



ConnectCore 93

Development Board

Hardware Reference Manual

Revision history—90002550

| Revision | Date | Description |
|----------|-------------|---|
| 1P | May 2023 | Initial release. |
| 2P | August 2023 | Added statement about size of MikroBus socket, updated Bluetooth version. |

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Contents

About the ConnectCore 93 DVK

| | |
|----------------------------------|----|
| Features and functionality | 6 |
| Safety instructions | 7 |
| Block diagram | 8 |
| Placement | 9 |
| Top view | 9 |
| Bottom view | 10 |
| Connectors | 10 |

Interfaces

| | |
|----------------------------------|----|
| Power | 13 |
| DC-in connector | 13 |
| RTC | 13 |
| Power and reset buttons | 13 |
| System boot | 14 |
| Debug interfaces | 14 |
| JTAG | 14 |
| Console | 15 |
| Multimedia | 15 |
| MIPI/HDMI display | 15 |
| LVDS | 17 |
| MIPI CSI | 18 |
| Audio | 18 |
| Storage | 19 |
| MicroSD | 19 |
| Communication | 19 |
| Gigabit Ethernet | 19 |
| RS-485 | 19 |
| CAN FD | 20 |
| USB | 20 |
| USB type-C port controller | 20 |
| PCIe | 20 |
| MikroBus | 20 |
| XBee | 21 |
| User interfaces | 21 |
| Wireless | 21 |

Specifications

| | |
|-----------------------------------|----|
| Electrical specification | 22 |
| Mechanical specification | 22 |
| Environmental specification | 22 |
| WLAN specification | 22 |

About the ConnectCore 93 DVK

The Digi ConnectCore® 93 Development Kit (DVK) and System-on-Module (SOM) platform is a highly integrated, cost-effective, connected, secure embedded solution, built on the i.MX 93 MPU family. It integrates memory, power management, pre-certified wireless connectivity, and advanced Digi TrustFence device security with a complete, open-source Linux software platform based on the Yocto Project.

Note While the ConnectCore 93 system-on-module is designed to be used in a production environment, the ConnectCore 93 Development Kit is designed only for development and testing in a pre-production environment.

Features and functionality

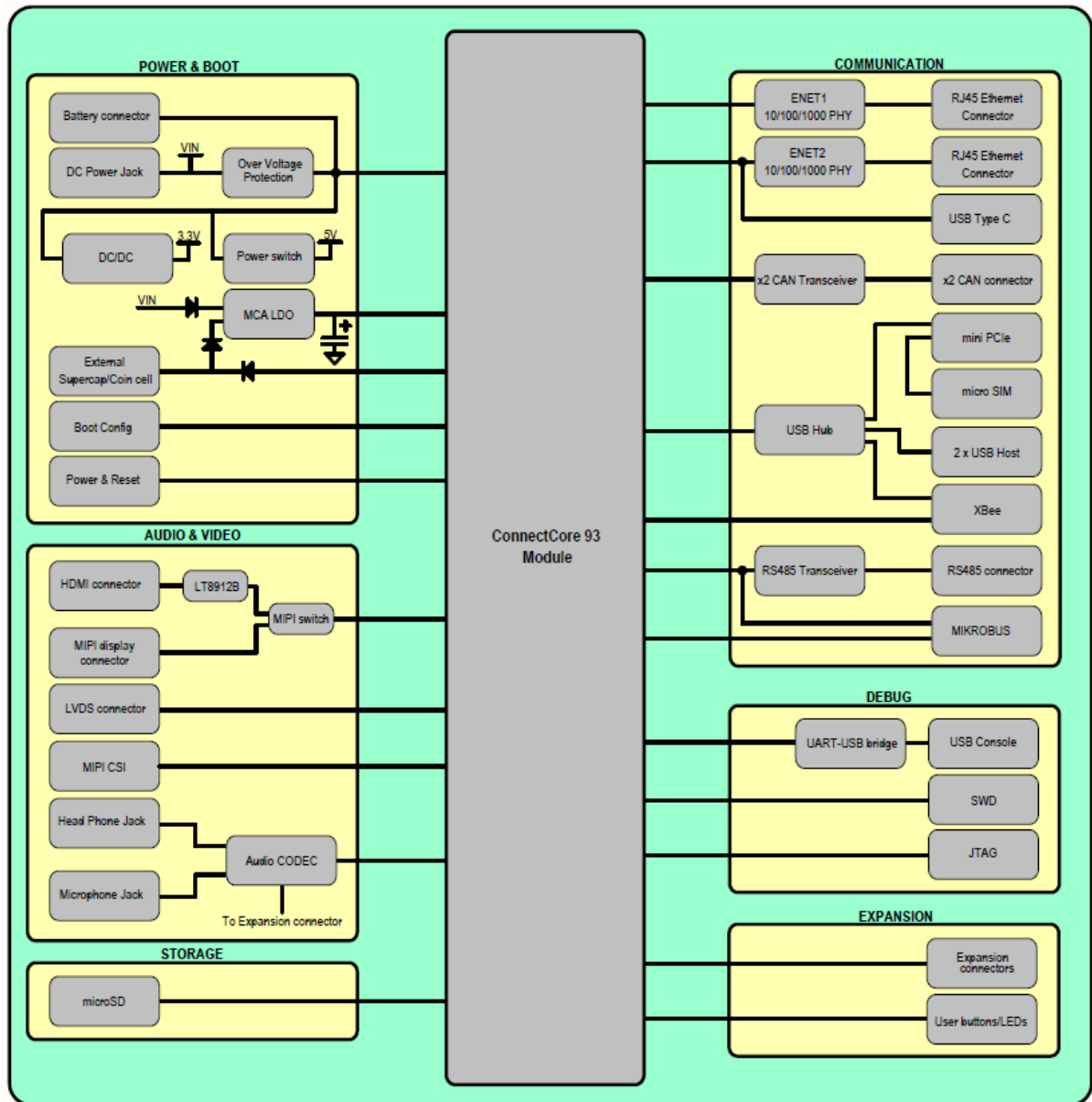
- ConnectCore 93 module
 - i.MX93 Single/Dual ARM Cortex-A55 operating at speeds up to 1.7 GHz
 - Up to 1 GB, 16-bit LPDDR4 memory
 - Up to 8 GB, 8-bit eMMC memory
 - IEEE 802.11 a/b/g/n/ac/ax WLAN and Bluetooth 5.3
- Power
 - Power jack or industrial-dedicated 5V power connector
 - On-board RTC with coin-cell connector
 - Power and reset buttons
- Boot source configuration
 - On-module eMMC
 - microSD
 - USB
- Debug
 - 5-pin JTAG interface
 - Serial console at USB type-C connector and TTL level
- Multimedia
 - MIPI DSI display
 - HDMI display (through MIPI-to-HDMI transceiver)
 - LVDS interface with up to four differential data pairs
 - MIPI CSI camera
 - Audio CODEC with the following functionality
 - One 3.5 mm headphone jack
 - One 3.5 mm microphone jack
 - Two speaker outputs

- One line-out output
- Two line-in inputs
- Storage
 - On-module eMMC
 - microSD card slot
- Communication
 - Dual Gigabit Ethernet
 - RS-485
 - Dual CAN FD
 - Dual USB Host 2.0 interfaces through a stacked USB A type connector
 - USB type-C port controller supporting USB 2.0
 - PCI Express Mini Card slot supporting full and half-size cards through USB interface
 - XBee socket supporting XBee Cellular
 - MikroBus socket
 - SISO IEEE 802.11 a/b/g/n/ac/ax + Bluetooth 5.3 with on-module U.FL or external SMA antenna connector
- User interface
 - Two user LED, shared with user buttons
- Dimensions:
 - 210 x 130 mm

Safety instructions

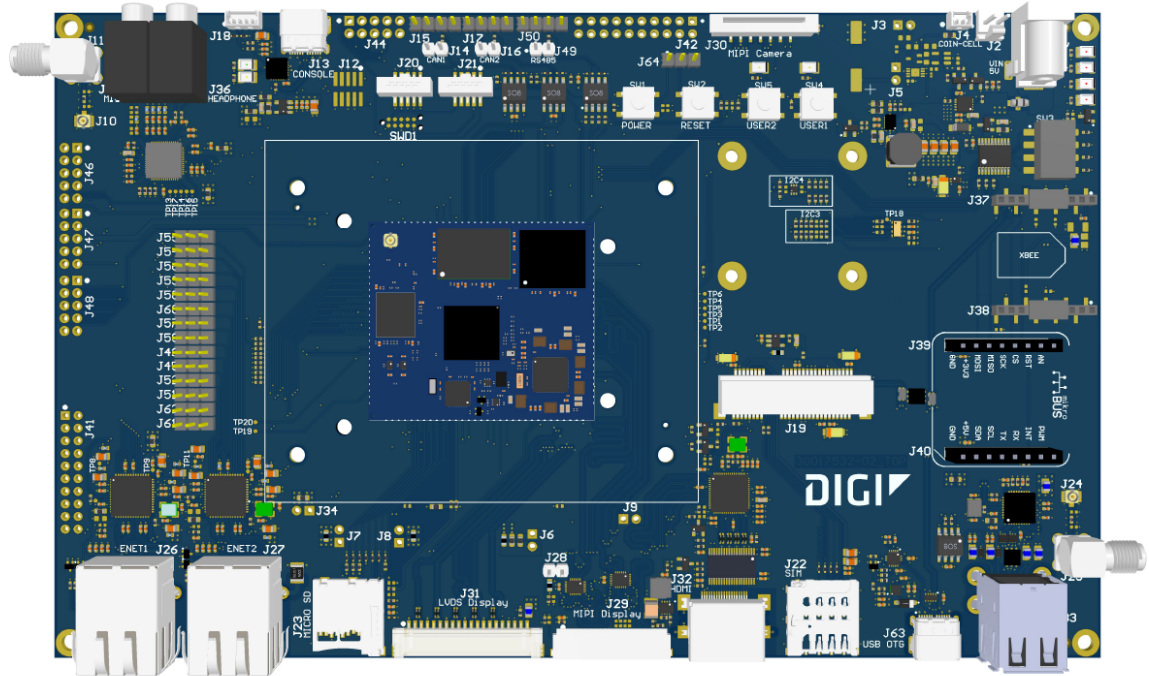
- The ConnectCore 93 DVK cannot be guaranteed operation due to the radio link and so should not be used for interlocks in safety critical devices such as machines or automotive applications.
- The ConnectCore 93 DVK has not been approved for use in (this list is not exhaustive):
 - nuclear applications
 - explosive or flammable atmospheres
- There are no user serviceable components inside the ConnectCore 93 DVK. Do not modify the ConnectCore 93 in any way. Modifications may exclude the DVK from any warranty and can cause the ConnectCore 93 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 93 DVK.
- Take care while handling to avoid electrical damage to the PCB and components.
- Do not expose ConnectCore 93 DVK to water or moisture.
- Use this product with the antennas specified in the ConnectCore 93 DVK user guides.
- The end user must be told how to remove power from the ConnectCore 93 DVK or to locate the antennas 20 cm from humans or animals.

Block diagram

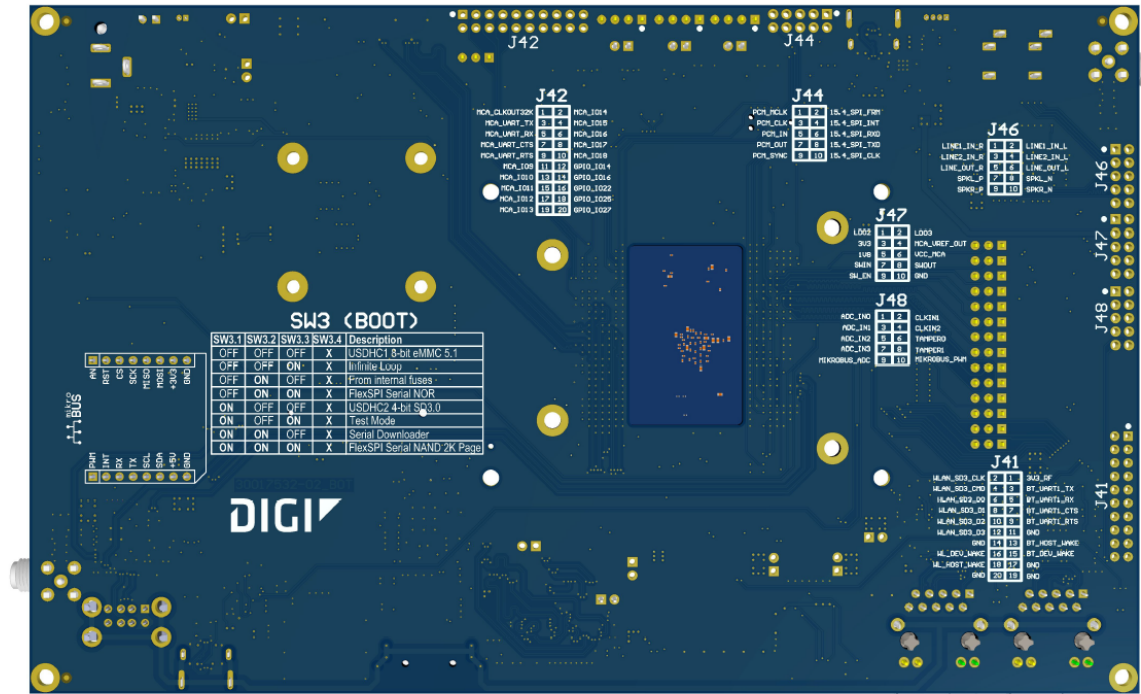


Placement

Top view



Bottom view



Connectors

The following table lists all connectors on the ConnectCore 93:

| Connector | Interface |
|-----------|---|
| J1 | 5V power-in jack |
| J2 | 5V power-in |
| J3 | VCC_MCA series jumper |
| J4 | Coin cell |
| J5 | Supercap series jumper |
| J6 | Module input power supply series jumper |
| J7 | 3V3 series jumper |
| J8 | 1V8 series jumper |
| J9 | Reserved |
| J10 | u.FL |
| J11 | SMA |

| Connector | Interface |
|-----------|------------------------------|
| J12 | On-module wireless chip JTAG |
| J13 | USB console |
| J14 | CAN1 termination resistor |
| J15 | CAN1 |
| J16 | CAN2 termination resistor |
| J17 | CAN2 |
| J18 | TTL console |
| J19 | Mini PCIe |
| J20 | i.MX93 JTAG |
| J21 | MCA SWD |
| J22 | Micro SIM |
| J23 | microSD |
| J24 | u.FL |
| J25 | SMA |
| J26 | 10/100/1000 Mbps RJ-45 |
| J27 | 10/100/1000 Mbps RJ-45 |
| J28 | MIPI switch selector |
| J29 | MIPI display |
| J30 | MIPI camera |
| J31 | LVDS display |
| J32 | HDMI |
| J33 | Dual USB A-type |
| J34 | 3V3_ETH2 series jumper |
| J35 | Microphone jack |
| J36 | Headphone jack |
| J37-J38 | XBee socket |
| J39-J40 | MikroBus socket |
| J41 | WLAN/Bluetooth expansion |
| J42 | MCA/GPIO expansion |

| Connector | Interface |
|-----------|--|
| J43 | Interface selection jumper |
| J44 | On-module wireless chip PCM, 15.4 SPI |
| J45 | Interface selection jumper |
| J46 | Audio expansion |
| J47 | Power expansion |
| J48 | ADCs, CLKs, Tamper, MikroBus expansion |
| J49 | RS485 termination resistor |
| J50 | RS485 |
| J51-J62 | Interface selection jumpers |
| J63 | USB type-C |
| J64 | Power and reset buttons |
| SW1 | Power button |
| SW2 | Reset button |
| SW3 | Boot switches |
| SW4 | User button |
| SW5 | User button |
| SWD1 | MCA SWD Tag Connect |

Interfaces

The following interfaces are available on the ConnectCore 93 DVK:

Power

This section describes the ConnectCore 93 DVK power interfaces.

DC-in connector

The input voltage of the ConnectCore 93 Development Board is 5V. This input power supply can be provided from two different connectors:

- DC-in power jack.
- J7, a 2-pin, 2.54 mm pitch connector:

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

Note Digi recommends *not* powering both connectors at the same time.

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

- 5V Load switch (U5): A 5V load switch that controls the power delivery to different interfaces on the carrier board.
- 3.3V On-board regulator (U6): A regulator that provides 3.3V to different peripherals of the development board.

RTC

The ConnectCore 93 Development Board supports an external RTC which is powered from an external source (typically a coin-cell or a supercap) at connector J4.

Power and reset buttons

One power button (SW1) and one reset button (SW2) are included on the development board.

System boot

The ConnectCore 93 module supports different boot modes (see the [ConnectCore 93 System-on-Module Hardware Reference Manual](#) for detailed information). The development board supports these boot modes, although some of them require changes to the populated components.

A quadruple switch (SW3) allows swapping between eight different boot modes:

| SW3.1 | SW3.2 | SW3.3 | SW3.4 | Boot mode |
|-------|-------|-------|-------|-----------------------------|
| Open | Open | Open | Open | On-module eMMC |
| Open | Open | Close | Open | Infinite loop |
| Open | Close | Open | Open | Internal fuses |
| Open | Close | Close | Open | FlexSPI Serial NOR |
| Close | Open | Open | Open | microSD |
| Close | Open | Close | Open | Test mode |
| Close | Close | Open | Open | Serial downloader |
| Close | Close | Close | Open | FlexSPI Serial NAND 2K page |

Debug interfaces

JTAG

The ConnectCore 93 Development Board provides a standard 10-pin, 1.27mm pitch connector (J20) for accessing the i.MX 93 JTAG debug port:

| Pin | Signal name | Description |
|-----|-------------|-----------------------|
| 1 | 1V8_SOM_EXT | 1.8 V power supply |
| 2 | JTAG_TMS | Mode select line |
| 3 | GND | |
| 4 | JTAG_TCK | Clock line |
| 5 | GND | |
| 6 | JTAG_TDO | Data output line |
| 7 | NC | |
| 8 | JTAG_TDI | Data input line |
| 9 | GND | |
| 10 | POR_B | Reset line of the CPU |

Console

A dedicated USB type-C port (J13) provides access to the console port of the ConnectCore 93 system-on-module. This USB port is routed directly to the CY7C65211 bridge, which converts the USB bus into TTL level. UART6 is used as the console debug port of the i.MX 93 CPU. This UART can also be accessed directly at TTL level through J18 connector:

| Pin | Signal name | Description |
|-----|-------------|-----------------------|
| 1 | CONSOLE_TX | CPU transmission line |
| 2 | CONSOLE_RX | CPU receiver line |
| 3 | 3V3 | 3.3 V power supply |
| 4 | GND | |

Default console port settings:

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

Multimedia

MIPI/HDMI display

The ConnectCore 93 supports only one MIPI-DSI display interface. On the development board, this MIPI-DSI display is managed so that two 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.
- MIPI-DSI: the native MIPI-DSI interface of the SOM is available over a 40-pin connector (J29):

| Pin | Signal name | Description |
|-----|-------------|-------------------|
| 1 | 3V3_SOM_EXT | 3.3V power supply |
| 2 | 3V3_SOM_EXT | 3.3V power supply |
| 3 | GND | |
| 4 | GND | |
| 5 | GND | |
| 6 | GND | |

| Pin | Signal name | Description |
|-----|------------------|----------------------|
| 7 | DISP_RESET | |
| 8 | GND | |
| 9 | GND | |
| 10 | GND | |
| 11 | GND | |
| 12 | GND | |
| 13 | GND | |
| 14 | GND | |
| 15 | GND | |
| 16 | GND | |
| 17 | GND | |
| 18 | GND | |
| 19 | GND | |
| 20 | GND | |
| 21 | GND | |
| 22 | GND | |
| 23 | NC | |
| 24 | NC | |
| 25 | GND | |
| 26 | NC | |
| 27 | NC | |
| 28 | GND | |
| 29 | MIPI_EXT_DATA1_P | Data pair 1 (+) line |
| 30 | MIPI_EXT_DATA1_N | Data pair 1 (-) line |
| 31 | GND | |
| 32 | MIPI_EXT_CLK_P | Clock pair (+) line |
| 33 | MIPI_EXT_CLK_N | Clock pair (-) line |
| 34 | GND | |
| 35 | MIPI_EXT_DATA0_P | Data pair 0 (+) line |

| Pin | Signal name | Description |
|-----|------------------|------------------------|
| 36 | MIPI_EXT_DATA0_N | Data pair 0 (-) line |
| 37 | 3V3_SOM_EXT | 3.3V power supply |
| 38 | GND | |
| 39 | LED | Backlight power supply |
| 40 | GND | |

LVDS

The ConnectCore 93 module has one native LVDS display interface, which is available through a 20-pin, 1.25 mm pitch connector (J31):

| Pin | Signal name | Description |
|-----|--------------|--|
| 1 | 3V3_SOM_EXT | 3.3V power supply |
| 2 | LVDS_D0_N | Transmission pair data line 0 (-) |
| 3 | LVDS_D0_P | Transmission pair data line 0 (+) |
| 4 | GND | |
| 5 | LVDS_D1_N | Transmission pair data line 1 (-) |
| 6 | LVDS_D1_P | Transmission pair data line 1 (+) |
| 7 | GND | |
| 8 | LVDS_D2_N | Transmission pair data line 2 (-) |
| 9 | LVDS_D2_P | Transmission pair data line 2 (+) |
| 10 | GND | |
| 11 | LVDS_CLK_N | Transmission pair clock line (-) |
| 12 | LVDS_CLK_P | Transmission pair clock line (+) |
| 13 | GND | |
| 14 | LVDS_D3_N | Transmission pair data line 3 (-) |
| 15 | LVDS_D3_P | Transmission pair data line 3 (+) |
| 16 | LVDS_PWM_OUT | Backlight PWM (connected to i.MX 93 GPIO2_IO23) |
| 17 | LVDS_I2C_SCL | i.MX 93 I2C3 bus clock line |
| 18 | LVDS_I2C_SDA | i.MX 93 I2C3 bus data line |
| 19 | LVDS_IRQ_N | Interrupt line (connected to i.MX 93 GPIO2_IO24) |
| 20 | 5V | 5V power supply |

MIPI CSI

The ConnectCore 93 Development Board provides a MPI camera serial interface (MIPI-CSI) over a 15-pin connector (J30):

| Pin | Signal name | Description |
|-----|-------------------|--|
| 1 | 3V3_SOM_EXT | 3.3V power supply |
| 2 | MIPI_CSI1_I2C_SDA | i.MX 93 I2C3 bus data line |
| 3 | MIPI_CSI1_I2C_SCL | i.MX 93 I2C3 bus clock line |
| 4 | NC | Not connected |
| 5 | MIPI_CSI1_RESET_N | Reset line (connected to i.MX 93 GPIO2_IO22) |
| 6 | GND | |
| 7 | MIPI_CSI1_CLK_P | Clock pair (+) line |
| 8 | MIPI_CSI1_CLK_N | Clock pair (-) line |
| 9 | GND | |
| 10 | MIPI_CSI1_DATA1_P | Data pair 1 (+) line |
| 11 | MIPI_CSI1_DATA1_N | Data pair 1 (-) line |
| 12 | GND | |
| 13 | MIPI_CSI1_DATA0_P | Data pair 0 (+) line |
| 14 | MIPI_CSI1_DATA0_N | Data pair 0 (-) line |
| 15 | GND | |

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 (J46):

| Pin | Signal name | Description |
|-----|-------------|----------------------------|
| 1 | LINE1_IN_R | Single-ended line input A1 |
| 2 | LINE1_IN_L | Single-ended line input A2 |

| Pin | Signal name | Description |
|-----|-------------|---|
| 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

MicroSD

A microSD socket connected to the USDHC2 port of the i.MX 93 CPU is available on the ConnectCore 93 DVK.

Communication

Gigabit Ethernet

The ConnectCore 93 Development Board supports up to two 10Base-T/100Base-Tx/1000Base-T Ethernet interfaces fully integrated in the board through the Marvell 88E1512 Ethernet PHY. These Ethernet interfaces are accessible through RJ-45 connectors with integrated link/activity LEDs.

Note Secondary Ethernet port is multiplexed with other functionality, such as XBee UART or USB Type-C. You can select between these interfaces via a group of jumpers (J43, J45, J51-J60).

RS-485

RS-485 standard is supported on the ConnectCore 93 DVK and it is available in connector J50:

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

You can connect a 120Ω terminator resistor to RS485 bus by closing J49.

Note The UART connected to RS-485 transceiver is shared with MikroBus socket. Select between these interfaces via jumpers J61 and J62.

CAN FD

Two CAN FD buses are available on the development board through connectors J15 (CAN1) and J17 (CAN2). The pinout of these connectors is as follows, where x refers to the CAN interface on each connector:

| Pin | Signal name | Description |
|-----|-------------|-----------------|
| 1 | 5V | 5V power supply |
| 2 | CANx_H | CAN high line |
| 3 | CANx_L | CAN low line |
| 4 | GND | |

You can connect 120Ω terminator resistors to each port by closing J14 (CAN1) and J16 (CAN2).

USB

The ConnectCore 93 Development Board offers support for four USB Host interfaces. Two of them are available over a stackable dual USB A-type connector. The third USB Host is connected to the PCI Express Mini card connector. The fourth is connected to the XBee socket. All USB Hosts can operate at full, high, and low speed.

USB type-C port controller

One USB type-C port controller is available on the development board, supporting USB 2.0. Power delivery can provide up to 3A.

Note The I2C bus connected to the USB type-C controller has data and clock lines swapped. This conflict is manually patched on the development board.

PCIe

The ConnectCore 93 Development Board provides a Mini PCI Express socket supporting USB and I2C connection to the ConnectCore 93 module. A micro SIM socket is also connected to the Mini PCI Express slot.

MikroBus

The ConnectCore 93 Development Board provides a socket compatible with MikroElektronika MikroBus click boards, supporting I2C, UART, SPI, ADC and PWM connectivity.



CAUTION! The distance between the connectors of the MikroBus socket is smaller than the specification. You can still attach MikroE click boards by applying extra pressure. This will be resolved in the next version of the ConnectCore 93 Development Board.

XBee

One XBee socket is populated on the development board, supporting XBee Cellular modules. The UART bus connected to the XBee socket is shared with RS485.

Note The UART connected to XBee socket (UART4) works at 1.8V on the CPU side, while XBee works at 3.3V. Digi recommends you include a series resistor on receiver lines of the CPU, XBEE_UART_RX and XBEE_UART_CTS.

User interfaces

Two LEDs are available on the development board, both of them connected to CPU GPIOs. These lines are also connected to user buttons.

Wireless

There is a u.FL connector (J10), which is routed directly to a SMA connector (J11). The purpose is to adapt the u.FL form factor to the SMA form factor to extend the number of antennas that can be used on the development board for either the on-module antenna path or any other RF path that could be used on a PCIe or XBee board.

Specifications

Electrical specification

The ConnectCore 93 Development Board has three supply inputs. Two of them power the whole system (ConnectCore 93 Development Board plus the ConnectCore 93 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 93 Development Board:

| Signal | Description | Min | Typ | Max | Unit |
|----------------------|----------------------------------|-----|-----|-----|------|
| VIN (jack connector) | Power jack input | 4.6 | 5.0 | 5.5 | V |
| VIN (2-pin header) | Additional input power connector | 4.6 | 5.0 | 5.5 | V |
| VCC_LICELL | Supply for RTC | 1.1 | - | 5.5 | V |

Mechanical specification

The ConnectCore 93 Development Board dimensions are 210 x 130 mm. Four 3.2 mm drills are located on the four corners of the PCB for assembling the board into an enclosure. These drills have a 5.5 mm round metalized area for the screws and nuts. The board has four 2.6 mm drills to assemble a half size or a full size PCI Express mini card module, with 5.8 mm x 5.8 mm square metalized area for the screws and nuts.

Environmental specification

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

WLAN specification

For a complete WLAN specification, refer to the [ConnectCore 93 System-on-Module Hardware Reference Manual](#).