



ConnectCore 8M Mini

Development Board

Hardware Reference Manual

Revision history—90002455

| Revision | Date | Description |
|----------|---------------|---|
| A | March 2020 | Initial release. |
| B | October 2021 | Added safety statements. |
| C | February 2022 | Corrected UART console port and J17 connector pin data. |
| D | April 2022 | Corrected capacitance value of supercap. |

Trademarks and copyright

Digi, Digi International, and the Digi logo are trademarks or registered trademarks in the United States and other countries worldwide. All other trademarks mentioned in this document are the property of their respective owners.

© 2020-2023 Digi International Inc. All rights reserved.

Disclaimers

Information in this document is subject to change without notice and does not represent a commitment on the part of Digi International. Digi provides this document “as is,” without warranty of any kind, expressed or implied, including, but not limited to, the implied warranties of fitness or merchantability for a particular purpose. Digi may make improvements and/or changes in this manual or in the product(s) and/or the program(s) described in this manual at any time.

Warranty

To view product warranty information, go to the following website:

www.digi.com/howtobuy/terms

Customer support

Gather support information: Before contacting Digi technical support for help, gather the following information:

- Product name and model
- Product serial number (s)
- Firmware version
- Operating system/browser (if applicable)
- Logs (from time of reported issue)
- Trace (if possible)
- Description of issue

Steps to reproduce

Contact Digi technical support: Digi offers multiple technical support plans and service packages. Contact us at +1 952.912.3444 or visit us at www.digi.com/support.

Feedback

To provide feedback on this document, email your comments to

techcomm@digi.com

Include the document title and part number (ConnectCore 8M Mini Development Board Reference Manual, 90002455 D) in the subject line of your email.

Contents

About the ConnectCore 8M Mini Development Board

| | |
|----------------------------------|---|
| Features and functionality | 5 |
| Safety instructions | 6 |
| Placement and connectors | 7 |

Interfaces

| | |
|--|----|
| Power | 12 |
| DC-in connectors | 12 |
| Power architecture configuration | 12 |
| Coin cell/Supercap | 12 |
| Battery connector | 13 |
| Power and reset buttons | 13 |
| System boot | 13 |
| Debug | 14 |
| JTAG | 14 |
| SWD | 14 |
| Console ports | 15 |
| USB recovery | 15 |
| Communication | 16 |
| Gigabit Ethernet | 16 |
| RS-485 | 16 |
| CAN | 17 |
| USB Host | 17 |
| USB OTG | 17 |
| Mini PCIe | 17 |
| XBee | 18 |
| Multimedia | 18 |
| HDMI, LVDS, and MIPI displays | 18 |
| MIPI-CSI camera | 19 |
| Audio | 20 |
| Storage interfaces | 21 |
| MicroSD | 21 |
| User interfaces | 21 |
| User LED | 21 |
| User button | 21 |

About the ConnectCore 8M Mini Development Board

The Digi ConnectCore 8M Mini Development Board is a system-on-module (SOM) development kit that streamlines the prototyping of a wide range of industrial and medical applications.

Built on the i.MX 8M Mini processor with power-efficient quad ARM® Cortex®-A53 and Cortex-M4 cores, Digi ConnectCore 8M Mini combines pre-certified wireless connectivity (802.11 a/b/g/n/ac and Bluetooth® 5) with Digi TrustFence® and Digi Microcontroller Assist™.

Features and functionality

- Power:
 - 5 V input power jack connector
 - Battery connector
 - Coin cell connector
 - On-board supercap supporting RTC functionality
 - Power and reset buttons
- Boot source configuration: eMMC, USB, microSD
- Debug:
 - Standard IEEE 1149.1 JTAG interface
 - Single Wired Debug (SWD) interface for the on-module Digi Microcontroller Assist™ (MCA)
 - USB console
 - USB for system-on-module recovery
- Multimedia:
 - HDMI display*.
 - LVDS display with backlight control and I2C touch interface*.
 - MIPI-DSI*.
 - MIPI-CSI camera supporting two data lanes. Two additional data lanes are available in the expansion connector.
- Storage:
 - microSD card slot
- Communication:
 - Gigabit Ethernet 10/100/1000 with RJ-45 connector
 - x2 USB host (dual type-A)
 - USB OTG on micro AB-type connector

- x5 GPIOs
- CAN FD (through SPI interface)
- RS-485
- PCI Express Mini Card slot supporting half- and full-size cards, with USB, PCIe and Micro-SIM connection.
- Audio interfaces:
 - x1 3.5 mm headphone jack
 - x1 3.5 mm microphone jack
 - x2 speaker outputs
 - x1 line-out output
 - x2 line-in inputs
- x2 XBee sockets, one supporting XBee cellular
- x2 SMA antenna connectors, one for the on-module antenna and another for the Mini PCIe card
- User interfaces:
 - x2 user buttons
 - x3 user LEDs
- Dimensions:
 - 210 x 130 mm

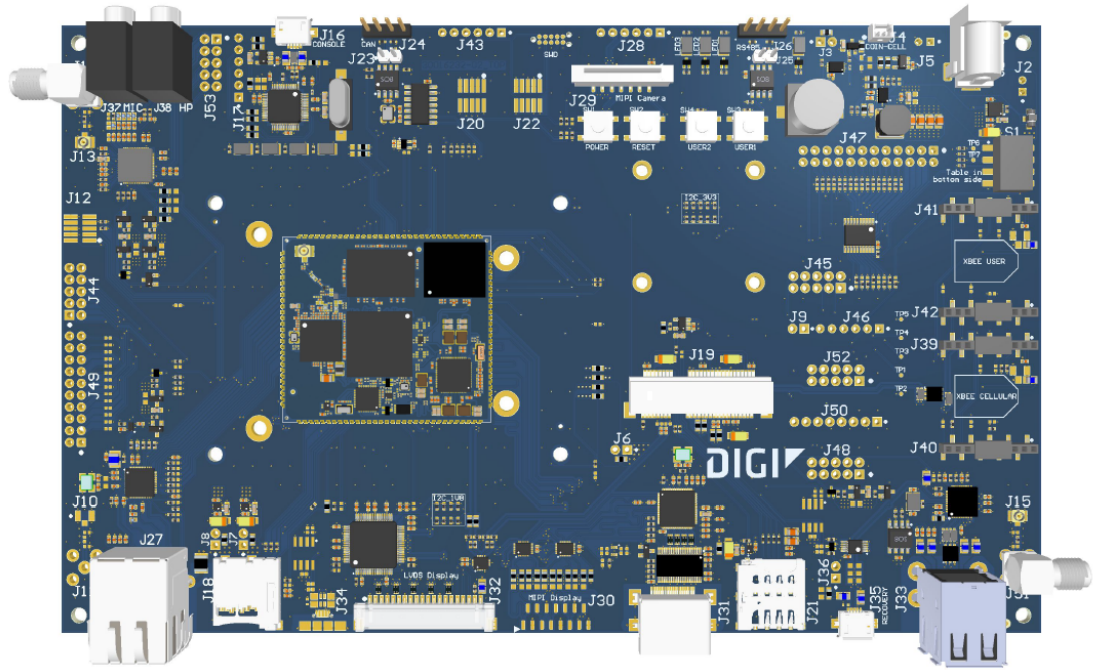
Note * Only one display interface can be enabled at a time.

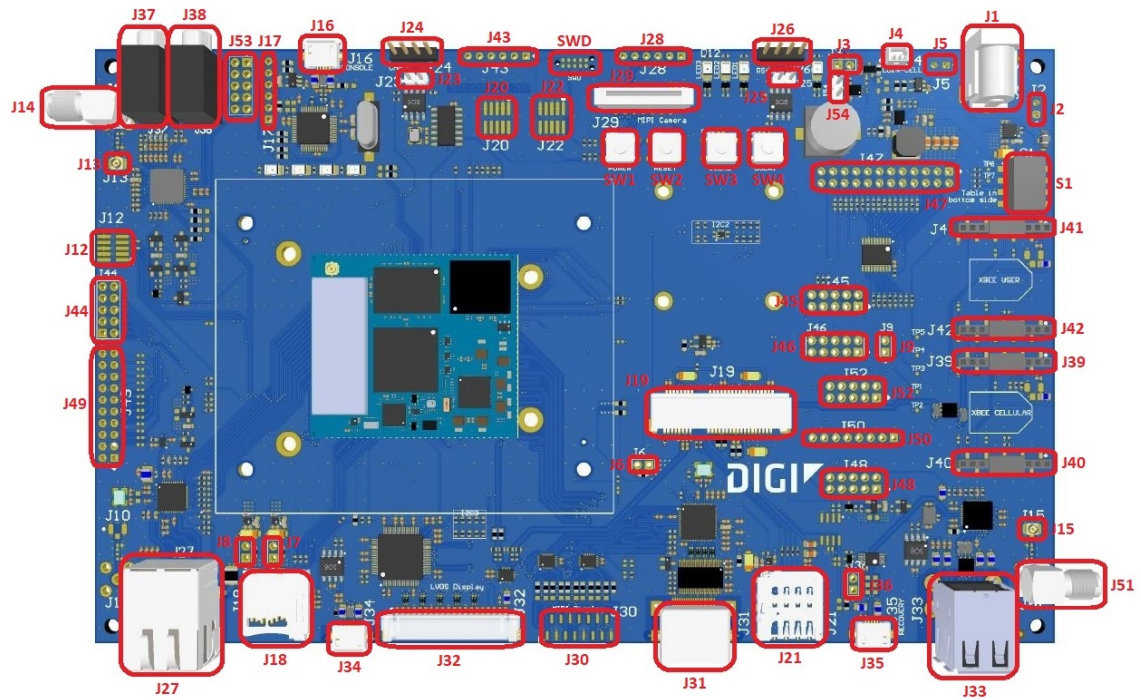
Safety instructions

- The ConnectCore 8M Mini development board 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 8M Mini development board 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 8M Mini development board. Do not remove the shield or modify the ConnectCore 8M Mini in any way. Modifications may exclude the development board from any warranty and can cause the ConnectCore 8M Mini 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 8M Mini development board.
- Take care while handling to avoid electrical damage to the PCB and components.
- Do not expose ConnectCore 8M Mini development board to water or moisture.

- Use this product with the antennas specified in the ConnectCore 8M Mini development board user guides.
- The end user must be told how to remove power from the ConnectCore 8M Mini development board or to locate the antennas 20 cm from humans or animals.

Placement and connectors





| Connector | Interface | Manufacturer | Manufacturer Part Number |
|-----------|---------------------------|-----------------|--------------------------|
| J1 | 5 V power-in jack | Bobbinttron | SCD443CCS011B00G |
| J2 | Alternative 5 V power-in | TE Connectivity | 640456-2 |
| J3 | MCA power consumption | - | - |
| J4 | Coin-cell | Molex | 53047-0210 |
| J5 | Battery connector | TE Connectivity | 640456-2 |
| J6 | SOM power consumption | - | - |
| J7 | 3V3 DVK power consumption | - | - |
| J8 | 1V8 DVK power consumption | - | - |
| J9 | Debug | - | - |
| J10 | u.FL antenna connector | Hirose | U.FL-R-SMT(10) |
| J11 | SMA antenna connector | Bobbinttron | SMA A700T |
| J12 | Wireless MAC JTAG | Samtec | FTSH-105-01-F-DV |

| Connector | Interface | Manufacturer | Manufacturer Part Number |
|-----------|----------------------------|-----------------------|--------------------------|
| J13 | u.FL antenna connector | Hirose | U.FL-R-SMT(10) |
| J14 | SMA antenna connector | Bobbintron | SMA A700T |
| J15 | u.FL antenna connector | Hirose | U.FL-R-SMT(10) |
| J16 | Console (USB) | Kycon | KMMX-ABSMT5SG-30TR |
| J17 | Console (TTL) | - | - |
| J18 | MicroSD | Amphenol | GTFP08431BEU |
| J19 | Mini PCIe | Foxconn | AS0B226-S68N-7F |
| J20 | i.MX8M JTAG | Samtec | FTSH-105-01-F-DV |
| J21 | MicroSIM | Molex | 78727-0001 |
| J22 | MCA SWD | Samtec | FTSH-105-01-F-DV |
| J23 | CAN termination resistor | - | - |
| J24 | CAN | Samtec | TSW-104-14-G-S |
| J25 | RS485 termination resistor | - | - |
| J26 | RS485 | Samtec | TSW-104-14-G-S |
| J27 | Ethernet | Xmultiple | XMG-J1B2211NPA-1-DIG |
| J28 | MIPI camera extension | - | - |
| J29 | MIPI camera | Amphenol | SFW15S-2STE1LF |
| J30 | MIPI display | Amphenol | SFW15S-2STE1LF |
| J31 | HDMI | Adam Tech | HDMI-S-RA-TSMT |
| J32 | LVDS | Hirose | DF14A-20P-1.25H(25) |
| J33 | USB Host | Excel Cell Electronic | ESB01211000Z |
| J34 | USB OTG | Kycon | KMMX-ABSMT5SG-30TR |
| J35 | USB recovery | Kycon | KMMX-ABSMT5SG-30TR |
| J36 | Force USB recovery | - | - |
| J37 | Microphone input | CUI Devices | SJ1-3533NG |
| J38 | Headphones output | CUI Devices | SJ1-3533NG |
| J39-J40 | XBee Cellular | Samtec | SMM-110-02-F-S-P-TR |
| J41-J42 | XBee user | Samtec | SMM-110-02-F-S-P-TR |
| J43 | Control signals | - | - |

| Connector | Interface | Manufacturer | Manufacturer Part Number |
|-----------|-----------------------|--------------|--------------------------|
| J44 | Wireless signals | - | - |
| J45 | UARTs | - | - |
| J46 | GPIOs | - | - |
| J47 | SAI1 | - | - |
| J48 | I2C | - | - |
| J49 | Wireless signals | - | - |
| J50 | Clocks | - | - |
| J51 | SMA antenna connector | Bobbinttron | SMA A700T |
| J52 | Power rails | - | - |
| J53 | Audio | - | - |
| J54 | Supercap | - | - |

Interfaces

The following interfaces are available on the ConnectCore 8M Mini:

| | |
|--------------------------|----|
| Power | 12 |
| System boot | 13 |
| Debug | 14 |
| Communication | 16 |
| Multimedia | 18 |
| Storage interfaces | 21 |
| User interfaces | 21 |

Power

DC-in connectors

The input voltage of the ConnectCore 8M Mini Development Board is 5 V. You can use one of two connectors to power the entire system. Note that you can only enable one at a time.

- DC-in power jack connector
- J2, a 2-pin, 2.54 mm pitch connector:

| Pin | Signal name | Description |
|-----|-------------|-----------------------|
| 1 | VIN | 5 V power supply rail |
| 2 | GND | Ground |

An overvoltage circuit protects the board from overvoltage and overcurrent events. Downstream from these input power protections, there are three regulators/switches for powering both the SOM and the carrier board circuitry:

- MCA LDO (U2): This regulator generates the 3.3 V that powers the on-module MCA.
- 5 V Load switch: A 5 V load switch controls the power delivery to some interfaces (CAN, HDMI, LVDS).
- 3.3 V On-board regulator (U4): This buck regulator powers the XBee and PCIe sockets.

Power architecture configuration

| SOM input supply | Power rail connected to | Nominal operating voltage |
|------------------|---------------------------------|--------------------------------|
| VSYS | VIN (input supply of the board) | 5V |
| VCC_MCA | Dedicated 3.3V regulator | 3V (considering forward diode) |
| VDD_USDHC2 | MUX_3V3_1V8 | 3.3V |
| VDD_ENET | 1V8 | 1.8V |
| VDD_UART | 3V3 | 3.3V |

Coin cell/Supercap

A 470 mF supercap supports RTC applications. Connector J4 on the board is included for attaching a coin-cell:

| Pin | Signal name | Description |
|-----|-------------|----------------------|
| 1 | VCC_RTC | Power supply for RTC |
| 2 | GND | Ground |

Note Coin-cell charger support will depend on the version of the SOM soldered to the Development Board.

Battery connector

The development board includes one battery connector (J5):

| Pin | Signal name | Description |
|-----|-------------|----------------------|
| 1 | VSYS2 | Battery power supply |
| 2 | GND | Ground |

Power applied to this power supply feeds the part of the ConnectCore 8M Mini SOM that supports battery applications.

Power and reset buttons

One power button (SW1) and one reset button (SW2) are included on the development board. These buttons support the following functionality:

| Button | Board status | Power button action | Response |
|--------|--------------|--------------------------|-----------|
| SW1 | OFF | Short press | Power on |
| | ON or SLEEP | Long press for 5 seconds | Power off |
| | SLEEP | Short press | Wake-up |
| | ON | Short press | Sleep |
| SW2 | - | Short press | Reset |

System boot

The ConnectCore 8M Mini supports different boot modes (see the [ConnectCore 8M Mini Hardware Reference Manual](#) for detailed information). The development board supports these boot modes, but some require changes to the populated components.

A quadruple switch (S1) allows you to easily swap between four different boot modes. Two of the four switches are used for this purpose:

| SW1.2 | SW1.1 | Description |
|-------|-------|-------------------|
| Open | Open | Boot from eMMC0 |
| Open | Close | Boot from fuses |
| Close | Open | Boot from microSD |
| Close | Close | Serial downloader |

Debug

JTAG

A JTAG connector (J20, not populated by default) is available on the development board for accessing the JTAG interface of the CPU:

| Pin | Signal name | Description |
|-----|-------------|--------------------|
| 1 | 1V8_SOM_EXT | 1.8 V power supply |
| 2 | JTAG_TMS | Mode select line |
| 3 | GND | Ground |
| 4 | JTAG_TCK | Clock line |
| 5 | GND | Ground |
| 6 | JTAG_TDO | Data output line |
| 7 | NC | Not connected |
| 8 | JTAG_TDI | Data input line |
| 9 | GND | Ground |
| 10 | POR_B | Reset line |

SWD

The development board provides two options for programming and debugging the ConnectCore 8M Mini on-module MCA:

- J22, a 10 pin (2x5), 1.27 mm pitch connector:

| Pin | Signal name | Description |
|-----|-------------|---------------------------------|
| 1 | VCC_MCA | 3.3 V supply voltage of the MCA |
| 2 | SWD_DIO | Data I/O line |
| 3 | GND | Ground |
| 4 | SWD_CLK | Clock line |
| 5 | GND | Ground |
| 6 | NC | Not connected |
| 7 | NC | Not connected |
| 8 | NC | Not connected |
| 9 | GND | Ground |
| 10 | SYS_RESET | Reset line |

- Tag Connect footprint.

Console ports

A dedicated USB micro AB-type port (J16) provides access to the two console ports of the ConnectCore 8M Mini system-on-module:

- i.MX 8M Mini Cortex A-53 serial debug port
- i.MX 8M Mini Cortex-M4 serial debug port

The USB port is routed directly to the FTDI FT232D bridge, which converts the USB bus into TTL UARTs:

| Debug port | UART port |
|-------------|-----------|
| Cortex A-53 | UART4 |
| Cortex-M4 | UART0 |

Note that UART4 is not connected to the FTDI chip by default. To access this UART, change the following resistors:

- Depopulate R152 and R154
- Populate R151 and R153

You can also access the UART ports at TTL level through the J17 connector:

| Pin | Signal name | Description |
|-----|------------------|---|
| 1 | 3V3_DBG | 3.3 V power rail |
| 2 | CONSOLE_TX | CPU console port transmission line |
| 3 | CONSOLE_RX | CPU console port receiver line |
| 4 | UART_M-CORTEX_TX | CORTEX microcontroller console port transmission line |
| 5 | UART_M-CORTEX_RX | CORTEX microcontroller console port receiver line |
| 6 | GND | Ground |

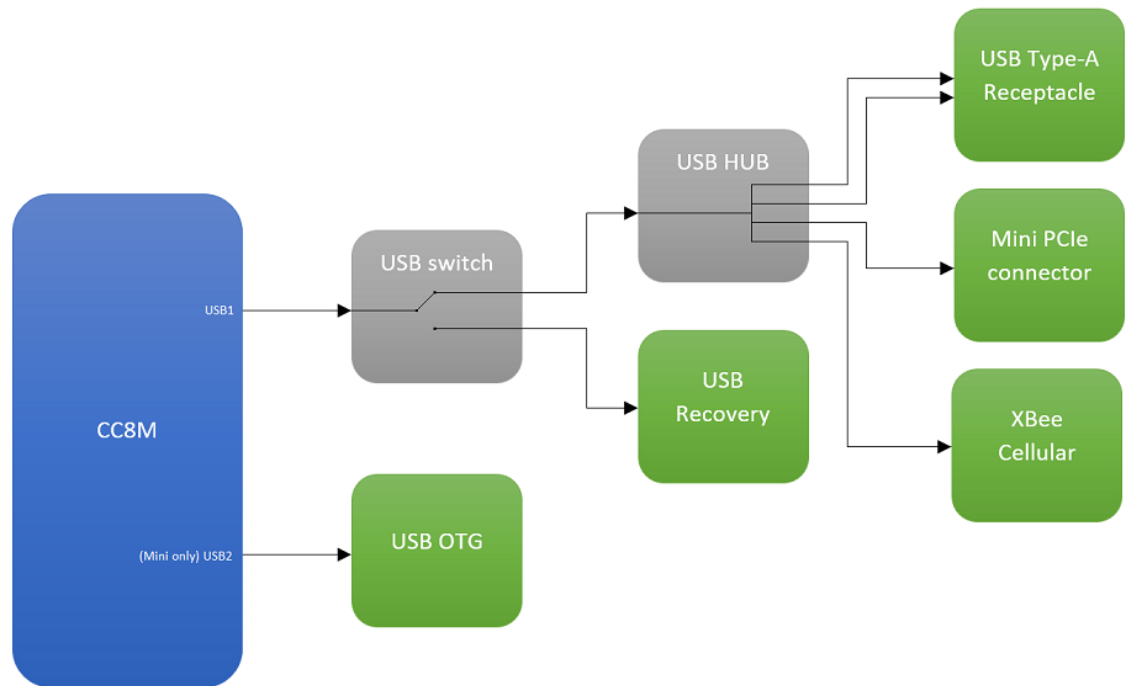
Default console port settings

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

USB recovery

The development board includes a dedicated USB micro AB-type port (J35) for recovery. This port detects when a cable is plugged in and automatically switches the USB1 bus of the CPU from its

default USB Host connection to the recovery port:



Note If J36 is closed, then the USB1 bus of the CPU is forced to be connected to the recovery connector J35.

Communication

Gigabit Ethernet

One 10Base-T/100Base-Tx/1000Base-T Ethernet interface is fully integrated in the board through the AR8031 Ethernet PHY. The bus is accessible through a RJ-45 connector with integrated link/activity LEDs, as specified in the following table:

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

RS-485

The development board supports one RS-485 half-duplex bus, available on an expansion connector (J26):

| Pin | Signal name | Description |
|-----|-------------|--------------------|
| 1 | 3V3_SOM_EXT | 3.3 V power supply |
| 2 | RS485_B | RS485 B line |
| 3 | RS485_A | RS485 A line |
| 4 | GND | Ground |

UART3 is used for this purpose, together with the LTC2862 transceiver. You can connect a 120 Ω terminator resistor to the bus by closing J25.

Note UART3 is also connected to expansion header J45. To use these lines on this connector, remove resistors R291, R359, and R292 to avoid collision with the RS485 transceiver.

CAN

One CAN FD bus is available on the development board through connector J24:

| Pin | Signal name | Description |
|-----|-------------|------------------|
| 1 | 5V | 5 V power supply |
| 2 | CAN1_H | CAN high line |
| 3 | CAN1_L | CAN low line |
| 4 | GND | Ground |

The i.MX 8M Mini CPU does not support any CAN interface, so the SPI3 bus of the CPU in combination with the MCP2517FD controller and the TCAN1042 transceiver are used for this purpose.

A 120 Ω terminator resistor can be connected to the bus by closing J23.

USB Host

Up to four USB Host interfaces are supported by the development board through the USB2514B USB hub:

- Two of the ports are available over a stackable dual USB A-type connector.
- One port is connected to the Mini PCI Express slot.
- One port is connected to the XBee Cellular socket.

USB OTG

A micro-AB type receptacle for USB OTG connection is available on the CC8M Mini development board. This interface can operate in both Host and Device mode.

Mini PCIe

The development board provides one Mini PCI Express socket (J19) supporting USB, PCIe and I2C connection to the ConnectCore 8M Mini module. A micro SIM socket is also connected to the Mini PCI Express slot.

XBee

Two XBee sockets are populated on the development board. One of the sockets supports the XBee Cellular.

Multimedia

HDMI, LVDS, and MIPI displays

The ConnectCore 8M Mini System-on-Module supports only one MIPI-DSI display interface. On the ConnectCore 8M Mini Development Board, this MIPI-DSI display is managed so that three different display interfaces are supported, although only one of them can work at a time.

- HDMI: The Lontium LT8912B bridge is populated on the development board to adapt the MIPI-DSI interface to HDMI. This HDMI interface is available over a standard HDMI connector.
- LVDS: The SN65DSI83 bridge is also populated on the development board to adapt the MIPI-DSI interface to LVDS. This LVDS is available over a 20-pin connector (J32), also supporting backlight control and I2C touch controller:

| Pin | Signal name | Description |
|-----|--------------|---------------------------------------|
| 1 | 3V3_SOM_EXT | 3.3 V power supply |
| 2 | LVDS_TX0_N | Data pair 0 (-) line |
| 3 | LVDS_TX0_P | Data pair 0 (+) line |
| 4 | GND | Ground |
| 5 | LVDS_TX1_N | Data pair 1 (-) line |
| 6 | LVDS_TX1_P | Data pair 1 (+) line |
| 7 | GND | Ground |
| 8 | LVDS_TX2_N | Data pair 2 (-) line |
| 9 | LVDS_TX2_P | Data pair 2 (+) line |
| 10 | GND | Ground |
| 11 | LVDS_CLK_N | Clock pair (-) line |
| 12 | LVDS_CLK_P | Clock pair (+) line |
| 13 | GND | Ground |
| 14 | LVDS_TX3_N | Data pair 3 (-) line |
| 15 | LVDS_TX3_P | Data pair 3 (+) line |
| 16 | LVDS_PWM_OUT | Backlight PWM (connected to MCA_IO17) |
| 17 | LVDS_I2C_SCL | i.MX8M I2C2 bus clock line |

| Pin | Signal name | Description |
|-----|--------------|---|
| 18 | LVDS_I2C_SDA | i.MX8M I2C2 bus data line |
| 19 | LVDS_IRQ_N | Interrupt line (connected to i.MX8M GPIO4_18) |
| 20 | 5V | 5 V power supply |

- MIPI-DSI: the native MIPI-DSI interface of the SOM is available over a 15-pin connector (J30):

| Pin | Signal name | Description |
|-----|------------------|----------------------|
| 1 | MIPI_EXT_DATA0_P | Data pair 0 (+) line |
| 2 | MIPI_EXT_DATA0_N | Data pair 0 (-) line |
| 3 | GND | Ground |
| 4 | MIPI_EXT_DATA1_P | Data pair 1 (+) line |
| 5 | MIPI_EXT_DATA1_N | Data pair 1 (-) line |
| 6 | GND | Ground |
| 7 | MIPI_EXT_DATA2_P | Data pair 2 (+) line |
| 8 | MIPI_EXT_DATA2_N | Data pair 2 (-) line |
| 9 | GND | Ground |
| 10 | MIPI_EXT_DATA3_P | Data pair 3 (+) line |
| 11 | MIPI_EXT_DATA3_N | Data pair 3 (-) line |
| 12 | GND | Ground |
| 13 | MIPI_EXT_CLK_P | Clock pair (+) line |
| 14 | MIPI_EXT_CLK_N | Clock pair (-) line |
| 15 | GND | Ground |

MIPI-CSI camera

The development board provides a MIPI camera serial interface (MIPI-CSI) over a 15-pin connector (J29):

| Pin | Signal name | Description |
|-----|------------------|----------------------------|
| 1 | 3V3_SOM_EXT | 3.3 V power supply |
| 2 | MIPI_CSI_I2C_SDA | i.MX8M I2C2 bus data line |
| 3 | MIPI_CSI_I2C_SCL | i.MX8M I2C2 bus clock line |
| 4 | NC | Not connected |

| Pin | Signal name | Description |
|-----|------------------|--|
| 5 | MIPI_CSI_RESET_N | Rreset line (connected to i.MX8M GPIO1_12) |
| 6 | GND | Ground |
| 7 | MIPI_CSI_CLK_P | Clock pair (+) line |
| 8 | MIPI_CSI_CLK_N | Clock pair (-) line |
| 9 | GND | Ground |
| 10 | MIPI_CSI_DATA1_P | Data pair 1 (+) line |
| 11 | MIPI_CSI_DATA1_N | Data pair 1 (-) line |
| 12 | GND | Ground |
| 13 | MIPI_CSI_DATA0_P | Data pair 0 (+) line |
| 14 | MIPI_CSI_DATA0_N | Data pair 0 (-) line |
| 15 | GND | Ground |

By default, only two data lanes are supported. The additional two data lanes are available over an expansion connector (J28):

| Pin | Signal name | Description |
|-----|------------------|----------------------|
| 1 | MIPI_CSI_DATA3_P | Data pair 3 (+) line |
| 2 | MIPI_CSI_DATA3_N | Data pair 3 (-) line |
| 3 | GND | Ground |
| 4 | MIPI_CSI_DATA2_P | Data pair 2 (+) line |
| 5 | MIPI_CSI_DATA2_N | Data pair 2 (-) line |
| 6 | GND | Ground |

Audio

The Maxim MAX98089 audio codec manages the audio interface on the development board. The board provides the following audio functionality:

- 3.5 mm headphone jack
- 3.5 mm microphone jack
- x2 speaker outputs (left and right)
- x1 line-out output
- x2 line-in inputs

The speakers, line-out signals, and line-in signals are available over a 10-pin connector (J53):

| Pin | Signal name | Description |
|-----|-------------|---|
| 1 | LINE1_IN_R | Single-ended line input A1 |
| 2 | LINE1_IN_L | Single-ended line input A2 |
| 3 | LINE2_IN_R | Single-ended line input B1 |
| 4 | LINE2_IN_L | Single-ended line input B2 |
| 5 | LINE_OUT_R | Right line output |
| 6 | LINE_OUT_L | Left line output |
| 7 | SPKL_P | Positive left-channel class D speaker output |
| 8 | SPKL_N | Negative left-channel class D speaker output |
| 9 | SPKR_P | Positive right-channel class D speaker output |
| 10 | SPKR_N | Negative right-channel class D speaker output |

Storage interfaces

MicroSD

A microSD socket (J18) is located on the top side of the board, next to the RJ45 connector. This interface is connected to the USDHC2 port of the i.MX8M Mini CPU.

User interfaces

User LED

Three LEDs are available on the development board: one green, one yellow, and one red. All of them are connected to SOM GPIOs.

User button

Two buttons are available on the development board, both of them connected to the SOM.