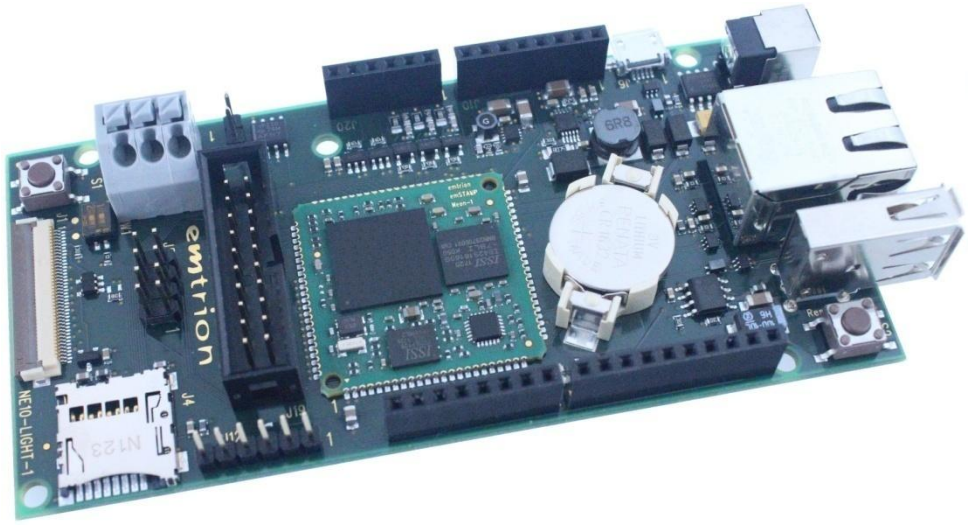
emtrion
embedded systems

emSBC-Neon

Hardware Manual

Rev4 / 26.09.2018



emtrion GmbH

Revision: **4 / 26.09.2018**

Rev	Date/Signature	Changes
1	15.06.2018/Sch	First revision
2	03.08.2018/Sch	Correct module name
3	14.08.2018/We	Changed module name to emSBC-Neon. Detailed description of FFC connector J1.
4	26.09.2018/Sch	Chapter (First Configuration) 4 removed

emtrion
embedded systems

Table of Content

1 Introduction

The emSBC-Neon is a carrier board for the CPU module emSTAMP-Neon. For more details about the Neon processor module, read the emSTAMP-Neon hardware manual.

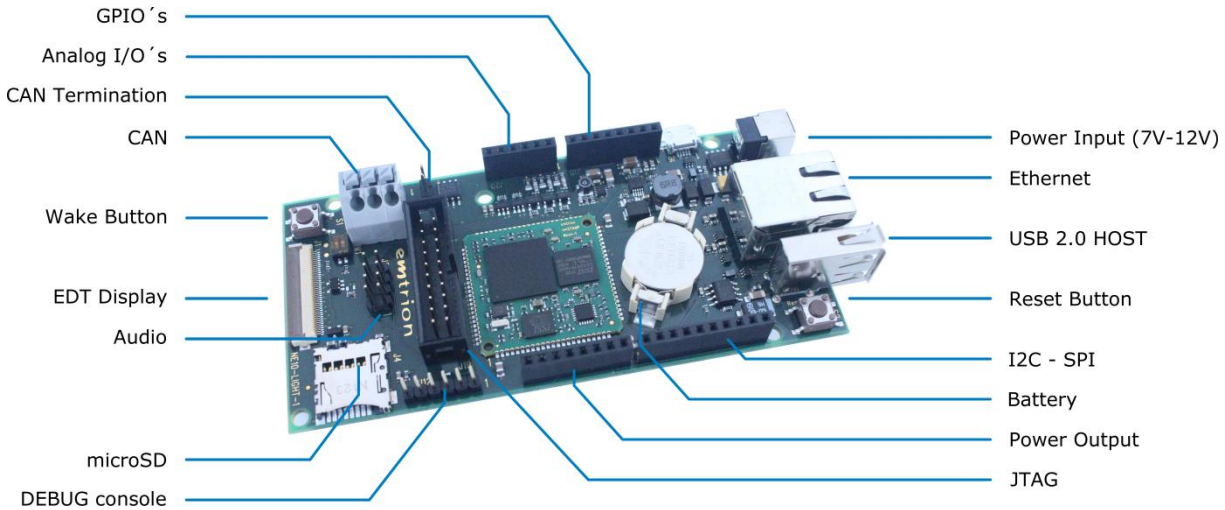
The board supports interfaces like 10/100 Mbit Ethernet, USB 2.0 Host, micro SDC and High Speed CAN. In addition to the basic communication interfaces such as UART, JTAG, I^2C and SPI, there are also 5 analog I/O´s and 6 GPIO´s available.

For multimedia applications, an 18 Bit RGB display port as well as an SAI audio interface is available on the board.

The processor and the board include a variety of functions required for industrial or multimedia applications. In addition, the board size and connector arrangement is designed according to the Arduino UNO form factor. So it can easily implement as a powerful replacement for existing Arduino projects.

This hardware manual describes the physical and electrical characteristics of the board. It covers the use of SBC-Neon with the supported core module but only gives additional details that are specific to the base. For this reason, it has to be used together with the manuals of the core.

2 Connector Overview



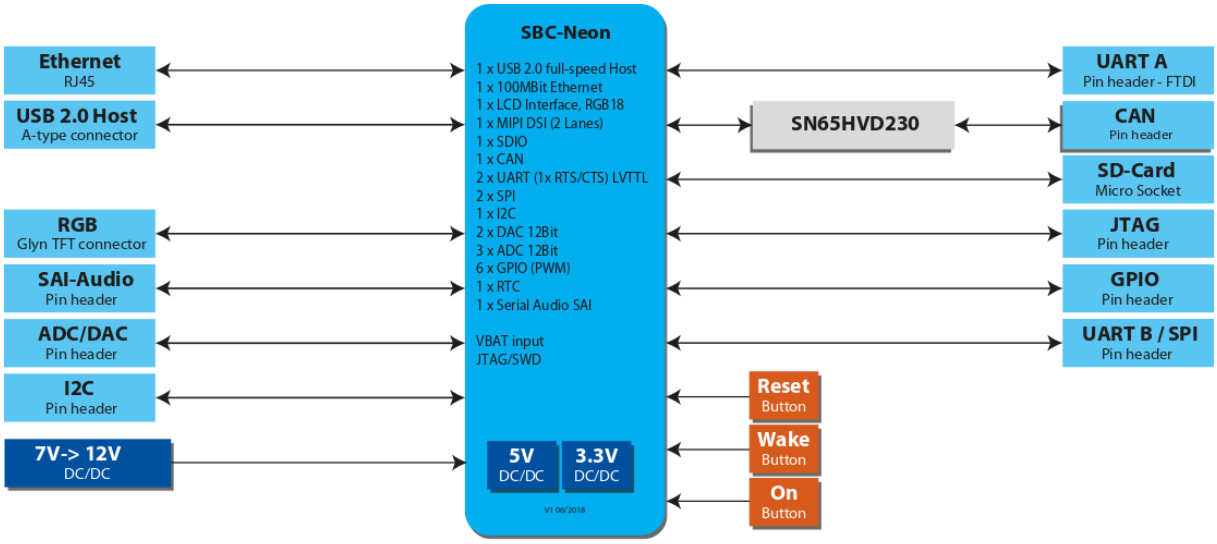
3 Handling Precautions

Please read the following notes prior to installing CPU module to the SBC-Neon base board. They apply to all ESD (electrostatic discharge) sensitive components:

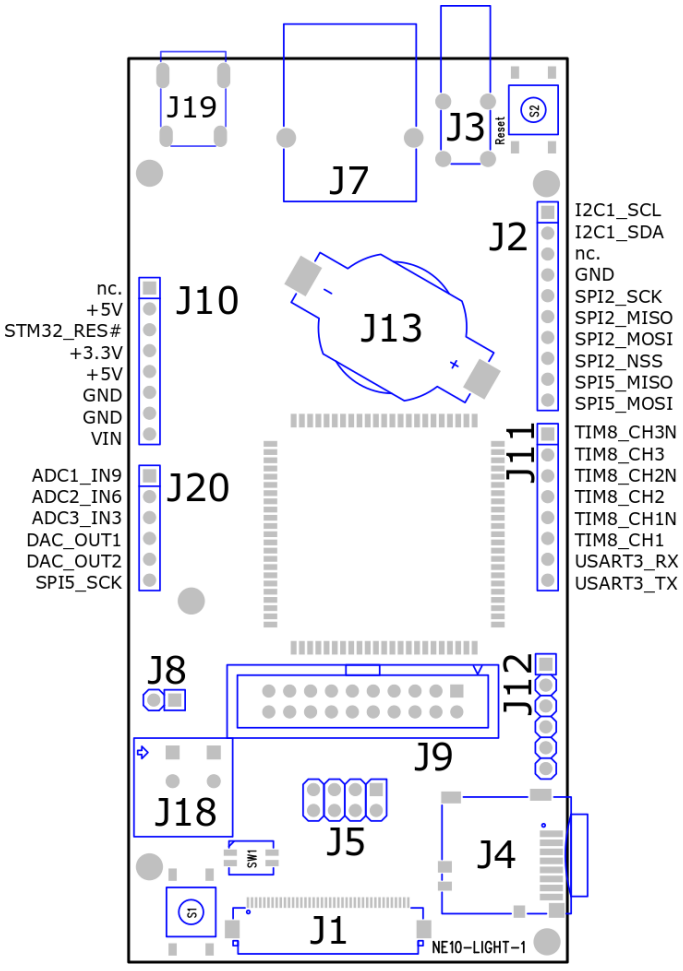
- Before installing a CPU module the SBC-Neon base board needs to be configured depending on the used CPU module. Further information can be found later in this document.
- Before touching the base board it is recommended that you discharge yourself by touching a grounded object.
- Be sure all tools required for installation are electrostatic discharged as well.
- Before installing (or removing) a CPU module, unplug the power cable from your main supply.
- Also switch off the power supply before you plug or unplug cables at not ESD protected connectors.
- Handle the board with care and try to avoid touching its components or tracks.

4 Functional Overview

The Block Diagram of the available Interfaces and their connectivity:



4.1 Connector Assignement



5 List of features

The emSBC-Neon Baseboard provides the following interfaces and functions.

- 10/100 Base-T Ethernet interface at RJ45 connector
- USB 2.0 Host interface at USB-A connector
- Micro SD Card socket
- 18 bit RGB interface for EDT TDT displays with integrated capacitive touch controller
- Serial Audio Interface (SAI)
- CAN controller
- 3 x ADC Analog Input
- 2 x DAC Analog Output
- 6 x GPIO
- Serial Interfaces
  - I^2C
  - SPI
  - UART
- JTAG debug interface
- UART debug interface with flow control RTS/CTS
- WAKE, RESET button for power management
- Power Supply Input (7V – 12V)
- Power Supply Output (3,3V and 5V)
- 2-bit CPU boot mode control by DIP switches
- Battery holder for RTC backup, CR1632

5.1 Ethernet

A 10/100 Mbit Ethernet interface is available via RJ45 connector (J7). The PHY on the CPU module uses the "current mode" for the 10/100 Mbit application. Therefore the center taps of the magnetics are connected to a 3.3V DC voltage source. The traffic and speed LEDs on the RJ45 connector are not connected.

5.2 USB 2.0

A USB 2.0 interfaces are accessible on the Board. It is dimensioned for full speed mode with 12 MBaud.

The USB 2.0 A port (J3) works in host mode. As soon as the hardware configuration process is completed, the "USB_OTG_HS_VBUS_EN" signal from the CPU module enables the output of the power switch which supplies the VBUS of the USB Host connector. If the USB port detects an over current condition, VBUS will be turned off to protect the circuitry from overloading. The power switches can provide up to 5W.

5.3 Micro SD-Card

A micro SD-Card socket (J4) is available. All signals are directly connected to the CPU module without any further provisions. Thus the characteristics depend on the used CPU board. A write protect is not provided, so the micro SD-Card is always writeable. Card detect is available at the socket.

5.4 EDT TFT

A TFT LCD display with 18 bpp color resolution can be connected to the connector (J1). The pinout of the connector conforms to a family of TFT displays that is available from the company EDT. Besides that, other TFT displays can also be connected with an appropriate adapter. In principal these displays are offered either with integrated 4-wire resistive touch interface or with projected capacitive touch interface. The connector is designed only for displays with capacitive touch interface, which is located on the back side of the display. The touch controller is connected to the I^2C interface. The touch controller's wake input is driven by the GPIO signal TIM8_CH1. The touch controller's interrupt output is connected to the GPIO signal TIM8_CH2. Further details about the touch controller can be found in the display's data sheet.

The backlight of the display is enabled by the GPIO signal TIM8_CH1N. Additionally the brightness can be controlled by the GPIO signal TIM8_CH2N. This signal should be driven by a PWM output. Since different displays use different pixel clock slopes to latch the data the active clock slope can be configured by the resistors R11 and R39. By default the pixel clock signal is not inverted, therefore R39 is placed and R11 is unplaced. For an inverted clock signal, R39 has to be unplaced and R11 placed.

5.5 Audio

The Serial Audio Interface (SAI) is available at the pin header (J5). This Interface is configurable and supports the most digital audio standards like I^2S, SPDIF, PCM, TDM and AC97.

Additional a 3.3 V and 5 V supply is available at the pin header.

5.6 CAN

The transmit and receive signals of the CPU module are routed to a 3-pole Push-in CAGE CLAMP (J18). A high-speed CAN transceiver is realized on the base, so that the CAN interface can directly connected to a CAN network. If this interface is an endpoint the Network can be AC terminated by setting a jumper on pin header (J8).

5.7 UART

Interface UART A on pin header (J12) is connected directly as LVTTL signal to the CPU module. Besides the data lines, RTS and CTS flow control signals are connected. The pinout is designed for FTDI connections.

Interface UART B is located on the I/O connector (J11).The transmit and the receive lines are connected directly as LVTTL signals to the CPU module.

5.8 JTAG

For debugging the emSTAMP-Neon CPU module, the JTAG signals are provided at the connector (J9).

5.9 I/O connector

The pin header J2, J10, J11 and J20 together form the I/O connector of the board. The placement of these connectors allows it to mount an Ardunio shield. The connection compatibility should still be checked before use. The connector assignment can be found in 5.1.

5.9.1 Power section

The pin header (J10) provides further power pins, which can be used to supply shields or other low power (< 500mA) components. It is not recommended to use this opportunity if the board is supplied by USB.

On the VIN pin, the supply voltage of the board (7V-12V) can be used as reference. Don't use this pin or the other pins on J10 to supply the board. Only the DC power jack (7V-12V) is intended to supply the board.

A reset input (STM32_RS#) to reset the CPU module is also located on the pin header.

5.9.2 Analog I/O´s

The Analog Inputs and Outputs are located on (J20).

There are three ADC connections for the Input and two DAC connections for the Output. For more details about the specification of the ADC/DAC use the manual of the emSTAMP Neon CPU module.

5.9.3 Digital I/O´s

The Digital Inputs and Outputs are located on the I/O connector (J11). There are 6 GPIO connections provided, each with PWM ability. The GPIO Signal TIM8_CH3 is connected to an activity LED (D1).

The GPIO´s TIM8_CH2, TIM8_CH2N, TIM8_CH1, TIM8_CH1N are also used to control the EDT Display. Don't use this pin if a Display is connected on (J1)

Interface UART B is also located on (J11).The transmit and the receive lines are connected directly as LVTTL signals to the CPU module.

5.9.4 Serial Interfaces

The I^2C Signals at the pin header (J2) are not ESD protected. The output high level of the I^2C interface is 3.3V. The SPI Signals from the CPU module are also directly connected to (J2) and partially on (J20).

Before touching the connector it is recommended that you discharge yourself by touching a grounded object.

5.10 Reset Button

A reset button (S2) is placed on the top right side of the board.

Pressing this button immediately pulls the signal STM32_RES# to GND and forces the CPU module to reset.

5.11 Wakeup Button

A Wakeup button (S1) is placed on the lower left side of the board.

Pressing this button immediately pulls the signal SYS_WKUP to GND and forces the CPU module to wake up.

5.12 Power On LED

The LED (D2) is active if the board is supplied by DC power jack (7V-12V) or the USB connector (5V).

5.13 Backup Battery

A battery holder (J13) for lithium coin cell CR1632 is available to supply the RTC of the CPU boards.

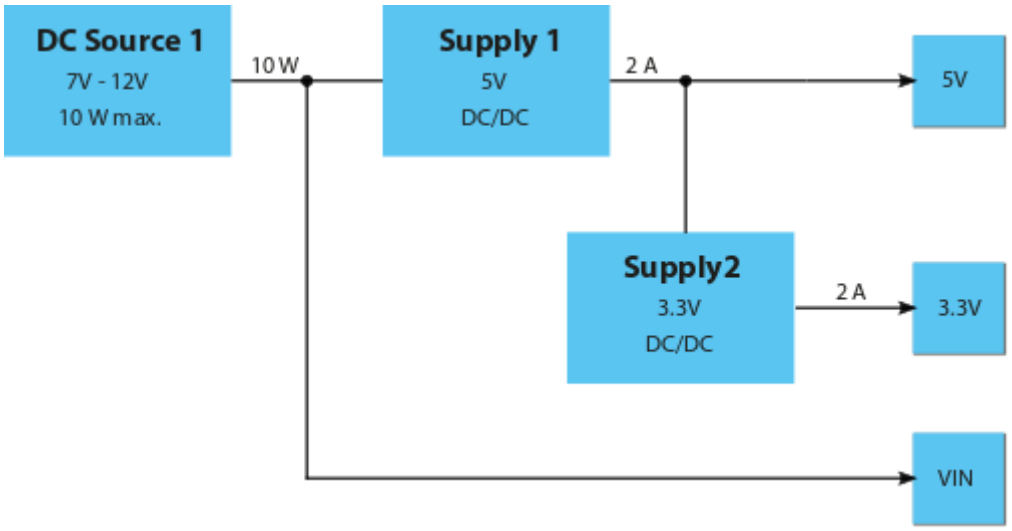
5.14 Boot Mode

The boot mode can be selected by the dip switch SW1 in the lower left region on the board.

5.15 Power Supply

The SBC-NEON board has a power supply input at the DC Jack (J19). The primary power supply can vary between +7 V and +12 V (± 10%) with a maximum power consumption of 10 W.

It is not recommended to supply the board from other access points as the DC Jack connector.



5.15.1 5 V Supply

The 5 Volt on the baseboard are generated directly from the main power supply (DC Jack) by a buck switch.

5.15.2 3.3 V Supply

The 3.3 Volt on the baseboard are generated from the 5V power supply by a buck switch.

6 Pin Assignments

6.1 Ethernet (J22)

Type: Rj45 Jack with magnetic

Pin	Signal
1	ETH_TDP
2	3.3V
3	ETH_TDM
4	ETH_RDP
5	3.3V
6	ETH_RDM
7	nc.
8	GND
9	nc.
10	nc.
11	nc.
12	nc.

6.2 USB 2.0 Host (J3)

Type: USB A connector

Pin	Signal
1	VBUS
2	USB_FS_DM
3	USB_FS_DP
4	GND

6.3 JTAG (J9)

Type: 2 pos 10 pin header

Pin	Signal	Pin	Signal
1	3V3	2	3V3
3	JTAG_TRST#	4	GND
5	JTAG_TDI	6	GND
7	JTAG_TMS	8	GND
9	JTAG_TCLK	10	GND
11	nc.	12	GND
13	JTAG_TDO	14	GND
15	STM32_RES#	16	GND
17	nc.	18	GND
19	nc.	20	GND

6.4 EDT (J1)

Type: FFC-connector FH12-40S from Hirose (40pol, 0.5mm pitch, bottom contact type)

Pin	Signal
1	n/c
2	RESO#_DISP
3	LTDC_B7
4	LTDC_B6
5	LTDC_B5
6	LTDC_B4
7	LTDC_B3
8	LTDC_B2
9	GND
10	LTDC_G7
11	LTDC_G6
12	LTDC_G5
13	LTDC_G4
14	LTDC_G3
15	LTDC_G2
16	GND
17	LTDC_R7
18	LTDC_R6
19	LTDC_R5
20	LTDC_R4
21	LTDC_R3
22	LTDC_R2
23	GND
24	LCD_CLK
25	TIM8_CH1 (WAKE#)
26	LTDC_HSYNC
27	LTDC_VSYNC
28	LTDC_DE
29	TIM8_CH1N (BL_EN)
30	3.3V
31	GND
32	GND
33	3.3V
34	3.3V
35	TIM8_CH2 (IRQ#)
36	TIM8_CH2N (BL_CTRL)
37	I2C1_SCL
38	TP2
39	I2C1_SDA
40	TP1

6.5 I/O Connector (J10, J2 | J20, J11)

Type: pin header

Pin	Signal
1	nc.
2	5V
3	STM32_RES#
4	3V3
5	5V
6	GND
7	GND
8	VIN

Pin	Signal
1	I2C1_SCL
2	I2C1_SDA
3	nc.
4	GND
5	SPI2_SCK
6	SPI2_MISO
7	SPI2_MOSI
8	SPI2_NSS
9	SPI5_MISO
10	SPI5_MOSI

Pin	Signal
1	ADC1_IN9
2	ADC2_IN6
3	ADC 3_IN3
4	DAC_OUT1
5	DAC_OUT2
6	SPI5_SCK

Pin	Signal
1	TIM8_CH3N
2	TIM8_CH3
3	TIM8_CH2N
4	TIM8_CH2
5	TIM8_CH1N
6	TIM8_CH1
7	USART3_RX
8	USART3_TX

6.6 micro SD Card (J4)

Type: microSDC Socket

Pin	Signal
1	SDIO_D2
2	SDIO_D3
3	SDIO_CMD
4	3V3
5	SDIO_CK
6	GND
7	SDIO_D0
8	SDIO_D1
9	SDIO_CD#
10	GND

6.7 Audio (J5)

Type: 2 pos 4 pin header

Pin	Signal	Pin	Signal
1	3.3V	2	GND
3	SAI1_FS_A	4	SAI1_SCK_A
5	SAI1_SD_A	6	SAI1_MCLK_A

6.8 CAN (J18)

Type: 3 pin Cage Clamp

Pin	Signal
1	CAN_L
2	CAN_H
3	GND

6.9 CAN Termination (J8)

Type: 1 pos 2 pin header

Pin	Signal
1	CAN_L (120Ω)
2	CAN_H

6.10 UART-A (J12)

Type: 6 pin header

Pin	Signal
1	GND
2	USART2_RTS
3	5V
4	USART2_RX
5	USART2_TX
6	USART2_CTS

6.11 RTC Battery Holder (J13)

Type: Battery Holder for CR1632

Pin	Signal
1	GND
2	BAT +

7 Technical Characteristics

7.1 Electrical Specifications

Electrical Specification	
Supply Voltage	+7 -> +12V ±10%
Current consumption max.	max. 10W depending on core module and connected peripherals

7.2 Environmental Specifications

Operating temperature	
Standard	-25°C ... +85°C
Storage temperature	
Storage temperature	-40 ... +125°C
Relative humidity	
Relative humidity	0 ... 95 %, non-condensing

7.3 Mechanical Specifications

Mechanical Specifications	
Weight	approx. 40 g
Board	glass-epoxy FR-4, UL-listed, 6 layers
Dimensions	118 mm x 54 mm x 18 mm

7.3.1 Drawings emSBC-Neon assembly view