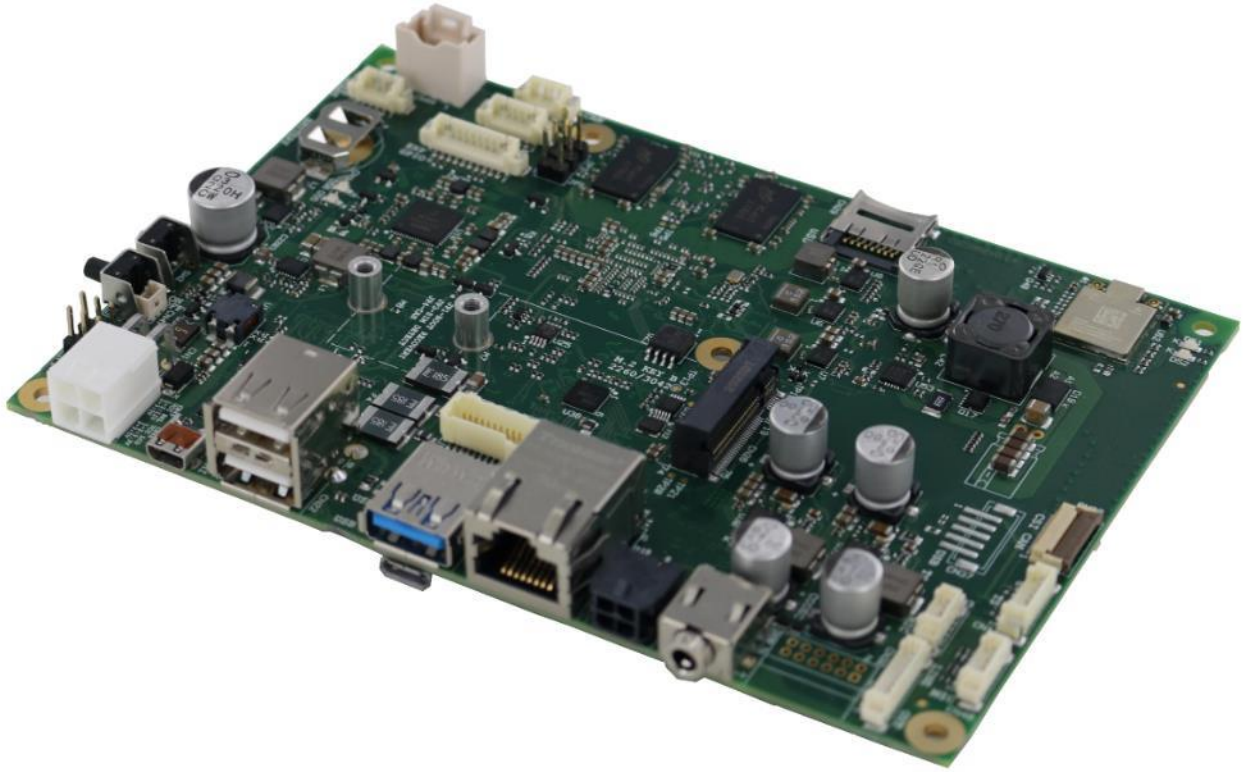
# SBC

## User Manual



# ALBION

Single Board Computer
with NXP i.MX 8M Applications Processors
in 3.5” form factor

SECO

www.seco.com

# REVISION HISTORY

| Revision | Date | Note | Ref |
|---|---|---|---|
| 1.0 | 27th January 2020 | First Official Release. | SB |
| 1.1 | 10th March 2021 | Second Official Release<br>- Changed Ethernet Connector CN3 part number (par.3.3.2)<br>- Board pictures updated to latest revision | AR |
| 1.2 | 21st May 2021 | Third Official Release<br>- Added FULL_CARD_PWR_OFF# signal on Connector CN26 (par. 3.3.10)<br>- Updated CN47 Connector p/n and pinout (par. 3.3.24)<br>- Added par. 3.3.25<br>- Added Safety Policy par. 1.7<br>- Updated technical specifications for temperatures (par. 2.2)<br>- Minor changes | AR |
| 1.3 | 10th December 2021 | Updated temperature range when uSD is present<br>Added admissible voltage by the LED string (par. 3.3.3) | SO |
| 1.4 | 27th April 2023 | Changed Boot Mode Selection Jumper serigraphic reference | SO |



Every effort has been made to ensure the accuracy of this manual. However, SECO S.p.A. accepts no responsibility for any inaccuracies, errors or omissions herein. SECO S.p.A. reserves the right to change precise specifications without prior notice to supply the best product possible.

For further information on this module or other SECO products, but also to get the required assistance for any and possible issues, please contact us using the dedicated web form available at http://www.seco.com (registration required).

Our team is ready to assist.

# INDEX

# Chapter 1.
# INTRODUCTION

- Warranty
- Information and assistance
- RMA number request
- Safety
- Electrostatic discharges
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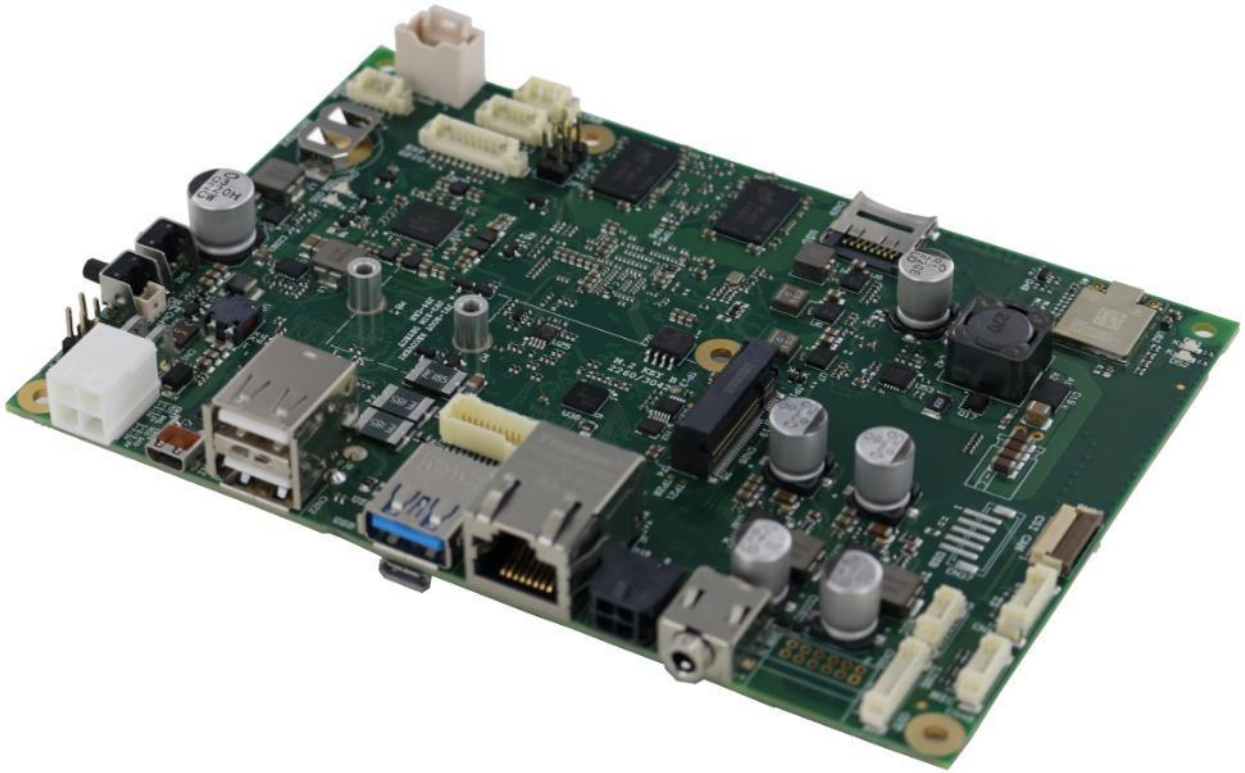
- Safety Policy
- Terminology and definitions
- Reference specifications



## 1.1 Warranty

This product is subject to the Italian Law Decree 24/2002, acting European Directive 1999/44/CE on matters of sale and warranties to consumers.

The warranty on this product lasts for 1 year.

Under the warranty period, the Supplier guarantees the buyer assistance and service for repairing, replacing or credit of the item, at the Supplier's own discretion.

Shipping costs that apply to non-conforming items or items that need replacement are to be paid by the customer.

Items cannot be returned unless previously authorized by the supplier.

The authorization is released after completing the specific form available on the web-site https://www.seco.com/it/support/online-rma.html (RMA Online). The RMA authorization number must be put both on the packaging and on the documents shipped with the items, which must include all the accessories in their original packaging, with no signs of damage to, or tampering with, any returned item.

The error analysis form identifying the fault type must be completed by the customer and has must accompany the returned item.

If any of the above-mentioned requirements for RMA is not satisfied, the item will be shipped back and the customer will have to pay any and all shipping costs.

Following a technical analysis, the supplier will verify if all the requirements, for which a warranty service applies, are met. If the warranty cannot be applied, the Supplier will calculate the minimum cost of this initial analysis on the item and the repair costs. Costs for replaced components will be calculated separately.

Warning!
All changes or modifications to the equipment not explicitly approved by SECO S.p.A. could impair the equipment's functionalities and could void the warranty

## 1.2 Information and assistance

What do I have to do if the product is faulty?

SECO S.p.A. offers the following services:

- SECO website: visit http://www.seco.com to receive the latest information on the product. In most of the cases it is possible to find useful information to solve the problem.
- SECO Sales Representative: the Sales Rep can help to determine the exact cause of the problem and search for the best solution.
- SECO Help-Desk: contact SECO Technical Assistance. A technician is at disposal to understand the exact origin of the problem and suggest the correct solution.

  E-mail: technical.service@seco.com

  Fax (+39) 0575 350210
- Repair center: it is possible to send the faulty product to the SECO Repair Centre. In this case, follow this procedure:
  - Returned items must be accompanied by an RMA Number. Items sent without the RMA number will be not accepted.
  - Returned items must be shipped in an appropriate package. SECO is not responsible for damages caused by accidental drop, improper usage, or customer neglect.

Note: Please have the following information before asking for technical assistance:

- Name and serial number of the product;
- Description of Customer's peripheral connections;
- Description of Customer's software (operative system, version, application software, etc.);
- A complete description of the problem;
- The exact words of every kind of error message encountered.

## 1.3 RMA number request

To request an RMA number, please visit SECO's web-site. On the home page, please select "CONTACT US" then "Online RMA" and follow the procedure described.

An RMA Number will be sent within 1 working day (only for on-line RMA requests).

## 1.4 Safety

The SBC-C20 board uses only extremely-low voltages.

While handling the board, please use extreme caution to avoid any kind of risk or damages to electronic components.

! Always switch the power off, and unplug the power supply unit, before handling the board and/or connecting cables or other boards.

Avoid using metallic components - like paper clips, screws and similar - near the board when connected to a power supply, to avoid short circuits due to unwanted contacts with other board components.

If the board has become wet, never connect it to any external power supply unit or battery.

Check carefully that all cables are correctly connected and that they are not damaged.

## 1.5 Electrostatic discharges

The SBC-C20 board, like any other electronic product, is an electrostatic sensitive device: high voltages caused by static electricity could damage some or all the devices and/or components on-board.

! Whenever handling an SBC-C20 board, ground yourself through an anti-static wrist strap. Placement of the board on an anti-static surface is also highly recommended.

## 1.6 RoHS compliance

The SBC-C20 board is designed using RoHS compliant components and is manufactured on a lead-free production line. It is therefore fully RoHS compliant.

## 1.7 Safety Policy

In order to meet the safety requirements of EN62368-1:2014 standard for Audio/Video, information and communication technology equipment, this product shall be:

- used inside a fire enclosure made of non-combustible material or V-1 material;
- used inside an enclosure provided with the symbol IEC 60417-5041(element 1a according to clause 9.5.2 of the IEC 62368-1) on the external part;
- installed inside an enclosure compliant with all applicable IEC 62368-1 requirements;

The manufacturer which includes this product in his end-user product shall:

- verify the compliance with B.2 and B.3 clauses of the EN62368-1 standard when the module works in its own final operating condition
- prescribe temperature and humidity range for operating, transport and storage conditions;
- prescribe to perform maintenance on the board only when it is off and has already cooled down;
- prescribe that the connections from or to the board have to be compliant to ES1 requirements;
- the board in its enclosure must be evaluated for temperature and airflow considerations.

## 1.8 Terminology and definitions

| | |
|---|---|
| API | Application Program Interface, a set of commands and functions that can be used by programmers for writing software for specific Operating Systems |
| CAN Bus | Controller Area network, a protocol designed for in-vehicle communication |
| DDR | Double Data Rate, a typology of memory devices which transfer data both on the rising and on the falling edge of the clock |
| DDR3L | DDR, 3rd generation, Low Voltage |
| eDP | embedded Display Port |
| GbE | Gigabit Ethernet |
| Gbps | Gigabits per second |
| GND | Ground |
| GPI/O | General purpose Input/Output |
| GPU | Graphics Processing Unit |
| I2C Bus | Inter-Integrated Circuit Bus, a simple serial bus consisting only of data and clock line, with multi-master capability |
| LVDS | Low Voltage Differential Signaling, a standard for transferring data at very high speed using inexpensive twisted pairs copper cables, usually used for video applications |
| MAC | Medium Access Controller, the hardware implementing the Data Link Layer of ISO/OSI-7 model for communication systems |
| Mbps | Megabits per second |
| MMC/eMMC | MultiMedia Card / embedded MMC, a type of memory card, having the same interface of SD. The eMMC are the embedded version of the MMC. They are devices that incorporate both the memory controller and the flash memories on a single BGA chip |
| N.A. | Not Applicable |
| N.C. | Not Connected |
| OpenGL | Open Graphics Library, an Open Source API dedicated to 2D and 3D graphics |
| OpenVG | Open Vector Graphics, an Open Source API dedicated to hardware accelerated 2D vector graphics |
| OS | Operating System |
| OTG | On-the-Go, a specification that allows to USB devices to act indifferently as Host or as a Client, depending on the device connected to the port |
| PHY | Abbreviation of Physical, it is the device implementing the Physical Layer of ISO/OSI-7 model for communication systems |
| PSU | Power Supply Unit |
| PWM | Pulse Width Modulation |
| PWR | Power |

| | |
|---|---|
| RGMII | Reduced Gigabit Media Independent Interface, a particular interface defining the communication between an Ethernet MAC and a PHY |
| SD | Secure Digital, a memory card type |
| SM Bus | System Management Bus, a subset of the I2C bus dedicated to communication with devices for system management, like a smart battery and other power supply-related devices |
| SPI | Serial Peripheral Interface, a 4-Wire synchronous full-duplex serial interface which contemplates a master and one or more slaves, individually enabled through a Chip Select line |
| TBM | To be measured |
| TTL | Transistor-transistor Logic |
| USB | Universal Serial Bus |
| uSDHC | Ultra Secure Digital Host Controller |
| V_REF | Voltage reference Pin |

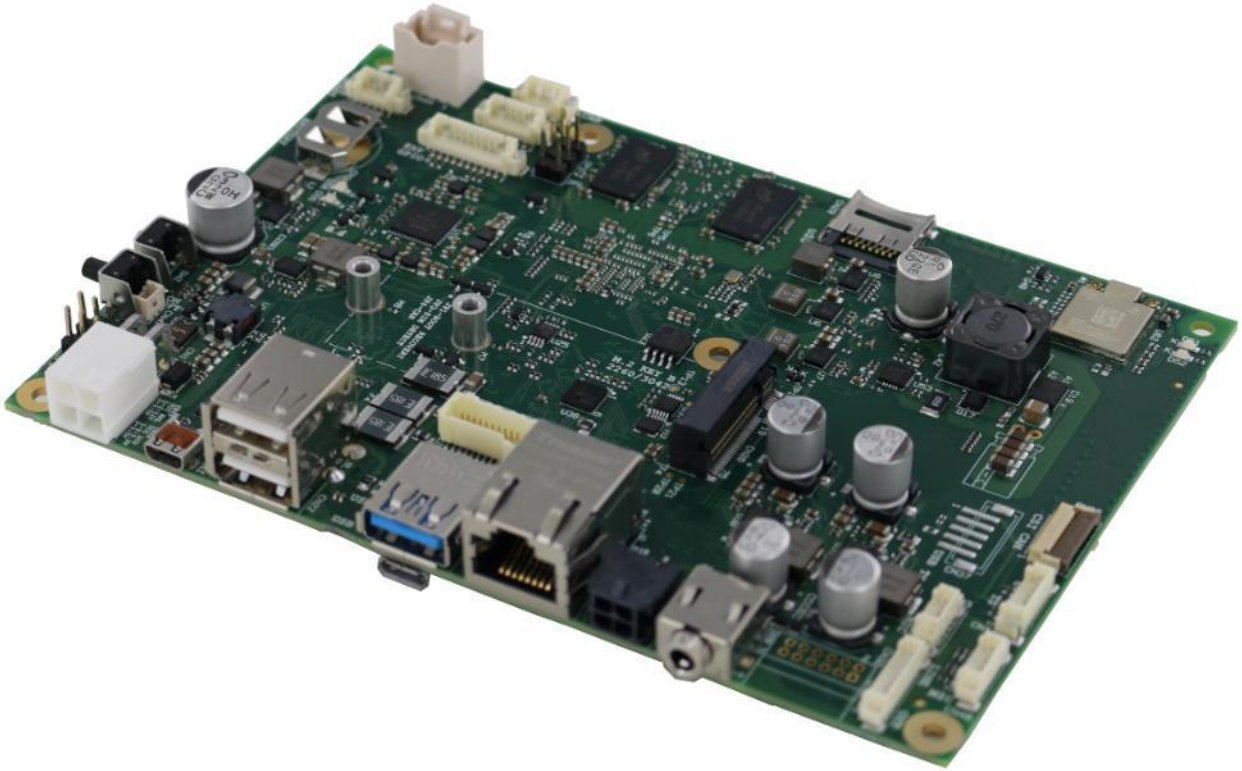
## 1.9 Reference specifications

Here below it is a list of applicable industry specifications and reference documents.

| Reference | Link |
|---|---|
| ACPI | https://uefi.org/specifications |
| CAN Bus | http://esd.cs.ucr.edu/webres/can20.pdf |
| Gigabit Ethernet | https://standards.ieee.org/standard/802_3-2018.html |
| I2C | https://www.nxp.com/docs/en/user-guide/UM10204.pdf |
| LVDS | http://www.ti.com/ww/en/analog/interface/lvds.shtml<br>http://www.ti.com/lit/ug/snla187/snla187.pdf |
| M.2 Specifications | https://pcisig.com/specifications/pciexpress/M.2_Specification/ |
| MMC/eMMC | https://www.jedec.org/committees/jc-64 |
| OpenGL | http://www.opengl.org |
| OpenVG | http://www.khronos.org/openvg |
| PCI Express | http://www.pcisig.com/specifications/pciexpress |
| SD Card Association | https://www.sdcard.org |
| SM Bus | http://www.smbus.org/specs |
| USB 2.0 and USB OTG | https://www.usb.org/sites/default/files/usb_20_20190524.zip |
| NXP i.MX 8M processor | https://www.nxp.com/products/processors-and-microcontrollers/arm-processors/i.mx-applications-processors/i.mx-8-processors/i.mx-8m-family-armcortex-a53-cortex-m4-audio-voice-video:i.MX8M |

# Chapter 2.
# OVERVIEW

- Introduction
- Technical specifications
- Electrical specifications
- Mechanical specifications
- Block diagram



## 2.1 Introduction

ALBION is a Single Board Computer, measuring just 101.6 x 147 mm (4" x 5,78") based on embedded NXP i.MX 8M Family, featuring multicore processing (Dual or Quad ARM Cortex®-A53 cores + general purpose Cortex®-M4 processor).

Graphics features of the board are managed directly by NXP i.MX8M processor, which integrate a Vivante GC7000Lite GPU, supporting OpenGL® ES 1.1 / 2.0 / 3.0 / 3.1, Open CL 1.2 and Vulkan.

The board is completed with up to 2GB DDR3L directly soldered on board, and one eMMC Flash Drive, directly accessible like any standard Drive, with up to 32GB of capacity. Mass storage capabilities are completed by a microSD Card slot.

The processor offers an RGMII interface which, through a dedicated Ethernet Transceiver, allows the implementation of a Gigabit Ethernet interface.

The communication / networking capabilities of the board are completed by an M.2 Key B Slot, which allows plugging M.2 Modem modules with USB or PCI-e interface and by an optional WiFi ac/a/b/g/n + BT 5.0 combo embedded module.

The M.2 Key B Slot and the embedded modem can rely on an on-board microSIM slot.

ALBION offers an USB 3.0 Standard Type-A connector (related USB 2.0 interface is also shared on a micro-AB connector), two USB 2.0 standard Type-A connectors and an internal USB 2.0 header (this connector shares one of the two USB 2.0 interfaces available on the dual type-A connector).

The audio functionalities of this board are realised by an I2S audio codec, which manages Speaker + microphone + earphone interfaces on an internal pin header, and Line out and Mic In interfaces on a combo TRRS audio jack. An optional 10W per channel audio amplifier is also optionally available.

Please refer to following chapter for a complete list of all peripherals integrated and characteristics. Not all combinations of these features are offered simultaneously; please visit SECO's website for a description of standard configuration modules offered. Configurations different from the standard offered must be evaluated singularly; please contact a SECO's sales representative / distributor for this.

## 2.2 Technical specifications

Processors

NXP i.MX 8M Family of processors, based on ARM® Cortex®-A53 MPCore + Cortex-M4 core platform:
i.MX 8M Quad, Quad A53-core up to 1.5GHz, with GPU and VPU
i.MX 8M QuadLite, Quad A53-core up to 1.5GHz, with GPU only
i.MX 8M Dual, Dual A53-core up to 1.5GHz, with GPU and VPU

Memory

32-bit soldered down DDR3L memory, up to 2GB

Graphics

Vivante GC7000Lite GPU supporting OpenGL ES 1.1 / 2.0 / 3.0 / 3.1, Open CL 1.2 and Vulkan
Dedicated VPU (not for QuadLite), supporting 4Kp60 HEVC/H.265 main and main 10 decoder, 4Kp60 VP9 decoder, 4Kp30 AVC/H.264 decoder, 1080p60 MPEG-2, MPEG-4p2, VC-1, VP8, RV9, AVS, MJPEG, H.263 decoder
Dual Display support

Video Interfaces

embedded Display Port 1.4 connector (optionally switched with HDMI)
Optional LVDS interface
Optional HDMI 1.4 / 2.0a interface (switched with eDP)
4-lane MIPI_CSI Camera interface

Video Resolution

HDMI, eDP: up to 4096x2160
LVDS: up to 1920x1080

Mass Storage

microSD card slot
Optional eMMC drive on-board, up to 32GB

Networking

1x Gigabit Ethernet port
Optional WiFi (802.11 ac / a / b / g / n) +BT 5.0 module + antenna on-board
M.2 Socket 2 Key B 2260/3042 Slot for WWAN modules
microSIM slot soldered on-board for the Modem

USB

Up to 2 x USB 2.0 Type-A sockets
Optional USB 2.0 internal connector (excludes one type-A socket)
USB Device on USB 2.0 micro-AB connector (interface shared with USB 3.0 port)
USB 3.0 Type-A connector (interface shared with USB 2.0 micro-AB)

Audio

I2S Audio Codec
Speaker + Microphone + Earphone interfaces on internal pin headers
Line Out + Mic In combo TRRS audio jack
Optional Speaker connector, 10W per channel amplified

Serial Ports

RS-232 Serial port connector
Debug UART on internal pin header
CAN Port

Other interfaces

microSIM slot for M.2 modems
SPI interface
I2C Touch Screen dedicated connector
8 x GPI/Os connector

Power supply voltage:

+12$V_{DC}$

Operating temperature**:

0°C ÷ +60°C (commercial version)

-40°C ÷ +85°C (industrial version, limited to -30°C ÷ +85°C when optional WiFi + BT module is mounted. Other limits depend on presence of sd-card/SDIO bridge and / or Push buttons)

Dimensions: 101.6 x 147 mm (4” x 5.78”).

Supported Operating Systems:

Linux
Android

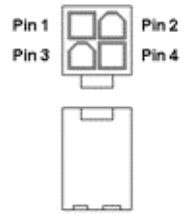
! *** Measured at any point of SECO standard heatspreader for this product, during any and all times (including start-up). Actual temperature will widely depend on application, enclosure and/or environment. Upon customer to consider application-specific cooling solutions for the final system to keep the heatspreader temperature in the range indicated.*

*Please also check paragraph 4.1*

## 2.3 Electrical specifications

This board needs to be supplied only with an external 12$V_{DC}$ ± 10% power supply, with a minimal 20W power rating (board power consumption by itself is around 5W, more power is required for the possible attached devices).

This voltage can be supplied through a Right-angle connector type Molex Mini-Fit Jr, p/n 39-30-0040 or equivalent, with the pinout indicated in the table below.




| Power In Connector – CN1 | | | |
|---|---|---|---|
| Pin | Signal | Pin | Signal |
| 1 | GND | 3 | VIN_SYS |
| 2 | GND | 4 | VIN_SYS |

### 2.3.1 RTC Battery

The board can be equipped with an optional low-power Real Time Clock embedded on the module (which is a NXP PCF2123).

If the board is not equipped with the optional rechargeable battery, then it will be available a soldered horizontal 3V coin cell lithium battery to supply the RTC.

The battery used is a not-rechargeable CR1225 Lithium coin-cell battery, with a nominal capacity of 48mAh.

In case of exhaustion, the battery should only be replaced with devices of the same type. Always check the orientation before inserting and make sure that they are aligned correctly and are not damaged or leaking.

Never allow the batteries to become short-circuited during handling.

! CAUTION: handling batteries incorrectly or replacing with not-approved devices may present a risk of fire or explosion.

Batteries supplied with this product are compliant to requirements of European Directive 2006/66/EC regarding batteries and accumulators. When putting out of order product, remove the batteries from the board in order to collect and dispose them according to the requirement of the same European Directive above mentioned. Even when replacing the batteries, the disposal has to be made according to these requirements.

### 2.3.2 Power rails

In all the tables contained in this manual, Power rails are named with the following meaning:

VIN_SYS: +12$V_{DC}$ voltage directly coming from the Power Supply connectors CN1

+3P3V_ALW: +3.3V Always voltage, derived from VIN_SYS voltage

+5V_ALW: +5V Always voltage, derived from VIN_SYS voltage

$V_{RTC}$: +3V external voltage for supplying the RTC clock

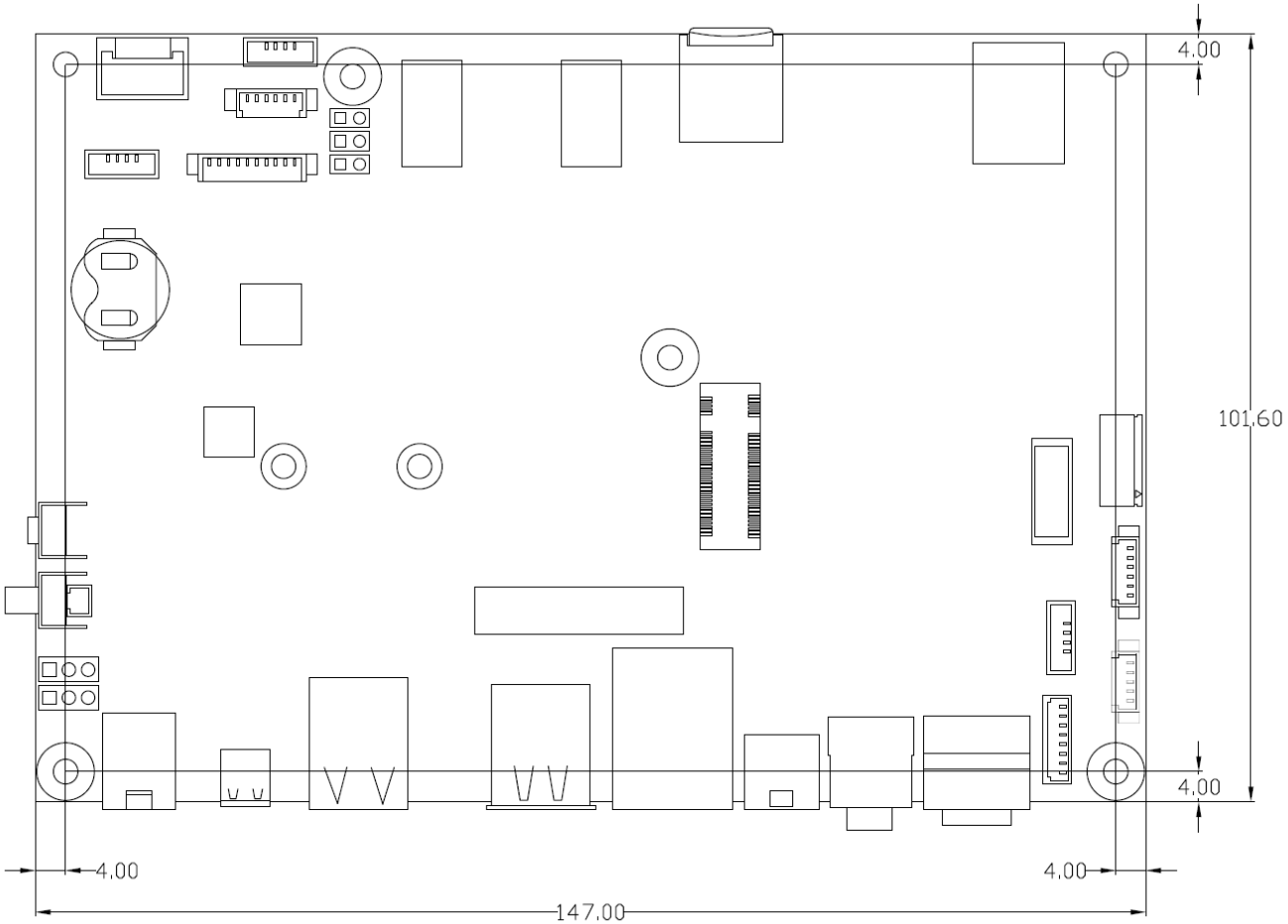
VDD_3P3V: +3.3V switched voltage directly derived from +3P3V_ALW

VDD_5V: +5V switched voltage directly derived from +5V_ALW

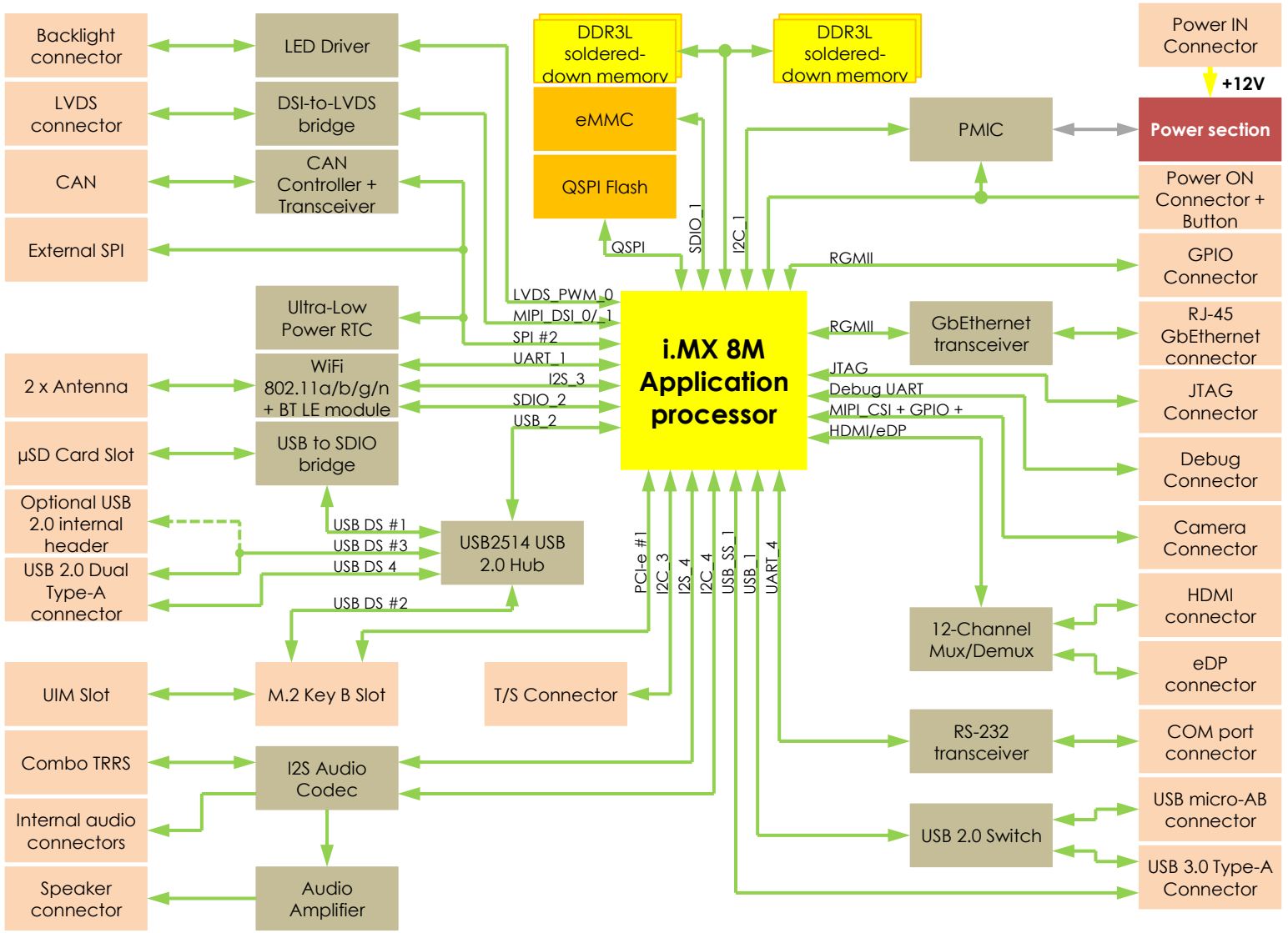
## 2.4 Mechanical specifications

Board dimensions are 101.6 x 147 mm (4” x 5.78”).

The printed circuit of the board is made of ten layers, some of them are ground planes, for disturbance rejection.

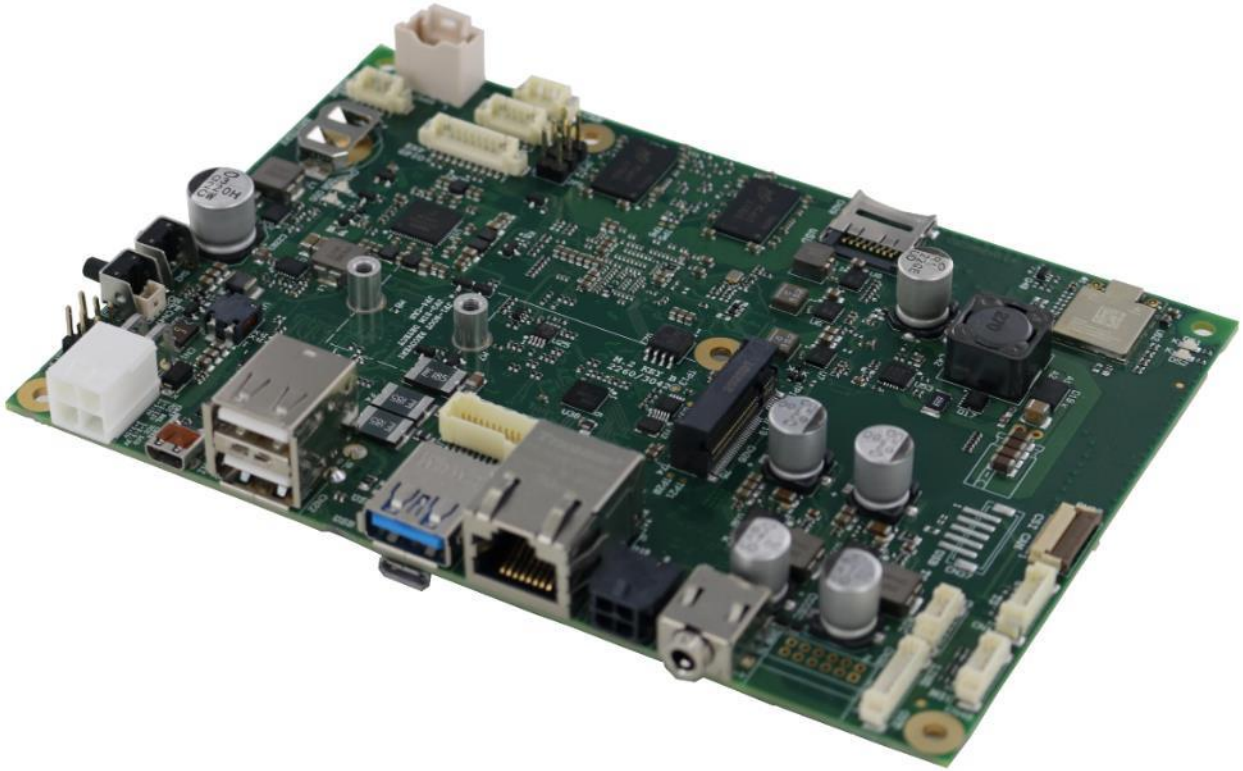


## 2.5 Block diagram



# Chapter 3.
# CONNECTORS

- Introduction
- Connectors overview
- Connectors description

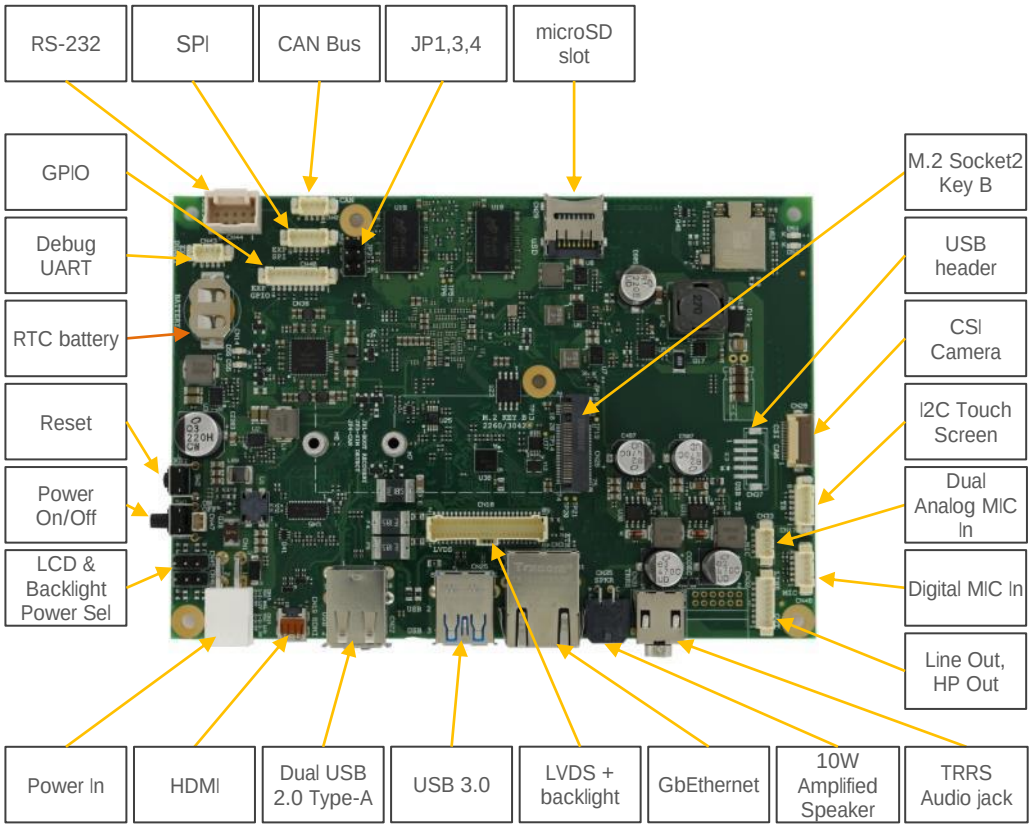


# 3.1 Introduction

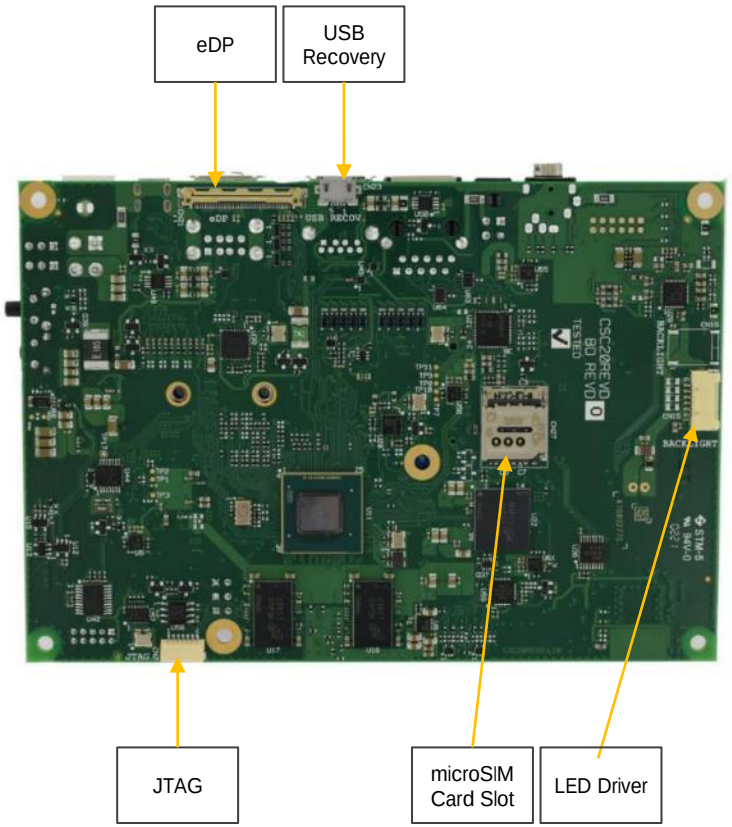
On this board, there are several connectors located on the upper plane. Standard connectors are placed on the same side of PCB, so that it is possible to place them on a panel of an eventual enclosure.

> **!** Please be aware that, depending on the configuration purchased, the appearance of the board can be significantly different from the following pictures.

**TOP SIDE**




**BOTTOM SIDE**



## 3.2 Connectors overview

| Name | Description | Name | Description |
|---|---|---|---|
| CN1 | Power In Connector | CN28 | CSI Camera connector |
| CN2 | JTAG connector | CN29 | microSD card Slot |
| CN3 | GbEthernet RJ-45 connector | CN31 | TRRS Audio Jack |
| CN14 | Coin Cell battery holder | CN32 | Line Out, HP Out Connector |
| CN15 | LED Driver Connector | CN33 | Dual Analog Mic In Connector |
| CN17 | I2C Touch Screen Connector | CN35 | Optional 10W Amplified Speaker Out Connector |
| CN18 | LVDS + backlight connector | CN37 | Optional USB internal header |
| CN19 | HDMI connector | CN38 | GPIO Connector |
| CN21 | eDP connector | CN40 | SPI Connector |
| CN22 | Dual USB 2.0 Type-A Connector | CN42 | CAN Bus Connector |
| CN23 | USB Recovery | CN43 | Debug UART Connector |
| CN25 | USB 3.0 Type-A Slot | CN44 | RS-232 Connector |
| CN26 | M.2 2260/3042 Socket 2 Key B Slot | CN47 | Power On/Off connector |
| CN27 | MicroSIM Card Slot | CN48 | Digital Mic In connector |

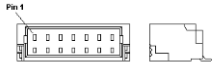
### 3.2.1 Jumper List

| Name | Description | Name | Description |
|---|---|---|---|
| CN45 | Backlight Power selector | JP3 | SIM Detect |
| CN46 | LCD Power selector | JP4 | CAN Bus Termination |
| JP1 | Boot Mode | | |

# 3.3 Connectors description

## 3.3.1 JTAG Connector

| JTAG Connector – CN2 | | | |
|---|---|---|---|
| Pin | Signal | Pin | Signal |
| 1 | VDD 3P3V | 5 | JTAG_TDO |
| 2 | JTAG_TCK | 6 | JTAG_TRST_B |
| 3 | JTAG_TMS | 7 | GND |
| 4 | JTAG_TDI | | |



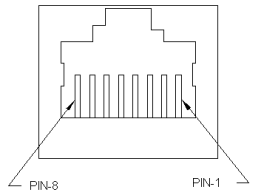
SBCC20 board is equipped with a connector reporting the JTAG signals coming from the i.MX8 processor, which can be useful for software debugging and tracing in development phase. This connector is a 7-pin single row male connector, type JST P/N SM07B-SRSS-TB or equivalent. Mating connector: JST 07SR-3S receptacle with JST SSH-003T-P0.2-H female crimp terminals.

All these JTAG signals are directly connected to i.MX8 pins with same name. Please refer to i.MX8 processor's documentation for a description of the signals and their usage

## 3.3.2 Ethernet Connector

On board there is an Ethernet Interface 10Base-T/100Base-Tx/1000Base-Tx Transceivers interfaced to NXP processor's eNET interface.

| GbEthernet RJ-45 connector – CN3 | | | |
|---|---|---|---|
| Pin | Signal | Pin | Signal |
| 1 | ETH_MDI0+ | 5 | ETH_MDI2- |
| 2 | ETH_MDI0- | 6 | ETH_MDI1- |
| 3 | ETH_MDI1+ | 7 | ETH_MDI3+ |
| 4 | ETH_MDI2+ | 8 | ETH_MDI3- |




Connector is type TRXCOM p/n TRJG16797CNL or equivalent, with 2kV decoupling capacitor, 100 Ohm impedance.

This interface is compatible both with Gigabit Ethernet (1000Mbps) and with Fast Ethernet (10/100Mbps) Networks. It will configure automatically to work with the existing network.

Please be aware that they will work in Gigabit mode only in case that they are connected to Gigabit Ethernet switches/hubs/routers. For the connection, cables category Cat5e or better are required. Cables category Cat6 are recommended for noise reduction and EMC compatibility issues, especially when the length of the cable is significant.

ETH_MDI0+/ETH_MDI0-: Ethernet Controller Media Dependent Interface (MDI) I/O differential pair #0. It is the first differential pair in Gigabit Ethernet mode, and the Transmit differential pair in 10/100 Mbps modes.

ETH _MDI1+/ ETH _MDI1-: Ethernet Controller Media Dependent Interface (MDI) I/O differential pair #1. It is the second differential pair in Gigabit Ethernet mode, and the Receive differential pair in 10/100 Mbps modes.

ETH _MDI2+/ ETH _MDI2-: Ethernet Controller Media Dependent Interface (MDI) I/O differential pair #2. It is the third differential pair in Gigabit Ethernet mode; it is not used in 10/100Mbps modes.

ETH _MDI3+/ ETH _MDI3-: Ethernet Controller Media Dependent Interface (MDI) I/O differential pair #3. It is the fourth differential pair in Gigabit Ethernet mode; it is not used in 10/100Mbps modes.

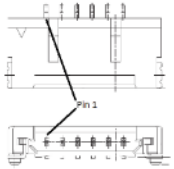
### 3.3.3 LED Driver connector

The SoC on this board allow the direct control of LCD LED units. This functionality is allowed by WLED Controller p/n MP3385GR-Z driven by I2C interface of iMX8. This functionality is ensured by connector CN15, which is a 6-pin FFC/FPC connector, type HR P/N A1253WR-SF-06P, whose pinout is available in the table.

**LED Driver connector– CN15**

| Pin | Signal |
|---|---|
| 1 | V_LED+ |
| 2 | V_LED+ |
| 3 | V_LED1- |
| 4 | V_LED2- |
| 5 | V_LED3- |
| 6 | V_LED4- |

Signal description:




V_LED+: Output voltage for LED strings. Connect the LED strings anode (common node) to this signal; maximum admissible voltage of the LED string will be +60V.

V_LED1-: LED string 1 current input. V_LED1- is the open-drain output of an internal dimming control switch. Connect the LED string 1 cathode to this pin.

V_LED2-: LED string 2 current input. V_LED2- is the open-drain output of an internal dimming control switch. Connect the LED string 2 cathode to this pin.

V_LED3-: LED string 3 current input. V_LED3- is the open-drain output of an internal dimming control switch. Connect the LED string 3 cathode to this pin.

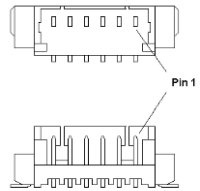
V_LED4-: LED string 4 current input. V_LED4- is the open-drain output of an internal dimming control switch. Connect the LED string 4 cathode to this pin.

### 3.3.4 I2C Touch Screen connector

The SoC on this board allow the control of a display touch screen, functionality integrated and controlled directly from iMX8M processor.

**I2C T/S connector– CN17**

| Pin | Signal |
|---|---|
| 1 | VDD_3P3V |
| 2 | TOUCH_SCREEN_IRQ |
| 3 | TOUCH_SCREEN_SDA |
| 4 | TOUCH_SCREEN_SCL |
| 5 | TOUCH_SCREEN_RST |
| 6 | GND |




The connector is a 6-pin MOLEX p/n 53398-0671 or equivalent, with pinout shown in the table on the left. Mating connector: MOLEX 51021-0600 receptacle with MOLEX 50079-8000 female crimp terminals.

Signal description:

TOUCH_SCREEN_IRQ: VDD_3P3V electrical level input with a 10k pull-up resistor. This signal can be used to serve the interrupt request of an eventual external Touch Screen connected to the dedicated I2C interface.

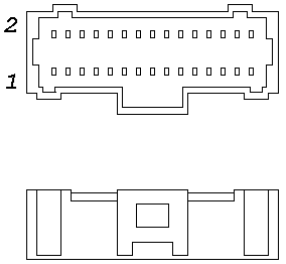
TOUCH_SCREEN_SDA: I2C Bus data line. Bidirectional signal, electrical level VDD_3P3V with a 2K2Ω pull-up resistor. It is managed by I2C channel #3 of iMX8M chipset.

TOUCH_SCREEN_SCL: I2C Bus clock line. Output signal, electrical level VDD_3P3V with a 2K2Ω pull-up resistor. It is managed by I2C channel #3 of iMX8M chipset.

TOUCH_SCREEN_RST: VDD_3P3V electrical level output with a 10KΩ pull-down resistor. This signal can be used to drive a reset of an eventual external Touch Screen connected to the dedicated I2C interface.

### 3.3.5 LVDS + backlight connector

| LVDS + backlight connector – CN18 | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 2 | +12V BKL2 | 1 | +12V BKL1 |
| 4 | VCC BKL SW | 3 | VCC_LCD_SW |
| 6 | VCC BKL SW | 5 | DISPLAY_ANA_BKL |
| 8 | GND | 7 | GND |
| 10 | LVDS0_TX0+ | 9 | LVDS0_TX0- |
| 12 | GND | 11 | GND |
| 14 | LVDS0_TX1+ | 13 | LVDS0_TX1- |
| 16 | GND | 15 | GND |
| 18 | LVDS0_TX2+ | 17 | LVDS0_TX2- |
| 20 | GND | 19 | GND |
| 22 | LVDS0_TX3+ | 21 | LVDS0_TX3- |
| 24 | GND | 23 | GND |
| 26 | LVDS0_CLK+ | 25 | LVDS0_CLK- |
| 28 | DISPLAY_BKL_CTRL | 27 | GND |
| 30 | LVDS_PANEL_ON | 29 | DISPLAY_BKL_ON |
| 32 | GND | 31 | GND |
| 34 | LVDS1_TX0+ | 33 | LVDS1_TX0- |
| 36 | GND | 35 | GND |
| 38 | LVDS1_TX1+ | 37 | LVDS1_TX1- |
| 40 | GND | 39 | GND |
| 42 | LVDS1_TX2+ | 41 | LVDS1_TX2- |
| 44 | GND | 43 | GND |
| 46 | LVDS1_TX3+ | 45 | LVDS1_TX3- |
| 48 | GND | 47 | GND |
| 50 | LVDS1_CLK+ | 49 | LVDS1_CLK+ |




This board can be interfaced to LCD displays using its LVDS interface, which allows the connection of displays with a colour depth of 18 or 24 bit, single or dual channel.

For the connection, a connector type HR A1014WV-S-2X25P or equivalent (2 x 25p, male, straight, P1, low profile, polarized) is provided, with the pin-out shown in the table below.

Mating connector: HR A1014H -2X25P with HR A1014-T female crimp terminals.

Alternative mating connector, MOLEX 501189-5010 with crimp terminals series 501334.

On the same connectors, are also implemented signals for direct driving of display's backlight: power voltages for LCD and backlight (VCC_BKL_SW and VCC_LCD_SW) and control signals (Backlight enable signal, DISPLAY_BKL_ON, LCD enable signal, LVDS_PANEL_ON, PWM and Analog Backlight Brightness Control signal, DISPLAY_BKL_CTRL and DISPLAY_ANA_BKL).

When building a cable for connection of LVDS displays, please take care of twist as tight as possible differential pairs' signal wires, in order to reduce EMI interferences. Shielded cables are also recommended. Here following the signals related to LVDS management:

LVDS0_TX0+/LVDS0_TX0-: LVDS Channel #0 differential data pair #0.

LVDS0_TX1+/LVDS0_TX1-: LVDS Channel #0 differential data pair #1.

LVDS0_TX2+/LVDS0_TX2-: LVDS Channel #0 differential data pair #2.

LVDS0_TX3+/LVDS0_TX3-: LVDS Channel #0 differential data pair #3.

LVDS0_CLK+/LVDS0_CLK-: LVDS Channel #0 differential Clock.

LVDS1_TX0+/LVDS1_TX0-: LVDS Channel #1 differential data pair #0.

LVDS1_TX1+/LVDS1_TX1-: LVDS Channel #1 differential data pair #1.

LVDS1_TX2+/LVDS1_TX2-: LVDS Channel #1 differential data pair #2.

LVDS1_TX3+/LVDS1_TX3-: LVDS Channel #1 differential data pair #3.

LVDS1_CLK+/LVDS1_CLK-: LVDS Channel #1 differential Clock.

12V_BKL1, 12V_BKLT2: 12V power rails, directly connected to Input Voltage VIN_SYS, fuse protected (max 1.85A per rail).

VCC_BKL_SW: SW enabled Backlight power rail. Please check par. 3.3.23

VCC_LCD_SW: SW enabled LCD Power rail. Please check par. 3.3.23

DISPLAY_ANA_BKL: Backlight analog dimming signal, electrical level VCC_LCD_SW with a10kΩ pull-up resistor.

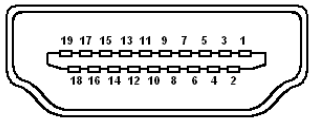
DISPLAY_BKL_CTRL: this signal can be used to adjust the backlight brightness in displays supporting Pulse Width Modulated (PWM) regulations (electrical level VCC_LCD_SW with a10kΩ pull-up resistor).

LVDS_PANEL_ON: LCD Panel enable signal, electrical level to VCC_LCD_SW with 10kΩ pull-up resistor

DISPLAY_BKL_ON: Backlight enable signal, electrical level to VCC_LCD_SW with 10kΩ pull-up resistor

### 3.3.6 HDMI connector

| HDMI Connector – CN19 | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | HPD | 2 | ---- |
| 3 | TMDS_LANE2+ | 4 | GND |
| 5 | TMDS_LANE2- | 6 | TMDS_LANE1+ |
| 7 | GND | 8 | TMDS_LANE1- |
| 9 | TMDS_LANE0+ | 10 | GND |
| 11 | TMDS_LANE0- | 12 | TMDS_CLK+ |
| 13 | GND | 14 | TMDS_CLK- |
| 15 | CEC | 16 | GND |
| 17 | SCL | 18 | SDA |
| 19 | $+5V_{HDMI}$ | | |




In addition to LVDS interface, NXP i.MX 8M processor also has an embedded HDMI Tx module, which provides a HDMI standard interface for HDMI1.4 / 2.0a compliant displays. This interface is multiplexed with an eDP interface (par 3.3.7).

For this reason, on this board there is the possibility of connecting directly one HDMI display, using a certified micro-HDMI connector (HDMI type D), type FCI p/n 10118242-001RLF.

Signals involved in HDMI management are the following:

TMDS_CLK+/TMDS_CLK-: TMDS differential Clock.

TMDS_LANE0+/TMDS_LANE0-: TMDS differential pair #0

TMDS_LANE1+/TMDS_LANE1-: TMDS differential pair #1

TMDS_LANE2+/TMDS_LANE2-: TMDS differential pair #2

SDA: DDC Data line for HDMI panel. Bidirectional signal, electrical level VDD_5V with a 1k5Ω pull-up resistor.

SCL: DDC Clock line for HDMI panel. Output signal, electrical level VDD_5V with a 1k5Ω pull-up resistor.

CEC: HDMI Consumer Electronics Control (CEC) Line. Bidirectional signal, electrical level +VDD_3P3V with a 27kΩ pull-up resistor.

HPD: Hot Plug Detect Input signal. VDD_3P3V electrical level signal with 1MΩ pull-down resistor.

$+5V_{HDMI}$ : Power voltage reference for HDMI, directly derived from VDD_5V.

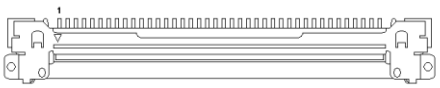
For ESD protection, on all data and voltage lines are placed clamping diodes for voltage transient suppression.

Always use HDMI-certified cables for the connection between the board and the HDMI display; a category 2 (High-Speed) cable is recommended for higher resolutions, category 1 cables can be used for 720p resolution.

### 3.3.7 eDP Connector

| eDP connector – CN21 |
|---|

| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | --- | 21 | VCC_LCD_SW |
| 2 | VCC_BKL_SW | 22 | VCC_LCD_SW |
| 3 | VCC_BKL_SW | 23 | VCC_LCD_SW |
| 4 | VCC_BKL_SW | 24 | GND |
| 5 | VCC_BKL_SW | 25 | eDP_AUX_N |
| 6 | --- | 26 | eDP_AUX_P |
| 7 | --- | 27 | GND |
| 8 | DISPLAY_BKL_CTRL | 28 | eDP_ML0P |
| 9 | DISPLAY_BKL_ON | 29 | eDP_ML0N |
| 10 | GND | 30 | GND |
| 11 | GND | 31 | eDP_ML1P |
| 12 | GND | 32 | eDP_ML1N |
| 13 | GND | 33 | GND |
| 14 | eDP_HPD | 34 | eDP_ML2P |
| 15 | GND | 35 | eDP_ML2N |
| 16 | GND | 36 | GND |
| 17 | GND | 37 | eDP_ML3P |
| 18 | GND | 38 | eDP_ML3N |
| 19 | --- | 39 | GND |
| 20 | VCC_LCD_SW | 40 | --- |



This board offers a dedicated embedded Display Port interface.

For the connection of this kind of displays, on-board there is a VESA® certified connectors for embedded Display Port interface, type STARCONN p/n 300E40-0110RA-G3 or equivalent (microcoaxial cable connector, 0.5mm pitch, 40 positions). This interface is multiplexed with the HDMI interface (par 3.3.6).

On this connector, VCC_BKL_SW and VCC_LCD_SW are the software-enabled voltage rails that can be used to supply the LCD and related Backlight Unit.

The LCD software-driven voltage, i.e. signal VCC_LCD_SW, can be manually configured to be connected to VDD_3P3V or +5V_ALW. Please check par. 3.3.23 for details.

Instead, the backlight software-driven voltage, i.e. signal VCC_BKL_SW, can be factory regulated regulated to be connected to +5V_ALW or VIN_SYS

These are factory configurations, please take care of specifying which is the configuration needed for VCC_BKL_SW voltage rail.

Here following the signals involved in eDP management:

eDP_ML0P/eDP_ML0N : embedded DP differential data pair #0.

eDP_ML1P/eDP_ML1N : embedded DP differential data pair #1.

eDP_ML2P/eDP_ML2N : embedded DP differential data pair #2.

eDP_ML3P/eDP_ML3N : embedded DP differential data pair #3.

eDP_AUXN/eDP_AUXP: embedded DP auxiliary channel differential data pair.

eDP_HPD: embedded DP Hot Plug Detect. +VDD_3P3V electrical level signal.

DISPLAY_BKL_CTRL: this signal can be used to adjust the backlight brightness in displays supporting Pulse Width Modulated (PWM) regulations (electrical level VCC_LCD_SW with a10kΩ pull-up resistor).

DISPLAY_BKL_ON: Backlight enable signal, electrical level to VCC_LCD_SW with 10kΩ pull-up resistor

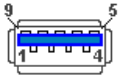
### 3.3.8 USB ports

The i.MX8M processor offers totally 2 USB interfaces, which can be expanded by using an optional SMSC USB2514 USB 2.0 Hi-Speed Hub Controller.

**USB 3.0 port Type-A connector – CN25**

| Pin | Signal |
|---|---|
| 1 | $+5V_{USB1}$ |
| 2 | USB_H1- |
| 3 | USB_H1+ |
| 4 | GND |
| 5 | USB_SSRX1- |
| 6 | USB_SSRX1+ |
| 7 | GND |
| 8 | USB_SSTX1- |
| 9 | USB_SSTX1+ |

The first USB port is connected directly a standard USB 3.0 type-A connector, described in the table on the left. This interface is mutually exclusive with




Signal description of this port:

USB_H1+/USB_H1-: USB 2.0 Host Port #1 differential pair;

USB_SSRX1+/USB_SSRX1-: USB Super Speed Port #1 receive differential pair;

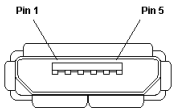
USB_SSTX1+/USB_SSTX1-: USB Super Speed Port #1 transmit differential pair;

Common mode chokes are placed on all USB differential pairs for EMI compliance. For ESD protection, on all data and voltage lines are placed clamping diodes for voltage transient suppression.

**USB recovery connector – CN23**

| Pin | Signal |
|---|---|
| 1 | USB_VBUS_RECOVERY |
| 2 | USB_D1- |
| 3 | USB_D1+ |
| 4 | --- |
| 5 | GND |

The USB 2.0 port available on USB 3.0 connector can be switched to a standard micro-AB connector, described in the table on the left. This connector must be used only for recovery purposes.




Working of this port is fixed in client mode.

When a microB plug is connected to CN23, then the external voltage provided on pin#1 will force automatically the switching of the USB 2.0 port to connector CN23.

In any case, the switching of the USB port is controlled via a 2-way jumper, JP1, which can be used to force i.MX8M processor in recovery mode. For normal working of the board, this jumper must not be inserted.


Signal description of this port:

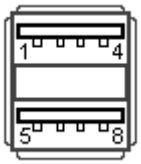
USB_D1+/USB_D1-: USB Device Port #1 differential pair.

USB_VBUS_RECOVERY: Recovery USB voltage rail input.

The second USB native port is carried to a Microchip USB2514 USB 2.0 Hub, factory optional, which can make available four further USB 2.0 Host ports .

| Dual USB 2.0 type A – CN22 | | | |
|---|---|---|---|
| Pin | Signal | Pin | Signal |
| 1 | $+5V_{USB3}$ | 5 | $+5V_{USB4}$ |
| 2 | USB_P3- | 6 | USB_P4- |
| 3 | USB_P3+ | 7 | USB_P4+ |
| 4 | GND | 8 | GND |

When the USH Hub is mounted, then two standard USB 2.0 Host ports are available on connector, CN22, which is a standard double USB Type A socket, shielded.




In case that the USB Hub is not mounted, then on this connector only the upper port will work, directly connected to the i.MX 8M native USB 2.0 Host port #2.

Since this connector is a standard type-A receptacle, it can be connected to all types of USB 1.1 / USB 2.0 devices using standard-A USB 2.0 plugs.

Signals description:

USB_P3+/USB_P3-: USB Port #3 differential pair; it can be managed by the i.MX 8M native USB 2.0 Host port #2 or by the optional SMSC USB2514 Hub controller's Downstream Port #3.

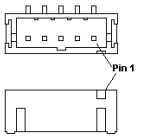
USB_P4+/USB_P4-: USB Port #4 differential pair; it is managed by SMSC USB2514 Hub controller's Downstream Port #4.

$+5V_{USB3}$ and $+5V_{USB4}$ voltages are derived from +5V_ALW power rail using a 500mA Dual-Channel power switch.

### 3.3.9 Internal USB header

| Internal USB Header – CN37 | |
|---|---|
| Pin | Signal |
| 1 | VBUS_HOST3 |
| 2 | USB_IH_DN |
| 3 | USB_IH_DP |
| 4 | GND |
| 5 | USB_IH_RST |

As a factory option, it is possible to provide this board with an internal connector designed specifically for connection of devices requiring an additional reset signal, like i.e. USB Touch Screen controllers-




In case that this connector is mounted, then the USB 2.0 Port #3 of connector CN22 will be not working.

The optional USB Internal header is CN37, which is a 5-pin male connector, type HR p/n A2001WV-S-5P with pinout shown in the table on the left.

Mating connector: HR A2001H-05P housing with HR A2001 series crimp terminals.

Signal description:

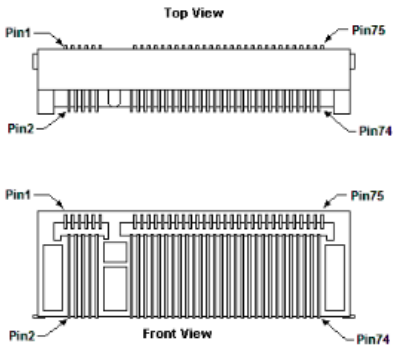
USB_IH_DN / USB_IH_DP: internal header's USB port differential pair, it is managed by the optional SMSC USB2514 Hub controller's Downstream Port #3.

USB_IH_RST: This signal can be used to drive the reset of an eventual external device connected to CN37. VDD_3P3V electrical level output.

### 3.3.10 M.2 Socket 2 Key B Slot

| M.2 WWAN Slot (Socket 2 Key B type 3042/2260- CN26) | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | --- | 2 | VDD_3P3V |
| 3 | GND | 4 | VDD_3P3V |
| 5 | GND | 6 | FULL_CARD_PWR_OFF# |
| 7 | USB_P2- | 8 | W_DISABLE1# |
| 9 | USB_P2+ | 10 | --- |
| 11 | GND | | |
| | | 20 | --- |
| 21 | --- | 22 | --- |
| 23 | --- | 24 | --- |
| 25 | --- | 26 | --- |
| 27 | GND | 28 | --- |
| 29 | --- | 30 | UIM_RESET |
| 31 | --- | 32 | UIM_CLK |
| 33 | GND | 34 | UIM_DATA |
| 35 | --- | 36 | UIM_PWR |
| 37 | --- | 38 | --- |
| 39 | GND | 40 | --- |
| 41 | PCIe1_Rx0+ | 42 | --- |
| 43 | PCIe1_Rx0- | 44 | --- |
| 45 | GND | 46 | --- |
| 47 | PCIe1_Tx0- | 48 | --- |
| 49 | PCIe1_Tx0+ | 50 | PCIE_RST# |
| 51 | GND | 52 | PCIe_CLQREQ# |
| 53 | DIF1#_REF_CLK | 54 | PCIe_WAKE# |
| 55 | DIF1_REF_CLK | 56 | --- |
| 57 | GND | 58 | --- |

This board provides a M.2 WWAN Slot, which allow the connection of Connectivity modules, using PCI-e interface or USB 2.0 interface.




The connector used for the M.2 WWAN slot is CN26, which is a standard 75 pin M.2 Key B connector, type LOTES p/n APCI0087-P001A, H=8.5mm, with the pinout shown in the table on the left.

It is possible to place directly modules in 2260 size, buy using the tallest Threaded Spacer mounted onboard.

It is possible to place also modules in 2242 / 3042 size, by using a M/F Spacer which allow fixing the module on the lower spacer soldered on the PCB, deemed for the fixing of shorter modules.

Here following the signals related to the PCI-e interface:

PCIe1_Tx0+/PCIe1_Tx0-: PCI Express port #1 lane #0, Transmitting Output Differential pair

PCIe1_Rx0+/PCIe1_Rx0-: PCI Express port #1 lane #0, Receiving Input Differential pair

DIF1#_REF_CLK / DIF1_REF_CLK: PCI Express Reference Clock for lane #0, Differential Pair

PCIE_RST#: Reset Signal that is sent from the i.MX8M processor to the PCI-e devices available on the module. It is a VDD_3P3V active-low signal.

PCIe_CLQREQ#: PCI Express Clock Request Input, active low signal, electrical level VDD_3P3V. This signal shall be driven low by any module inserted in the connectivity slot, in order to ensure that the SoC makes available the reference clock.

PCIe_WAKE#: Board's Wake Input, VDD_3P3V active low signal. It must be externally driven by the Connectivity module plugged in the slot when it requires waking up the system.

Here following the signals related to the USB interface:

USB_P2+/USB_P2-: USB 2.0 Port #2 differential pair. It is managed by the optional SMSC USB2514 Hub controller's Downstream Port #2.

| | | | |
|---|---|---|---|
| 59 | --- | 60 | --- |
| 61 | --- | 62 | --- |
| 63 | --- | 64 | --- |
| 65 | --- | 66 | SIM_DETECT |
| 67 | --- | 68 | --- |
| 69 | --- | 70 | VDD_3P3V |
| 71 | GND | 72 | VDD_3P3V |
| 73 | GND | 74 | VDD_3P3V |
| 75 | ---- | | |

W_DISABLE1#: M.2 module disable output signal #1, VDD_3P3V active low output

FULL_CARD_PWR_OFF#: Power Off signal for plugged modules, usually used in battery-powered systems. Fixed 82kΩ pull-up @ VDD_3P3V.

UIM_RESET: Reset signal line, sent from M.2 WWAN card to the UIM module.

UIM_DATA: Bidirectional Data line between M.2 WWAN card and UIM module.

UIM_CLK: Clock line, output from M.2 WWAN card to the UIM module.

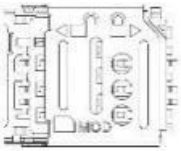
UIM_PWR: Power line for UIM module.

SIM_DETECT: This signal can be forced to VDD_3P3V (through a 10kΩ pull-up resistor) by using a dedicated jumper, JP3. When JP3 is not placed, this pin will be floating.

### 3.3.11 microSIM Card Slot

| microSIM Card Slot – CN27 | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | UIM_PWR | 5 | GND |
| 2 | UIM_RST# | 6 | --- |
| 3 | UIM_CLK | 7 | UIM_DATA |
| 4 | --- | 8 | --- |

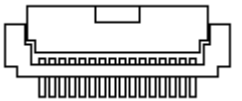
Interfaced to the M.2 slot CN26, as already told in paragraph 3.3.10, there is a microSIM Card Slot, to be used in conjunction with M.2 Socket 2 Key B modems. Here it is possible to insert the microSIM card provided by any telecommunication operator for the connection to their network.



The socket is type MOLEX. p/n 78800-0001or equivalent, with the pinout shown in the table on the left. The signals are already described in par 3.3.10.

### 3.3.12 CSI Camera Connector

The SoC of this board includes an Image Processing Subsystem, that can be used for video applications, like video-preview, video recording and frame grabbing.



It is possible to access to the video input port through an FFC/FPC connector, type HIROSE p/n FH12-18S-0.5SH(55) which is able to accept 18 poles 0.5mm pitch FFC cables.

**CSI Camera Connector – CN28**

| Pin | Signal | Pin | Signal |
|---|---|---|---|
| 1 | CSI_P1_DN3 | 10 | CSI_P1_DN0 |
| 2 | CSI_P1_DP3 | 11 | CSI_P1_DP0 |
| 3 | CSI_P1_DN2 | 12 | GND |
| 4 | CSI_P1_DP2 | 13 | MIPI_CSI0_EN |
| 5 | CSI_P1_DN1 | 14 | MIPI_CSI0_MCKL_OUT |
| 6 | CSI_P1_DP1 | 15 | MIPI_CSI0_I2C0_SCL |
| 7 | CSI_P1_CKN | 16 | MIPI_CSI0_I2C0_SDA |
| 8 | CSI_P1_CKP | 17 | MIPI_CSI0_RST_B |
| 9 | GND | 18 | VDD_3P3V |

The pinout of this connector is shown in the table on the left. All CSI differential pairs are managed by i.MX8M CSI Host Controller's Camera Input #1

CSI_P1_DP0 / CSI_P1_DN0: CSI2 Camera serial input, Receiving Input Differential pair #0.

CSI_P1_DP1 / CSI_P1_DN1: CSI2 Camera serial input, Receiving Input Differential pair #1.

CSI_P1_DP2 / CSI_P1_DN2: CSI2 Camera serial input, Receiving Input Differential pair #2.

CSI_P1_DP3 / CSI_P1_DN3: CSI2 Camera serial input, Receiving Input Differential pair #3.

CSI_P1_CKP / CSI_P1_CKN: CSI Camera, Clock input differential pair.

MIPI_CSI0_EN: External camera module Power enable signal. It is an active high signal with electrical level VDD_3P3V.

MIPI_CSI0_MCKL_OUT: Master Clock, it is managed by i.MX8M GPIO_15 pin. It is suggested, however, to use camera modules with onboard crystal / oscillator, and avoid using this signal. Indeed, it could cause problems for EMI compliance requirements.

MIPI_CSI0_I2C0_SCL: general purpose I2C Bus clock line. Output signal, electrical level VDD_3P3V with a 2k2Ω pull-up resistor. It is managed by i.MX8M processor's I2C controller #2.

MIPI_CSI0_I2C0_SDA: general purpose I2C Bus data line. Bidirectional signal, electrical level VDD_3P3V with a 2k2Ω pull-up resistor. It is managed by i.MX8M processor's I2C controller #2.

MIPI_CSI0_RST_B: External camera module reset signal output, it is an active low signal.

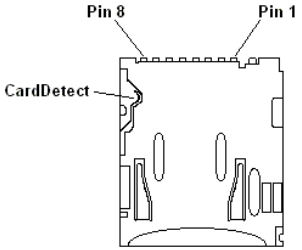
### 3.3.13 µSD card slot

| µSD Card Slot – CN29 | |
|---|---|
| **Pin** | **Signal** |
| 1 | SDIO_DAT2 |
| 2 | SDIO_DAT3 |
| 3 | SDIO_CMD |
| 4 | +3.3V$_{SDIO}$ |
| 5 | SDIO_CLK |
| 6 | GND |
| 7 | SDIO_DAT0 |
| 8 | SDIO_DAT1 |

for 4-bit communication mode.

The i.MX8M Family of SoCs embed two Ultra Secured Digital Host controller (uSDHC), able to support SD / SDIO / MMC Cards.

One of them is used for the implementation of the optional onboard eMMC drive, the other one is used to manage a µSD Card Slot for the use of standard microSD cards, which can be used as Mass Storage and/or Boot Devices.




If the optional WiFi + BT module is mounted, one uSDHC is used for this module. In this case, the µSD Card Slot is made available through a USB2.0 Card Reader Controller, type ALCOR p/n AU6465R-GBF, when mounted the board functionality will be limited to -30°C ÷ +85°C temperature range.

The connector is a microSD connector, push-push type, H=2mm, p/n TKS0192003.

SDIO_CLK: SD Clock Line (output).

SDIO_CMD: Command/Response bidirectional line.

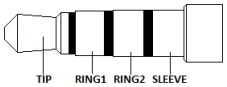
SDIO_DAT[0÷3]: SD Card data bus. SDIO_DAT0 signal is used for all communication modes. SDIO_DAT[1÷3] signals are required

### 3.3.14 Audio connectors

This board offers many possibilities for audio connection, all of them controlled by the I2S Audio Codec type TLV320AIC3204IRHBR.

| TRRS Audio jack- CN31 | |
|---|---|
| **Pin** | **Signal** |
| TIP | Headphone Out Left Channel |
| RING1 | Headphone Out Right Channel |
| RING2 | GND |
| SLEEVE | MIC_IN |

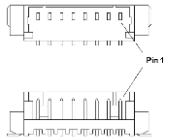
In order to reduce the space dedicated to connectors, there is a TRRS Combo Audio Jack, i.e. a single jack which offer both stereo Line Out and Mic In functionalities.




Such TRRS Combo Audio jack can be used with any 4-poles 3.5mm diameter audio jack, with pinout compatible with the most recent Headsets, shown in the table on the left.

| Line Out, HP Out Connector– CN32 | |
|---|---|
| Pin | Signal |
| 1 | LINE_OUT_L_FILT |
| 2 | GND |
| 3 | LINE_OUT_R_FILT |
| 4 | GND |
| 5 | HP_OUT_L_FILT |
| 6 | GND |
| 7 | HP_OUT_R_FILT |
| 8 | GND |

Additionally, it is available a dedicated output connector carrying out Headphone and Line-Out stereo outputs




For this purpose, the connector used is CN32, which is a 8-pin p1.27mm connector type Molex p/n 53398-0871 or equivalent, with pinout shown in the table on the left.

Mating connector: MOLEX 51021-0800 receptacle with MOLEX 50079-8000 female crimp terminals.

LINE_OUT_L_FILT: Left line output, ac coupled.

LINE_OUT_R_FILT: Right line output, ac coupled.

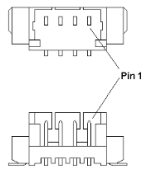
HP_OUT_L_FILT: Headphone Left output, ac coupled

HP_OUT_R_FILT: Headphone Right output, ac coupled

### 3.3.15 Dual Analog Mic in Connector

| Dual Analog Mic In – CN33 | |
|---|---|
| Pin | Signal |
| 1 | MIC2_L |
| 2 | MIC2_R |
| 3 | MIC1_L |
| 4 | MIC1_R |

It is also possible to connect up to two additional analog microphones by using dedicated connector CN33, which is a 4-pin p1.27mm connector type Molex p/n 53398-0471 or equivalent, with pinout shown in the table on the left.




Mating connector: MOLEX 51021-0400 receptacle with MOLEX 50079-8000 female crimp terminals.

MIC2_L: Microphone #2 left channel analog input for audio codec

MIC2_R: Microphone #2 right channel analog input for audio codec

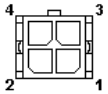
MIC1_L: Microphone #1 left channel analog input for audio codec

MIC1_R: Microphone #2 right channel analog input for audio codec

### 3.3.16 Optional 10W Amplified Speaker Out Connector

| 10W Amplified Speaker Out – CN35 | |
|---|---|
| Pin | Signal |
| 1 | AMP_SPEAKER_LP |
| 2 | GND |
| 3 | GND |
| 4 | AMP_SPEAKER_RP |

An additional connector carries out two additional audio signals, managed by the same Codec and amplified by two Audio Amplifiers model MP7720DS (each one offering output power 10W on an 8Ohm load / 20W on a 4Ohm load). This connector is type MOLEX Micro-Fit 3.0 p/n 43045-0400 or equivalent.



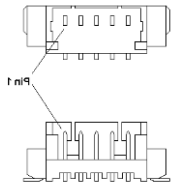

AMP_SPEAKER_LP: amplified line output Left channel

AMP_SPEAKER_RP: amplified line output Right channel

### 3.3.17 Digital Mic In connector

| Digital Mic IN connector – CN48 | |
|---|---|
| Pin | Signal |
| 1 | +3P3V_AUDIO |
| 2 | MIC_DAT1 |
| 3 | MIC_CLK |
| 4 | MIC_DIR |
| 5 | GND |

On this board, the TLV320AIC3204IRHBR Audio Codec offer also the possibility of connecting external digital microphones, by using the connector CN48, which is 5-pin p1.27mm connector type Molex p/n 53398-0571 or equivalent, with pinout shown in the table on the left.



Mating connector: MOLEX 51021-0500 receptacle with 50079-8000 female crimp terminals.

Type MOLEX p/n 53398-0571 or equivalent Audio input signals to right and left ADC are received.

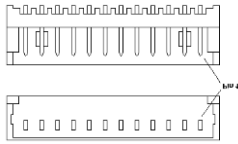
MIC_DAT1: digital microphone data bidirectional, electrical level +3P3V_AUDIO with 10K pull-up resistor.

MIC_CLK: digital microphone clock output, electrical level +3P3V_AUDIO with 10K pull-up resistor.

MIC_DIR: direct connection to GND through a 10K pull-down resistor.

### 3.3.18 GPIO connector

| GPIO connector – CN38 | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | VDD_3P3V | 6 | GPIO_4 |
| 2 | GPIO_0 | 7 | GPIO_5 |
| 3 | GPIO_1 | 8 | GPIO_6 |
| 4 | GPIO_2 | 9 | GPIO_7 |
| 5 | GPIO_3 | 10 | GND |



This board offers a dedicated connector with 8x General Purpose GPIOs, directly managed by the i.MX8M processor.

These GPIOS are available on connector CN38, which is a 10-pin p1.27mm connector type Molex p/n 53398-1071 or equivalent, with pinout shown in the table on the left.

Mating connector: MOLEX 51021-1000 receptacle with 50079-8000 female crimp terminals.

GPIO_0: General purpose IO #0, electrical level VDD_3P3V, connected to i.MX8M processor's pin ESCPI2_MOSI (pad E5)

GPIO_1: General purpose IO #1, electrical level VDD_3P3V, connected to i.MX8M processor's pin ESCPI2_SCLK (pad C5)

GPIO_2: General purpose IO #2, electrical level VDD_3P3V, connected to i.MX8M processor's pin GPIO1_IO01 (pad T7)

GPIO_3: General purpose IO #3, electrical level VDD_3P3V, connected to i.MX8M processor's pin GPIO1_IO02 (pad R4)

GPIO_4: General purpose IO #4, electrical level VDD_3P3V, connected to i.MX8M processor's pin GPIO1_IO03 (pad P4)

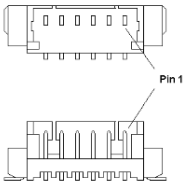
GPIO_5: General purpose IO #5, electrical level VDD_3P3V, connected to i.MX8M processor's pin NAND_DATA05 (pad J22)

GPIO_6: General purpose IO #6, electrical level VDD_3P3V, connected to i.MX8M processor's pin NAND_DATA06 (pad L19)

GPIO_7: General purpose IO #7, electrical level VDD_3P3V, connected to i.MX8M processor's pin NAND_DATA07 (pad M19)

### 3.3.19 SPI Connector

| SPI Connector – CN40 | |
|---|---|
| **Pin** | **Signal** |
| 1 | VDD_3P3V |
| 2 | EXT_SPI_CS |
| 3 | EXT_SPI_MISO |
| 4 | EXT_SPI_MOSI |
| 5 | EXT_SPI_SCLK |
| 6 | GND |




i.MX8M enhanced configurable serial peripheral interface (ECSPI) #1 is externally available on connector CN40, which is a 6-pin p1.27mm connector type Molex p/n 53398-0671 or equivalent, with pinout shown in the table on the left.

Mating connector: MOLEX 51021-0600 receptacle with MOLEX 50079-8000 female crimp terminals.

Signal description

EXT_SPI_CS: SPI chip select, output signal, active high, electrical level VDD_3P3V. This signal is activated when this interface is used as communication with external devices. It is managed by i.MX8M signal ECSPI_SS02 through i.MX8M processor's pin GPIO1_IO07 (pad N6)

EXT_SPI_MISO: SPI Master Input Slave Output, input signal, electrical level VDD_3P3V.

EXT_SPI_MOSI: SPI Master Output Slave Input, ouput signal, electrical level VDD_3P3V.

EXT_SPI_SCLK: SPI Serial Clock, electrical level VDD_3P3V

### 3.3.20 CAN Bus connector

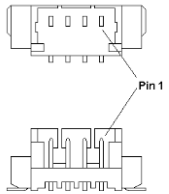
| CAN BUS – CN42 | |
|---|---|
| **Pin** | **Signal** |
| 1 | VIN_SYS |
| 2 | CAN_H |
| 3 | GND |
| 4 | CAN_L |

This interface is compliant to CAN specifications rel. 2.0 part B. The transceiver used is designed for high-speed (up to 1Mbps) CAN applications, and also offers improved EMC and ESD performances.

CAN Bus Connector is a 4-pin single line SMT connector, type MOLEX 53398-0471 or equivalent, with pinout shown in the table on the left. Mating connector: MOLEX 51021-0400 receptacle with MOLEX 50079-8000 female crimp terminals.

CAN_H: High-Level CAN bus line.

CAN_L: Low-Level CAN bus line.





A 120Ω termination resistor can be placed between CAN_H and CAN_L signals. It can be connected or disconnected from the line by using JP4 jumper (Jumper inserted = termination connected).

### 3.3.21 Debug UART Connector

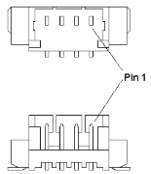
| Debug UART – CN43 | |
|---|---|
| **Pin** | **Signal** |
| 1 | VDD_3P3V |
| 2 | UART_Rx |
| 3 | UART_Tx |
| 4 | GND |

Onboard, connector CN43 carries out signals related to Debug Serial Port, which is managed by NXP i.MX8 UART2 internal controller, with signals available at TTL level. This interface can be used for the debugging of the processor.

For this purpose, a dedicated 4-pin Connector, Type MOLEX p/n 53398-0471 or equivalent is provided. Mating connector: MOLEX 51021-0400 receptacle with MOLEX 50079-8000 female crimp terminals.

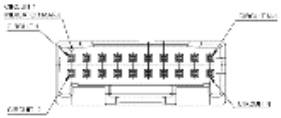
UART_RXD: UART #1 Receive data signal, electrical level VDD_3P3V.

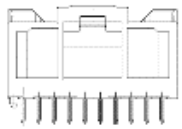
UART_TXD: UART #1 Transmit data signal, electrical level VDD_3P3V.



### 3.3.22 RS-232 Connector

| RS-232 Connector– CN44 | | | |
|---|---|---|---|
| **Pin** | **Signal** | **Pin** | **Signal** |
| 1 | RS232_Tx | 2 | VDD_3P3V |
| 3 | RS232_Rx | 4 | VDD_5V |
| 5 | RS232_RTS | 6 | VIN_SYS |
| 7 | RS232_CTS | 8 | GND |
| 9 | GND | 10 | GND |





This board offers an RS-232 interface with flow control (CTS and RTS signals) on dedicated connector CN44. This interface is managed by i.MX8M internal UART4 Controller.

CN44 is a dual row 10-pin 2mm p connector, type MOLEX p/n 501645-1020 or equivalent.

Mating connector MOLEX 501646-1000 receptacle with MOLEX 501647, 501648 or 503096 series female crimp terminals.

Pin configuration is described on the table here.

RS232_Rx : COM PORT #4 RS-232 Receive data

RS232_Tx : COM PORT #4 RS-232 Transmit data

RS232_RTS : COM PORT #4 RS-232 Request to Send handshaking signal.

RS232_CTS : COM PORT #4 RS-232 Clear To Send handshaking signal

### 3.3.23 LCD / Backlight Power Selection

| Backlight Power (VCC_BKL_SW) Selector – CN45 | |
|---|---|
| **Position** | **Voltage Value** |
| 1-2 | VIN_SYS |
| 2-3 | +5V_ALW |

| LCD Power (VCC_LCD_SW) Selector– CN46 | |
|---|---|
| **Position** | **Voltage Value** |
| 1-2 | VDD_3P3V |
| 2-3 | +5V_ALW |


On this board, two dedicated PCB jumpers are available in order to select the LCD and Backlight Power level that can be supplied.

CN45 is dedicated to the backlight power, while CN46 is dedicated to LCD Power.

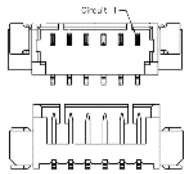
Different power level can be supplied according to how jumper pins are closed.

Please refer to the tables on the left to see proper settings for the voltage levels that can be supplied.

A standard 3-way jumper, P2.54mm is used.

### 3.3.24 Power On/Off connector

| Power On/Off connector – CN47 | |
|---|---|
| **Pin** | **Signal** |
| 1 | VDD_5V |
| 2 | GND |
| 3 | SYS_ONOFF# |
| 4 | GND |
| 5 | RST_BTN |



To allow the integration of this board in a boxed solution, there is a connector on the board that allows remoting the signal for the Power and Reset Button

The dedicated connector is a 5-pin male connector, type HR p/n A1250WV-S-05P or equivalent, with pinout shown in the table on the left.

Mating connector: HP p/n A1250H-05P.

Signals Description:

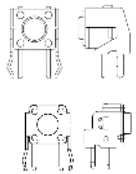
SYS_ONOFF#: Power switch input signal. This signal has to be connected to an external momentary pushbutton (contacts normally open). Upon the pressure of this pushbutton (i.e., the signal is connected to GND), the pulse of this signal will let the switched voltage rails turn on or off.

Please be aware that the power switch input signal is also managed directly on the board by the pushbutton SW1, so it is not mandatory to connect them externally using CN47.

RST_BTN: Reset switch input signal. This signal has to be connected to an external momentary pushbutton (contacts normally open). Upon the pressure of this pushbutton (i.e., the signal is connected to GND), the pulse of this signal will cause the reset of the board. VDD_3P3V electrical level with 10kΩ pull-up resistor.

Please be aware that the reset switch input signal is also managed directly on the board by the pushbutton SW2, so it is not mandatory to connect them externally using CN47.

### 3.3.25 Power and Reset Buttons



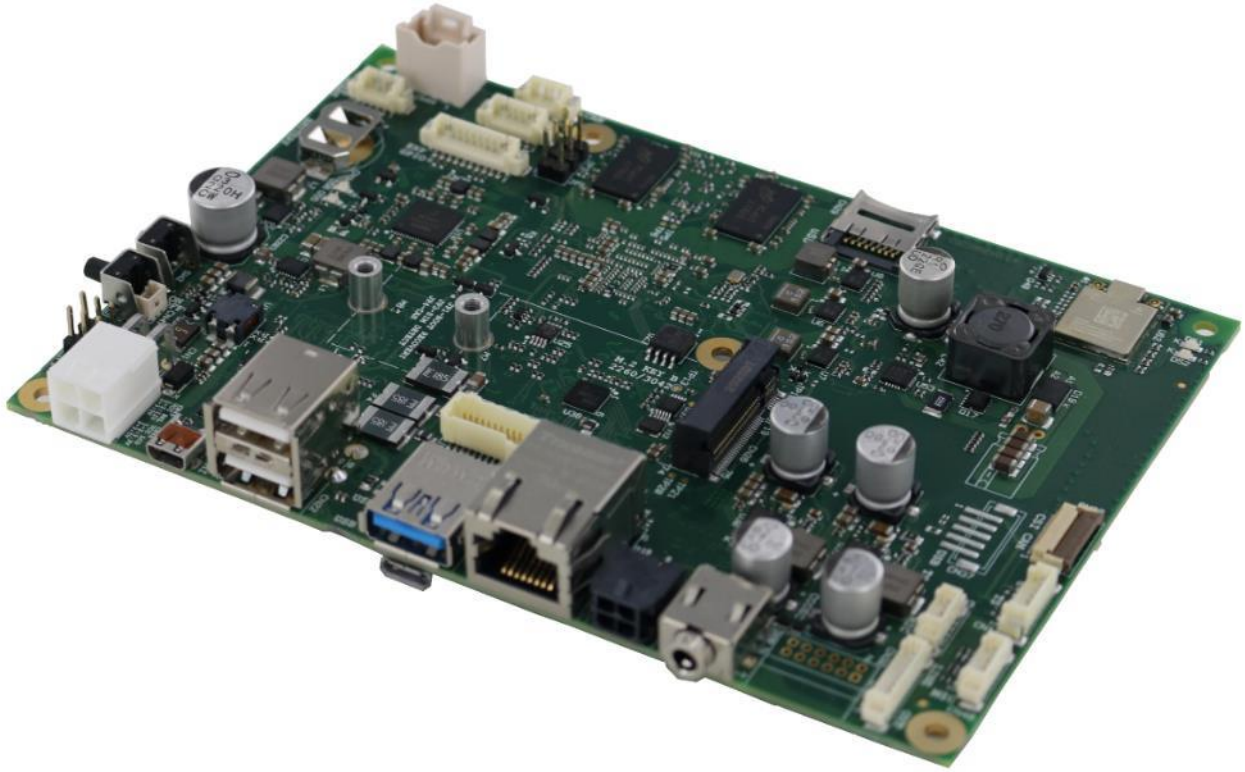
This board board can be equipped by factory option with a Power button SW1 and Reset button SW2.
The functionality of these buttons is limited to the temperature range -20°C ÷ +85°C.
For SW1 Power button, type Alps Alpine p/n SKHHLVA010, upon the pressure of this pushbutton, will let the switched voltage rails turn on or off.
For SW2 Reset button, type Wurth p/n 431256038716, upon the pressure of this pushbutton, will cause the reset of the board.

### 3.3.26 Boot Mode Selection jumper JP1

The onboard 2-way jumper JP1 can be used to select boot mode for this board.
When the jumper is inserted, then the processor will search for the USB OTG connection to be established, in order to download a program image to the chip.
When the jumper is not inserted, the processor will continue to execute the boot code from the internal boot ROM.

# Chapter 4.
# APPENDICES

- Thermal Design



## 4.1 Thermal Design

A parameter that has to be kept in very high consideration is the thermal design of the system.

Highly integrated systems, like the SBC-C20 board, offer the user excellent performance in a much reduced space, therefore allowing the system's minimization. On the other hand, the miniaturizing of IC's and the increase of clock frequencies of the processors lead to the generation of a big amount of heat that must be dissipated to prevent critical operating conditions, system hang-off or failures.

It is extremely important to note that, for this reason, a critical design parameter always to be kept in very high consideration is the thermal design and analysis of the final assembled system. It is necessary to carefully consider the heat generated by the module in the final assembled system and the application.

The customer must always ensure that the heatspreader/heatsink surface temperature remain within the declared operating temperature range at any point of the cooling element.

Please always keep in mind that heavy computational tasks will generate much heat, on all versions of the processor.

Therefore, it is always necessary that the customer studies and develops a specifically tailored cooling solution for the final system by evaluating processor's workload, application environment, system enclosure, air flow and so on.

SECO can provide SBC-C41-pITX specific passive heatspreader, but please remember that their use must be evaluated accurately inside the final system, and that they should be used only as a part of a more comprehensive ad-hoc cooling solutions.

| Ordering Code | Description |
|---|---|
| **SC20-DISS-1-PK** | SBC-C41-pITX Heat Spreader (PASSIVE) |

Warning!

The thermal solutions available with SECO boards are tested in the temperature range (-40°C ÷ +85°C), without housing and inside climatic chamber. Therefore, the customer is suggested to study, develop and validate the cooling solution for his system, considering ambient temperature, processor's workload, utilisation scenarios, enclosures, air flow and so on.

In particular, the heatspreader is not intended to be a cooling system by itself, but only as the standard means for transferring heat to cooler, like heatsinks, cold plate, heat pipes and so on.

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