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.
3P	May 2024	Replaced placement images with updated versions; changed J42 connector label to MCA expansion; added connectors J65 and J66; revised System boot, USB type-C port controller, PCIe, MikroBus, XBee, and Wireless topics; added new Multiplexed interfaces topic; replaced block diagram.
4P	February 2025	Updated Bluetooth version; added MIPI CSI note; renamed and expanded USB Host section; fixed minor typos.

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Operating system/browser (if applicable)

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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 5.4
- 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 5.4 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
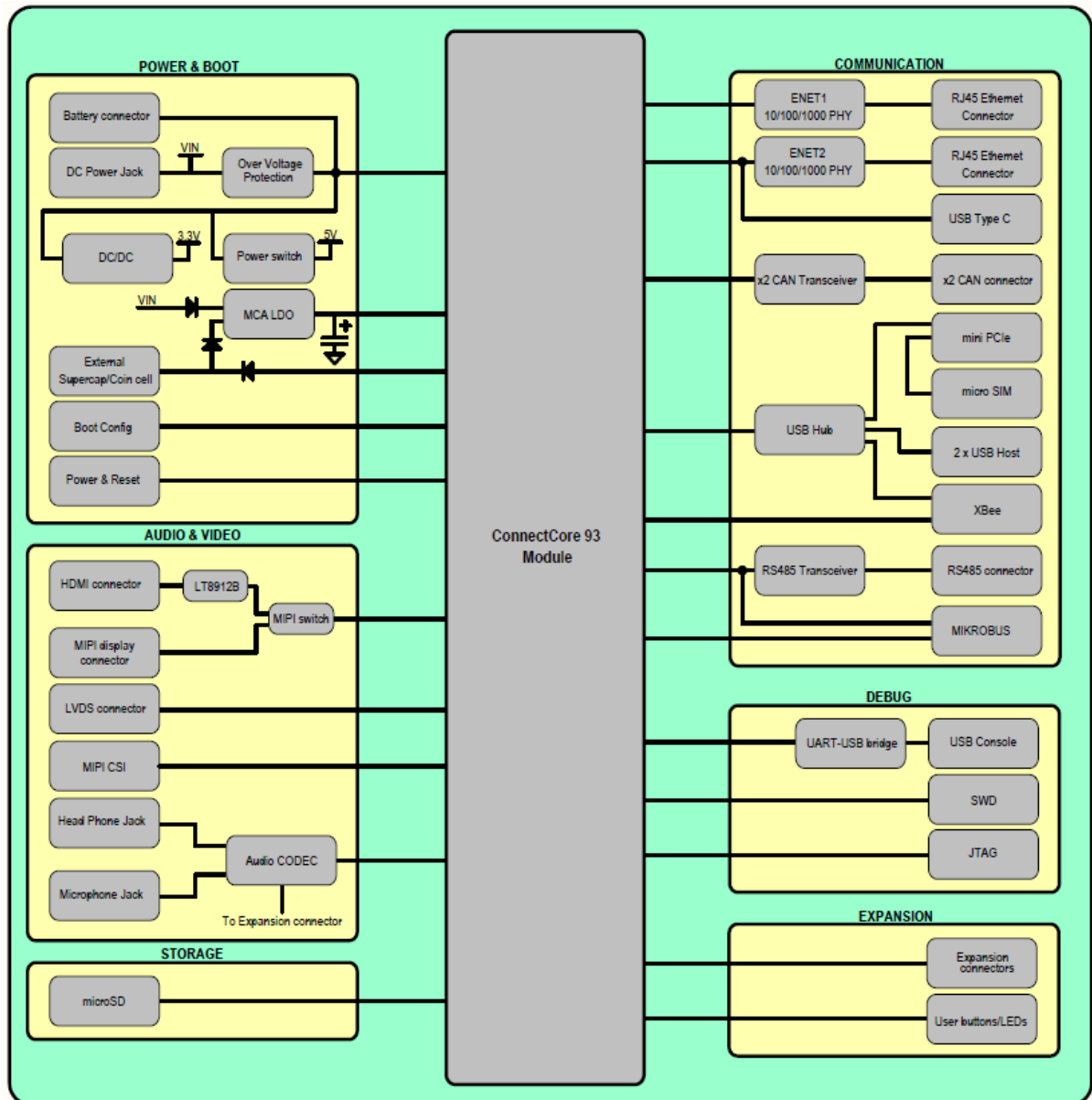
Bottom view
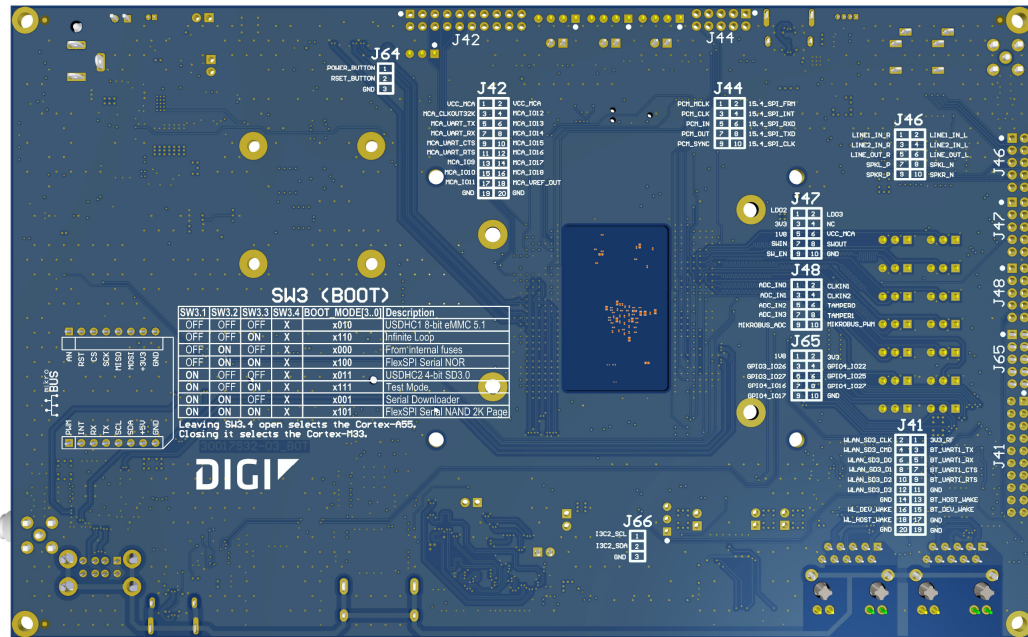
Connectors

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

Connector	Interface
J11	SMA
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

Connector	Interface
J42	MCA expansion
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
J65	GPIO expansion
J66	I3C
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). All of them are also supported on the ConnectCore 93 development board. You can use a quadruple switch (SW3) to swap between them:

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

Note Use SW3.4 to select between the two types of i.MX93 boot processes

- Open: Single boot (Cortex-A55)
- Closed: Low-power boot (Cortex-M33)

Debug interfaces

JTAG

The ConnectCore 93 Development Board provides a standard 10-pin, 1.27 mm 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	

Pin	Signal name	Description
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	
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

Pin	Signal name	Description
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
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 (-)

Pin	Signal name	Description
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 MIPI 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	

Note J30 pinout mirrored compared to Raspberry Pi.

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
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 termination 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 termination resistors to each port by closing J14 (CAN1) and J16 (CAN2).

USB Host

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 low-speed, full-speed, and hi-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.

PCIe

The ConnectCore 93 Development Board provides a Mini PCI Express socket supporting USB 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.

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.

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 are two u.FL connectors (J10, J24), which are routed directly to SMA connectors (J11, J25, repectively). Their 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.

Multiplexed interfaces

The ConnectCore 93 DVK includes a series of jumpers to multiplex and extend the available functionality of the board. These jumpers are available on 3-pin connectors J43, J45 and J51-J60, and allow you to select between the following interfaces:

- Secondary Ethernet (ENET2)
- USB Type-C port
- XBee UART
- RS485
- MikroBus UART
- Expansion GPIOs

Connector	Jumper position and signal connection	
	1-2	2-3
J43	ENET2_TXC	USBC_ALERT_N
J45	ENET2_TD2	GPIO4_IO17
J51	ENET2_TX_CTL	USBC_INT_B
J52	ENET2_TD3	GPIO_IO16
J53	ENET2_RXC	ULED/BUTTON_2
J54	ENET2_RD0	XBEE_UART_RX

Connector	Jumper position and signal connection	
	1-2	2-3
J55	ENET2_RX_CTL	GPIO4_IO22
J56	ENET2_RD1	GPIO4_IO25
J57	ENET2_TD0	XBEE_UART_TX
J58	ENET2_RD2	XBEE_UART_CTS
J59	ENET2_TDI	XBEE_UART_RTS
J60	ENET2_RD3	GPIO4_IO27
J61	RS485_TX	MIKROBUS_UART_TX
J62	RX485_RX	MIKROBUS_UART_RX
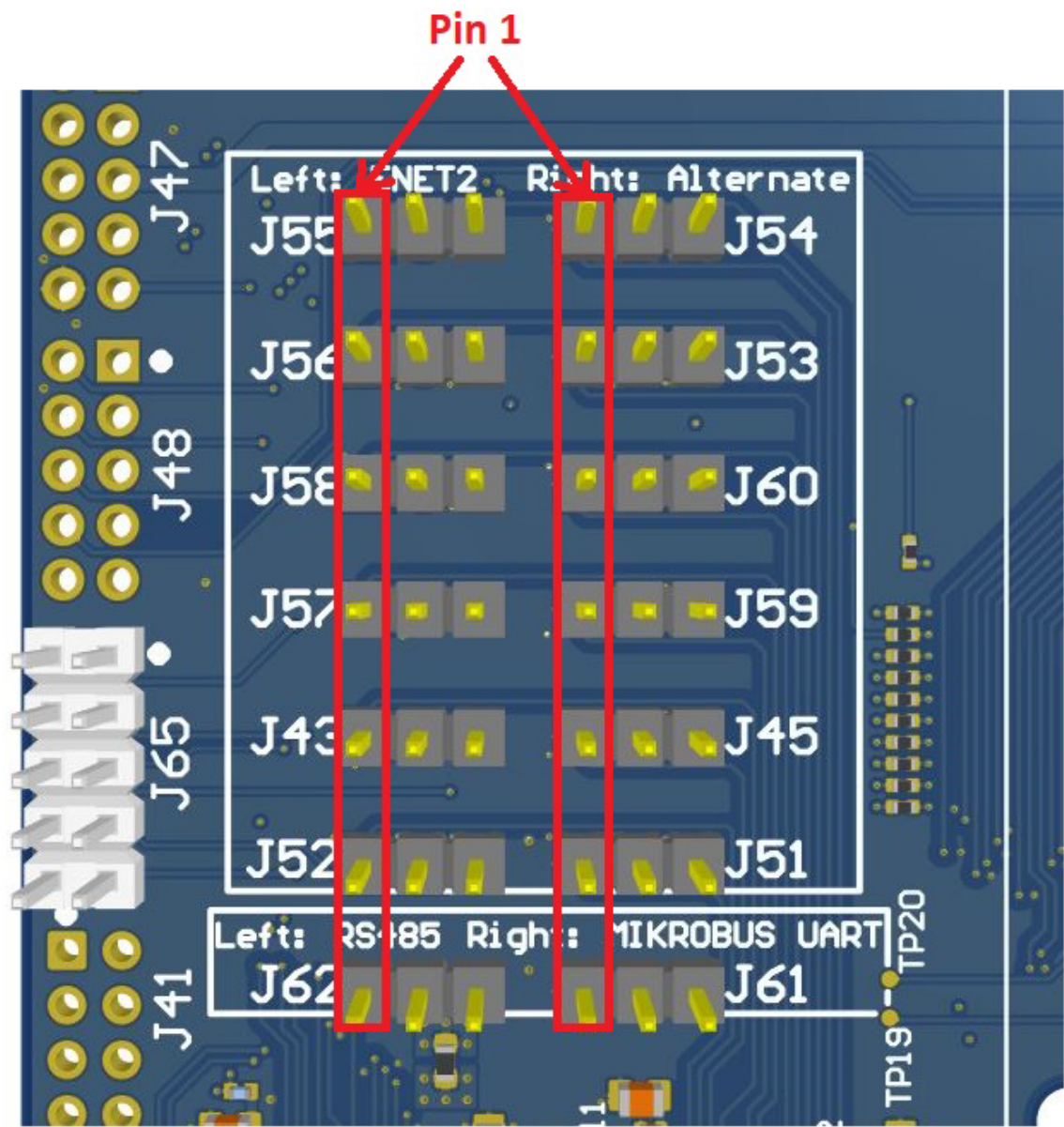
Specifications

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.