</b>	MCA_IO9	<b>8</b>	<b>7</b>	MCA_IO8	MCA GPIO.
MCA GPIO. <b>Line not available for general purpose usage.</b>	MCA_IO5	<b>10</b>	<b>9</b>	GND	
MCA voltage reference output.	MCA_VREF_OUT	<b>12</b>	<b>11</b>	MCA_IO14	MCA GPIO.
i.MX 8X GPIO.	GPIO4_21	<b>14</b>	<b>13</b>	GPIO4_20	i.MX 8X GPIO.
MCA GPIO.	MCA_IO17	<b>16</b>	<b>15</b>	3V3_RF	3.3V power supply rail of the RF section of the SOM.
Connected to on-module wireless MAC.	BT_WAKEUP_SLAVE	<b>18</b>	<b>17</b>	BT_WAKEUP_HOST	Connected to on-module wireless MAC and to MCA_IO12.
Connected to on-module wireless MAC.	PCM_IN	<b>20</b>	<b>19</b>	PCM_CLK	Connected to on-module wireless MAC.



Description	Signal name	Pin		Signal name	Description
Connected to on-module wireless MAC.	PCM_SYNC	22	21	PCM_OUT	Connected to on-module wireless MAC.
Connected to on-module wireless MAC.	LTE_PRI	24	23	GPS_COEX	Connected to on-module wireless MAC.
Connected to on-module wireless MAC.	LTE_SYNC	26	25	QOW	Connected to on-module wireless MAC.
Negative differential microphone input.	MIC_N	28	27	LINE1_IN_R	Audio codec line A1 input.
Positive differential microphone input.	MIC_P	30	29	LINE1_IN_L	Audio codec line A2 input.
Positive left-channel speaker output.	SPKL_P	32	31	LINE2_IN_R	Audio codec line B1 input.
Negative left-channel speaker output.	SPKL_N	34	33	LINE2_IN_L	Audio codec line B2 input.
Positive right-channel speaker output.	SPKR_P	36	35	LINE_OUT_R	Right output line.
Negative right-channel speaker output.	SPKR_N	38	37	LINE_OUT_L	Left output line.
Power button of the ConnectCore 8X SOM.	POWER_BUTTON	40	39	SYS_RESET	Input reset line of the ConnectCore 8X SOM.
<b>J27</b>					
	GND	2	1	3V3_EXT	3.3V power supply line.
i.MX 8X SPI0 chip select 0 line.	SPI0_CS0	4	3	SPI0_SCK	i.MX 8X SPI0 clock line.
i.MX 8X SPI0 bus chip select 1 line.	SPI0_CS1	6	5	SPI0_SDI	i.MX 8X SPI0 bus input data line.
i.MX 8X SPI0 bus interrupt line.	SPI0_IRQ_N	8	7	SPI0_SDO	i.MX 8X SPI0 bus output data line.
CAN2 low line.	CAN2_L	10	9	CAN1_L	CAN1 low line.
CAN2 high line.	CAN2_H	12	11	CAN1_H	CAN1 high line.
i.MX 8X I2C3 bus interrupt line.	EXP_I2C_IRQ_N	14	13	EXP_I2C_SCL	i.MX 8X I2C3 bus clock line.
i.MX 8X I2C3 bus dedicated GPIO.	EXP_I2C_GPIO	16	15	EXP_I2C_SDA	i.MX 8X I2C3 bus data line.
i.MX 8X UART0 bus request	UART0_RTS_B	18	17	UART0_TX	i.MX 8X UART0 bus

Description	Signal name	Pin		Signal name	Description
to send line.					transmission line.
i.MX 8X UART0 bus clear to send line.	UART0_CTS_B	20	19	UART0_RX	i.MX 8X UART0 bus receiver line.
RS485 A line.	RS485_A	22	21	M40_UART_TX	i.MX 8X M40 UART bus transmission line.
RS485 B line.	RS485_B	24	23	M40_UART_RX	i.MX 8X M40 UART bus receiver line.
i.MX 8X ADC channel 4.	ADC_IN4	26	25	ADC_IN0	i.MX 8X ADC channel 0.
i.MX 8X ADC channel 5.	ADC_IN5	28	27	ADC_IN1	i.MX 8X ADC channel 1.
i.MX 8X GPIO.	GPIO4_19	30	29	CAN1_MODE	Connected to SN65HVD233DR Rs pin (8).
USB expansion bus 1 differential data line (+).	EXPANSION_USB1_D_P	32	31	CAN2_MODE	Connected to SN65HVD233DR Rs pin (8).
USB expansion bus 1 differential data line (-).	EXPANSION_USB1_D_N	34	33	EXPANSION_USB2_D_P	USB expansion bus 2 differential data line (+).
i.MX 8X GPIO.	GPIO0_12	36	35	EXPANSION_USB2_D_N	USB expansion bus 2 differential data line (-).
Power supply line for RTC.	VCC_LICELL	38	37	GPIO5_09	i.MX 8X GPIO.
5V power supply line.	5V	40	39	GND	

**Note** MCA\_IO5 is used by default as enable line for 3V3\_EXT power switch (U32).

MCA\_IO6 is used by default as enable line for 1V8\_EXT power switch (U33).

MCA\_IO9 is used by default as a power on line controlling MOSFET (Q1).

Using these lines for another purpose could alter functionality of the ConnectCore 8X SBC.

## User LEDs

Two user LEDs are located on the top side of the ConnectCore 8X SBC Pro board. Both LEDs are connected to GPIOs from the MCA as follows:

Device	MCA port
User LED0	PTD5
User LED1	PTA2

## Specifications

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## Electrical specification

### Supply voltages

The ConnectCore 8X SBC Pro has three supply inputs. Two of them power the whole system (ConnectCore 8X SBC Pro plus the ConnectCore 8X system-on-module) and the other one powers the RTC of the module when the main supply is not present. The following table shows the voltage range of the input supplies of the ConnectCore 8X SBC Pro:

Signal	Description	Min	Typ	Max	Unit
VIN (jack connector)	Power jack input	4.6	5.0	5.5	V
VIN (additional connector)	Additional connector input	4.6	5.0	5.5	V
VCC_LICELL	Supply for RTC	2.4	-	3.6	V

### Power consumption

See the [ConnectCore 8X Performance and Power Benchmarking Report](#) for information on power consumption for the ConnectCore 8X.

### Mechanical specification

The ConnectCore 8X SBC Pro is a 100mm x 72mm pico-ITX board. Four 3.2mm drills are located on the four corners of the PCB for assembling the board into an enclosure. These drills have a 5.5mm round metalized area for the screws and nuts. Four additional 3.2mm drills are located around the ConnectCore 8X system-on-module for assembling a heat sink. The board has two additional 2.6mm drills to assembly a full size PCI express mini card module.

There must be a recess in the board to accommodate the components on the bottom side of the SOM.

### Environmental specification

The operating temperatures defined for the ConnectCore 8X are as follows:

Specification	Operating temperature
Industrial	-40°C to +85°C

### WLAN specification

For a complete WLAN specification please refer to the [ConnectCore 8X System-on-Module Hardware Reference Manual](#).

## Regulatory information and certifications

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**Note** The ConnectCore 8X SBC Pro complies with Part 15 of the United States FCC rules and regulations.

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## United States FCC

The ConnectCore 8X SBC Pro complies with Part 15 of the FCC rules and regulations. Compliance with the labeling requirements, FCC notices and antenna usage guidelines is required. To fulfill FCC Certification, the OEM must comply with the following regulations:

The system integrator must ensure that the text on top side of the module is placed on the outside of the final product.

The ConnectCore 8X SBC Pro may only be used with approved antennas. (See [FCC-approved antennas](#).)

### Labeling requirements



**WARNING!** The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the final product enclosure that displays the contents shown below. Required FCC Label for OEM products containing the ConnectCore 8X module.

#### Contains FCC ID: MCQ-CCIMX8

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, and (2) this device must accept any interference received, including interference that may cause undesired operation.

### Maximum power and frequency specifications (FCC)

RF band	Peak antenna gain	Technology	Channel bandwidth	Channel number (Center frequency, MHz)
2.4 GHz	2.5 dBi	BT + EDR Bluetooth LE	1	79 non-overlapping channels: 0 (2400) to 78 (2480)
			2	40 non-overlapping channels: 0 (2402) to 39 (2480)
		WLAN	20	1(2412), 2(2417), 3(2422), 4(2427), 5(2432), 6 (2437), 7(2442), 8(2447), 9 (2452), 10(2457), 11 (2462)
			40	3(2422), 4(2427), 5(2432), 6(2437), 7(2442), 8 (2447), 9(2452)
5 GHz	4.6 dBi	WLAN	20	36(5180), 40(5200), 44(5220), 48(5240), 52 (5260), 56(5280), 60(5300), 64 (5320), 100(5500), 104(5520), 108(5540), 112(5560), 116(5580), 120 (5600), 124(5620), 128(5640), 132(5660), 136 (5680), 140(5700), 149 (5745), 153(5765), 157 (5785), 161(5805), 165(5825)

RF band	Peak antenna gain	Technology	Channel bandwidth	Channel number (Center frequency, MHz)
			40	38(5190), 46(5230), 54(5270), 62(5310), 102(5510), 110(5550), 118(5590), 126(5630), 134(5670), 151(5755), 159(5795)
			80	42(5210), 58(5290), 106(5530), 122(5610), 155(5775)

### FCC notices

**IMPORTANT:** OEMs must test final product to comply with unintentional radiators (FCC section 15.107 & 15.109) before declaring compliance of their final product to Part 15 of the FCC Rules.

**IMPORTANT:** The ConnectCore 8X SBC Pro has been certified for remote and base radio applications. If the module will be used for portable applications, the device must undergo SAR testing. 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: Re-orient or relocate the receiving antenna, Increase the separation between the equipment and receiver, Connect equipment and receiver to outlets on different circuits, or Consult the dealer or an experienced radio/TV technician for help.

### FCC-approved antennas

The ConnectCore 8X SBC Pro can be installed utilizing antennas and cables constructed with non-standard connectors (RPSMA, RPTNC, and so on).

The modules are FCC approved for fixed base station and mobile applications for the channels indicated in the tables below. If the antenna is mounted at least 20 cm (8 in) from nearby persons, the application is considered a mobile application. Antennas not listed in the table must be tested to comply with FCC Section 15.203 (Unique Antenna Connectors) and Section 15.247 (Emissions).

The following table shows the antenna that was used to certify the ConnectCore 8X wireless module. This antenna can be replaced by others, however further certification testing is required. The number of tests to be carried out can be decreased by using an antenna of the same type, i.e. dualband omnidirectional dipole, showing lower peak gain. In such case, only a spot check may be required by the certification laboratories to keep current certifications valid according to FCC regulations. If replacing by an antenna with higher gain, complete radiated tests according to FCC regulations are required by the certification laboratories.

**Antenna used to certify the ConnectCore 8X wireless SBC Pro**

Antenna type	Supplier	Antenna part no.	Freq. (MHz)	Peak antenna gain (dBi)	Directional gain (dBi)
PCB	YAGEO	ANTX100P001B24553	2402~2480	4.6	7.61
			5150~5250	4.9	7.91
			5250~5350	3.9	6.91
			5470~5725	5.1	8.11
			5725~5850	5.1	8.11
PCB	TAOGLAS	FXP830.07.0100C	2402~2480	3.32	6.33
			5150~5250	6.11	9.12
			5250~5350	6.11	9.12
			5470~5725	6.11	9.12
			5725~5850	6.11	9.12
Dipole	TAOGLAS	GW.48.A151	2402~2480	3.42	6.43
			5150~5250	4.56	7.57
			5250~5350	4.56	7.57
			5470~5725	4.56	7.57
			5725~5850	4.56	7.57
PCB	TAOGLAS	FXP522.A.07.A.001	2402~2480	3.78 (Port 1) 3.15 (Port 2)	6.79
			5150~5250	4.63 (Port 1) 4.61 (Port 2)	7.64
			5250~5350	4.63 (Port 1) 4.61 (Port 2)	7.64
			5470~5725	4.63 (Port 1) 4.61 (Port 2)	7.64
			5725~5850	4.63 (Port 1) 4.61 (Port 2)	7.64
Dipole	Linx	ANT-DB1-RAF-RPS	2402~2480	2.5	5.51
			5150~5250	4.6	7.61
			5250~5350	4.6	7.61
			5470~5725	4.6	7.61
			5725~5850	4.6	7.61



Antenna type	Supplier	Antenna part no.	Freq. (MHz)	Peak antenna gain (dBi)	Directional gain (dBi)
PCB	Ethertronic	1001932	2402~2480	2.5	5.51
			5150~5250	5	8.01
			5250~5350	5	8.01
			5470~5725	5	8.01
			5725~5850	5	8.01
PCB	TAOGLAS	FXP831.07.0100C	2402~2480	3	6.01
			5150~5250	5.5	8.51
			5250~5350	5.5	8.51
			5470~5725	5.5	8.51
			5725~5850	5.5	8.51

**Note** If using the RF module in a portable application (for example - if the module is used in a hand-held device and the antenna is less than 20 cm (8 in) from the human body when the device is in operation): The integrator is responsible for passing additional SAR (Specific Absorption Rate) testing based on FCC rules 2.1091 and FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, OET Bulletin and Supplement C. The testing results will be submitted to the FCC for approval prior to selling the integrated unit. The required SAR testing measures emissions from the module and how they affect the person.

## RF exposure



**CAUTION!** To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm (8 in) or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance are not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter. The preceding statement must be included as a CAUTION statement in OEM product manuals in order to alert users of FCC RF Exposure compliance.

## Operating frequency

- 802.11 b/g/n: 2412-2462 MHz
- 802.11 a/n/ac : 5150-5250 MHz; 5250-5350 MHz; 5470-5725MHz; 5725-5850 MHz
- Bluetooth : 2402-2480 MHz

## Europe and UK

- 2.412 to 2.472 GHz; 13 channels
- 5.180 to 5.320 GHz; 8 channels
- 5.500 to 5.700 GHz, 8 channels (excludes 5.600 to 5.640 GHz)

### CE mark

The ConnectCore 8X SBC Pro is certified for use in several European countries. For information, visit [www.digi.com/resources/certifications](http://www.digi.com/resources/certifications).

If the ConnectCore 8X SBC Pro is incorporated into a product, the manufacturer must ensure compliance of the final product with articles 3.1a and 3.1b of the RE Directive (Radio Equipment Directive). A Declaration of Conformity must be issued for each of these standards and kept on file as described in the RE Directive (Radio Equipment Directive).

Furthermore, the manufacturer must maintain a copy of the ConnectCore 8X module user manual documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation requirements as specified in the user manual. If any of these specifications are exceeded in the final product, a submission must be made to a notified body for compliance testing to all required standards.

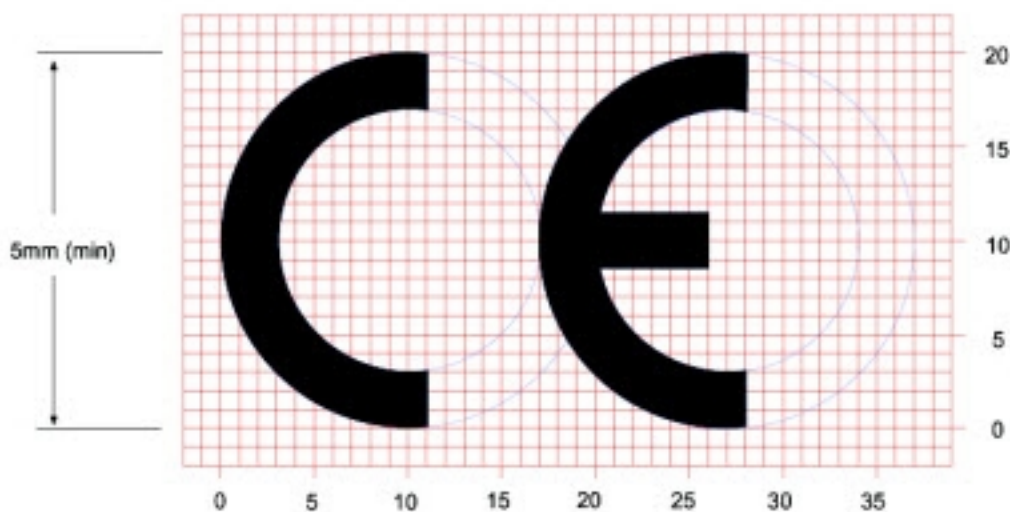
**This equipment should be installed and operated with a minimum distance of 20 cm between the radiator and your body.**

### CE and UKCA OEM labeling requirements

The CE and UKCA markings must be clearly visible and legible when you affix it to the product. If this is not possible, you must attach these marks to the packaging (if any) or accompanying documents.

#### **CE labeling requirements**

The “CE” marking must be affixed to a visible location on the OEM product. The following figure shows CE labeling requirements.



The CE mark shall consist of the initials “CE” taking the following form:

- If the CE marking is reduced or enlarged, the proportions given in the above graduated drawing must be respected.
- The CE marking must have a height of at least 5 mm except where this is not possible on account of the nature of the apparatus.
- The CE marking must be affixed visibly, legibly, and indelibly.

### **UK Conformity Assessed (UKCA) labeling requirements**



See <https://www.gov.uk/guidance/using-the-ukca-marking> for further details.

You must make sure that:

- if you reduce or enlarge the size of your marking, the letters forming the UKCA marking must be in proportion to the version set out below
- the UKCA marking is at least 5 mm in height – unless a different minimum dimension is specified in the relevant legislation
- the UKCA marking is easily visible, legible (from 1 January 2023 it must be permanently attached)
- the UKCA marking can take different forms (for example, the colour does not have to be solid), as long as it remains visible, legible and maintains the required proportions.

#### **Important note**

Digi customers assume full responsibility for learning and meeting the required guidelines for each country in their distribution market. Refer to the radio regulatory agency in the desired countries of operation for more information.

### **Declarations of Conformity**

Digi has issued Declarations of Conformity for the ConnectCore 8X SBC Pro concerning emissions, EMC, and safety. For more information, see <http://www.digi.com/resources/certifications>.


#### **Important note**

Digi customers assume full responsibility for learning and meeting the required guidelines for each country in their distribution market. Refer to the radio regulatory agency in the desired countries of operation for more information.

## Approved antennas

The same antennas have been approved for Europe as stated in the FCC table for use with the ConnectCore 8X module.

### Country list



AT	BE	BG	CZ	DK
EE	FR	DE	IS	IE
IT	EL	ES	CY	LV
LI	LT	LU	HU	MT
NL	NO	PL	PT	RO
SI	SK	TR	FI	SE
CH	UK	HR		

**Note** This device is restricted to indoor use only when operating in the 5150-5350MHz frequency range within all member states.

Radio Type / Description		Transmitter Frequency (MHz)	Maximum Output Power
Bluetooth	BR+EDR	2402 ~ 2480	15.86 dBm
	Low Energy	2402 ~ 2480	6.88 dBm
WLAN 2.4G	802.11b	2412 ~ 2472	19.24 dBm
	802.11g	2412 ~ 2472	19.31 dBm
	802.11n 20	2412 ~ 2472	19.54 dBm
	802.11n 40	2422 ~ 2462	19.45 dBm
WLAN 5G	802.11a	5150 ~ 5350	22.16 dBm
		5470 ~ 5725	21.99 dBm
		5725 ~ 5850	13.17 dBm
	802.11n_20M 802.11ac_20M	5150 ~ 5350	22.22 dBm
		5470 ~ 5725	22.00 dBm
		5725 ~ 5850	13.16 dBm
	802.11n_40M 802.11ac_40M	5150 ~ 5350	22.55 dBm
		5470 ~ 5725	21.82 dBm
		5725 ~ 5850	13.28 dBm
	80211ac_80M	5150 ~ 5350	21.52 dBm
		5470 ~ 5725	20.90 dBm
		5725 ~ 5850	13.15 dBm

## Canada (IC)

**IC:** 1846A-CCIMX8

**PMN:** CC8X

**HVIN:** ConnectCore 8X

### Canadian Notice

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(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.

Avis Canadien

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. L'appareil ne doit pas produire de brouillage;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

### Labeling requirements

Labeling requirements for Industry Canada are similar to those of the FCC.

#### **Required End Product Labeling**

Any device incorporating this module must include an external, visible, permanent marking or label which states: "Contains IC : 1846A-CCIMX8"

Obligation d'étiquetage du produit final:

Tout dispositif intégrant ce module doit comporter un externe, visible, marquage permanent ou une étiquette qui dit: "Contient IC : 1846A-CCIMX8"

### Transmitters with detachable antennas

This radio transmitter (IC: 1846A-CCIMX8) has been approved by Industry Canada to operate with the antenna types listed in the table above with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (IC: 1846A-CCIMX8) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types

d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the

equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

The ConnectCore 8X module is for professional (OEM) installation only.

Le module ConnectCore 8X doit impérativement être installé par un professionnel (OEM).

## RF exposure



To satisfy Industry Canada RF exposure requirements, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation.

Pour satisfaire aux exigences d'Industrie Canada concernant l'exposition RF, une distance égale ou supérieure à 20cm doit être respectée entre les antennes de ce produit et les personnes se trouvant à proximité.

**The preceding statement must be included as a CAUTION statement in OEM product manuals in order to alert users of Industry Canada RF Exposure compliance.**

**Cette information doit être incluse dans le manuel du produit OEM afin d'alerter les utilisateurs sur la nécessité de respecter l'exposition RF d'Industrie Canada.**

## Approved antennas

The same antennas have been approved for Canada as stated in the FCC table for use with the ConnectCore 8X module.

## Japan

電波法により5GHz帯は屋内使用に限ります。

This device has been granted a designation number by Ministry of Internal Affairs and Communications according to:

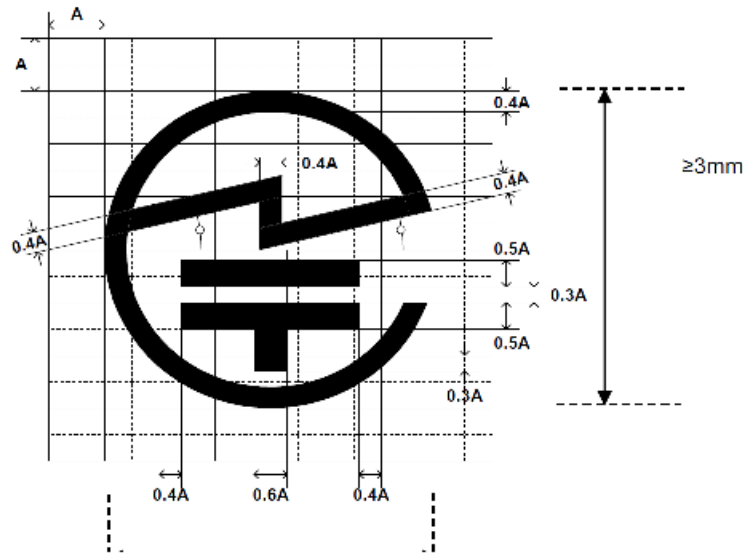
Ordinance concerning Technical Regulations Conformity Certification etc. of Specified Radio Equipment (特定無線設備の技術基準適合証明等に関する規則).

- Article 2, Paragraph 1, Item 19, 19-3, 19-3-2 Category: WW, XW, YW
- Model/Name of equipment: ConnectCore 8X
- Radio label marking:
  - R: 202-LSF056
  - T: D 17-0014 202

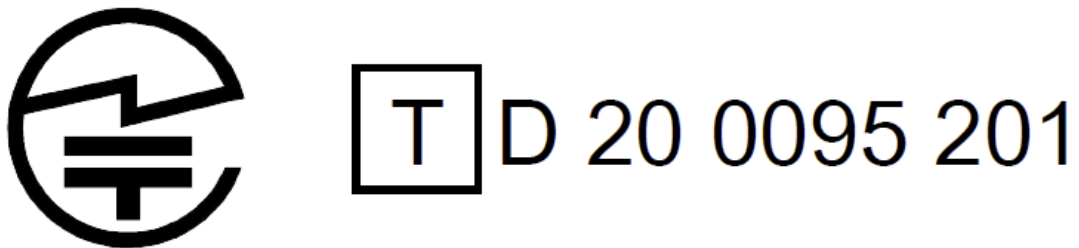
This device should not be modified (otherwise the granted designation number will be invalid).

- 2.412 to 2.472 GHz; 13 channels
- 5.180 to 5.320 GHz; 8 channels
- 5.500 to 5.700 GHz; 11 channels

### Approval Label (MIC Marking)



### Label text



**Note** Due to space constraints, the ConnectCore 8X module label doesn't support radio marking for Japan. If space allows, end product label should support radio marking for Japan. If not, radio marking shall be documented in the user manual.

**Note** The warning "Indoor only(5GHz)" must go on the end product – or E Label (Display).