ConnectCore 6UL

SBC Pro

Hardware Reference Manual

Revision history–90001531

Revision	Date	Description
G	April 2020	Update mechanical drawings to show additional dimensions
H	July 2020	Add statement regarding powering XBee socket
J	September 2021	Removed I2C from the Mini PCI Express interface list and modified pin 30/32 descriptions
K	October 2021	Added safety instructions and UKCA labeling requirements.
L	January 2022	Updated Bluetooth version throughout.

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- Logs (from time of reported issue)
- Trace (if possible)
- Description of issue
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About the ConnectCore 6UL SBC Pro

Overview

The ConnectCore 6UL SBC Pro, formerly known as the ConnectCore 6UL SBC, is an ultra compact Pico-ITX board featuring the Digi ConnectCore 6UL system-on-module that integrates an NXP i.MX6UL application processor, DDR3 memory, NAND flash memory, WLAN/Bluetooth, power management IC for optimized power consumption applications, and a microcontroller assistant (MCA) for supporting additional functionality. This stand-alone product serves as the reference design for the ConnectCore 6UL system-on-module and can also be used on its own to accelerate time to market.

Features and functionality

- ConnectCore 6UL module
    - i.MX6UL single ARM Cortex-A7 core operating at speeds up to 528 MHz
    - 16-bit DDR3-800 memory interface with a density up to 1 GB (default: 256 MB)
    - 8-bit SLC NAND flash with density up to 2 GB (default: 256 MB)
    - IEEE 802.11 a/b/g/n/ac WLAN and Bluetooth 5 dual mode
- Power:
    - Power jack or industrial-dedicated 5V power connector
    - Coin-cell battery charger, supplying the on-module RTC
    - Power and reset buttons
- Boot source configuration: NAND, USB
- Debug:
    - Standard IEEE 1149.1 JTAG interface
    - Single Wired Debug (SWD) interface for the microcontroller assistant (MCA) and the I/O expander
    - TTL serial console
- Multimedia:
    - Parallel 24-bit LCD interface with FFC on-board connector
    - LVDS interface with up to four differential data pairs
    - 8-bit parallel camera interface

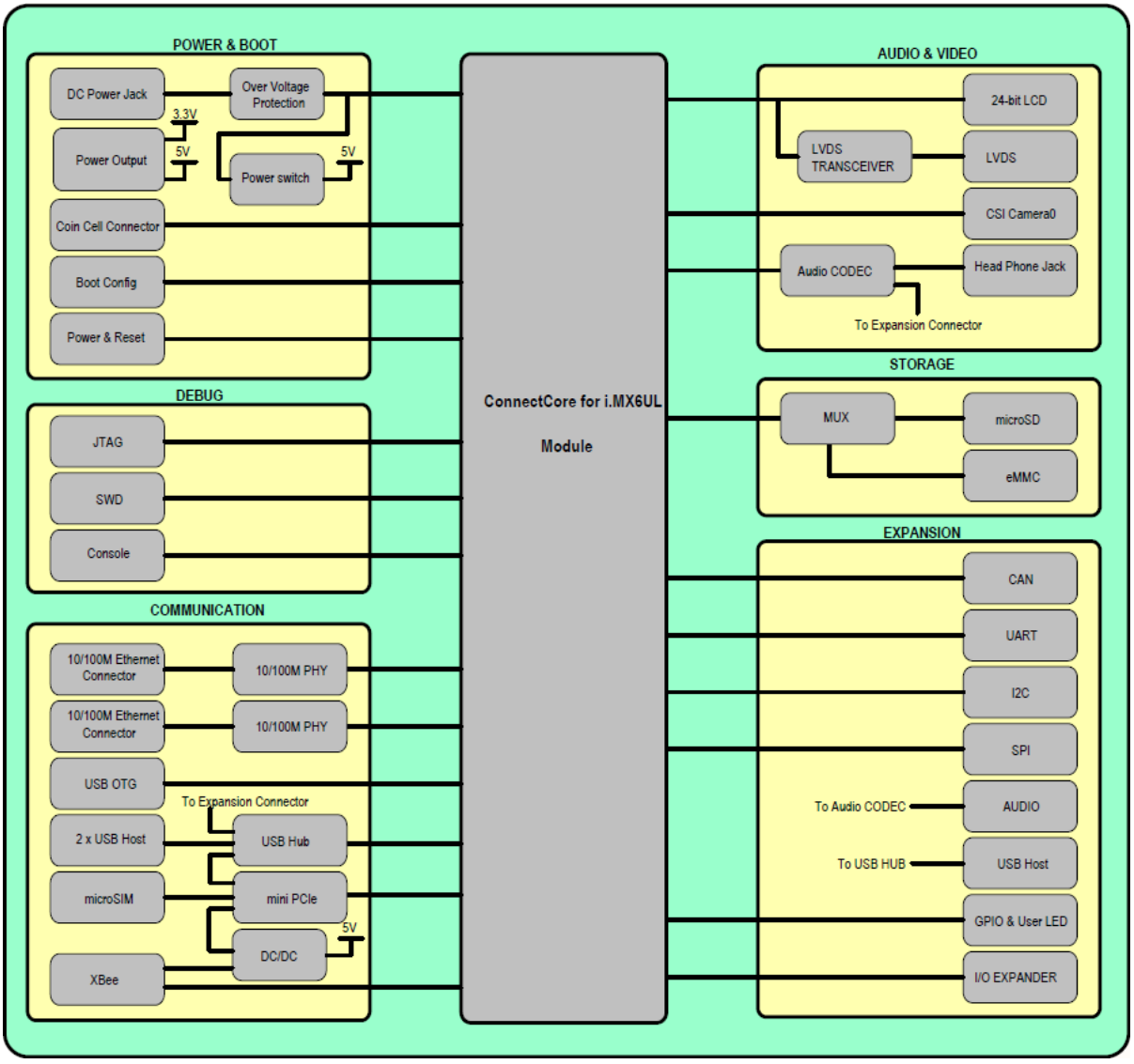
    - Audio CODEC with a stereo headphone jack and expansion connectors for speakers, line-in, mic-in, and line-out lines

- Storage:
    - NAND flash
    - microSD card slot
    - 4 GBytes eMMC
- Communication:
    - Two 10/100 Mbps Ethernet interface
    - Two USB Host 2.0 interfaces through a stacked USB A type connector
    - USB OTG with micro AB USB connector
    - SISO IEEE 802.11 a/b/g/n/ac + Bluetooth 5 dual mode with on-board U.FL or external MMCX antenna connector
    - PCI Express Mini Card slot supporting full and half-size cards
    - 2 KBytes NFC NTAG
- Expansion:
    - USB Host 2.0 port
    - CAN connector with two FlexCAN interfaces including transceivers
    - UART connector with one TTL level UART and two RS-232 UART ports
    - SPI
    - Audio connector with MIC, LINE-IN, and LINE-OUT
    - Audio connector with speakers and LINE-IN
    - GPIO connector with analog input for touch and digital GPIO signals
    - I2C
- User interface:
    - One user LED
- I/O expander: to allow advanced power-management functionality over the carrier board
- 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.)

Safety instructions

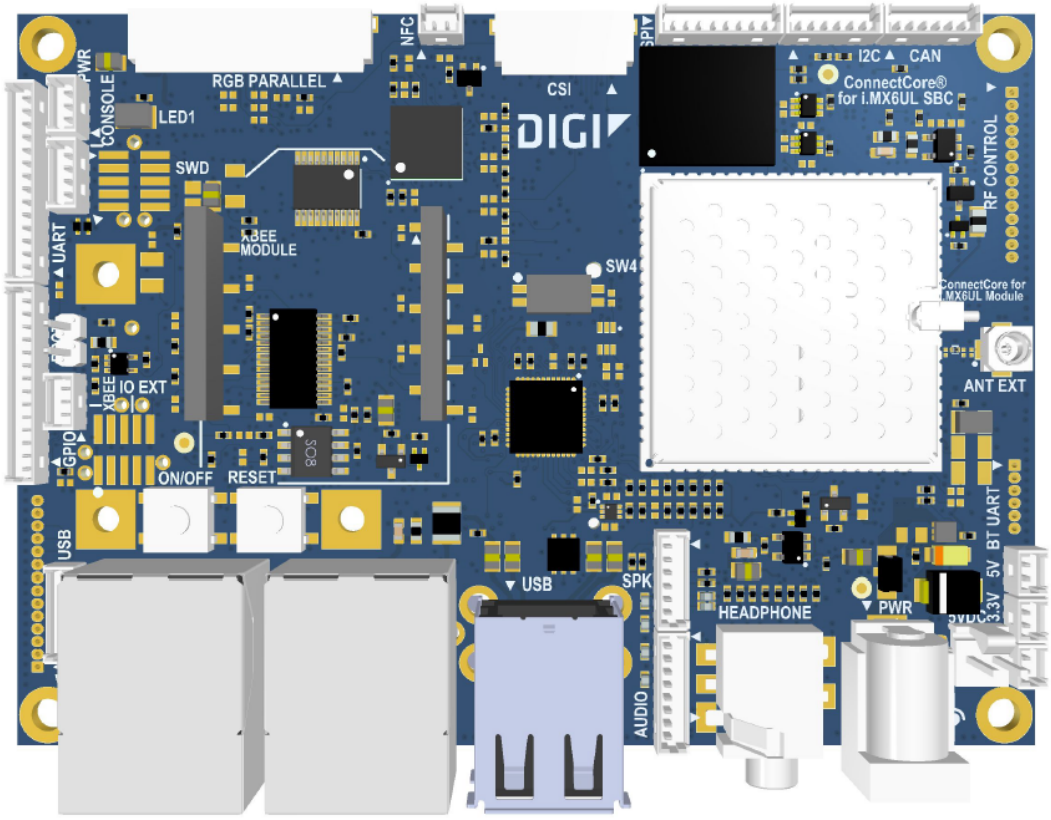
- The ConnectCore 6UL SBC Pro cannot be guaranteed operation due to the radio link and so should not be used for interlocks in safety critical devices such as machines or automotive applications.
- The ConnectCore 6UL SBC Pro has not been approved for use in (this list is not exhaustive):
  - nuclear applications
  - explosive or flammable atmospheres
- There are no user serviceable components inside the ConnectCore 6UL SBC Pro. Do not remove the shield or modify the ConnectCore 6UL in any way. Modifications may exclude the SBC Pro from any warranty and can cause the ConnectCore 6UL 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 6UL SBC Pro.
- Take care while handling to avoid electrical damage to the PCB and components.
- Do not expose ConnectCore 6UL SBC Pro to water or moisture.
- Use this product with the antennas specified in the ConnectCore 6UL SBC Pro user guides.
- The end user must be told how to remove power from the ConnectCore 6UL SBC Pro or to locate the antennas 20 cm from humans or animals.

Block diagram

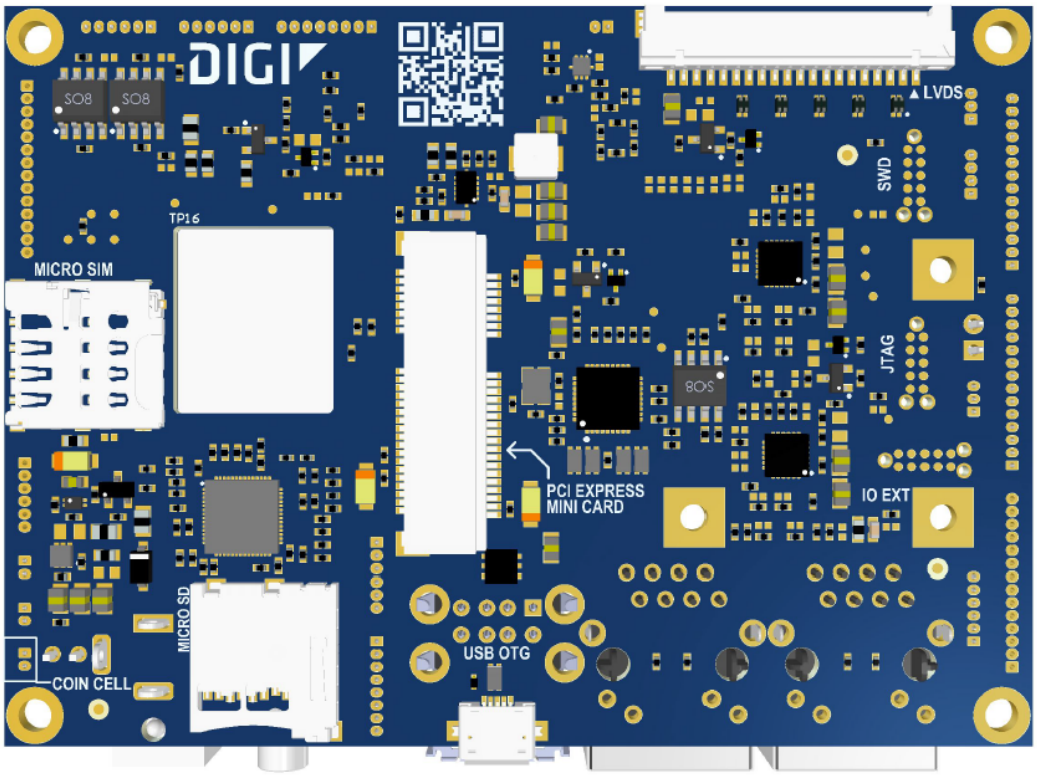


Placement

Top view

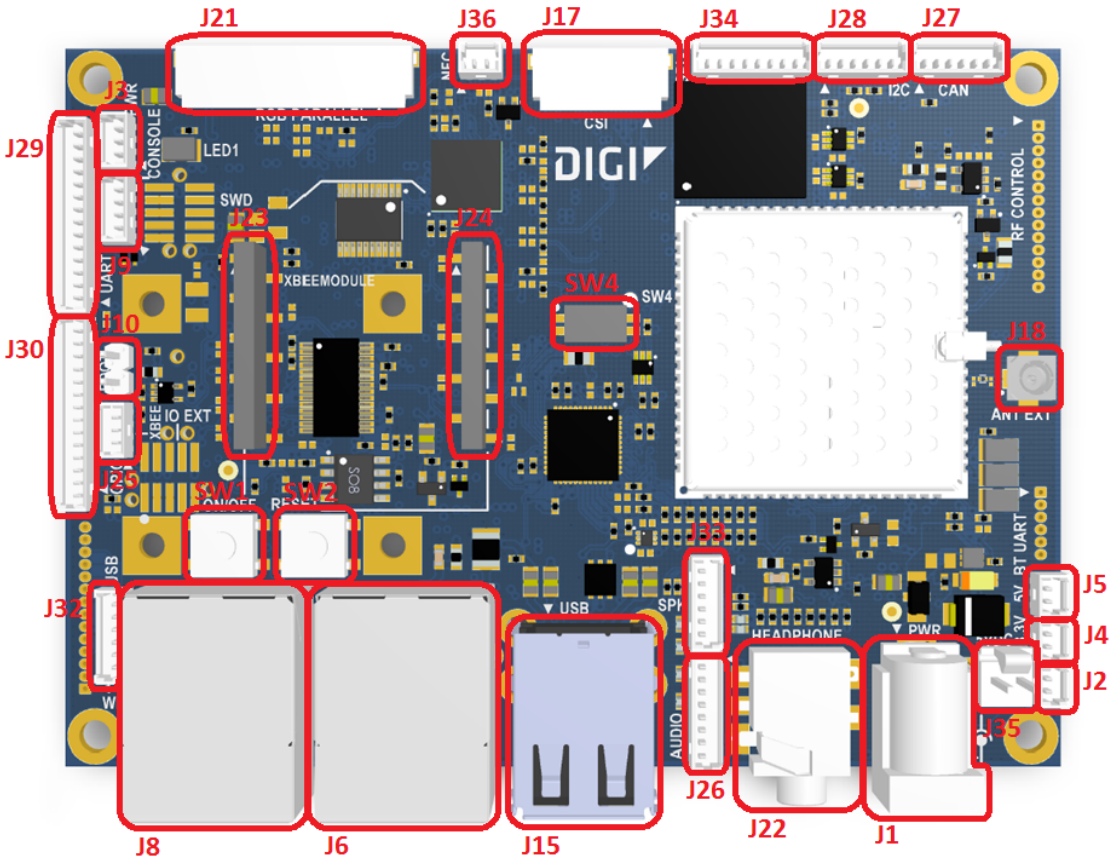


Bottom view

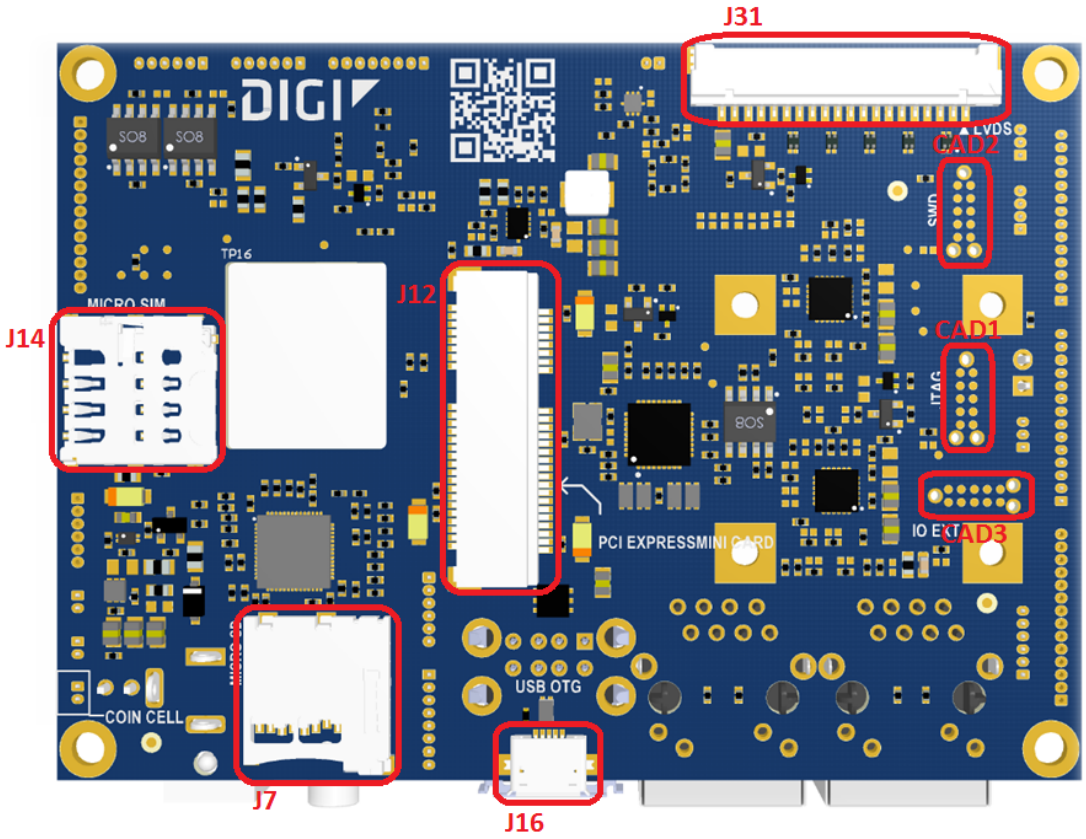

DIGI
SO8
SO8
TP16
MICRO SIM
LVDS
SWD
JTAG
PCI EXPRESS
MINI CARD
IO EXT
MICRO SD
COIN CELL
USB OTG

Connectors

Top view



Bottom view



Part numbers

The following table lists manufacturers and part numbers for each connector.

Connector	Interface	Manufacturer	Manufacturer part number
J1	5V power-in jack	SHOGYO	MJ-179LR
J2	Coin cell	Molex	53047-0210
J3	Power and reset	Molex	53047-0310
J4	3.3V output	Molex	53047-0210
J5	5V output	Molex	53047-0210
J6	Ethernet 1	Xmultiple	XMG-9799-8821-100D-L1TO-H-HIM
J7	microSD	Molex	500873-0806

Connector	Interface	Manufacturer	Manufacturer part number
J8	Ethernet 2	Xmultiple	XMG-9799-8821-100D-L1TO-H-HIM
J9	Console	Molex	53047-0410
J10	Boot mode	Samtec	TSW-102-07-G-S
J12	Mini PCIe	Foxconn	AS0B226-S68Q-7H
J14	Micro SIM	Molex	78727-0001
J15	USB Host	KYCON	KUSBX-AS2N
J16	USB OTG	KYCON	KMMX-ABSMT5SG-30TR
J17	Parallel camera	OMRON	XF2M-2015-1A
J18	Antenna	Amphenol	908-22101
J21	Parallel display	OMRON	XF2M-4015-1A
J22	Audio jack	CUI Inc.	SJ1-3515-SMT
J23-J24	XBee module	Samtec	SMM-110-02-F-S-P-TR
J25	XBee expansion	Molex	53047-0310
J26	Audio expansion - line in, line out, and microphone	Molex	53047-0810
J27	CAN expansion	Molex	53047-0610
J28	I2C expansion	Molex	53047-0610
J29	UART expansion	Molex	53047-1410
J30	GPIO expansion	Molex	53047-1410
J31	LVDS	Hirose	DF14A-20P-1.25H
J32	USB expansion	Molex	53047-0610
J33	Audio expansion - speaker and line in	Molex	53047-0610
J34	SPI expansion	Molex	53047-0810
J35	5V power in	TE Connectivity	640456-2
J36	NFC NTAG	Molex	53047-0210
SW1	Power button	ITT	KSC221JLFS
SW2	Reset button	ITT	KSC221JLFS

Connector	Interface	Manufacturer	Manufacturer part number
SW4	RF kill & RF antenna internal/external selection switch	C&K Components	TDA02H0SB1
CAD1	i.MX6UL JTAG Tag Connect	-	-
CAD2	MCA SWD Tag Connect	-	-
CAD3	IO expander SWD Tag Connect	-	-

ConnectCore 6UL SBC Pro interfaces

Power interfaces

DC-in jack connector

A 5V DC-in power jack connector provides power to the entire ConnectCore 6UL 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 (U7) controls the power delivered to the SBC. The enable pin of the power switch is controlled through PWR_EN/IO14 signal of the I/O expander. A green LED on the top of the board lights up when the 5V output of the load switch is enabled.

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 PCB 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 (J35):

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

Note Definition of pin 1 in SBC Pro design for J35 (MFG PN: 6440456-2) is reversed from manufacturer datasheet.

Coin cell connector

A 2-pin, 1.25 mm pitch straight connector provides battery charging functionality and powers the real-time-clock (RTC) interface when the main supply 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.

Note For more information about the coin cell, see Electrical specification.

The following table shows the pinout of the coin cell connector (J2):

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

Power and reset buttons

The power button (SW1) on the ConnectCore 6UL SBC Pro is connected to the on-module MCA, which 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 ConnectCore 6UL SBC Pro also has a "Reset" button (SW2), which resets the ConnectCore 6UL module.

Note You can configure the duration of some power button actions. See the device tree bindings for the MCA power key driver for more information.

5V supply connector

The ConnectCore 6UL 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 6UL SBC for powering interfaces such as the displays (LCD and LVDS) and the USB VBUS. The following table shows the pinout of the 5V supply connector (J5).

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

3.3V supply connector

The ConnectCore 6UL SBC Pro provides a 2-pin, 1.25 mm pitch straight connector with a regulated 3.3V supply for powering external circuitry. The 3.3V supply is generated on a buck regulator of the ConnectCore 6UL PMIC (3V3_EXT power domain), which is also used on-board for powering many interfaces of the ConnectCore 6UL SBC carrier board. The following table shows the pinout of the 3.3V supply connector (J4).

Pin	Signal name	Description
1	3V3	3.3V power line
2	GND	

System boot interfaces

Boot configuration

The ConnectCore 6UL SBC Pro has several 10 K resistors to allow for maximum flexibility when setting up the boot source configuration of the ConnectCore 6UL module. The following table provides detailed information about resistor configuration.

Note Default configuration is shown in bold.

BOOT_CFG bit (pad)	Resistor configuration	
	Pull-up	Pull-down
BOOT_CFG1[0] (LCD_DATA0)	R222	**R112**
BOOT_CFG1[1] (LCD_DATA1)	R233	**R113**
BOOT_CFG1[2] (LCD_DATA2)	R234	**R147**
BOOT_CFG1[3] (LCD_DATA3)	R235	**R153**
BOOT_CFG1[4] (LCD_DATA4)	**R17**	R238
BOOT_CFG1[5] (LCD_DATA5)	R236	**R156**
BOOT_CFG1[6] (LCD_DATA6)	R237	**R166**
BOOT_CFG1[7] (LCD_DATA7)	**R100**	R239

BOOTSTRAP	NAND
BOOT_CFG1[0]	Row address cycles: **00 - 3 cycles** 01 - 2 cycles 10 - 4 cycles 11 - 5 cycles
BOOT_CFG1[1]	
BOOT_CFG1[2]	Number of devices: **00 - 1 device** 01 - 2 devices 10 - 4 devices 11 - Reserved
BOOT_CFG1[3]	
BOOT_CFG1[4]	Pages in block: 00 - 128 pages **01 - 64 pages** 10 - 32 pages 11 - 256 pages
BOOT_CFG1[5]	
BOOT_CFG1[6]	Samsung toggle mode DDR NAND: **0 - Raw NAND** 1 - Toggle mode NAND
BOOT_CFG1[7]	Boot device selection: **1 - Boot from NAND interface**

Note Boostrap pins are protected against being overwritten by devices connected to the LCD signals. See the ConnectCore 6UL SBC Pro schematics (PDF) for circuitry around U30 and U31.

Boot mode

By default, the ConnectCore 6UL module boots from the internal board settings, allowing it to boot from internal NAND memory. However, it is possible to boot from USB through a jumper (J10). This jumper forces the i.MX6UL to boot from the source programmed in the one-time-programmable (OTP) bits. If the boot configuration OTP bits are not programmed, the CPU falls back to booting into USB debug mode.

The default state for the jumper is open, which configures the i.MX6UL to boot from board settings (from NAND flash). If the NAND flash doesn't contain valid firmware, the i.MX6UL also falls back to booting into USB debug mode. You can use this functionality for recovery purposes, such as if the boot loader is erased or cannot boot.

For advanced functionality, the ConnectCore 6UL SBC Pro provides four resistors to configure the SOM boot mode. For more information about boot mode configuration, please refer to the ConnectCore for i.MX6UL system-on-module Hardware Reference Manual.

The following table shows resistor configuration for the different boot modes:

R24	R25	R28	R29	Comment
Not populated	Not populated	Populated	Populated	Boot from fuses
Populated	Not populated	Not populated	Populated	Boot from serial downloader
Not populated	Populated	Populated	Not populated	Boot from board settings (default)
Populated	Populated	Not populated	Not populated	Reserved

Note A different resistor configuration may prevent the ConnectCore 6UL module from booting.

Debug interfaces

JTAG

The ConnectCore 6UL SBC Pro provides a Tag Connect footprint for accessing the i.MX6UL JTAG debug port. You can find this footprint on the bottom side of the board.

SWD

The ConnectCore 6UL SBC Pro provides two options for programming and debugging the MCA of the ConnectCore 6UL module. The first option is a 2x5, 1.27 mm pitch pin header on the top side of the board (which, by default, is not populated). The following table shows the pinout of the SWD connector.

Pin	Signal name	Description
1	VCC_MCA	3.3V supply voltage of the MCA

Pin	Signal name	Description
2	MCA_SWD_DIO	SWD bidirectional data pin
3	GND	Ground
4	MCA_SWD_CLK	SWD clock signal
5	VCC_MCA	3.3V supply voltage of the MCA
6	NC	Not connected
7	NC	Not connected
8	NC	Not connected
9	GND	Ground
10	MCA_RESET_N	Reset signal for MCA

The second option is the Tag Connect footprint on the bottom side of the board.

You can also access the SWD interface of the I/O expander using options similar to those found on the on-module MCA: a non-populated 2x5, 1.27 mm pitch pin header and a Tag Connect footprint.

Console port

The ConnectCore 6UL SBC Pro provides a 4-pin, 1.25 pitch connector for the debug console port. The UART5 port of the ConnectCore 6UL module is used as the console port. The console signal is a serial TTL, which travels through the console connector directly to the i.MX6UL processor. You can use a TTL-to-USB cable to access this console port from a host PC USB port. The following table shows the pinout of the console connector (J9):

Pin	Signal name	Description
1	UART5_TX	Transmission line
2	UART5_RX	Receiver line
3	3V3	3.3V power line
4	GND	Ground

CAUTION! Pin 3 - 3V3 is a power output of the SBC. It should not be connected to a power input coming from the USB to TTL cable, for instance.

Console default settings:

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

Communication interfaces

NFC NTAG

A 2KB (2016 bytes of EEPROM and 64 bytes of SRAM) NTAG is carried by the ConnectCore 6UL SBC Pro. This NTAG is an energy-harvesting NFC Forum type 2 Tag with field detection and I2C interface. The RF interface is based on the ISO/IEC 14443 Type A standard. This RF interface is passive and must be supplied by an RF field.

The SBC has an antenna connector (36) for the NTAG:

Pin	Signal name	Description
1	LA	Antenna connection LA
2	LB	Antenna connection LB

Note For more information on this interface, please contact Digi technical support at www.digi.com/support.

10/100 Mbps Ethernet

The ConnectCore 6UL SBC Pro provides two 10Base-T/100Base-Tx Ethernet interfaces using two Microchip LAN8720Ai 10/100 Ethernet PHYs. The Ethernet PHYs are connected to the i.MX6UL ENET1 and ENET2 instances, respectively. Both Ethernet interfaces are accessible through RJ-45 connectors with integrated link/activity LEDs. The following table shows the pinout of both RJ45 connectors.

Pin	Signal name	Description
1	TD+	Transmit pair data (+)
2	TD-	Transmit pair data (-)
3	RD+	Receive pair data (+)
4	CT	Center tap
5	CT	Center tap
6	RD-	Receive pair data (-)
7	NC	Not connected
8	GND	Ground
9	LED1_P	Green LED anode
10	LED1_N	Green LED cathode
11	LED2_P	Yellow LED anode
12	LED2_N	Yellow LED cathode

The 10/100 Ethernet PHYs have two outputs to indicate the link and activity status of the port. These outputs are connected to two LEDs that are integrated with the Ethernet connectors. The following table shows the link/activity status indicated by the two LEDs:

Green LED	Yellow LED	Link/activity status
OFF	OFF	Link OFF
ON	OFF	10 Link/no activity
Blinking	OFF	10 Link/activity
ON	ON	100 Link/no activity
Blinking	ON	100 Link/activity

Ethernet PHY on/off

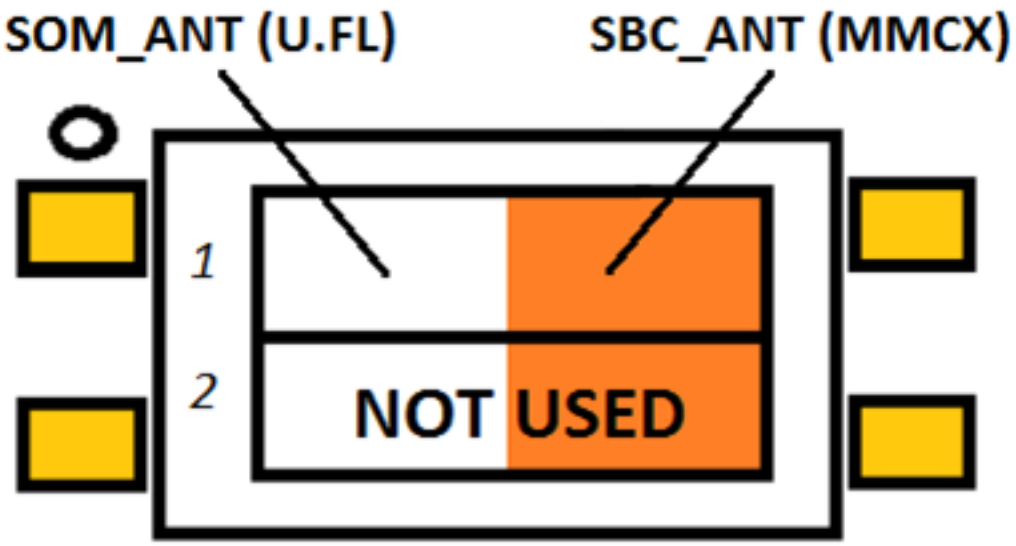
You can control Ethernet PHY power supply through a power switch to improve system power management. ENET_PWR/IO26 signal from the I/O expander controls the state of the power switch.

Note The PHYs share the same power switch, so they will always be switched on or off together.

Antenna connector

The ConnectCore 6UL SBC Pro includes an MMCX jack connector to support the wireless and Bluetooth functionality available in the ConnectCore 6UL module. The connector for this antenna is placed on the top-right side of the board.

Note The double switch SW4 selects between the on-module antenna and the SBC antenna, so they cannot be used simultaneously. The upper switch (1) selects the antenna (see picture below).



See the Regulatory Information and Certifications section of the ConnectCore 6UL module Hardware Reference Manual for a list of certificated antennas for the ConnectCore 6UL module.

This double switch SW4 also controls one of the RF kill signals: RF_KILL_HW#. Either this RF_KILL_HW# or the internal RF_KILL_SW# (connected to the I/O expander RF_KILL_SW#/IO2 signal) must be triggered to generate an RF kill event.

CAUTION! The signals WLAN_RF_KILL#, BT_RF_KILL#, WLAN LED and BTLED are not yet supported by the wireless baseband chip. Please contact Digi technical support at www.digi.com/support before using these features.

USB Host

The ConnectCore 6UL SBC Pro offers support for four USB Host interfaces. Two of them are available over a stackable dual USB A-type connector located on the front of the board. The third USB Host is connected to the PCI Express Mini card connector. The fourth is available on a 6-pin, 1.25 mm pitch expansion connector. All USB Hosts can operate at full, high, and low speed.

The following table shows the pinout of the dual stackable USB Host connector:

Pin	Signal name	Description
1	VIN	5V power line
2	USBH1_D_N	USB 1 differential data signal (-)
3	USBH1_D_P	USB 1 differential data signal (+)

Pin	Signal name	Description
4	GND	Ground
5	VIN	5V power line
6	USBH2_D_N	USB 2 differential data signal (-)
7	USBH2_D_P	USB 2 differential data signal (+)
8	GND	Ground

The following table shows the pinout of the USB expansion connector:

Pin	Signal name	Description
1	VIN	5V power line
2	USBH4_D_P	USB 4 differential data signal (+)
3	USBH4_D_N	USB 4 differential data signal (-)
4	USBH4_OC_N	Over current input
5	USBH4_PWR_EN	Power enable output
6	GND	Ground

The USB hub can be switched off for advanced power management through the USB_PWR/IO21 signal from the I/O expander.

USB OTG

A micro-AB type receptacle for USB OTG connection is available on the bottom side of the ConnectCore 6UL SBC Pro. This interface can operate in both Host and Device mode.

High-speed, full-speed, and low-speed connections are supported in Host mode. High-speed and full-speed connections are supported in Device mode.

When the interface is configured as Host mode, a 5V power supply line is connected to pin 1 (VBUS) of the USB OTG connector. In Device mode, this line is opened. The following table shows the pinout of the USB OTG connector:

Pin	Signal name	Description
1	USB_OTG_VBUS	5V power line
2	USB_OTG_D_N	USB differential data signal (-)
3	USB_OTG_D_P	USB differential data signal (+)
4	USB_OTG_ID	Connected to GND for Host and floating for Device
5	GND	Ground

Mini PCI Express slot

The ConnectCore 6UL SBC Pro provides a Mini PCI Express connector with the following interfaces:

- USB Host port (USBH3)
- GPIO signal (I/O expander PCIE_WAKE_N/IO38 signal) for the open drain, low-level PCIe wake up signal
- GPIO signal (I/O expander PCIE_DIS_N/IO12 signal) for the low-level PCIe disable signal
- SIM interface
- +3.3V supply

The PCIe interface has a dedicated 3.3V regulator. For power consumption management, this regulator can be controlled through I/O expander PCIE_VCC_EN/IO27 signal.

The ConnectCore 6UL SBC Pro has four 2.6 mm metalized drills: two for the half-size and two for the full-size mechanization. These drills have a 5.8 mm x 5.8 mm area without parts or routes for the screws and nuts. To install a PCI Express mini card on the ConnectCore 6UL SBC Pro, you need two M2.5 nuts, two M2.5 screws, two 4 mm M2.5 spacers, and two M2.5 washers.

The following table shows the pinout of the PCI Express Mini card connector:

Pin	Signal name	Description
1	PCIE_WAKE_N	Wake-up signal
2	PCIe_VCC	3.3V power line
3	NC	Not connected
4	GND	Ground
5	NC	Not connected
6	NC	Not connected
7	NC	Not connected
8	PCIE_UIM_PWR	Power supply for SIM card
9	GND	Ground
10	PCIE_UIM_DATA	SIM card data line
11	NC	Not connected
12	PCIE_UIM_CLK	SIM card clock line
13	NC	Not connected
14	PCIE_UIM_RST	SIM card reset line
15	GND	Ground
16	PCIE_UIM_VPP	Power supply for SIM programming
17	NC	Not connected
18	GND	Ground
19	NC	Not connected
20	PCIE_DIS_N	Disable signal
21	GND	Ground
22	NC	Not connected
23	NC	Not connected
24	PCIe_VCC	3.3V power line
25	NC	Not connected
26	GND	Ground
27	GND	Ground
28	NC	Not connected
29	GND	Ground

Pin	Signal name	Description
30	PCIE_I2C_SCL	Not connected (R95 depopulated)
31	NC	Not connected
32	PCIE_I2C_SDA	Not connected (R96 depopulated)
33	NC	Not connected
34	GND	Ground
35	GND	Ground
36	USBH3_D_N	USB 3 differential data signal (-)
37	GND	Ground
38	USBH3_D_P	USB 3 differential data signal (+)
39	PCIe_VCC	3.3V power line
40	GND	Ground
41	PCIe_VCC	3.3V power line
42	NC	Not connected
43	GND	Ground
44	NC	Not connected
45	NC	Not connected
46	NC	Not connected
47	NC	Not connected
48	NC	Not connected
49	NC	Not connected
50	GND	Ground
51	NC	Not connected
52	PCIe_VCC	3.3V power line

Micro-SIM

A micro-SIM card slot is located on the bottom side of the board. The SIM interface is connected to the PCIe Mini card connector, enabling cellular communication when a modem is installed in the Mini Card connector.

The following table shows the SIM card slot pinout:

Pin	Signal name	Description
1	PCIE_UIM_PWR	Power supply line

Pin	Signal name	Description
2	PCIE_UIM_RST	SIM card reset line
3	PCIE_UIM_CLK	SIM card clock line
4	NC	Not connected
5	GND	Ground
6	PCIE_UIM_VPP	Power supply for SIM programming
7	PCIE_UIM_DATA	SIM card data line
8	NC	Not connected

XBee

The ConnectCore 6UL SBC Pro provides two 10-pin, 2 mm pitch connectors to connect a Digi XBee/XBee-PRO module. The XBee identification and association signals are connected to a 3-pin, 1.25 mm pitch expansion connector.

The XBee module communicates with the ConnectCore 6UL through the UART2 port. This UART2 port is also available on the UART expansion connector to allow for other uses besides the XBee interface.

Four GPIO signals of the ConnectCore 6UL reset the XBee and control the status of the XBee module.

The table below shows the pinout of the XBee module connectors (J23 and J24):

Pin	Signal name	Description
1	XBEE_VCC	3.3V power line
2	UART2_RX	XBee output data line
3	UART2_TX	XBee input data line
4	NC	Not connected
5	XBEE_RESET_N	XBee reset line (connected to I/O expander XBEE_RSTN/IO7 signal)
6	NC	Not connected
7	NC	Not connected
8	NC	Not connected
9	XBEE_SLEEP_RQ	XBee request line (connected to I/O expander XBEE_SLP_RQ/IO9 signal)
10	GND	Ground
11	NC	Not connected
12	UART2_RTS_N	XBee request to send

Pin	Signal name	Description
13	XBEE_ ON/SLEEP_N	XBee status line (connected to I/O expander XBEE_ON/SLP_N/IO11 signal)
14	NC	Not connected
15	XBEE_ASSOC	XBee associated line
16	UART2_CTS_N	XBee clear to send line
17	NC	Not connected
18	NC	Not connected
19	NC	Not connected
20	XBEE_IDENT	XBee commissioning line (connected to I/O expander XBEE_ IDENT/IO33 signal)

The following table shows the pinout of the XBee expansion connector (J22):

Pin	Signal name	Description
1	XBEE_IDENT	XBee commissioning line
2	XBEE_ASSOC	XBee associated line
3	GND	Ground

CAUTION! 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 6UL module, Digi recommends you use bus switches for all I/Os connected to the XBee socket.

CAUTION! Do not expose any XBee socket pins to 5V unless it is specifically allowed by the XBee model.

Multimedia interfaces

Parallel display

The ConnectCore 6UL provides a 24-bit RGB LCD interface available on the top side of the board through a 40-pin, 0.5 mm pitch, FFC connector. Backlight control signal, I2C port, and interrupt line for the touch screen panel are available on the LCD connector. This connector also provides a 3.3V power line for the LCD display and a 5V power line for the LED backlight.

By default, only data lines 0 to 17 are connected, allowing an 18-bit parallel video interface. Data lines 18 to 23 can be connected through 0-ohm resistors that, by default, are not populated.

The 5V power supply is controlled through I/O expander DISP_5V_PWR/IO29 signal.

The following table shows the pinout of the parallel display connector (J21):

Pin	Signal name	Description	16-bit	18-bit	24-bit
1	GND	Ground			
2	LCD_DATA0	Display data line 0	B[0]	B[0]	B[0]
3	LCD_DATA1	Display data line 1	B[1]	B[1]	B[1]
4	LCD_DATA2	Display data line 2	B[2]	B[2]	B[2]
5	LCD_DATA3	Display data line 3	B[3]	B[3]	B[3]
6	LCD_DATA4	Display data line 4	B[4]	B[4]	B[4]
7	LCD_DATA5	Display data line 5	G[0]	B[5]	B[5]
8	LCD_DATA6	Display data line 6	G[1]	G[0]	B[6]
9	LCD_DATA7	Display data line 7	G[2]	G[1]	B[7]
10	LCD_DATA8	Display data line 8	G[3]	G[2]	G[0]
11	LCD_DATA9	Display data line 9	G[4]	G[3]	G[1]
12	LCD_DATA10	Display data line 10	G[5]	G[4]	G[2]
13	LCD_DATA11	Display data line 11	R[0]	G[5]	G[3]
14	LCD_DATA12	Display data line 12	R[1]	R[0]	G[4]
15	LCD_DATA13	Display data line 13	R[2]	R[1]	G[5]
16	LCD_DATA14	Display data line 14	R[3]	R[2]	G[6]
17	LCD_DATA15	Display data line 15	R[4]	R[3]	G[7]
18	LCD_DATA16	Display data line 16		R[4]	R[0]
19	LCD_DATA17	Display data line 17		R[5]	R[1]
20	LCD_DATA18	Display data line 18 (NC, serial resistor: R41)		-	R[2]
21	LCD_DATA19	Display data line 19 (NC, serial resistor: R207)		-	R[3]
22	LCD_DATA20/SPI1_CLK	Display data line 20 (NC, serial resistor: R208)		-	R[4]
23	LCD_DATA21/SPI1_SS0	Display data line 21 (NC, serial resistor: R209)		-	R[5]

Pin	Signal name	Description	16-bit	18-bit	24-bit
24	LCD_ DATA22/SPI1_ MOSI	Display data line 22 (NC, serial resistor: R210)		-	R[6]
25	LCD_ DATA23/SPI1_ MISO	Display data line 23 (NC, serial resistor: R211)		-	R[7]
26	GND	Ground			
27	DISP0_CLK	Display clock line			
28	GND	Ground			
29	DISP0_HSYNC	Horizontal sync line			
30	DISP0_VSYNC	Vertical sync line			
31	DISP0_DRDY				
32	DISP0_RESET				
33	DISP0_I2C_SCL	i.MX6UL I2C1 bus clock line			
34	DISP0_I2C_SDA	i.MX6UL I2C1 bus data line			
35	DISP0_IRQ_N	Interrupt line (connected to i.MX6UL GPIO5_ IO02) with a 10K pull-up			
36	GND	Ground			
37	BCKL_PWM	Backlight PWM (connected to i.MX6UL NAND_ DQS)			
38	3V3	3.3V power line			
39	5V_DISPLAY	5V power line			
40	5V_DISPLAY	5V power line			

Note 24-bit displays can be connected to an 18-bit parallel LCD bus. For this, the six most significant data bits of the display are connected to the 18-bit LCD bus. The remaining two least significant data bits of the display can be connected in two ways:

- Connected either to GND or VCC. In this case, it's not possible to reach a full black or white.
- Connected to the lower bits of the same color. In this case, full black and white can be reached, but some color gradients are lost.

LVDS

The ConnectCore 6UL SBC Pro provides an LVDS interface from a parallel-to-LVDS transceiver. The LVDS connector is on the bottom side of the board, close to the LCD connector.

Pad conflicts
The LVDS and parallel connectors share the same video interface and therefore cannot be used simultaneously.

This LVDS connector provides access to the following LVDS capabilities:

- Up to four LVDS differential data pairs
- One LVDS differential clock pair
- Interrupt signal with 10K pull-up resistor for touch screen (shared with parallel display interface)
- Control of the backlight contrast (shared with parallel display interface)
- I2C (shared with parallel display interface)
- 3.3V power supply for the LCD
- 5V power supply for the LED backlight (shared with parallel display interface)

The LVDS interface is available in a 20-pin, 1.25 mm pitch Hirose DF14 connector (J31). The following table shows the pinout:

Pin	Signal name	Description
1	3V3	3.3V power line
2	LVDS0_TX0_N	Transmission pair data line 0 (-)
3	LVDS0_TX0_P	Transmission pair data line0 (+)
4	GND	Ground
5	LVDS0_TX1_N	Transmission pair data line 1 (-)
6	LVDS0_TX1_P	Transmission pair data line 1 (+)
7	GND	Ground
8	LVDS0_TX2_N	Transmission pair data line 2 (-)
9	LVDS0_TX2_P	Transmission pair data line 2 (+)
10	GND	Ground
11	LVDS0_CLK_N	Transmission pair clock line (-)
12	LVDS0_CLK_P	Transmission pair clock line (+)
13	GND	Ground
14	LVDS0_TX3_N	Transmission pair data line 3 (-)
15	LVDS0_TX3_P	Transmission pair data line 3 (+)
16	BCKL_PWM	Backlight PWM (connected to i.MX6UL NAND_DQS)
17	DISP0_I2C_SCL	i.MX6UL I2C1 bus clock line
18	DISP0_I2C_SDA	i.MX6UL I2C1 bus data line

Pin	Signal name	Description
19	DISP0_IRQ_N	Interrupt line (connected to i.MX6UL GPIO5_09)
20	5V_DISPLAY	5V power line

You can switch off the parallel-to-LVDS transceiver for advanced power management through I/O expander LVDS_PD#/IO30 signal.

Parallel camera

The ConnectCore 6UL SBC Pro provides a parallel camera sensor interface (CSI), which is located on the top side of the board. This camera interface is composed of an 8-bit data line bus, a master clock, and three synchronization signals (PIXCLK, HSYNC, and VSYNC).

This parallel camera interface is available in a 20-pin, 0.5 mm pitch FFC connector (J17). The pinout is shown in the following table:

Pin	Signal name	Description
1	GND	Ground
2	CSI_DATA02	Camera data line 0
3	CSI_DATA03	Camera data line 1
4	CSI_DATA04	Camera data line 2
5	CSI_DATA05	Camera data line 3
6	CSI_DATA06	Camera data line 4
7	CSI_DATA07	Camera data line 5
8	CSI_DATA08	Camera data line 6
9	CSI_DATA09	Camera data line 7
10	GND	Ground
11	CSI_MCLK	Camera master clock line
12	CSI_PIXCLK	Camera pixel clock line
13	CSI_HSYNC	Camera horizontal sync
14	CSI_VSYNC	Camera vertical sync
15	CSI_GPIO/IO31	Connected to I/O expander CSI0_GPIO/IO31 signal
16	CSI_ PWDN/IO22	Camera power down line (connected to I/O expander CSI_ PWDN/IO22)
17	GND	Ground
18	CSI_I2C_SCL	i.MX6UL I2C1 bus clock line
19	CSI_I2C_SDA	i.MX6UL I2C1 bus data line
20	3V3	3.3V power line

Pad conflicts
The data lines of the camera interface are shared with the eMMC and microSD interfaces, so the camera cannot be used simultaneously with these interfaces.

Audio

Audio functionality on the ConnectCore 6UL SBC Pro provides headphone, speaker, line-out, two line-in, and microphone signals. A Maxim MAX98089 audio codec manages the audio interface. You can configure the audio codec through the i.MX6UL I2C1 bus. For power management, the ConnectCore 6UL SBC Pro provides a switch for powering on and off the audio interface. The switch is controlled with the I/O expander AUD_PWR/IO28 signal.

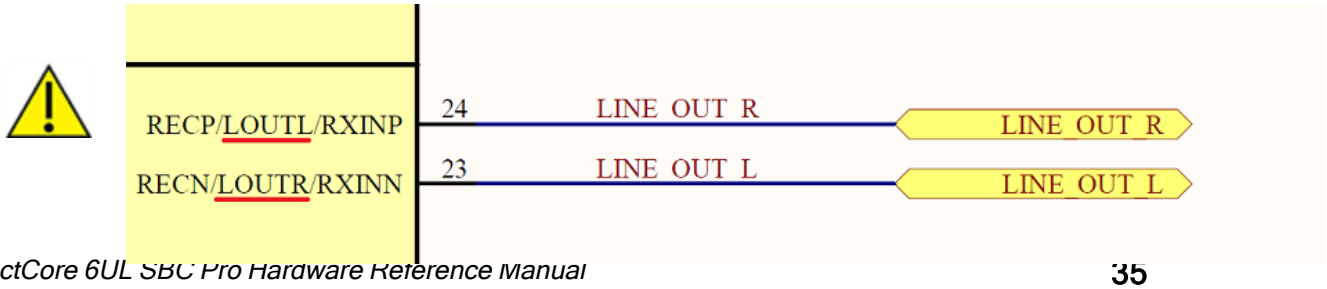
The headphone audio output of the audio codec is connected to a stereo audio jack located on the front edge of the SBC. The table below shows the pinout of the audio jack connector:

Pin	Signal name	Description
1	GND	Ground
2	HPR	Audio right channel output
3	HPL	Audio left channel output
4	NC	Not connected
5	NC	Not connected

The line-in, line-out, and microphone audio signals are available through an 8-pin, 1.25 mm pitch expansion connector (J26). The following table shows the pinout of this connector:

Pin	Signal name	Description
1	MIC_N	Microphone input negative signal
2	MIC_P	Microphone input positive signal
3	LINE_IN_A_R	Line-in A right channel signal
4	LINE_IN_A_L	Line-in A left channel signal
5	GND	Ground
6	LINE_OUT_R	Line-out left channel signal
7	LINE_OUT_L	Line-out right channel signal
8	GND	Ground

LINE_OUT_R and LINE_OUT_L are swapped in the design. LINE_OUT_R signal corresponds to left channel and LINE_OUR_L to right channel:



The MAX98089 audio codec also allows speakers to be connected to internal Class D amplifiers. An additional line-in input is also available on the audio codec. This additional functionality is available in a 6-pin, 1.25 mm pitch expansion connector (J33). The following table shows the pinout:

Pin	Signal name	Description
1	SPKL_P	Positive left-channel Class D speaker output
2	SPKL_N	Negative left-channel Class D speaker output
3	SPKR_P	Positive right-channel Class D speaker output
4	SPKR_N	Negative right-channel Class D speaker output
5	LINE_IN_B_R	Line-in B right channel
6	LINE_IN_B_L	Line-in B left channel

Storage interfaces

microSD

A microSD connector is located on the bottom side of the SBC. This interface is connected to the USDHC2 controller of the i.MX6UL CPU.

The following table shows the pinout of the microSD socket:

Pin	Signal name	Description
1	CSI_DATA04	Serial data 2
2	CSI_DATA05	Serial data 3
3	SD_CMD	Command line - output of the analog switch (U33) for CSI0_HSYNC signal
4	3V3	3.3V power line
5	SD_CLK	Serial clock - output of the analog switch (U34) for CSI0_VSYNC signal
6	GND	Ground
7	CSI_DATA02	Serial data 0
8	CSI_DATA03	Serial data 1
9	GND	Ground
10	GND	Ground

eMMC

The ConnectCore 6UL SBC Pro carries a 4 GBytes eMMC memory. This interface is connected to the USDHC2 controller of the i.MX6UL CPU.

Pad conflicts
The eMMC shares the connection to the i.MX6UL processor with the microSD interface. The selection is made via the eMMC/SD# signal, which is driven by the i.MX6UL processor, so the devices cannot be used simultaneously.

The eMMC/SD# signal is connected to the GPIO5_01 port of the i.MX6UL. The following table describes its behavior:

eMMC/SD# level	Description
Low	microSD connected
High	eMMC connected

The eMMC memory can be switched off for advanced power management through I/O expander eMMC_PWR/IO8 signal.

Additional expansion interfaces

I/O Expander

Introduction

The digital I/O Expander is an IC that extends the available GPIOs, ADCs, and IRQ sources available on the ConnectCore 6UL SBC Pro. The I/O Expander and the ConnectCore 6UL module are connected through an I2C interface and two interrupt lines that allow the I/O Expander to request attention from the host (IOEXP_INT_MCA# and IOEXP_INT_iMX#). However, only IOEXP_INT_MCA# is currently used by the firmware.

The I/O Expander provides the following functionalities on the ConnectCore 6UL SBC Pro:

- Ability to control different power domains through GPIOs configured as outputs.
- General purpose I/O, IRQ, and ADCs through user connectors.
- Peripheral control:
  - User LED
  - Parallel camera port reset
  - XBee socket lines.

Power domain control

The following table lists the lines that are intended to control the power domains of the peripherals in the ConnectCore 6UL SBC Pro:

I/O Expander pin name	Signal name	Pin direction	Description	Peripheral affected
IO2	RF_KILL_ SW#IO2	Output	Part of the logic for disabling RF modules. Currently not supported.	CCWi-i.MX6UL
IO8	eMMC_ PWR/IO8	Output	Controls the 3V3_eMMC power rail.	eMMC
IO12	PCIE_DIS_ N/IO12	Output	Connected to the miniPCIe socket.	miniPCIe socket
IO14	PWR_ EN/IO14	Output	Controls the 5V power supply line for external load.	5V regulator and LED.
IO15	CAN_ EN2/IO15	Output	Enables/disables the CAN2 transceiver. Currently not supported.	CAN2 transceiver
IO17	CAN_ EN1/IO17	Output	Enables/disables the CAN1 transceiver. Currently not supported.	CAN1 Transceiver
IO18	UART_ PWR/IO18	Output	Controls the RS232-TTL transceiver.	UART 1 & UART 3 transceivers
IO21	USB_ PWR/IO21	Output	Controls the 3V3_USB power rail.	USB Host Hub Controller.
IO26	ENET_ PWR/IO26	Output	Controls the 3V3_ETH power rail.	Ethernet PHYs.
IO27	PCIE_VCC_ EN/IO27	Output	Controls the PCIe_VCC power rail.	miniPCIe socket
IO28	AUD_ PWR/IO28	Output	Controls the 3V3_CODEC power rail.	Audio codec
IO29	DISP_5V_ PWR/IO29	Output	Controls the 5V_Display power rail.	LVDS and Parallel display sockets.
IO30	LVDS_ PD#/IO30	Output	Powers down the LVDS transmitter.	LVDS Transmitter
IO34	CAN_ STBY/IO34	Output	Sets the CAN1 and CAN2 transceiver into low-power standby mode.	CAN1 & CAN2 Transceiver
IO38	PCIE_ WAKE_ N/IO38	Output	Connected to the miniPCIe socket.	miniPCIe socket

User IOs

The following lines of the I/O Expander are available for general purpose use:

I/O Expander pin name	Signal name	Connector and pin	Digital I/O	IRQ capable	ADC capable
IO3	IOEXP_3	J30 pin 1	✓		✓
IO4	IOEXP_4	J30 pin 3	✓		✓
IO5	IOEXP_5	J30 pin 4	✓		✓
IO6	IOEXP_6	J30 pin 2	✓		
IO37	IOEXP_37	J30 pin 6	✓	✓	
IO32	EXP_I2C_ GPIO/IO32	J28 pin 5	✓	✓	

Digital IOs

All I/O Expander lines can be configured as digital inputs/outputs and are powered from the 3V3_ IOEXP power rail, directly connected to 3V3.

Note Since the GPIOs do not incorporate internal pull-ups or pull-downs, you must add the components to the exterior of the module carrier board.

I/O Expander IRQs

You can configure a subset of the available IOs as interrupt inputs and specifically to configure the active edge of the interrupt (rising, falling, or both). When one or more IRQs are activated, the I/O Expander interrupts the main ConnectCore 6UL module through the corresponding IRQ line, signaling the active IRQs in the IRQ status registers. The IRQ inputs can wake the system from any low power mode (suspend or power off).

The I/O Expander uses the IOEXP_INT_MCA# line to signal the interrupts to the ConnectCore 6UL SoM, which means that all enabled IRQs in the I/O Expander will wake up the SOM from a sleep status. To prevent this, the IRQs should be masked before suspending the module.

See the I/O Expander GPIO driver documentation for additional information about how to configure and access its lines.

Analog to Digital Converter

You can configure a subset of the available IOs as Analog to Digital channels. The index of the MCA ADC channels corresponds to the index of the IO listed. This means that the ADC channel 3 corresponds to the IO3 signal, the ADC channel 4 to the IO4, and so on.

The result of the ADC conversion for a given input voltage is inversely proportional to the reference voltage of the ADC. For the I/O Expander in the ConnectCore 6UL SBC, the reference voltage corresponds to the 3V3_IOEXP voltage. (Note that it is a different voltage reference than the ConnectCore 6UL MCA ADCs.) The ADCs provide 12-bit resolution with right-justified, unsigned format output. They are suitable for low-frequency sampling (under 10 Hz). For higher frequency sampling, Digi recommends the CPU ADC channels.

See the I/O Expander software documentation for additional information about how to configure and access the I/O Expander ADCs.

Other peripherals

User LED

The I/O Expander controls a LED through line USER_LED1/IO23. You can drive the user LED by configuring this line as a digital output and setting its value.

XBee Socket

The following table shows the lines of the I/O Expander that are connected to the XBee socket, allowing more precise control of these modules. However, it is important to note that the actual behavior depends on the XBee version and how it is configured. Refer to the XBee manual reference for more details on how these lines behave.

I/O Expander pin name	Signal name	Pin direction	Description
IO7	XBEE_RSTN/IO7	Output	Used for controlling the XBee reset line.
IO9	XBEE_SLP_ RQ/IO9	Output	Used for both requesting the XBee to sleep and waking it.
IO11	XBEE_ON/SLP_ N/IO11	Input	Used for reading the power status of the XBee.
IO33	XBEE_ IDENT/IO33	Output	Used for commissioning of the XBee.

Parallel Camera

Lines connected to the parallel camera port control some of its features. Refer to the specific device manual for details on how to interface with these signals.

I/O Expander pin name	Signal name	Pin direction	Connector and pin
IO22	CSI_PWDN/IO22	Output	J17 pin 15
IO31	CSI_GPIO/IO31	Input/Output	J17 pin 14

LVDS transceiver

Two lines connected to the LVDS transceiver control some of its features. Refer to the specific device manuals for details on how to interface with these signals.

I/O Expander pin name	Signal name	Pin direction	Description
IO10/SWD_ CLK	IOEXP_SWD_ CLK/LVDS_ FLIP	Output	Connected to LVDS_FLIP pin of the LVDS transceiver. It allows you to reverse the output.
IO13/SWD_ DIO	IOEXP_SWD_ DIO/LVDS_RF	Output	Connected to LVDS_RF pin of the LVDS transceiver. It allows you to select the input CLK triggering edge.

UART 1

Two signals of the I/O Expander are reserved to be used as a UART. They are connected to an RS-232 level adapter.

CAUTION! This functionality is not supported by the current I/O Expander firmware.

I/O Expander pin name	Signal name	Pin direction	Connector and pin
IO0/UART2_TX	RS232_IOEXP_2_TX	Output	J29 pin 1
IO0/UART2_RX	RS232_IOEXP_2_RX	Input	J29 pin 2

CAN

The ConnectCore 6UL SBC Pro provides two CAN bus ports compatible with the CAN 2.0B protocol. Two CAN transceivers are used on the SBC to provide transmit and receive capability between the CAN bus and the CAN controller of the i.MX6UL. These transceivers allow signal rates up to 1 Mbps.

The CAN_STBY signal, driven by I/O expander CAN_STBY/IO34 signal, allows the standby mode for both CAN transceivers simultaneously.

Pad conflicts
CAN1 data lines are shared with UART3 flow control lines (CTS and RTS), and CAN2 data lines are shared with UART2 flow control lines. You cannot use CAN1 and UART3 in 4-wire configuration simultaneously.

The two CAN ports are available on a 6-pin, 1.25 mm pitch expansion connector. The following table shows the pinout of the CAN expansion connector (J27):

Pin	Signal name	Description
1	CAN1_L	CAN1 bus low signal line
2	CAN1_H	CAN1 bus high signal line
3	GND	Ground
4	CAN2_L	CAN2 bus low signal line
5	CAN2_H	CAN2 bus high signal line
6	GND	Ground

Two 120Ω termination resistors are populated on the CAN transceivers:

Resistor	Description
R104	CAN1 termination resistor
R116	CAN2 termination resistor

I2C

The ConnectCore 6UL SBC Pro provides access to an I2C interface. This I2C bus is connected to the I2C1 instance of the i.MX6UL CPU. Two 2.2 K pull-up resistors to a 3.3V power line are populated on the clock and data I2C1 lines. This I2C1 instance communicates with several interfaces on the SBC. The following table shows the interfaces connected to the I2C1 bus and their default I2C addresses:

	Interface	Speed (Kbps)	Address (7-bit)	Comment
SBC	PCIe	100	-	
	LVDS display touch	100	0x14 (Fusion 10")	Fusion 7 and Fusion 10 have the same touch controller, which has the same I2C address as Audio codec (0x10). For this reason, a new address for the touch controller has been configured through the Linear Tech LTC4316 address translator that is placed on the Video Adapter Board (not on the SBC).
	Parallel display touch	100	0x14 (Fusion 7")	
	CSI camera	100	-	
	Audio codec	100	0x10	
	I/O expander	100	0x6E	The I/O Expander address will only be visible if the IC has firmware programmed.
	NTAG	100	0x55	
Module	PMIC	100	0x08	
	MCA	100	0x7E	
	Cryptography chip	100	0x60	

This I2C1 bus is available on a 6-pin, 1.25 mm pitch expansion connector, which provides access to the following signals:

- I2C1 SDA and SCL lines
- Interruption line
- GPIO

The following table shows the pinout of the I2C1 expansion connector (J28):

Pin	Signal Name	Description
1	EXP_I2C_SCL	i.MX6UL I2C1 Bus Clock line
2	EXP_I2C_SDA	i.MX6UL I2C1 Bus Data line
3	3V3	3.3V power line

Pin	Signal Name	Description
4	EXP_I2C_IRQ_N	Interrupt line, connected to i.MX6UL GPIO5_05
5	EXP_I2C_GPIO	GPIO line, connected to I/O expander EXP_I2C_GPIO/IO32 signal
6	GND	Ground

SPI

The ConnectCore 6UL SBC Pro provides an SPI (serial peripheral interface), accessible through an 8-pin, 1.25 mm pitch expansion connector which allows access to the following signals:

- i.MX6UL SPI1 instance
- One slave select line
- Interrupt line

The following table shows the pinout of the SPI expansion connector (J34):

Pin	Signal name	Description
1	3V3	3.3V power line
2	LCD_DATA20/SPI1_CLK	SPI clock line
3	LCD_DATA23/SPI1_MISO	SPI *Master Input Slave Output* line
4	LCD_DATA22/SPI1_MOSI	SPI *Master Output Slave Input* line
5	LCD_DATA21/SPI1_SS0	SPI *Slave Select* line
6	MCA_IO5	Connected to on-module MCA
7	SPI1_IRQ_N	Interrupt line, connected to i.MX6UL GPIO5_08
8	GND	Ground

GPIO

The ConnectCore 6UL SBC Pro has a 14-pin, 1.25 mm pitch expansion connector, which provides access to several GPIO lines of the i.MX6UL, on-module MCA and I/O expander.

The pinout of the GPIO expansion connector (J30) is shown below:

Pin	Signal name	Description
1	IOEXP_3	Connected to I/O expander
2	IOEXP_6	Connected to I/O expander
3	IOEXP_4	Connected to I/O expander
4	IOEXP_5	Connected to I/O expander
5	3V3	3.3V power line
6	IOEXP_37	Connected to I/O expander

Pin	Signal name	Description
7	MCA_IO1	Connected to MCA
8	MCA_IO3	Connected to MCA
9	MCA_IO2	Connected to MCA
10	NC	Not connected
11	EXP_GPIO_1	Connected to i.MX6UL GPIO1_IO5
12	EXP_GPIO_2	Connected to i.MX6UL GPIO1_IO3
13	EXP_GPIO_3	Connected to i.MX6UL GPIO1_IO2
14	GND	Ground

UART

The ConnectCore 6UL SBC Pro provides access to three UART ports through a 14-pin, 1.25 mm pitch expansion connector. This connector provides access to the following UART instances:

- I/O expander UART2: 2 wires, RS-232 levels
- i.MX6UL UART3: 4 wires, RS-232 levels
- i.MX6UL UART2: 4 wires, TTL levels (shared with XBee and CAN2 interfaces)

i.MX6UL UART2 and UART3 interfaces have hardware flow control lines (RTS and CTS) while I/O expander UART 2 has just transmission and receiver signals.

The pinout of the UART expansion connector (J29) is shown below:

Pin	Signal name	Description
1	RS232_IOEXP_2_TX	I/O expander UART2 transmission line
2	RS232_IOEXP_2_RX	I/O expander UART2 receiver line
3	NC	Not connected
4	NC	Not connected
5	3V3	3.3V power line
6	RS232_3_TX	UART3 transmission line
7	RS232_3_RX	UART3 receiver line
8	RS232_3_RTS_N	UART3 request to send line
9	RS232_3_CTS_N	UART3 clear to send line
10	GND	Ground
11	UART2_TX	UART2 transmission line
12	UART2_RX	UART2 receiver line
13	UART2_RTS_N/CAN2_RX	UART2 request to send line
14	UART2_CTS_N/CAN2_TX	UART2 clear to send line

The RS-232 drivers that manage UART3 and UART2 can be switched off for advanced power management through I/O expander UART_PWR/IO18 signal.

Pad conflicts
CAN1 data lines are shared with UART3 flow control lines (CTS and RTS), and CAN2 data lines are shared with UART2 flow control lines. You cannot use CAN1 and UART3 in 4-wire configuration simultaneously.

Note I/O expander UART2, 2-wire RS-232 port is not supported by default. If your application requires this port, please contact Digi technical support at www.digi.com/support.

User interfaces

User LED

The ConnectCore 6UL SBC Pro provides one user LED, which is controlled through the I/O expander.

LED	Signal	Description
LED1	USER_LED1	Yellow LED, controlled by I/O expander USER_LED1/IO23 signal

ConnectCore 6UL SBC Pro specifications

Electrical specification

Supply voltages

The ConnectCore 6UL SBC Pro has three supply inputs. Two of them power the whole system (ConnectCore 6UL SBC Pro plus the ConnectCore 6UL 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 6UL 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	3.0	3.6	V

Note If the voltage in the VCC_LICELL pin is higher than 3.0 V, some current drawback may occur even when the system is in “run mode”.

Power consumption

The power consumption of the entire board (the ConnectCore 6UL SBC Pro plus the ConnectCore 6UL module) has been measured directly through the 5V input power supply. The following table lists power consumption figures measured in the ConnectCore 6UL SBC Pro under specific use cases.

SBC Power consumption (VIN)					
		Run-time			
Suspend mode	Power-off mode	IDLE	Display connected (IDLE)	Decoding video	CPU stress
40 mW	2 mW	0.84 W	2.85 W	3.10 W	1.375 W

Note To better understand the power consumption of the system, see the ConnectCore 6UL system on module Hardware Reference Manual to see the power consumption of the module (isolated) under the same use cases.

Use case descriptions

This section describes the use cases that were used to measure power consumption of the ConnectCore 6UL SBC.

Suspend

System in suspend to RAM mode.

CAUTION! You can achieve minimum power consumption numbers by disabling both 3.3V power domains. However, in some applications it may not be possible to switch them off, depending on what they are powering.

Power-off

System in power-off with RTC enabled.

IDLE

System up and running. Ethernet and wireless disabled.

Decoding video

System up and running with the following configuration:

- Ethernet and wireless disabled.
- Fusion7 parallel display connected to the system.

Includes two different use cases:

- Display connected in IDLE mode (without decoding video).
- CPU decoding video.

CPU stress

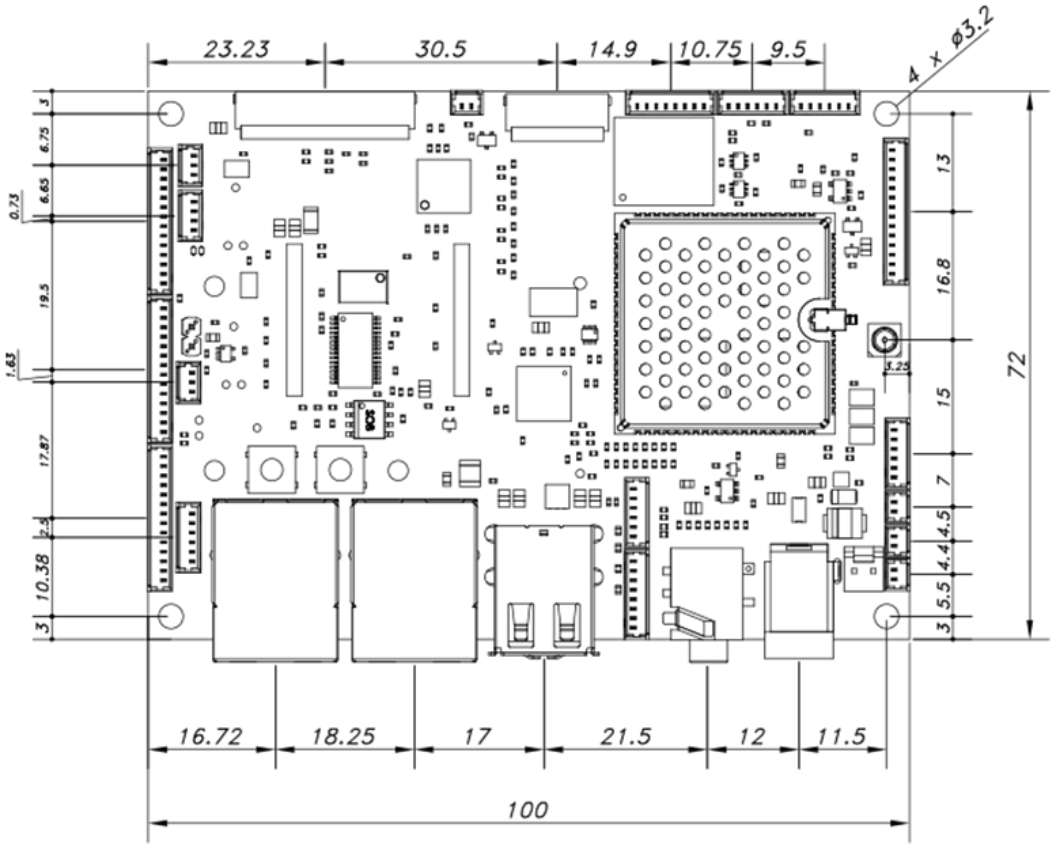
System up and running with the following configuration:

- One Ethernet interface up and linked. The other one disabled.
- USB connected to the system.
- Hanoi application running (Hanoi application stresses the CPU and put it at 100% work load).

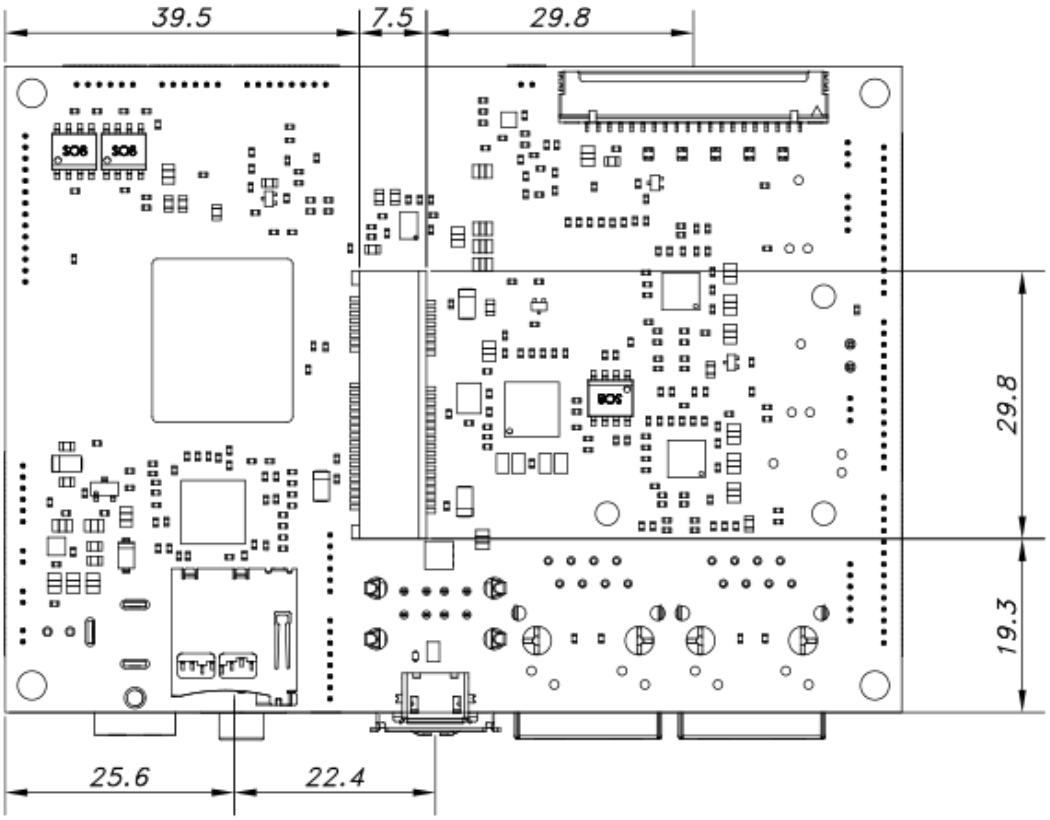
Mechanical specification

The ConnectCore 6UL 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. The board has four 2.6mm drills to assembly a half size or a full size PCI express mini card module. These drills have a 5.8mm x 5.8mm square metalized area for the screws and nuts. There must be a recess in the board to accommodate the components on the bottom side of the SOM. All dimensions on the following pictures are in millimeters.

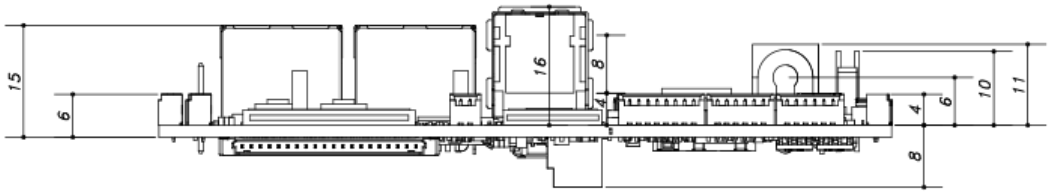
Top view



Bottom view



Profile view



Note See the ConnectCore 6UL product page for mechanical design documents, drawings, and other resources.

Environmental specification

The operating temperatures defined for the ConnectCore 6UL are as follows:

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

WLAN specification

For a complete WLAN specification please refer to the ConnectCore 6UL System-on-Module Hardware Reference Manual.

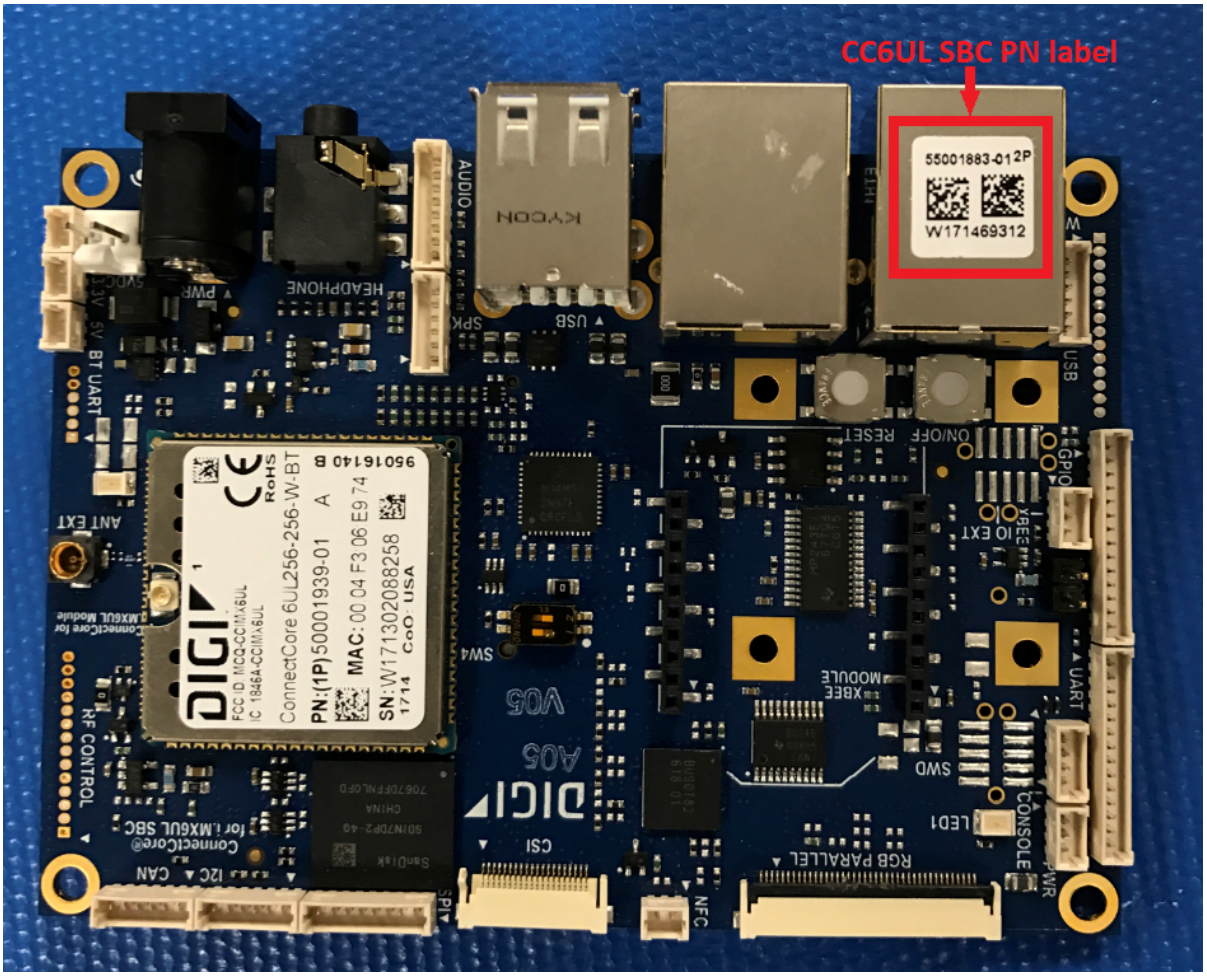
Known issues

Known issue: Connecting Fusion 7" display causes system to wake from suspend mode

The LCD interface in the ConnectCore 6UL SBC Pro causes the system to wake up from suspend mode when the Fusion 7" display is connected.

Affected versions/models

This issue is related to a population option that affects the first kits and prototypes of the ConnectCore 6UL SBC Pro, meaning **any board revision prior to revA**.
To check the board version of your SBC Pro, look for the part number in the label as shown in the following photo.



The board shown in the photo is a 2P revision, which precedes revA and therefore exhibits the issue described in this section.

Description

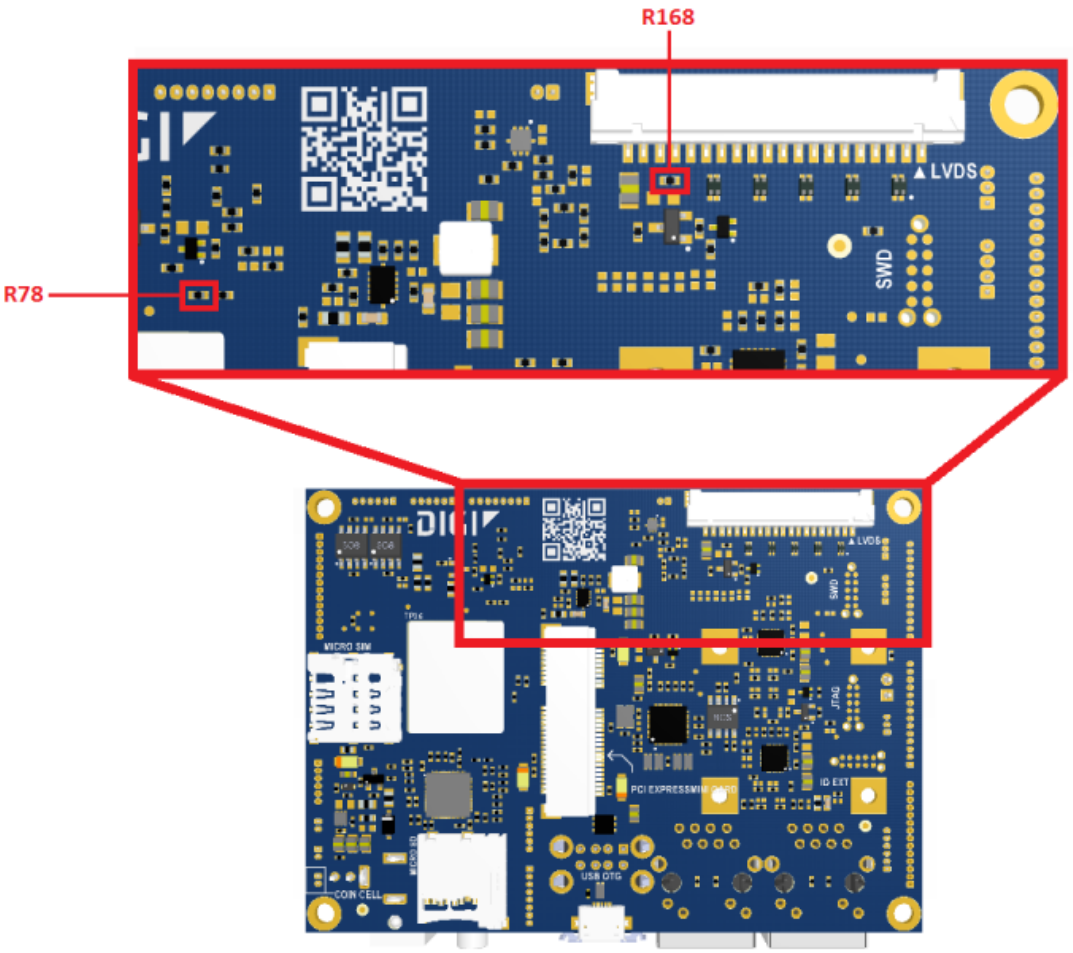
Two pull-up resistors (R78 and R168) are placed in the interrupt line of the LCD interface (LCD_IRQ_N) that goes to both the LCD and the LVDS connectors. The interrupt line of the touch controller in the Fusion 7" display is rising-edge active and should not be driven by the carrier board. When going to suspend to RAM mode, the LCD_IRQ_N line must be kept low in order to

avoid waking the system up. However, the Fusion 7" display is not managing it properly, and the pull-ups generate the rising-edge event that wakes the system from suspend mode.

Note This issue is not exclusive to the Fusion 7" display; it can potentially occur with any touch controller. Check the interrupt line of the LCD interface (LCD_IRQ_N) in your carrier board for this wake-from-suspend behavior.

Workaround/fix

Remove the following resistors from your ConnectCore 6UL SBC Pro before connecting the Fusion 7" display:



Design recommendation

When connecting any display to this interface, make sure that the LCD_IRQ_N line is properly driven by the display. If it is not, Digi recommends that you pull the display touch interrupt line up or down depending on the polarity of the touch controller interrupt (pull down if rising-edge active, pull up if falling-edge active).

Regulatory information

Maximum power and frequency specifications

Note The following maximum power and frequency values are for the ConnectCore 6UL system-on-module.

Maximum power	Frequencies
63.1 mW	13 overlapping channels each 22 MHz wide and spaced at 5 MHz. Centered at 2.412 to 2.472 MHz.
31.62 mW	165 overlapping channels each 22 or 40 MHz wide and spaced at 5 MHz. Centered at 5180 to 5825 MHz.

Europe and UK

CE mark

The ConnectCore 6UL SBC Pro is certified for use in several European countries. For information, visit www.digi.com/resources/certifications.

If the ConnectCore 6UL 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).

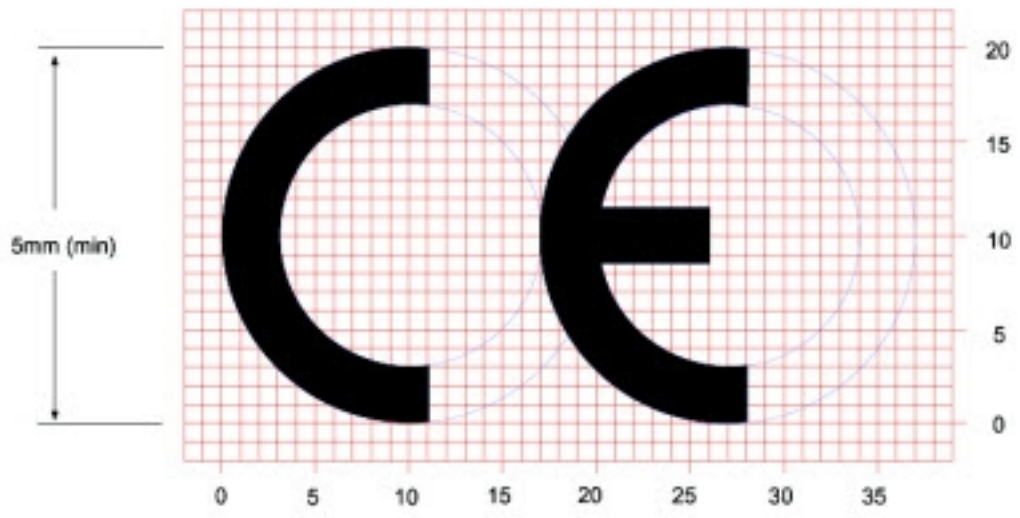
Furthermore, the manufacturer must maintain a copy of the ConnectCore 6UL SBC Pro user manual documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation requirements as specified in the user manual. If any of these specifications are exceeded in the final product, a submission must be made to a notified body for compliance testing to all required standards.

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 6UL 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.