SBC

User Manual

SBC-B08

Single Board Computer
with NXP i.MX6SoloX Processor

www.seco.com

REVISION HISTORY

Revision	Date	Note	Ref
1.0	16 January 2018	First Official Release.	SB
1.1	02 August 2019	RGB power rails specifications updated, power up/down sequence added CN12 max current and max voltage added CAN Connector CN24 added	SB

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.

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Chapter 1.
INTRODUCTION

- Warranty
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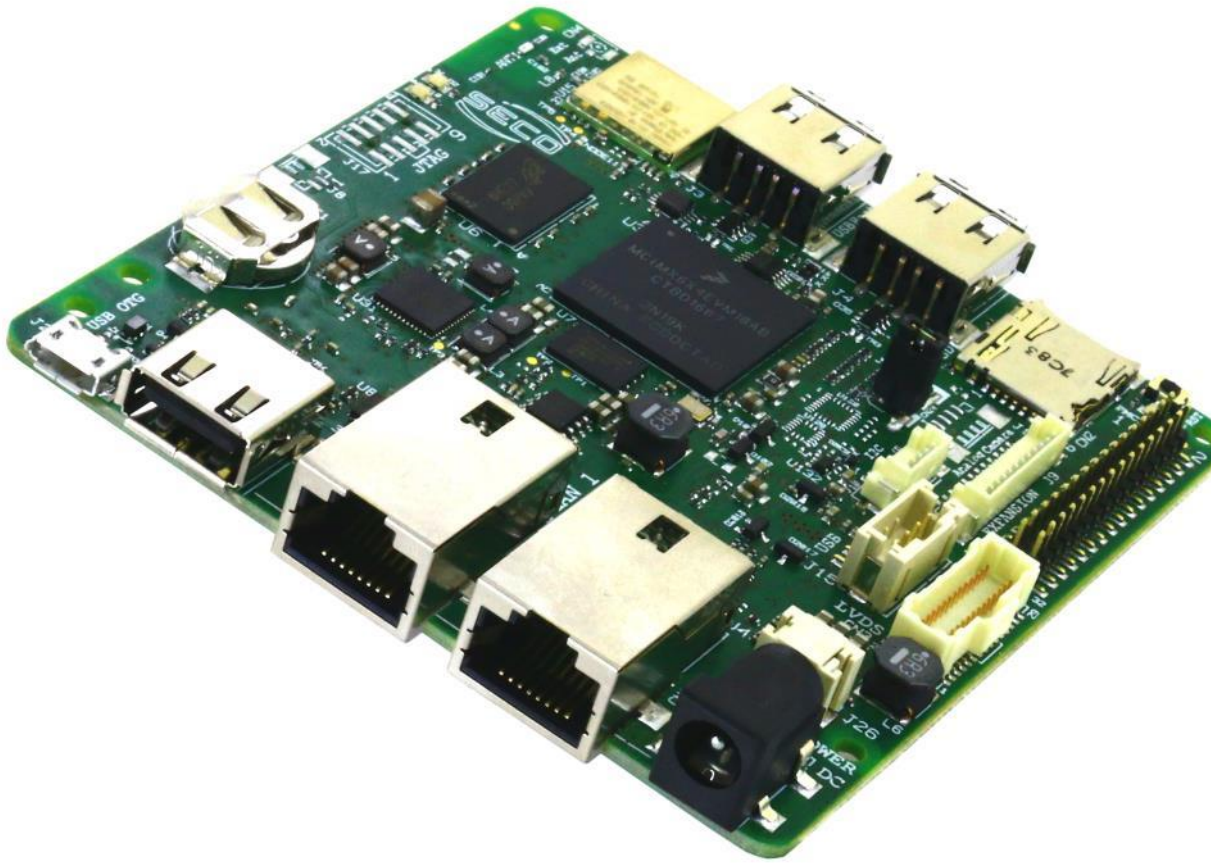


1.1 Warranty

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 http://www.seco.com/en/prerma (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 340434
- 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 a 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 a RMA number, please visit SECO's web-site. On the home page, please select "RMA Online" and follow the procedure described.

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

1.4 Safety

The SBC-B08 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-B08 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 a SBC-B08 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-B08 board is designed using RoHS compliant components and is manufactured on a lead-free production line. It is therefore fully RoHS compliant.

1.7 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
CSI2	MIPI Camera Serial Interface, 2nd generation standard regulating communication between a peripheral device (camera) and a host processor
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
FFC/FPC	Flexible Flat Cable / Flat Panel Cable
GND	Ground
GPI/O	General purpose Input/Output
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
MIPI	Mobile Industry Processor Interface Alliance
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
OpenCL	Open Computing Language, a software library based on C99 programming language, conceived explicitly to realise parallel computing using Graphics Processing Units (GPU)
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

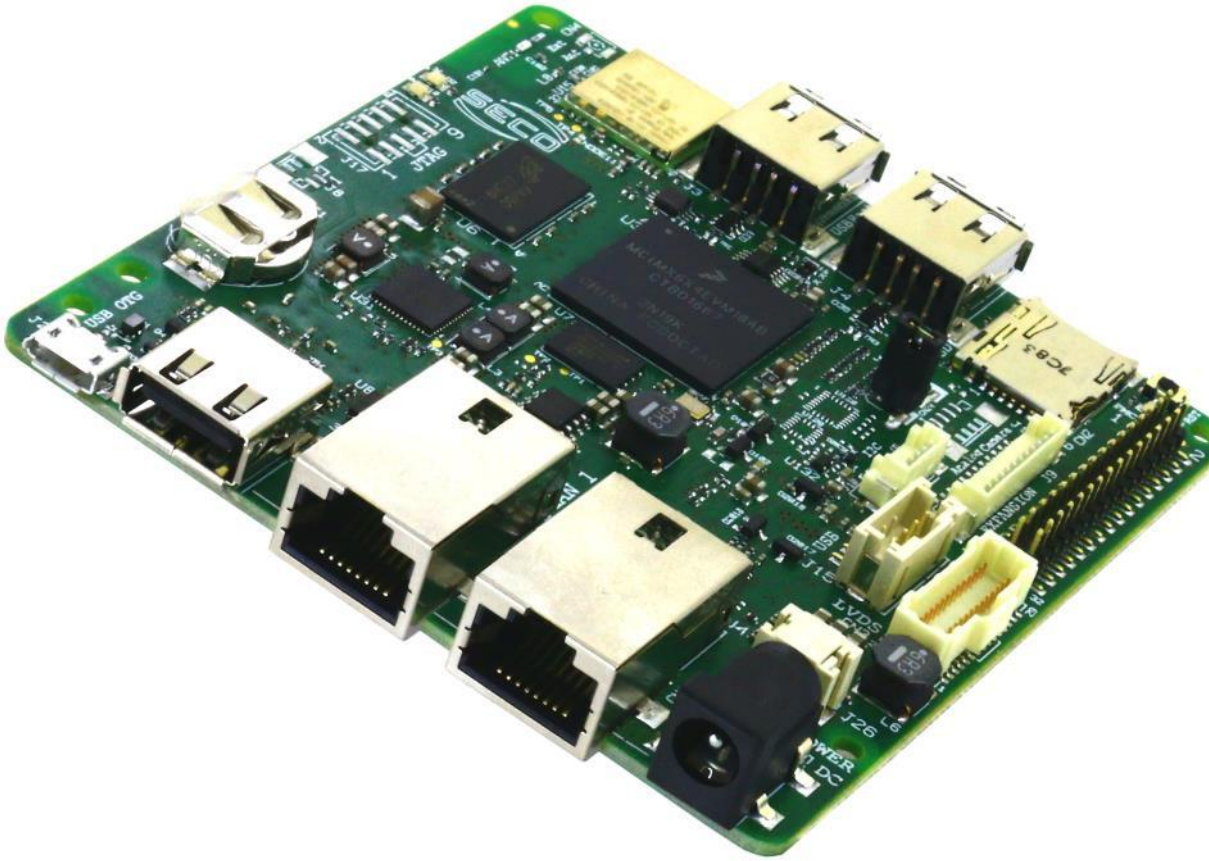
1.8 Reference specifications

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

Reference	Link
CAN Bus	http://www.bosch-semiconductors.de/en/ubk_semiconductors/safe/ip_modules/can_literature/can_literature.html
CSI	http://www.mipi.org/specifications/camera-interface
Gigabit Ethernet	http://standards.ieee.org/about/get/802/802.3.html
I2C	http://www.nxp.com/documents/other/UM10204_v5.pdf
LVDS	http://www.ti.com/ww/en/analog/interface/lvds.shtml http://www.ti.com/lit/ml/snla187/snla187.pdf
MIPI	http://www.mipi.org
MMC/eMMC	http://www.jedec.org/committees/jc-649
OpenCL	http://www.khronos.org/opencl
OpenGL	http://www.opengl.org
OpenVG	http://www.khronos.org/openvg
SD Card Association	https://www.sdcard.org/home
SM Bus	http://www.smbus.org/specs
TMDS	http://www.siliconimage.com/technologies/tmds
USB 2.0 and USB OTG	http://www.usb.org/developers/docs/usb_20_070113.zip
NXP i.MX6 SoloX processor	https://www.nxp.com/products/processors-and-microcontrollers/applications-processors/i.mx-applications-processors/i.mx-6-processors/i.mx-6solox-processors-heterogeneous-processing-with-arm-cortex-a9-and-cortex-m4-cores:i.MX6SX

Chapter 2.
OVERVIEW

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



2.1 Introduction

SBC-B08 is a Single Board Computer, measuring just 89.5 x 87 mm (3.52" x 3.43") based on embedded NXP i.MX6SoloX processors, a Single Core ARM® Cortex®-A9 processor, with frequencies up to 1GHz, which is ideal for applications requiring low power consumptions, secuirity features and connectivity, like i.e. IoT applications.

Graphics features of the board are managed directly by NXP i.MX6SoloX processor, which integrate a Vivante GC400T 2D/3D GPU , supporting OpenGL® ES2.0.

The board is able to support up to 2 independent displays, which can be driven through the LVDS connector and/or the RGB parallel connector.

The board is completed with up to 1GB DDR3L directly soldered on board, and one eMMC Flash Drive, directly accessible like any standard Drive, with up to 8GB of capacity. Mass storage capabilities are completed by a microSD Card slot.

The two RGMII i.MX6 native interfaces are internally carried to as many Micrel KSZ8091 Ethernet Transceiver, allowing the implementation of up to two Gigabit Ethernet interfaces (one of them optional).

USB HSIC native port is carried to an USB HSIC Hub controller, which allows implementing two standard USB 2-0 Type A ports and an internal USB port on dedicated connector

The i.MX6 SoloX OTG port and the native USB 2.0 Host ports, instead, are carried respectively to a USB micro-AB and an USB Type-A connectors.

The standard functionalities of this board are then completed by a 32-pin expansion connector, which carries out directly 26 signals coming from the i.MX6 processor. These signals can all be used as Generic Purpose Input/Outputs (GPIOs). Due to the pin multiplexing possibilities offered by the i.MX6 processor, however, it is possible to use some groups of these pins to implement other functionalities, like 3 x UARTs (which can also be offered with RS-232 or RS-485 interface), SPI, CAN interfaces and more.

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.MX6SX SoloX, Single ARM® CORTEX-A9 core processor @ 1GHz + Cortex®-M4 core @ 227MHz

Memory

32-bit soldered down DDR3L memory, up to 1GB

Graphics

Integrated Graphics Vivante GC400T
Dedicated 2D and 3D Hardware accelerator
Supports OpenGL® ES2.0 / 1.1 , OpenVG 11.1, DirectFB, GDI/DirectDraw

Video Interfaces

Single-Channel 18-/24-bit LVDS connector with Touch Screen dedicated signals
24-bit Parallel RGB connector

Video Resolution

LVDS, up to 1366x768 @ 60Hz, 24bpp
RGB, up to 1920x1080p @ 60Hz, 24bpp

Mass Storage

Optional onboard eMMC Disk, up to 8GB *
microSD card slot
16MB NOR Quad-SPI Flash soldered on-board

Networking

Up to two FastEthernet RJ-45 connectors
Optional WiFi (802.11 b / g / n) +BT LE combo module + antenna on-board

USB

1 x USB 2.0 OTG port
3 x USB 2.0 Host port on standard Type-A sockets
1 x USB 2.0 Host port on internal pin header

Audio

I2S Audio interface on programmable pin header
S/PDIF interface (In and Out) on programmable pin header

** Please consider that for HDD and Flash Disk manufacturers, 1GB = 10^9 Byte. Some OS (like, for example, Windows) intends 1GB = 1024^3 byte, so global capacity shown for Disk Properties will be less than expected. Please also consider that a portion of disk capacity will be used by internal Flash Controller for Disk management, so final capacity will be lower*

Serial Ports

1 x CAN Port reconfigurable as GPIO
1 x optional dedicated CAN Port (PCB RevB or higher)
3 x UARTS on programmable pin header (optionally available with RS-232 or RS-485 interface)

Other interfaces

2 x I2C dedicated connectors (one reserved for Touch Screen)
6 analog inputs for A / D Conversion
Programmable (*) expansion pin header connector, able to offer:

- Up to 26 GPIO
- SPI interface
- S/PDIF Audio interface
- I2S Audio interface
- CAN interface (TTL level)
- 3 x PWM
- 2 x I2C
- 3 x UARTs (TTL, RS-232 or RS-485 interface)
- CSI interface (PAL and NTSC formats supported)

Embedded additional RTC circuitry for lowest power consumption
Optional 3-Axis Digital Gyroscope + 3D Accelerometer & Magnetometer

(*) Please note that some of these interfaces are factory options, other configurations are made via SW using the pin multiplexing possibilities of the i.MX6SX processor.

Power supply voltage: +12V_{DC} ± 10%

Operating temperature: 0°C ÷ +60°C** (commercial version)
-40°C ÷ +85°C** (industrial version)

Dimensions: 89.5 x 87 mm (3.52” x 3.43”).

Supported Operating Systems:

Linux
Android

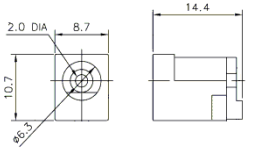
! *** Measured at any point of the heatspreader/heatsink during any and all times (including start-up). Actual temperature will widely depend on application, enclosure and/or environment. Upon customer to consider specific cooling solutions for the final system.*

Please also check paragraph 4.1

2.3 Electrical specifications

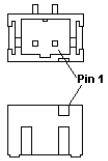
SBC-B08 needs to be supplied only with an external $12V_{DC}$ ± 10% power supply, with a minimal 20W power rating (SBC-B08 power consumption by itself is around 5W, more power is required for the possible attached devices).

This voltage can be supplied through an optional standard 6.3mm (internal pin, diameter 2.0 mm) Power Jack. Internal pin is V_{IN} power line.



Power In Connector - J26	
Pin	**Signal**
1	V_{IN}
2	GND

As an alternative, $+12V_{DC}$ can also be supplied using dedicated internal connector J26, which is a HR p/n A2001WV-S-02PD01 connector or equivalent.



Mating connector: HR p/n A2001H-02P with A2001 series female crimp terminals.

2.3.1 RTC Battery

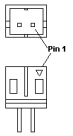
The SBC-B08 board can be equipped with an optional low-power Real Time Clock embedded on the module (which is a NXP PCF2123). In this case, the board also mounts a soldered horizontal 3V coin cell lithium battery to supply such a RTC.

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

As a factory alternative, it is possible to connect external cabled RTC batteries to supply the RTC clock embedded on the i.MX6SX processor.

Battery connector - J8	
Pin	**Signal**
1	V_{RTC}
2	GND

The battery used for this purpose must be not rechargeable, and can be connected to the board using dedicated connector, J8, which is a 2-pin p1.27 mm type MOLEX p/n 53398-0271 or equivalent, with pinout shown in the table on the left.



Mating connector: MOLEX 51021-0200 receptacle with MOLEX 50079-8000 female crimp terminals.

Please be aware that such a connector is optional, it will be present only in case that there isn't the additional low-power external RTC

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 SBC-B08 are compliant to requirements of European Directive 2006/66/EC regarding batteries and accumulators. When putting out of order SBC-B08, 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:

V_{IN}: +12V_{DC} voltage directly coming from the Power Supply connectors CN1 or J26

V_{RTC}: +3V external voltage for supplying the RTC clock embedded on the i.MX6Sx.

VCC_SW: +5V switched voltage directly derived from V_{IN} voltage

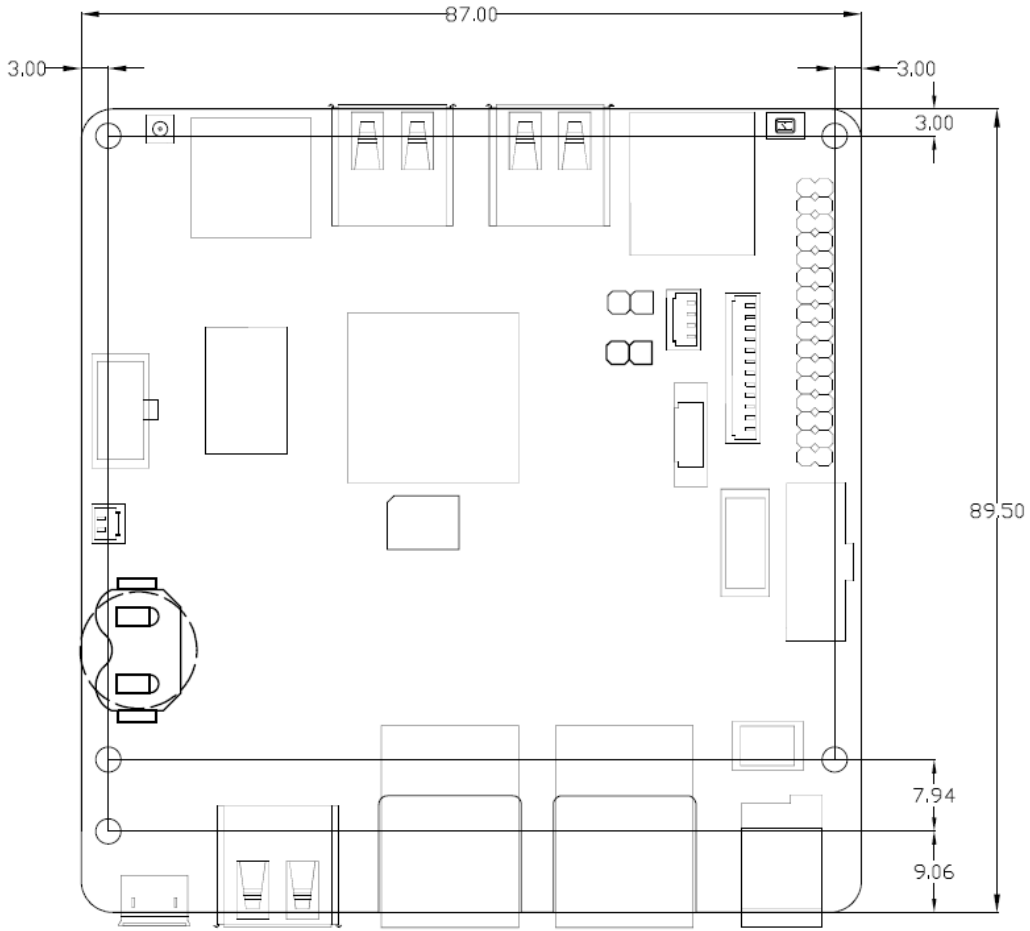
NVCC_3V0: +3.3V switched voltage derived from VCC_SW voltage

VDD_SNVS: +3.3V switched voltage derived from VCC_SW voltage, controlled by the PMIC

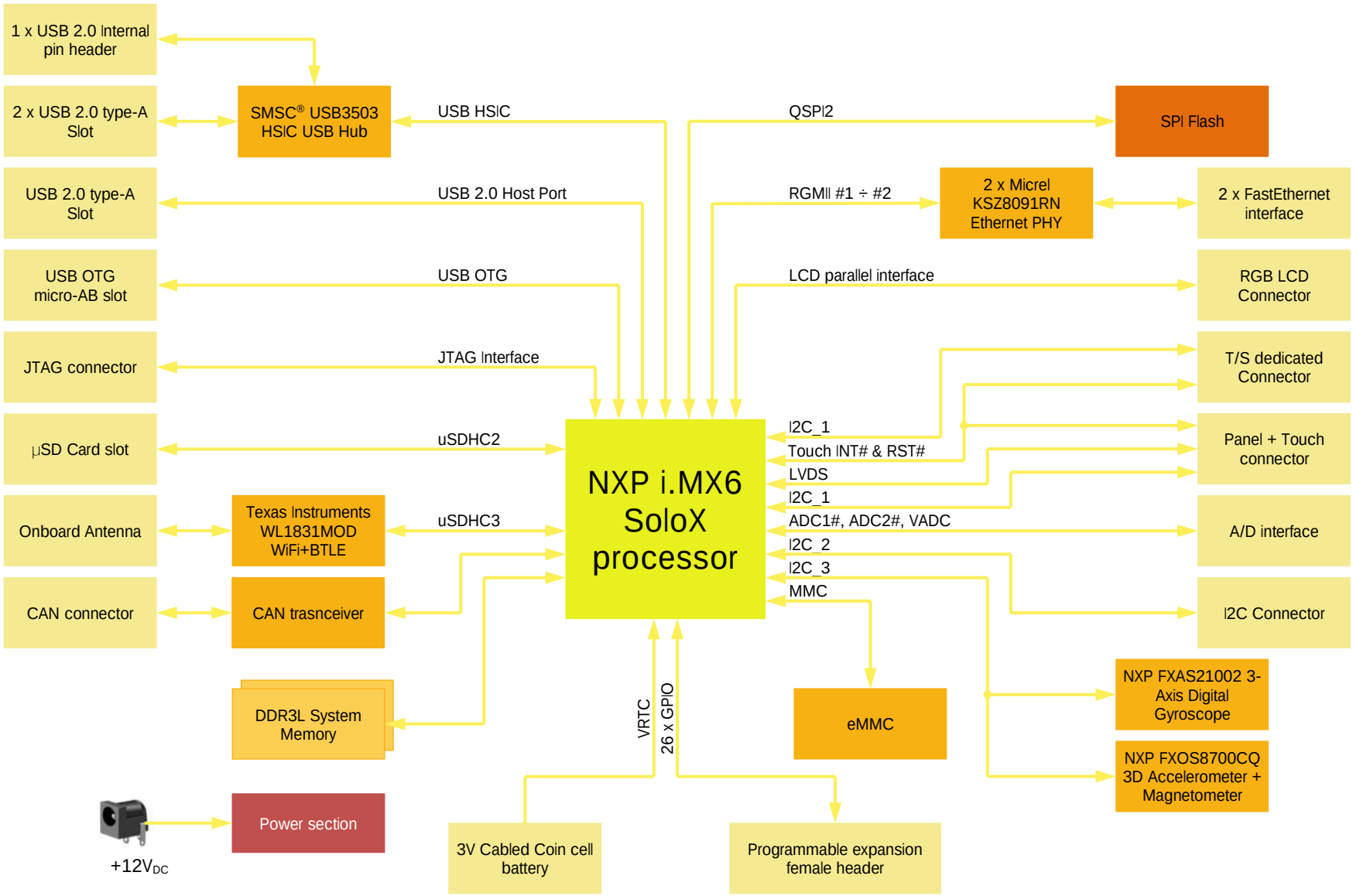
2.4 Mechanical specifications

Board dimensions are 89.5 x 87 mm (3.52” x 3.43”).

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

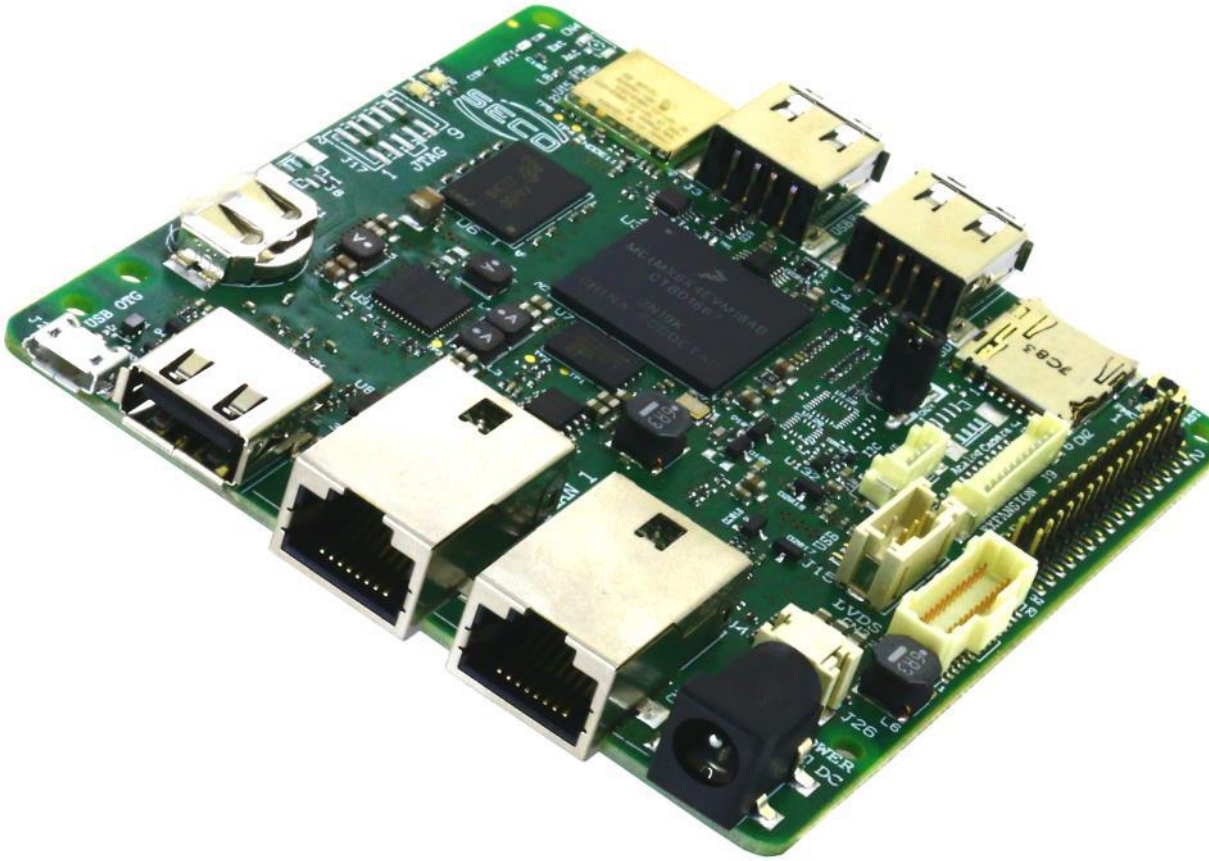


2.5 Block diagram



Chapter 3.
CONNECTORS

- Introduction
- Connectors overview
- Connectors description



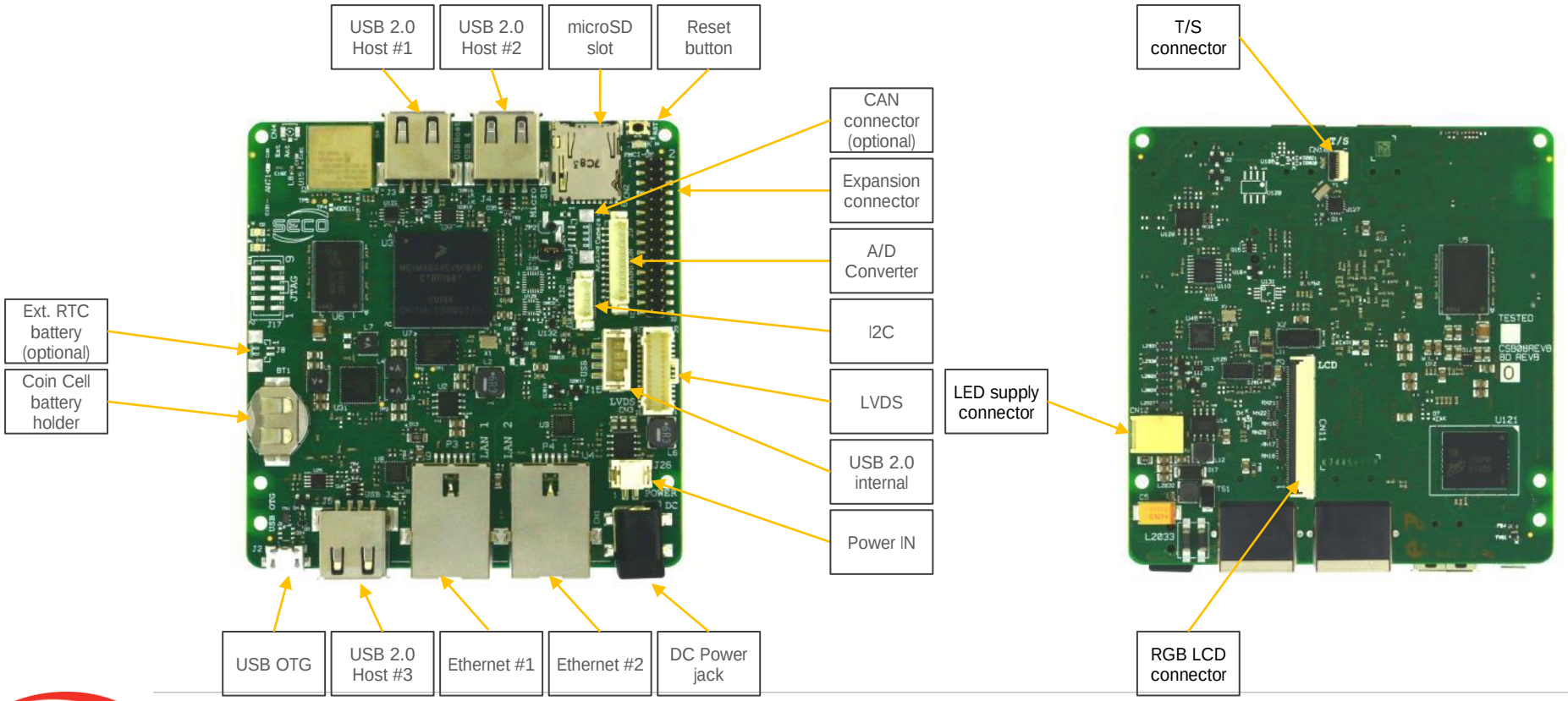
3.1 Introduction

On SBC-B08 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 could be slightly different from the following pictures.

TOP SIDE

BOTTOM SIDE



3.2 Connectors overview

Name	Description	Name	Description
BT1	Coin Cell battery holder	J4	USB 2.0 Host #3 connector
CN1	DC Power Jack	J5	USB 2.0 Host #2 connector
CN2	microSD slot	J8	External RTC battery
CN3	LVDS	J9	Expansion connector
CN10	I2C Touch Screen Connector	J10	I2C connector
CN11	RGB LCD connector	J14	A/D Converter connector
CN12	LED Supply connector	J15	USB 2.0 internal connector
CN24	CAN connector	J26	Power IN connector
J2	USB OTG micro-AB connector	P3	Ethernet #1 RJ-45 connector
J3	USB 2.0 Host #1 connector	P4	Ethernet #2 RJ-45 connector

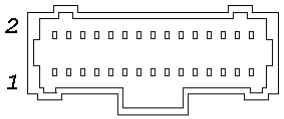
3.3 Connectors description

3.3.1 LVDS + backlight connector

SBC-B08 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 channel.

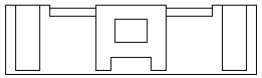
LVDS connector - CN3			
Pin	**Signal**	**Pin**	**Signal**
1	GND	2	LVDS0_TX0-
3	I2C1_SCL	4	LVDS0_TX0+
5	I2C1_SDA	6	GND
7	GND	8	LVDS0_TX1-
9	+5V$_{LCD}$	10	LVDS0_TX1+
11	+5V$_{LCD}$	12	GND
13	+3.3V$_{LCD}$	14	LVDS0_TX2-
15	+3.3V$_{LCD}$	16	LVDS0_TX2+
17	NVCC_3V0	18	GND
19	LVDS_BLT_EN	20	LVDS0_CLK-
21	TOUCH_INT	22	LVDS0_CLK+
23	TOUCH_RST	24	GND
25	GND	26	LVDS0_TX3-
27	VIN	28	LVDS0_TX3+
29	VIN	30	GND

For the connection, a connector type HR A1014WVA-S-2x15P or equivalent (2 x 15p, male, straight, P1, low profile, polarized) is provided, with the pin-out shown in the table below.



Mating connector: HR A1014H-2X15P with HR A1014-T female crimp terminals.

On the same connectors, are also implemented signals for direct driving of display's backlight: voltages (VIN, +5V$_{LCD}$ and +3.3V$_{LCD}$) and control signals (Backlight enable signal, LVDS_BLT_EN).



V_{IN} voltage, available on pins 27-29, is the Power Voltage that is supplied to the board though DC Jack CN1 or Power in connector J26 (+12V$_{DC}$ is supported).

+5V$_{LCD}$ is derived from VCC_SW power rail. +3.3V$_{LCD}$ is derived from NVCC_3V0 power rail. Both voltages are switched on and off via SW.

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.

LVDS_BLT_EN: NVCC_3V0 electrical level Output with a 10kΩ pull-down resistor, Panel Backlight Enable signal. It can be used to turn On/Off the backlight's lamps of connected LVDS display.

I2C1_SCL: I2C Bus clock line. Bidirectional signal, electrical level NVCC_3V0 with a 10kΩ pull-up resistor. It is managed by i.MX6 processor's I2C1 controller.

I2C1_SDA: I2C Bus data line. Bidirectional signal, electrical level NVCC_3V0 with a 10kΩ pull-up resistor. It is managed by i.MX6 processor's I2C1 controller.

TOUCH_INT: Touch Screen IRQ line, NVCC_3V0 electrical level with a 10kΩ pull-up resistor.

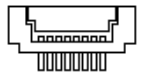
TOUCH_RST: Touch Screen Reset signal, NVCC_3V0 electrical level with a 10kΩ pull-down resistor.

3.3.2 I2C Touch Screen Connector

I2C Touch Screen Connector - CN10	
Pin	**Signal**
1	N.C.
2	NVCC_3V0
3	N.C
4	TOUCH_RST
5	TOUCH_INT
6	I2C1_SDA
7	I2C1_SCL
8	GND

Onboard, connector CN10 carries out signals to the I2C interface which can be used for I2C Touch Screen controller connection.

For this purpose, a dedicated 8-pin FFC Connector, Type HIROSE p/n FH34S-8S-0.5SH(50) or equivalent is provided.



This connector mates with 0.5mm pitch 8-poles FFC cables.

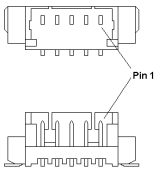
The signals available on this connector are the same available on LVDS connector; please check the previous paragraph for their description.

3.3.3 I2C connector

On-board, it is available a dedicated connector with I2C only interface plus an ALERT# signal.

I2C Connector - CN12	
Pin	**Signal**
1	NVCC_3V0
2	ALERT#
3	I2C2_SDA
4	I2C2_SCL
5	GND

The connector is J10, which is a 5-pin 1.25mm pitch connector, type MOLEX p/n 53398-0571 or equivalent, with the pinout shown in the table on the left.



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

ALERT#: General Purpose I/O signal, managed by i.MX6SX signal GPIO4_IO14. Electrical level NVCC_3V0 with a 10kΩ pull-up resistor.

I2C2_SDA: general purpose I2C Bus data line. Bidirectional signal, electrical level NVCC_3V0 with a 2k2Ω pull-up resistor. It is managed by i.MX6 processor's I2C2 controller. It is the same signal that is available also on Expansion header Connector J9.

I2C2_SCL: general purpose I2C Bus clock line. Output signal, electrical level NVCC_3V0 with a 2k2Ω pull-up resistor. It is managed by i.MX6 processor's I2C2 controller. It is the same signal that is available also on Expansion header Connector J9.

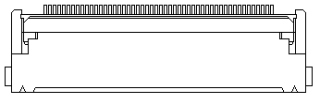
3.3.4 RGB LCD connector

In addition to LVDS interface, NXP i.MX6 SoloX processor also has an enhanced LCD interface, which is able to provide a 24-bit RGB data.

RGB LCD Connector - CN11

Pin	Signal	Pin	Signal
1	VLED+	26	LCD_G1
2	VLED+	27	LCD_G0
3	VLED-	28	LCD_R7
4	VLED-	29	LCD_R6
5	GND	30	LCD_R5
6	VCOM	31	LCD_R4
7	3V3_RGB	32	LCD_R3
8	LCD_MODE	33	LCD_R2
9	LCD_DE	34	LCD_R1
10	LCD_VSYNC	35	LCD_R0
11	LCD_HSYNC	36	GND
12	LCD_B7	37	LCD_CLK
13	LCD_B6	38	GND
14	LCD_B5	39	SHLR
15	LCD_B4	40	UPDWN
16	LCD_B3	41	LCD_VGH
17	LCD_B2	42	LCD_VGL
18	LCD_B1	43	AVDD_LCD
19	LCD_B0	44	LCD_RST#
20	LCD_G7	45	GND
21	LCD_G6	46	VCOM
22	LCD_G5	47	DITH
23	LCD_G4	48	GND
24	LCD_G3	49	GND
25	LCD_G2	50	GND

For this reason, on SBC-B08 board there is the possibility of connecting directly one RGB LCD connector though a 50-pin 0.5mm pitch FFC/FPC connector, type OMRON XF2M-5015-1A, with the pinout shown in the table on the left.



Signals involved in LCD management are the following:

VLED+: Positive reference voltage for LED backlight (Anode), voltage value ranging from V_{IN} to V_{IN}-0.19V (PWM controlled)

VLED-: Negative reference voltage for LED backlight (Cathode)

VCOM: TFT Common voltage output

3V3_RGB: 3.3 V voltage for LCD digital circuitry, derived by NVCC_3V0 voltage rail

LCD_MODE: TFT DE/SYNC working mode select. Output signal, electrical level 3V3_RGB with a 10kΩ pull-up resistor.

LCD_DE: Data enable signal output, electrical level NVCC_3V0.

LCD_VSYNC: LCD Vertical Sync signal output, electrical level NVCC_3V0

LCD_HSYNC: LCD Horizontal Sync signal output, electrical level NVCC_3V0

LCD_B[0..7]: LCD Blue Data signals output, electrical level NVCC_3V0

LCD_G[0..7]: LCD Green Data signals output, electrical level NVCC_3V0

LCD_R[0..7]: LCD Red Data signals output, electrical level NVCC_3V0

LCD_CLK: LCD clock output, electrical level NVCC_3V0

SHLR: LCD Left / Right scanning direction. Output signal, electrical level 3V3_RGB with a 10kΩ pull-up resistor.

UPDWN: LCD Up / Down scanning direction. Output signal, electrical level 3V3_RGB with a 10kΩ pull-down resistor.

LCD_VGH: Positive reference voltage for TFT Gate On (16V)

LCD_VGL: Negative reference voltage for TFT Gate On (-8V)

AVDD_LCD: Power for TFT analog Circuitry (10.5V)

LCD_RST#: LCD Reset output signal, electrical level 3V3_RGB with a 10kΩ pull-up resistor.

DITH: Dithering signal. Output signal, electrical level 3V3_RGB with a 10kΩ pull-down resistor.

Concerning the LCD_B[0..7], LCD_G[0..7] and LCD_R[0..7] signals, these are also used as strap configurations pins by the i.MX6SoloX processor, therefore these signals are configured with 33kΩ pull-up or pull-down resistors.

More exactly:

LCD_B0, LCD_B3, LCD_B4, LCD_B6 are configured with 33kΩ pull-up resistors.

LCD_B1, LCD_B2, LCD_B5, LCD_B7 are configured with 33kΩ pull-down resistors.

LCD_G1, LCD_G3, LCD_G7 are configured with 33kΩ pull-up resistors.

LCD_G0, LCD_G2, LCD_G4, LCD_G5, LCD_G6 are configured with 33kΩ pull-down resistors.

LCD_R[0..7] are all configured with 33kΩ pull-down resistors.

LCD_VGH, LCD_VGL and AVDD_LCD are obtained on-board by using a TI TPS65142 LCD Integrated BIAS and Backlight Power IC.

In the picture on the right it is shown the power up/down sequence of the voltages managed by this device

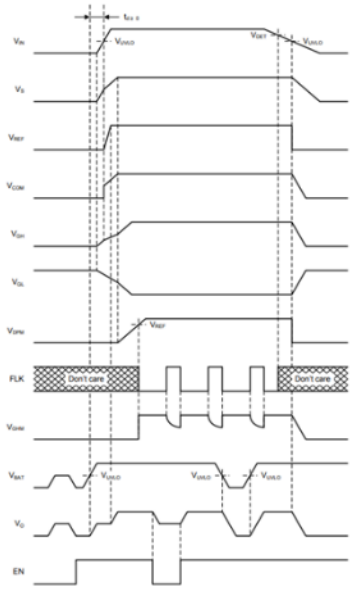


Figure 32. Power Up/Down Sequence

3.3.5 LED backlight connector

On-board, it is available a dedicated connector for LED backlight supply, which carries out the same reference voltages also available on connector CN11.

LED Backlight Connector - CN12	
Pin	**Signal**
1	VLED+
2	VLED-

The connector is CN12, which is a 2-pin 3.50mm pitch connector type JST p/n SM02B-BHSS-1-TB(LF)(SN), with the pinout shown in the table on the left.

Mating connector JST p/n BHSR-02VS-1(N) with SBHS-002T-P0.5A crimp terminals

VLED+: Positive reference voltage for LED backlight (Anode), voltage value ranging from V_{IN} to V_{IN}-0.19V (PWM controlled)

VLED-: Negative reference voltage for LED backlight (Cathode)

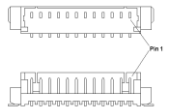
Rail	Forward Current Max	Forward Voltage Max
VLED+ VLED-	170mA	12V

3.3.6 A/D Converter Connector

A/D converter connector - J14			
Pin	**Signal**	**Pin**	**Signal**
1	VGEN5_3V3	7	ADC2_IN0
2	ADC1_IN0	8	ADC2_IN1
3	ADC1_IN1	9	GND
4	ADC1_IN2	10	N.C.
5	ADC1_IN3	11	GND
6	GND	12	N.C.

ADC2_IN[0..1]: A/D Converter Channel 2 inputs #0 #1

NXP i.MX6 SoloX Processor includes an Analog-to-Digital Converter (ADC), which can be used to manage up to 6 analog inputs.



The A/D converter interface is accessible through a 12-pin 1.25mm pitch connector, type MOLEX p/n 53398-1271 or equivalent, with the pinout shown in the table on the left.

Mating connector: MOLEX 51021-1200 receptacle with MOLEX 50079-8000 female crimp terminals.

Signals' description:

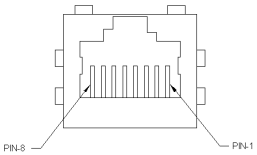
VGEN5_3V3: PMIC generated 3.3V reference voltage for analog inputs

ADC1_IN[0..3]: A/D Converter Channel 1 inputs #0 ..#3

3.3.7 Ethernet connectors

10/100 Ethernet Port #1 - P3			
Pin	**Signal**	**Pin**	**Signal**
1	ETH1_Tx+	5	---
2	ETH1_Tx-	6	ETH1_Rx-
3	ETH1_Rx+	7	---
4	---	8	---

10/100 Ethernet Port #2 - P4			
Pin	**Signal**	**Pin**	**Signal**
1	ETH2_Tx+	5	---
2	ETH2_Tx-	6	ETH2_Rx-
3	ETH2_Rx+	7	---
4	---	8	---



On board, there can be up to two FastEthernet interfaces, made available by a Micrel KSZ8091RNA 10Base-T/100Base-Tx Ethernet Transceivers interfaced to NXP processor's RGMII interfaces.

Connectors are type Wellco T&C p/n M1Z10NL or equivalent, with 2kV decoupling capacitor.

ETH1_Tx+/ETH1_Tx--: Ethernet Controller #1 Transmit differential pair.

ETH1_Rx+/ETH1_Rx--: Ethernet Controller #1 Receive differential pair.

ETH2_Tx+/ETH2_Tx--: Ethernet Controller #2 Transmit differential pair.

ETH2_Rx+/ETH2_Rx--: Ethernet Controller #2 Receive differential pair.

The first Ethernet port is always available, while the second port is a factory option.

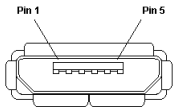
3.3.8 USB ports

The i.MX6 SoloX processor offers a native USB HSIC and two USB 2.0 OTG interface.

Micro-AB USB connector - J2	
Pin	**Signal**
1	USB_OTG1_VBUS
2	USB_OTG1-
3	USB_OTG1+
4	USB_ID
5	GND

The first USB OTG port is carried out to a standard micro-AB connector, described in the table on the left.

Depending on the needed use of the system, it is necessary to connect micro-A or micro-B USB cables to connector CN13.



A micro-A USB cable has to be used when the system has to work in Host mode. In this case, USB_VBUS is a power output of SBC-B08 Board for the connected device.

When a micro-B USB cable is used, its USB_ID pin is floating; this way, the board acknowledges that it must configure itself to work as a Client. In this case, USB_VBUS is an input of the carrier board from the external Host.

Signal description of this port:

USB_OTG1+/USB_OTG1-: USB OTG Port #1 differential pair.

USB_OTG1_VBUS: USB voltage rail. It is an input for USB port working in Client mode, an output for Host mode.

USB_ID: Client/Host identification signal. This signal is high when the USB port works in client mode, is low when works in Host mode. NVCC_3V0 electrical level with a 10KΩ pull-up resistor

The second USB OTG port is used with an host only interface, therefore it is carried out to a standard type-A connector, described in the table on the left.

USB Host port #1 connector - J3	
Pin	**Signal**
1	USB_OTG2_VBUS
2	USB_OTG2-
3	USB_OTG2+
4	GND

Signal description of this port:

USB_OTG2+/USB_OTG2-: USB OTG Port #2 differential pair.

USB_OTG2_VBUS: USB voltage rail, output supply voltage for USB client devices connected to this port.

The USB HSIC interface is carried to an SMS USB3503 HSIC Hub, which makes available three further USB 2.0 Host ports.

Two of them are carried out to as many Type-A standardconnectors.

USB Host port #2 connector - J5	
Pin	**Signal**
1	USB_OTG3_VBUS
2	USB_DP1-
3	USB_DP1+
4	GND

Signal description of this port:

USB_DP1+/USB_DP1-: USB HSIC Hub Downstream port #1 differential pair.

USB_OTG3_VBUS: USB voltage rail, output supply voltage for USB client devices connected to this port.

USB Host port #3 connector - J4	
Pin	**Signal**
1	USB_OTG4_VBUS
2	USB_DP2-
3	USB_DP2+
4	GND

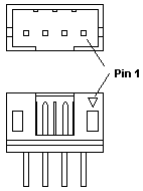
Signal description of this port:

USB_DP2+/USB_DP2-: USB HSIC Hub Downstream port #2 differential pair.

USB_OTG4_VBUS: USB voltage rail, output supply voltage for USB client devices connected to this port.

USB Host internal connector - J15	
Pin	**Signal**
1	VCC_SW
2	USB_DP3-
3	USB_DP3+
4	GND

The third downstream port, instead, is carried to an internal 4-pin male connector, type HR p/n A2001WV-S-04 or equivalent, with pinout shown in the table on the left.



Mating connector: HR A2001H-04P housing with HR A2001 series crimp terminals.

USB_DP3+/USB_DP3-: USB HSIC Hub Downstream port #3 differential pair.

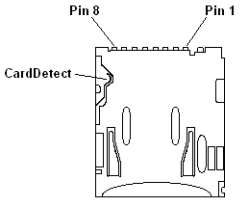
Common mode chokes are placed on all USB differential pairs for EMI compliance. For ESD protection, on all data and voltage lines are placed clamping diodes for voltage transient suppression.

3.3.9 µSD card slot

µSD Card Slot - CN2	
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
CardDetect	SDIO_CD#

The NXP i.MX6 family of processors embeds four Ultra Secured Digital Host controllers (uSDHC), able to support SD / SDIO / MMC Cards.

For this reason, on SBC-B08 board there is also a socket, for the use of standard microSD cards, which can be used as Mass Storage and/or Boot Devices.



The connector is a microSD connector, push-push type, H=1.68 mm, type JST DM3AT-SF-PEJM5 or equivalent.

SDIO_CD#: Card Detect Input.

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 for 4-bit communication mode.

+3.3V$_{SDIO}$ voltage is derived from NVCC_3V0 power rail. It can be switched on and off via SW (SDIO_PWR signal, managed using the i.MX6 pad B15).

3.3.10 Boot Selection jumper J27

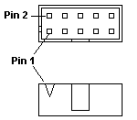
The onboard 2-way jumper J27 can be used to select boot source for the SBC-B08 module.

When the jumper is inserted, then the boot will be performed from the uSD Card, otherwise, if the jumper is not placed, the boot will be performed from the internal eMMC.

3.3.11 Optional JTAG connector

Optional JTAG connector - J17			
Pin	**Signal**	**Pin**	**Signal**
1	VDD_SNVS	2	JTAG_TMS
3	GND	4	JTAG_TCK
5	GND	6	JTAG_TDO
7	GND	8	JTAG_TDI
9	GND	10	JTAG_TRST_B

On customer specific request, the board can be equipped with a connector reporting the JTAG signals coming from the i.MX6 processor, which can be useful for software debugging and tracing in development phase. This optional connector is a 10-pin dual row male connector, type MOLEX p/n 87832-1020 or equivalent, with pinout shown in the table on the left.



Mating connector: MOLEX 51110-1050 crimp housing with MOLEX 50394 series crimp terminals.

All these JTAG signals are directly connected to i.MX6 SoloX pins with same name. Please refer to i.MX6 processor's documentation for a description of the signals and their usage.

3.3.12 Expansion connector

The SBC-B08 board offers the possibility of accessing directly to some of the various features offered by i.MX6 processor through the pin multiplexing.

This means that onboard there is a dedicated 32-pin connector, J9, which is a standard dual-way male pin header, p=2mm, h= 4mm, type Townes P1022-2*16MGF or equivalent.

The pinout of this connector is shown in the following table. In there, near each pin name, it is also indicated the possible uses of those pins, according to the pin multiplexing possibilities of i.MX6 processors. Port numbering is written only for easier identification, but each pin can be individually set, independently from the use of the other pins of the same port.

Due to the various pin multiplexing possibilities offered by i.MX6 SoloX processor, in the following table are shown the features supported by SECO's BSP. It is also shown the i.MX6 pad name connected to each pin of connector J9, for the users who want to explore different configurations not directly managed by the BSP provided.

Expansion Connector – J9

Pin nr.	Pin Name	Pinout configuration Option			Port Number	i.MX6 Pad Name
1	VCC_SW					---
2	NVCC_3V0					----
3	GND					---
4	EXP_GPIO_1	PWM_1		GPIO5_IO15	1	RGMII2_RD3
5	EXP_GPIO_2	SPI5_MISO		GPIO4_IO04	2	NAND_DATA00
6	EXP_GPIO_3	SPI5_CLK		GPIO4_IO06	2	NAND_DATA02
7	EXP_GPIO_4	SPI5_MOSI		GPIO4_IO05	2	NAND_DATA01
8	EXP_GPIO_5	SPI5_SS		GPIO4_IO07	2	NAND_DATA03
9	EXP_GPIO_6	FLEXCAN1_TX		GPIO4_IO28	3	QSP1B_DQS
10	EXP_GPIO_7	FLEXCAN1_RX		GPIO4_IO23	3	QSP1A_SS1_B
11	EXP_GPIO_8	UART6_CTS	CSI1_DATA09	I2C4_SDA	GPIO1_IO21	4	CSI_DATA07
12	EXP_GPIO_9	UART6_TXD	CSI1_DATA07	SPDIF_IN	GPIO1_IO19	4	CSI_DATA05
13	EXP_GPIO_10	UART6_RTS	CSI1_DATA08	I2C4_SCL	GPIO1_IO20	4	CSI_DATA06
14	EXP_GPIO_11	UART6_RX	CSI1_DATA06	SPDIF_OUT	GPIO1_IO18	4	CSI_DATA04
15	EXP_GPIO_12		CSI1_PIXCLK		GPIO1_IO24	5	CSI_PIXCLK
16	EXP_GPIO_13	SPDIF_IN		PWM2_OUT	GPIO1_IO11	5	GPIO1_IO11
17	EXP_GPIO_14	SPDIF_OUT1		PWM3_OUT	GPIO1_IO12	5	GPIO1_IO12

18	EXP_GPIO_15	I2S_SYNC	CSI1_DATA03		GPIO1_IO15	6	CSI_DATA01
19	EXP_GPIO_16	I2S_CLK	CSI1_DATA02		GPIO1_IO14	6	CSI_DATA00
20	EXP_GPIO_17	I2S_DI	CSI1_VSYNC		GPIO1_IO25	6	CSI_VSYNC
21	EXP_GPIO_18	I2S_DO	CSI1_HSYNC		GPIO1_IO22	6	CSI_HSYNC
22	EXP_GPIO_19	GPIO_19	CSI1_DATA04		GPIO1_IO16	6	CSI_DATA02
23	EXP_GPIO_20	GPIO_20	CSI1_DATA05		GPIO1_IO17	6	CSI_DATA03
24	EXP_GPIO_21	I2C2_SDA			GPIO1_IO03	7	GPIO1_IO03
25	EXP_GPIO_22	I2C2_SCL			GPIO1_IO02	7	GPIO1_IO02
26	EXP_GPIO_23	UART1_RXD			GPIO1_IO05	8	GPIO1_IO05
27	EXP_GPIO_24	UART1_TXD			GPIO1_IO04	8	GPIO1_IO04
28	EXP_GPIO_25	UART2_RXD		UART1_CTS	GPIO1_IO07	9	GPIO1_IO07
29	EXP_GPIO_26	UART2_TXD		UART1_RTS	GPIO1_IO06	9	GPIO1_IO06
30	EXP_GPIO_27	PWM_2			GPIO5_IO14	10	RGMII2_RD2
31	EXP_GPIO_28	PWM_5			GPIO5_IO21	10	RGMII2_TD3
32	GND						---

As a factory option, it is possible to have UART6 (port #4) configured with TTL or RS-485 interface, and UART1 (port #8) + UART 2 (port#9) with TTL or RS-232 interface. Indeed, there is only one RS-232 transceiver, which acts simultaneously on UART1 and UART2 interfaces.

Considering the pin multiplexing offered by i.MX6 SoloX processor, it is possible to have two serial ports with only Tx/Rx signals (UART1 and UART2), or only a serial port (UART1) with Tx, Rx, RTS and CTS signals. This configuration can be chosen via SW, while it is a factory option the fact that the interface be TTL or RS-232.

Please consider that the pins dedicated to UART1, UART2 and UART6 can be used as General Purpose I/Os exclusively in the case that the corresponding UART is at TTL level (which means with no RS-232 or RS-485 transceiver interposed).

3.3.13 CAN Bus connector

The i.MX6SoloX processor includes two Flexible Controller Area Network (FlexCAN).

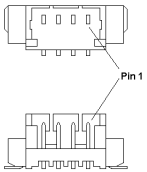
For this reason, as a factory option, on the SBC-B08 board it is possible to have a CAN transceiver, for the direct connection of the board to a CAN Bus network, managed by i.MX6SoloX FlexCAN2 interface.

Optional CAN Bus Connector - CN24

Pin	Signal
1	V_{IN}
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.

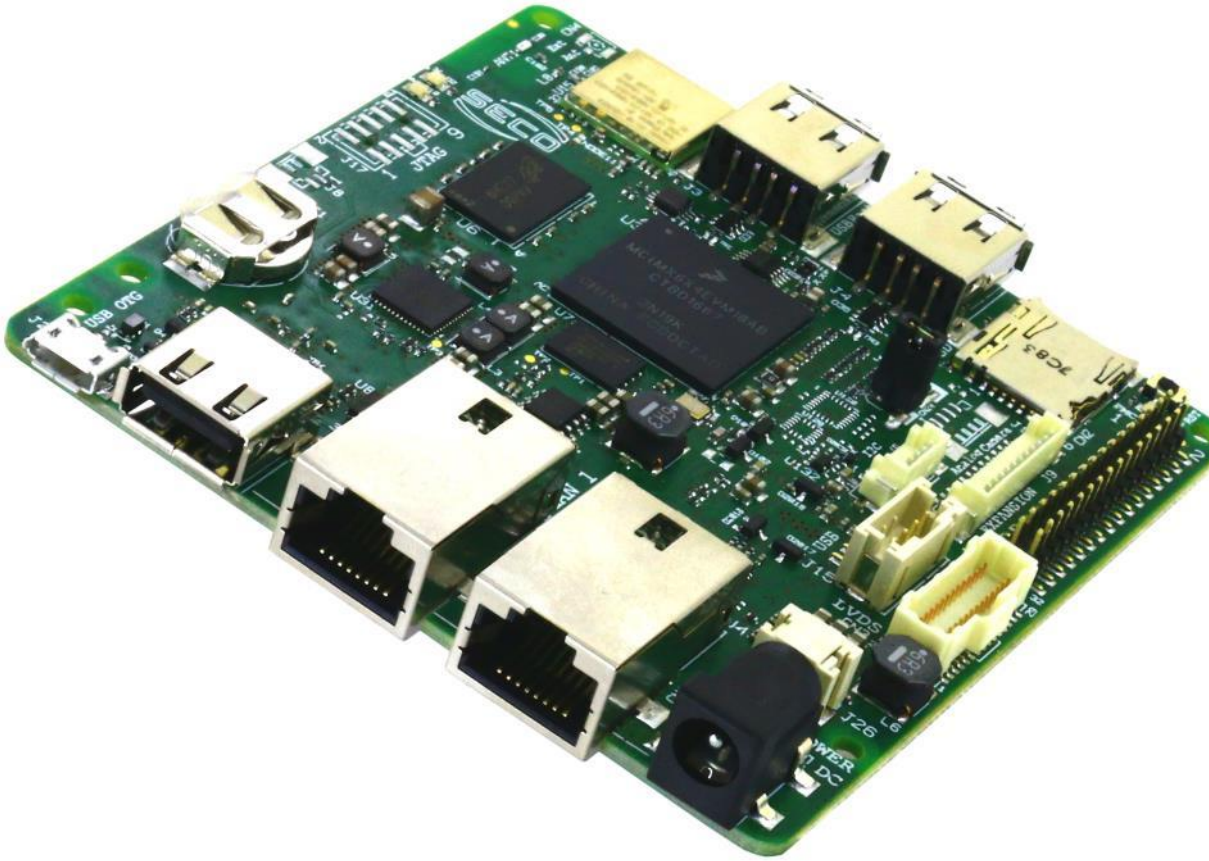
CAN_L: Low-Level CAN bus line.

A 120Ω termination resistor is placed between CAN_H and CAN_L signals. It can be connected or disconnected from the line by using JP2 jumper (Jumper inserted = termination connected).

When the CAN transceiver is not mounted as a factory option, it is possible to use the FlexCAN1 interface, at TTL level, through the expansion connector J9, port #3.

Chapter 4.
APPENDICES

- Thermal Design
- Accessories



4.1 Thermal Design

Highly integrated systems, like the SBC-B08 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.

SECO can provide the customer with SBC-B08 specific passive heatsinks, which can be useful during the phase of development, in a laboratory, in free - air conditions or just for software development and system tuning.

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. Please remember that the use of SECO heat-dissipation components must be accurately evaluated within the final system and that they should be part of a more comprehensive ad-hoc cooling solution.

Please contact SECO for ordering part numbers.

4.2 Accessories

SECO can offer various accessories in completion of SBC-B08 functionalities

4.2.1 Serial port adapter cable

This cable can be used to connect standard RS-232 serial ports, available on connector J9, to standard PC serial ports through a null-modem serial cable.

This cable should be used exclusively with SBC-B08 boards configured to have UART1 + UART2 ports in RS-232 mode.

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